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Enhancing Natural Catastrophic Risk Management in New Zealand: Insights from the 2022 National Seismic Hazard Model and RiskScape Applications

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10D: Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 2:30 PM - 4:00 PM

New Zealand's geological location at the boundary between the Pacific and Australian tectonic plates has historically predisposed it to frequent seismic activity and consequent land failures. This dynamic environment necessitates continuous advancements in seismic hazard assessment to safeguard communities and infrastructure. The 2022 update of the New Zealand National Seismic Hazard Model (NSHM) represents a significant advancement in seismic hazard assessment, integrating the latest scientific insights and refined data. This revision revealed increased ground shaking hazards in regions such as Wellington, Christchurch and the central North Island, driven by new fault discoveries and enhanced subduction zone modelling. Thus, these developments necessitate a re-evaluation of risk and loss projections, as heightened seismic hazard levels suggest potential increases in damage to infrastructure and lifelines, impacting insurance costs and resilience investments. However, the relationship between hazard and risk is complex, emphasizing the need for precise risk quantification.

In this context, Aon, in partnership with GNS Science, has effectively utilized RiskScape in various projects, including government and infrastructure portfolios, showcasing our versatility and the tool's effectiveness. Developed collaboratively by GNS Science and NIWA, RiskScape facilitates geospatial data integration, enabling decision-makers to estimate economic losses and infrastructure impacts. Thus, it emerges as a crucial tool for assessing the implications of the updated NSHM on infrastructure, such as the buried pipe networks owned by Councils like the Outer Wellington Councils which includes Porirua City Council, Kapiti-Coast District Council, Upper Hutt City Council, and Hutt City Council, as well as telecommunications assets like those managed by Chorus. Our work explores insights from these projects, providing an understanding of how advanced modelling tools can enhance the management of natural hazards and risks to linear infrastructures. This also includes informing insurance policies and emergency response strategies, ultimately supporting disaster resilience and risk-informed decision-making.

The Paleo-Anthropocene and the genesis of the current landscape of Israel

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10F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 2:30 PM - 4:00 PM

This study explores the nature of the Paleo-Anthropocene in Israel, beginning with the earliest human occupation of the region, which served as a catalyst for ongoing changes in the physical and biotic landscapes. Focusing on human impacts on the natural and physical environment, we propose a division into four key stages that mark turning points in the intensification of anthropogenic activity:

“Natural Ecosystem and Landscape” – as characterized during the period inhabited by hunter-gatherers, beginning around 1.5 Ma years BP.

The onset of “Human Niche Construction”, starting around 12,500 BCE.

The emergence of an “Anthropogenic Ecosystem”, beginning around 3300 BCE.

The shift to a “Total Anthropogenic Ecosystem and Landscape”, from approximately 1200 CE.

Each stage represents a progression marked by acceleration in the pace and extent of human intervention. As such, the landscapes and ecosystems of modern-day Israel are not “natural” in the conventional sense but are the direct outcome of a long sequence of continuous anthropogenic modifications.

Validation of Analytical Morphodynamic Theories through Observations of Alternate Bars in the Alpine Rhine

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

This study investigates the applicability of linear analytical theories of river morphodynamics to real-world observations of alternate bar formation, with a specific focus on the Alpine Rhine. Building upon classical formulations derived from the Saint-Venant and Exner equations, the study applies a 2D linear stability analysis to predict bar wavelengths and migration behavior in channelized river reaches. The analytical outcomes are then compared to a comprehensive dataset of bathymetric surveys collected over multiple decades along a 20 km stretch of the Alpine Rhine near Widnau, Switzerland.

A hybrid methodology combining Fourier analysis and semi-automated detection algorithms is developed to extract dominant bar wavelengths and migration velocities from observational data. These metrics are then matched with theoretical predictions under varying hydraulic and sediment transport conditions. The results demonstrate a remarkable agreement between theoretical and observed bar characteristics, particularly in terms of longitudinal wavelengths and their dependence on flow depth and Froude number. The study also highlights the influence of local channel geometry and sediment availability on the spatial variability of morphodynamic patterns.

This validation effort not only corroborates the predictive potential of linearized morphodynamic models for engineered river systems but also identifies their limitations in contexts where non-linear effects or boundary constraints prevail. The findings offer a robust framework for the design and adaptive management of river training works in gravel-bed rivers, especially in Alpine contexts where morphological stability is critical for flood safety and ecological integrity.

Responses of mangroves to environmental changes in estuaries that periodically close to the sea

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05F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 11:35 AM - 1:20 PM

The distribution and growth of mangroves in closed estuaries provides insight to the functioning of mangrove ecosystems and future responses to environmental extremes. Estuaries that close to the sea experience rapid changes in salinity and water level; mangroves either adapt or die rapidly. In the Kobonqaba Estuary, South Africa Avicennia marina died after three months of pneumatophore inundation when the mouth closed to the sea and water level increased. Extended mouth closure in the St Lucia Estuary has led to a freshening of the system and replacement of mangrove habitat by reeds and sedges. Increases or decreases in freshwater inflow in response to climate change will change the connectivity of estuaries with the sea and thus the distribution and growth of mangrove species that prefer tidal conditions. Artificial mouth opening or entrance training such as that at Lake Illawarra, Australia modified the tidal frame and its elevation, leading to proliferation of mangroves but loss of salt marsh. A conceptual model is presented that captures our global knowledge on estuarine morphodynamics, abiotic drivers and mangrove responses in estuaries that close to the sea. These systems occur predominantly along the Gulf of Mexico, Brazil, India, South Africa and Australia. An understanding of mangrove changes in temporarily closed estuaries allows us to plan for conservation and restoration interventions.

The tale of two glaciers: reassessing the climatic sensitivity of the Otira and Bealey Glaciers in Arthur's Pass, New Zealand.

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05G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 11:35 AM - 1:20 PM

Two paleo-glaciers, Otira and Bealey, once flowed from the same source—Mt. Rolleston in Arthur's Pass National Park—yet their subtly different aspects and exposure to regional atmospheric conditions resulted in contrasting glacial behaviours. Both glaciers faced west, but the Bealey glacier lay in the lee of Mt. Rolleston, largely shielded from prevailing westerly winds, while the Otira glacier remained fully exposed to them.

The majority of Otira ice flowed westward down the Taramakau Valley towards the West Coast. However, a significant eastern lobe of Otira overtopped the Arthur's Pass saddle and merged with the Bealey glacier, flowing eastward into the headwaters of the Waimakariri River. This eastern lobe persisted until approximately 16.6 ka, when thinning caused it to cease overtopping the pass, leaving behind the prominent Dobson Memorial Moraines as its terminal expression.

Continued thinning of the Otira glacier led to its retreat to the vicinity of Lake Misery, forming largely lateral moraines. This phase coincides with the onset of the Antarctic Cold Reversal (ACR; ca. 14.4 ka), during which remaining ice was funnelled westward over the steep escarpment at Falling Mountain, continuing towards the Taramakau. The Otira glacier persisted in a much-reduced form near Lake Misery until the early Holocene, with evidence for ice lingering until ca. 9.8 ka.

The Bealey glacier exhibits a retreat sequence that appears broadly coeval with the Otira's eastern lobe, though Bealey's behaviour was more sensitive to variations in precipitation. Being shielded from direct westerly flow, Bealey was more readily starved of moisture during minor reductions in westerly wind strength.

Dynamics of Modern Washover Deposits in Southern New South Wales, Australia

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02E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 2:00 PM - 3:30 PM

Washover deposits are layers of sediment moved inland when strong waves overtop sandy barriers (overwash), leaving behind a geological record of storm events that shape and reshape these deposits. Along the stable, wave-dominated sandy coast of southern New South Wales (NSW), Australia, these processes occurred during the later stages of the post-glacial marine transgression. Since Holocene sea levels stabilised, they have been far less common as barriers have built vertically and seaward. However, in recent decades contemporary examples of barrier washover are evident re-shaping the barrier morphology. Understanding these modern washover dynamics is crucial as they provide valuable analogues for the past but may also indicate present and future sensitivity of barrier systems to episodic high-energy events, which may become more frequent or intense under future sea-level rise scenarios. In this study we investigated one such example of modern washover integrating a range of datasets to document its morphology and the process driving its formation. Elevation and shoreline change data derived from spatial datasets such as LiDAR and DEA Coastlines provided detailed insights into surface morphology and shoreline dynamics. Complementary hydrodynamic data including nearshore wave and ocean tide records as well as river discharge data were used to quantify the external forcing mechanisms responsible for overwash initiation and sediment transport. Furthermore, high-resolution temporal imagery from Nearmap and Planet Labs enabled detailed monitoring of surface changes and sediment redistribution following overwash events. The results emphasise that washover and associated ongoing reshaping of the sandy barrier is driven by the interaction of episodic storms with tides and river discharge. The results also highlight the importance of continuous, high-resolution monitoring and have broader implications for barrier resilience and future coastal management as overwash becomes a more dominant feature of sandy shorelines impacted by projected sea-level rise.

Rethinking GLOF Hazard Assessment: Lessons from Overlooked Small Glacial Lakes and Their Socio-Environmental Impacts

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11J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 5:00 PM - 6:30 PM

Glacial Lake Outburst Floods (GLOFs) are high-magnitude cryospheric hazards that are increasing in frequency and intensity in response to ongoing climatic and glaciological changes. While existing GLOF risk frameworks predominantly focus on large glacial lakes (>0.1 km²), small glacial lakes (<0.01 km²) remain systematically overlooked, despite mounting evidence of their potential to cause devastating downstream impacts. This study analyzes two recent, high-impact GLOF events triggered by small glacial lakes: the Limi Valley flood in northwestern Nepal (May 15, 2025) and the Huaraz flood in the Peruvian Andes (April 28, 2025). Although these lakes were well below the size thresholds commonly used to classify potentially dangerous glacial lakes (PDGLs), both events resulted in catastrophic consequences, including fatalities, infrastructure destruction, agricultural losses, and widespread displacement. We employed high-resolution satellite data (Sentinel-2, PlanetScope, Maxar), and pre-/post-event digital elevation model (DEM) analysis to characterize geomorphic changes. Flood propagation was modeled using HEC-RAS 2D, and findings were validated through post-event field surveys and stakeholder engagement. Our findings challenge the prevailing area-threshold paradigm for GLOF hazard classification. We demonstrate that lake area alone is insufficient to assess risk. Key contributing factors—including dam material and structure, proximity to steep slopes, glacial connectivity, and basin topography—play critical roles in determining the likelihood and magnitude of GLOFs from small lakes. We argue for the integration of multi-criteria approaches in GLOF hazard assessments, moving beyond simplistic size-based classifications. Recognizing and addressing the overlooked threat of small glacial lakes is essential for strengthening early warning systems, informing policy, and safeguarding vulnerable mountain communities in an era of accelerating cryospheric change.

Landscape sensitivity and change in the Gisborne region of New Zealand

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12J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 9:35 AM - 11:05 AM

The Gisborne region of New Zealand's North Island is a landscape exposed to a range of natural hazards, including earthquakes, tsunamis, landslides, mud volcanoes, and flooding. Landslides, in particular, are often generated by the passage of severe rainstorms, and this can generate 10s of 1000s of landslides in a single event. This study provides an initial assessment of landslide hazards within Gisborne City and along a segment of State Highway 35 (SH35), stretching from Tokomaru Bay to Ruatoria. The region is particularly vulnerable to landslides due to a combination of geological, climatic, and human-induced factors. Important geological factors include the typically weak rocks and overlying sensitive, clay-rich, residual and transported soils, as well as colluvium, which fail due to increased porewater pressure, reducing the effective stress in the slope, following heavy rainfall. The styles of landslides in suburban Gisborne tend to be rotational slumps that quickly transition downslope into flows, which can damage residential property. Along the segment of the SH35 transport corridor, both over-slips and under-slips occur, with shallow translational landslides extending downslope and across SH35 at some locations. The clay-rich soils also exhibit expansive behaviour, leading to strain-softening over time. Anthropogenic factors such as deforestation, land-use changes, and slope cutting and filling are also important, and along SH35, vibration-induced slope failures from heavy vehicles is also a problem that has been identified. All of these factors can decrease the factor of safety below one. Remote sensing techniques, including UAV, LiDAR, and InSAR, are employed here to detect and monitor changes in the landscape, as well as targeted ground investigations. It is envisaged that results will help in the development of regionally appropriate engineering solutions aimed at reducing slope failure risk in this sensitive landscape.

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Biogenic-abiogenic interactions in soil and soil-like bodies of Antarctica: insights from micromorphology

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The identification of pedogenetic processes in Antarctica is crucial for understanding not only the current state of its environment, but also for better understanding of soil development on Earth through time. East Antarctic ice-free areas are characterized by acute lack of moisture, ultraviolet radiation, sharp temperature changes and strong winds, which significantly reduce the primary production of organic matter and the formation of organogenic horizons on the surfaces of loose and rocky substrates that prevail there. This study examines micromorphological features of soil and soil-like bodies in Larsemann Hills and Bunger Hills. Soils investigated predominantly exhibit coarse texture, low organic carbon content, and pH ranging from alkaline to near-neutral. Thin section analysis reveals a dominance of primary mineral grains (quartz, feldspars) with angular morphology, indicating limited mineral alteration. Cryogenic processes significantly influence soil microfabric, evidenced by cracks and vertically oriented mineral structures; microfabric is characterized by a coarse detrital matrix with abundant voids; clay particles are mainly dispersed within the fine earth fraction. Topsoil horizons often contain localized clay plasma zones showing signs of accumulation and mobility, with mineral grains coated by thin clay films (cutans), indicating clay translocation. Conversely, soils from Maritime Antarctica (previously studied) display high humus-like plasma accumulation on large particles, including guano and ornithogenic organic matter. Organo-mineral interactions in studied soils of East Antarctica are primarily associated with biofilm development in topsoil horizons, correlating with higher biological activity rates. The findings support that soil formation in Antarctic oases results from the combined effects of the "oasis" phenomenon, surrounding ice influence, and local climate. Moisture availability, rather than temperature alone, limits biological activity and pedogenesis in coastal eastern Antarctic substrates. Microclimatic factors—such as wind sheltering and moisture retention in wet valleys—are critical for creating conditions conducive to increased biomass under harsh climatic regimes.

Estuary Dentistry: The Mouth of Te Waihora / Lake Ellesmere

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08B: Predicting and responding to geomorphic change: case studies from Aotearoa New Zealand, Dobson 1, February 5, 2026, 9:35 AM - 11:05 AM

Te Waihora / Lake Ellesmere has been opened to the Pacific Ocean by humans since Ngāi Tahu settled the area centuries ago. The arrival of European settlers saw new technology used to manage the lake, enabling more frequent lake openings and lower operating levels that led to farming in the surrounding low-lying land of the old lakebed. The management of river mouths and estuaries has recently re-emerged into the public spotlight following several flood events around the country, including the rainfall event in May 2025 which again raised questions about the management of Te Waihora and the neighbouring Wairewa / Lake Forsyth. These public and political pressures will compound the need to understand the potential impact of sea level rise and climate change on the management of Te Waihora.

While connecting the lake to the sea appears a simple task (i.e., move gravel so water can flow out), a number of complex geomorphic and environmental challenges must be navigated in order to complete a successful opening. The opening is completed with a very small difference in water level between lake and sea, deep water is required in the feeder channel, sea conditions quickly overwhelm the beach, and wind fetch can alter the lake level by up to 1m.

In addition to the combination of required physical conditions outlined above for a successful opening, the National Water Conservation (Te Waihora/Lake Ellesmere) Order 1990 also directs when and at what level the lake can be opened to the ocean. This paper will describe how these challenges are met, along with the future challenges to come as a result of climate change.

Potential Origin of Mushroom Rocks in Barbados' Scotland District

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02F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 2:00 PM - 3:30 PM

A small tropical island mainly formed via tectonic uplift of an accretionary wedge, Barbados' rocky eastern coastline and northern coastal areas remain dotted with large coral limestone boulders, many of which have distinct basal notches. Instead of wave action, however, the tidal notch shape of these boulders is due mostly to bioerosion from West Indian chiton feeding patterns. While some of the smaller boulders are obvious products of headland erosional processes (e.g., sea stacks, undercutting), the larger, so-called "mushroom rocks" of the island's Scotland District do not match the area's main geology of sandstones, marls, clay/silt/mudstones, and older oceanic basement sediments. The leading (unsubstantiated) presumption for the large boulders' origins suggests they are remnants from mass wasting processes along Hackleton's Cliff ridge – a limestone member dated to >484,000 years ago (Upper Coral Rock, UCR) and approximately 1.5 km away from, and more than 300 meters above, the mushroom rocks' current coastal location, with an average slope of ~20o. However, younger, interdigitated coral limestone exposures (Middle Coral Rock, MCR, 127,000-484kya) surveyed near the shoreline displayed greater similarities in fossil coral species to the larger mushroom rocks, suggesting a more coastline-contiguous origin. We also compared the ages of MCR and morphology of the mushroom rocks determined by chiton feeding rates with fossil coral species in the UCR, considering current and potential paleoslope angles in the coastal MCR outcrops and higher elevation UCR. These data support the notion that Barbados' large mushroom rocks likely have an adjacent source rather than the always assumed but unsupported origin hypothesis of Hackleton's Cliff.

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Linking geomorphology and biogeochemisty to predict soil organic carbon stocks at landscape scales

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08C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 9:35 AM - 11:05 AM

Soil organic carbon (SOC) is the largest terrestrial pool of C, exceeding the size of the atmospheric pool by a factor of ~ 3 or more. Thus, changes in SOC can have pronounced impacts on atmospheric greenhouse gas concentrations (GHG) and climate. Wise management of SOC can modulate atmospheric GHG concentrations, help mitigate some of the negative effects of anthropogenic GHG emissions and improve soil health. In this context, inventories of SOC take on added significance. At global scales, inventories identify state and trend, possibly signally trajectories to tipping points, while national inventories serve to meet reporting requirements for global climate treaties. Inventories of SOC stocks are commonly based on empirical (statistical) models using training datasets and covariates derived from harmonised environmental data, remote sensing or topographic analysis. There is potential for improving inventories by developing semi-mechanistic models of SOC that link geomorphic and biogeochemical processes underpinned by detailed topographic data. Here we review a recent model relating topographic characteristics to erosion, soil production and soil residence time and ultimately the formation of poorly crystalline secondary minerals, which are fundamental in forming stable SOC pools. We present a data set from soils on hilltops with different curvatures in a superhumid region of western South Island, New Zealand to test the model's predictions. We conclude that the model as currently formulated fails to capture strong interactions of inorganic and organic phases in "podzolising" soil environments, which have a large bearing on mineral weathering rates and trajectories. We offer alternate model routines to account for these effects.

Long-term plant-herbivore dynamics and niche shifts in arctic–alpine ecosystems disclosed by ancient sedimentary DNA

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04K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 3, 2026, 9:35 AM - 11:05 AM

To respond to ongoing climate change and establish resilient ecological baselines, we need to understand the long to medium-term drivers of ecosystem dynamics. Biotic drivers may be as strong, or even stronger, than climatic drivers and changes in community composition can alter the ecological niches species occupy. Ancient sedimentary DNA (sedaDNA) has revolutionised our ability to study the formation and dynamics of past ecosystem by enabling the simultaneous identification of plant and animals from their past living and physical environment. Reconstructing past plant-herbivore interactions marks a crucial first step toward understanding ecosystem dynamics over time. Using sedaDNA, bones and archaeological data we show how the ecosystem of Northern Fennoscandinavia and the Alps changed over time and was virtually never the same as it is today. Emphasis is placed here on keystone species, such as the beaver and reindeer in the Arctic and domesticated animals (cattle, sheep et.) in the Alps. Although less complete, we show that other organism groups are also recorded including the immigration and establishment of freshwater fish, aquatic plants and even freshwater annelids (worms). The ability to be able to identify multiple biotic components of the ecosystem from a definable area makes this data far more valuable for defining past ecosystem states and potential equilibria than traditional proxies such as pollen. But further than this, the realization that key-species niche-size changes provides some avenues for exploring future ecosystem change in a warming world. So although Arctic-Boreal and Alpine ecosystems show resilience to increased interaction complexity, individual species may change their niche due to human influence such as reindeer husbandry, grazing regimes, hunting and introductions.

Pedogenesis vs. Morphogenesis in Vertisols: implications for OSL dating in the Brazilian Semiarid region

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Optically Stimulated Luminescence (OSL) has been applied to various soil types, including Vertisols, which are notable for their pedoturbation processes. The results of such analyses are often interpreted as depositional phases, without considering the roles of pedogenesis and morphogenesis. Our study aimed to understand the balance between pedogenesis and morphogenesis in the genesis of Vertisols and their impact on the ages obtained through OSL. We analyzed two Vertisol profiles in the Brazilian semiarid region: P1 in Souza, Paraíba, developed from sedimentary parent material; and P2 in Madalena, Ceará, developed from meta-igneous parent material. We conducted analyses of: a) particle-size distribution, to determine the quantity and predominance of soil particles and to assess the feasibility of using quartz for OSL; b) OSL dating in horizons Bv1, Bv2, BC, C/Cr, and C or BC, to determine the age of the material and evaluate whether it reflects pedogenesis or morphogenesis; and c) soil micromorphology, to assess the degree of development (pedality) and composition. In the Vertisols, sand content was predominantly concentrated in the horizons of profile P2 compared to P1, indicating a strong influence of the parent material in these horizons. The OSL results revealed Holocene ages that coincide with stabilizing current semiarid conditions in northeastern Brazil in both profiles, although older ages were found in P2. The micromorphological analysis of P1 revealed a crystalline birefringent, subparallel, and undifferentiated fabric with coarse material in Bv2, whereas P2 showed a granostriated fabric, suggesting a dual contribution: morphogenetic in P1 and pedogenetic in P2. These findings indicate that both profiles receive allochthonous materials. Still, the ages result from pedoturbation processes, with meta-igneous materials appearing more susceptible to pedogenetic processes or being exposed to them for more time (FAPESP 2020/16446-1).

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Reframing Landscape Evolution in Tropical Drylands: a pedogeomorphological approach to the lowlands of the Brazilian Northeast

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09J: Responses of geomorphic processes and earth surface systems to extreme weather and climate events, Conway 5, February 5, 2026, 11:35 AM - 1:05 PM

The Brazilian Northeast is a key region for investigating long-term landscape dynamics, shaped by morphogenetic processes such as the uplift of sedimentary basins, exposure of ancient massifs, differential erosion, and prolonged denudation. These processes contributed to forming the low-relief Sertaneja Surface, a prominent planation feature in the region. Although classical models, such as peneplanation, pediplanation, and structural geomorphology, have been proposed to explain its genesis, they often underestimate the role of soils as both archives of environmental history and agents of landform transformation. This study analyzes how soil characteristics and spatial distribution relate to different surface levels, using them as indicators of the evolutionary stages of the landscape. Soils were categorized into two main groups: those formed under humid paleoclimatic conditions, such as deeply weathered tropical soils (e.g., Latossolos), found in relict landscapes; and those developed under present-day semiarid conditions, including Planossolos, Luvissolos, Vertissolos, and Chernossolos (as defined by the Brazilian Soil Classification System), typically occupying low-relief positions. Their spatial stability suggests they correspond to a steady-state level in the landscape and are thus essential for interpreting planation surfaces. The presence of soils with contrasting climatic signatures at similar elevations and under comparable lithological and climatic conditions reveals a complex pedological mosaic. This diversity challenges the assumption that morphogenesis necessarily precedes pedogenesis, suggesting instead that multiple phases of landscape transformation have occurred. We argue that soils on the Sertaneja Surface offer critical insights into polygenetic processes shaping tropical drylands and advocate for an integrative framework in which pedogenesis and morphogenesis are interpreted as co-evolving processes across spatial and temporal scales, thereby enhancing our ability to reconstruct the morphoclimatic history of tropical drylands.

Spatial Distribution of Woody Vegetation within River Channels: A Case Study of Major Rivers in South Korea

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08A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 9:35 AM - 11:05 AM

Vegetation establishment within river channels alters fluvial landscapes and influences geomorphological processes. In particular, woody vegetation increases potential flood risks (Rood et al., 2019) and enhances ecological functions by diversifying habitats (Gurnell, 2014). Such changes have been observed in many South Korean rivers. Due to levees constructed on both sides, Korean rivers are spatially confined, making it essential to balance river management with ecological conservation. Accordingly, understanding the current status of surface cover within river channels is a critical first step.

Traditional field-based vegetation surveys have limitations in capturing the spatial complexity of dynamic river environments. To address this, the present study used Sentinel-2 satellite imagery and the Random Forest classification algorithm to assess surface cover in the Naeseong Stream(An et al., 2024). Ground truth data from 2016 were used for training, and the classification covered the period from 2016 to 2023. Surface cover was classified into four categories: open water, bare bars, herbal vegetation, and woody vegetation, with an overall accuracy of 85.1%.

This methodology was expanded to major rivers across South Korea. For each river, datasets from 2016 to 2023 were constructed. River channels were segmented at 1 km intervals to calculate the proportion of woody vegetation and a relative distance score, with higher scores for vegetation near the channel center, where flood risk is greater (Bae et al., 2024). Among 6,115 river segments, 3,868 were classified as low-density with dispersed woody vegetation, while 282 showed intermediate densities with potential to develop into high-density areas.

This study demonstrates the effectiveness of combining satellite data and machine learning for riverine vegetation monitoring and offers a cost-efficient, quantitative tool for decision-making on vegetation management within confined river channels.

LiDAR-Based Analysis of 19th-Century Fortifications in the Reims Region (France): Morphogenesis, Geoheritage, and Environmental Impact

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05K: Identification, quantitative assessment and mapping of anthropogenic landforms in urban areas, February 3, 2026, 11:35 AM - 1:20 PM

Following the Franco-Prussian War (1870–1871), the French government launched the ex nihilo construction of 234 forts, built using a variety of geomaterials and covered with massive earthworks involving several tens of thousands of cubic meters of fill. In Reims (northeastern France), a belt of 13 detached forts was constructed and modernized between 1875 and 1892, later integrated into the defensive networks of the WW1. This PhD research offers a morphological analysis of the "Séré de Rivières" fortifications, anchored in the broader field of geomorphological studies on the environmental imprint of warfare.

Using high-resolution airborne LiDAR data covering the entire Reims fortification belt, this study aims to (1) analyze the morphological structures resulting from the hybridization of topography and fortification design, (2) investigate the morphogenesis of these war-related anthropogenic landforms to decode the « palimpsest » of the current landscape, and (3) assess their multifaceted legacy—geomorpological, biogeographical, historical, architectural, military, and cultural—with implications for heritage conservation, ecological dynamics, and environmental risk assessment. These contrasting territorial trajectories—ranging from ruin and reforestation to abandonment, preservation, or museographic valorization—reflect the diverse outcomes of military landform integration into peri-urban environments.

The complexity of these artificial terrains calls for an interdisciplinary GIS-based approach combining geomorphology with archaeology, history, military and historical geography, geo-history, biogeography, and spatial planning, to explore past, present, and potential future landscape transformations.

This research situates war landforms within anthropogeomorphology, where war is considered a powerful shaping force of contemporary landscapes. It also contributes to the recognition of these inherited reliefs as geoheritage objects—carrying scientific, historical, and ecological value—and calls for their inclusion in landform classification frameworks, as well as in heritage management policies and strategies addressing the long-term environmental impacts of conflict-altered terrains, particularly in post-conflict and rapidly urbanizing areas.

Toward a carbon budget in the Arctic Canning River delta

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The carbon budgets of dynamic river corridors are less studied than surrounding terrestrial environments, even though eroded terrestrial material including carbon must pass through river corridors to reach the ocean. In river corridors, carbon accumulates through growth of pioneering riparian flora, deposition of exogenous organic matter, and burial. Decomposition and fluvial erosion remove carbon. We outline elements of a carbon budget for the fan-delta of the Canning River (70°N, 146°W) in continuous permafrost on the North Slope of Alaska.

Canning River delta deposits cover 980 km² of the ~32 km wide coastal plain abutting the Beaufort Sea. The three active gravel channel belts found in the eastern third of the delta contain anastomosing channels in summer but are fully submerged during spring freshet when clogged by ice. In the channel belts growth of willow (Salix)-dominated vegetation adds new carbon, although typical soil carbon stocks are low (3-10 kgC/m², to 0.3 m) and vulnerable to either removal and loss by fluvial scour, or burial and preservation by deposition. Delta deposits outside the active channel belts appear less disturbed and much older judging from their ice wedge polygons and more carbon rich soils (~18 kgC/m², to 0.3 m). These dominant delta deposits are eroded only where the channel flow impinges against the outer wall of a channel belt. Thermal undercutting mobilizes the sedge-shrub tundra in meter-scale turf blocks, a process favored in warmer summer flows despite lower stages that limit channel-outer wall impingement to ~10-30% of channel lengths. Toppled turf blocks line channel belt edges awaiting transport in higher stage flows and protecting banks in the meantime. Some proportion of transported turf blocks strand on bars. The net effect of riparian vegetation growth, and fluvial erosion, deposition and burial, on carbon stocks across river corridors has yet to be fully quantified.

Lingering beneath crumbing walls: the necessary conditions for rock glaciers

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03G: Open session on rock glaciers dynamics, Conway 2, February 2, 2026, 4:00 PM - 5:30 PM

Rock glaciers may appear to be stubby, slow-moving, debris-mantled cousins of glaciers, yet the controls on their formation, size, and persistence differ from glaciers. Their defining feature is a debris cover sufficiently thick to protect the icy core from ablation, even below the regional equilibrium line altitude. We therefore focus on controls on debris thickness at the down-valley end of the rooting zone, the area where avalanches and rockfall deliver the ingredients for a rock glacier. We incorporate debris input, ice accumulation, and the resulting surface speed of the rock glacier. Our model shows that rock glaciers exist in a narrow range of conditions that provides sufficient debris from eroding headwalls, and enough ice from focused snow avalanches to create a small ice accumulation area. The ice deformation speed sets the time available to accumulate the protective cover. A tradeoff between headwall backwearing rate and the duration that ice lingers in the rooting zone controls the conditions necessary for rock glacier formation and persistence. Quantitatively, if a 2 m thick debris cover is required to fully prevent melt of underlying ice, a 100 m tall headwall eroding at 1 mm/yr produces enough debris cover only if rock glacier surface speeds are less than 1 m/yr. This low speed limits the maximum length of rock glaciers. Where surface ages have been constrained, rock glaciers are found to have originated in the early Holocene. There is only so far, typically hundreds of meters, that rock glacier lobes can advance in the Holocene. The handover from glacial to rock glacial occupation of alpine valleys may involve complete deglaciation before rock glacier conditions are met. Finally, the headwall retreat required to produce a protective debris mantle far outpaces vertical summit lowering rates, offering an explanation for the asymmetry observed along ridgelines.

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Ground surface temperature linked to remote sensing land surface temperature in mountain environments

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04H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 3, 2026, 9:35 AM - 11:05 AM

Ground surface temperature (GST, approximately 5 cm deep) is a crucial parameter influencing all subsurface biophysical processes in the complex land-atmosphere interaction and is vital for understanding climate-induced impacts across various environments. Despite the GST significant importance, it remains a challenge to monitor the GST due to the high heterogeneity of surface cover and topography, and the sparse observational network. This work assesses the potential of the physical model GEOtop to simulate GST driven by satellite-based land surface temperature (LST) and climatic variables. The LST derived from the Terra MODerate resolution Imaging Spectroradiometer (MODIS) was downscaled to a finer spatial resolution of 250-m using data-driven sharpening from random forest algorithm. Comparisons at 14 weather stations in Matsch Valley, North-eastern Italian Alps, revealed larger LSTs than GST with an average difference of 7.9 °C from 2013 to 2017. The 1D simulations of GST at 1500 m elevation in meadows revealed the highest accuracy (r^2 = 0.96, RMSE = 2 °C, Bias = 0.68 °C) when the model was forced by hourly air temperature as the upper boundary condition. Forcing the model only based on daily LST revealed a lower accuracy (r^2 = 0.88, RMSE = 9.27 °C, Bias = –8.72 °C) but with a bias still in the range of the differences between the compared in-situ GST and MODIS LST. Forcing the model based on hourly air temperature and humidity, solar short-wave incoming radiation, precipitation, and wind speed, also revealed a high accuracy (r^2 = 0.95, RMSE = 2.57 °C, Bias = –1.76 °C). Although the model overestimates GST, the LST closely followed the pattern of the GST variability, suggesting the possibility of linking GST to LST products. Using the satellite LST as input in data-based models could simplify and improve the simulation of GST over large areas.

CanRoGI: Towards a National Rock Glacier Inventory in Canada as a Foundation for Geomorphic and InSAR-Based Analysis

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rock glaciers are key indicators of mountain permafrost and hydrological storage, yet remain poorly mapped across much of Canada's vast alpine regions. While comprehensive inventories exist for several alpine countries, Canada currently lacks a standardized rock glacier dataset at the national level. This project aims to address that gap through the development of the Canadian Rock Glacier Inventory (CanRoGI) which will be the first coordinated, nationwide inventory of rock glaciers in Canada. The project follows the guidelines established by the Rock Glacier Inventory and Kinematics (RGIK) Working Group (BPC v1.0) and leverages publicly available high-resolution imagery and digital elevation models to identify and classify rock glaciers based on geomorphological criteria. To date, rock glacier investigations in Canada have been limited in both spatial and temporal resolution, with only a handful of regional studies conducted using varying classification methods (i.e. 3 regional inventories within the past 5 years). This fragmented coverage underscores the need for a unified and consistent mapping effort. Current work is focused on regions such as Western Canada, the Yukon Territory, and Nunavut, where rock glaciers remain largely undocumented, further emphasizing the potential scale of these landforms across northern and western Canada. The resulting CanRoGI dataset will support interferometric SAR (InSAR) time-series analysis and enable future assessments of kinematic activity, permafrost stability/hazards, and long-term landscape evolution. It will also contribute to international efforts to standardize and compare rock glacier dynamics in the context of climate change. This contribution highlights the urgent need for coordinated rock glacier mapping in Canada and the foundational role of CanRoGI in advancing national and global periglacial science.

Distribution and Surface Morphology of Debris-Covered Glaciers and the Latitude Dependent Mantle (LDM) in Phlegra Montes, Mars

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02D: Planetary Geomorphology, Dobson 3, February 2, 2026, 2:00 PM - 3:30 PM

Debris-covered glaciers, or Viscous Flow Features (VFFs), in Phlegra Montes exhibit systematic variations in morphology and distribution with latitude. Using a newly developed Confinement Index (CI), we categorize 479 VFFs, ranging from fully confined (CI = 1) to fully unconfined (C=0). Our results show that CI values decrease at northern latitudes (>40°N), where low-relief landscapes host only unconfined and isolated glaciers. A focused analysis of 83 of these isolated lobate debris aprons (LDAs) reveals a southward offset in massif bedrock exposures positions and ice accumulation on pole-facing slopes, which is accentuated towards higher latitudes. SHARAD radar data shows that the total ice thickness increases with latitude, with a maximum thickness of ~390 m at 48°N. We identify five surface textures associated with LDAs (i.e. Lineated, Knobby, Undulating, Smooth, and Scalloped terrains), which exhibit latitudinal trends. We interpret Lineated terrain (30°-44°N) as a relict of active glacier flow, derived from Knobby terrain (28°-44°N), with a gradational lateral contact between the two facies. Smooth-Undulating (~40°–46°N) and Scalloped (>44°N) terrains are expressions of the LDM. Smooth-Undulating terrain reflects a range of surface roughness with no clear stratigraphy, whereas Scalloped terrain marks the most degraded form of the LDM, characterized by relatively high ice purity. Our findings suggest that the LDM, deposited episodically due to obliquity-driven climate variations, modulates and/or is modulated by subsurface ice. Overtime, ice degradation, sublimation, and debris redistribution influence the LDM with distinct surface textures, reflecting the long-term stability and modification of Martian debris-covered glaciers.

Assessment of urbanisation-related groundwater flooding process: a case study for Almaty, Kazakhstan

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Groundwater flooding might be triggered by disregarding hydrogeological processes during urban area development. Such flooding might result in public disruption, engineering infrastructure destruction and general damage to the natural and human environment. During the development of a new residential area in the northern part of Almaty city, repeated flooding of these newly developed neighbourhoods has started, which motivated research aimed at recognising the causes and the means for preventing the flooding. A MODFLOW groundwater flow model was used to simulate and quantitatively assess the changes in hydrogeological conditions affecting the flooding process. A field study of the Akbulak micro-district research site showed that groundwater rise caused flooding to occur in its centre owing to a water table hillock with a total area of 0.07 km2, with groundwater levels ranging from 1.2 to 0.25 m below the ground surface. The MODFLOW simulation suggested that this water table hillock developed from runoff, which, owing to a decrease in natural infiltration across the urbanised area, accumulated in low-elevation areas and infiltrated. This runoff accumulation effect may be up to eight times the annual average precipitation amount. Once larger runoff volumes in local sub-basins infiltrate into an underlying aquifer with a water table that is already high, groundwater flooding in populated areas might occur. The Almaty scenario simulation confirmed the field observations, suggesting that the clogging of the Karasu-type stream has concentrated runoff to low-elevation areas and is the leading cause of flooding.

Urban development effect on Mediterranean karstic mountainous watersheds

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11J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 5:00 PM - 6:30 PM

Anthropogenic development considerably influences a watershed's ability to absorb runoff. Transformation of permeable natural areas into impervious surfaces (e.g. roads, parking lots, and buildings) is altering the watershed response to precipitation, generating bigger runoff volumes with increased peak discharges. As climate change seems to motivate the generation of a larger volume of precipitation over a shorter time period, once such a large runoff volume travels to the watershed outlet, it might accumulate in intermittent basins and cause flooding. While a karstic rural landscape is highly permeable, impervious urban area land cover expansion is known to reduce this inherent permeability and cause runoff intensification. Urban area flooding often results in severe economic damage and even a life hazard. Runoff/recharge modelling is an essential tool for a water-sensitive urban area design, which may prevent such negative outcomes. In the establishment of such a model for flat terrains of porous and fractured lithological infrastructure, constant infiltration rate and runoff velocity may be assumed, which is not the case in mountainous karstic terrains. This presentation summarises an over a decade-long, detailed study that estimated the effect of urbanisation and climate change on runoff and groundwater recharge in a karstic mountainous terrain (Samaria) that encounters rapid urban area expansion. Within this study, several common, readily available models were integrated and adjusted to act as a nominal tool for urban mountainous karstic area hydrological modelling. The study indicates that optimal modelling resolution is not necessarily the highest available and that with the application of nominal resolution modelling, the urban area may be designed with local runoff sinks and retention areas, which can absorb the surplus urban runoff. It is also suggested that scattering many small-scale retention-infiltration systems across the watershed is more efficient than placing larger ones near flood-prone areas.

Assessing Landslide Block Movement with NDVI Ratio from Sentinel-2 and UAV Data in Hokkaido, Japan

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Monitoring the deformation rates of deep-seated landslides is crucial for hazard assessment, but it remains challenging in forested and remote areas. Here, we estimate landslide deformation using NDVI (normalized difference vegetation index) values derived from open-source Sentinel-2 satellite imagery. These slowly deforming landslides in forests may often cause increase in tree tilt with declining vitality, hence, reducing NDVI values. If satellite-derived NDVI values accurately represent landslide vegetation health, it may reveal deformation history and rate.

We applied this approach to the Otarimappu landslide (ca. 1.6 ha) in Hokkaido, Japan, consisting of seven internal blocks with distinct, active deformation histories, tracked by LiDAR (light detection and ranging) surveys since 2010, and compared to an adjacent inactive reference landslide (ca. 0.8 ha). NDVI values for 77 larches on active blocks and 20 on the reference were extracted from UAV (uncrewed aerial vehicle) multispectral data (8 cm resolution, 2021–2024) and Sentinel-2 images (10 m resolution). The standardized NDVI ratios were then calculated as the active/reference ratio to eliminate climatic variations. Field measurements of trunk tilt were also performed.

Results show that blocks with greater movement since 2010 had more tilted and unhealthy trees, as reflected by lower NDVI ratios. Despite the variability within active blocks, UAV and satellite NDVI values were strongly correlated. We found a linear relationship between annual block movement (V, m/yr) and satellite NDVI ratio (s): $V = -3.35s + 3.80$ ($R^2 = 0.78$).

These results demonstrate the promise of satellite-based NDVI for remotely assessing landslide deformation. Further research should address environmental variability and landslide history to refine this relationship.

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Seasonal Nitrate Concentration and Flow Regimes Control Nitrous Oxide Saturation Across Multiple Channels in Braided Rivers

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12A: River and catchment evolution, processes, and management, Auditorium, February 6, 2026, 9:35 AM - 11:05 AM

Human activities have increased reactive nitrogen inputs to rivers, intensifying emissions of nitrous oxide (N2O), a potent greenhouse gas and ozone-depleting substances. While rivers are a significant source of N2O, the interactive effects of hydrology and nitrate availability remain unclear. Braided rivers, with their dynamic, parallel channels, offer a unique system to examine these drivers. To assess how flow and nitrate influence N2O dynamics, eight braided rivers in Canterbury, New Zealand, were sampled: four small hill-fed rivers (average flow ~8 m3s-1) and four large alpine-fed rivers (average flow ~160 m3s-1), during winter and summer across multiple channel types (backwaters, side channels, and main channels). Concentrations of N2O exceeded saturation across all rivers and seasons. Hill-fed rivers had higher average N2O saturation, 215.8% (SD ± 118.9%), than alpine-fed rivers, 120.3% (SD ± 16.9%), with significantly higher summer values for both river types ($p < 0.001$), likely due to temperature-driven microbial activity. Higher N2O saturation in hill-fed rivers likely reflects slower flows and higher nitrate availability, while lower saturation in alpine-fed rivers is consistent with faster flows and frequent channel migration disrupting biogeochemical processes. A similar pattern of N2O saturation was also observed across channel types, with backwaters showing the highest average levels, 212% (SD ± 362%), followed by side channels, 176.6% (SD ± 255.4%), and main channels, 123.2% (SD ± 55.6%). All rivers showed a seasonal shift toward higher nitrate in winter but lower N2O saturation from summer to winter. By linking N2O saturation to the interacting effects of flow conditions and nutrient availability, this study advances our understanding of the mechanisms driving riverine N2O dynamics, highlighting how geomorphic and seasonal variability modulate saturations beyond braided river systems.

THE ATACAMA DESERT ROCK COAST: A MULTISCALE PERSPECTIVE ON WAVE-DRIVEN EROSION

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02F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 2:00 PM - 3:30 PM

The Atacama Desert rock coast provides a unique natural laboratory to study long-term interactions between tectonic activity, climate, and coastal erosion in a hyper-arid environment. Despite its geomorphological significance, evident in features such as the Great Coastal Cliff and extensive staircased marine terraces, this region remains understudied regarding the surface processes that shape its evolution. This work presents a multiscale approach to understanding wave-driven erosion and its role in the construction of the coastal relief along the Atacama Desert. By integrating morphometric analysis, numerical modeling, and field observations, we investigate the spatial and temporal dynamics of marine erosion across time scales ranging from annual variability to processes operating over 10^4 to 10^6 years. At short-term scales, we explore the influence of coastal geometry and wave refraction on erosion patterns. At long-term scales, we assess how wave erosion, intertidal weathering, sea-level fluctuations, and tectonic uplift collectively drive the formation and preservation of shore platforms and marine terraces. We develop a quasi-3D numerical model that simulates the evolution of rocky coastal landscapes under variable uplift rates and marine conditions. The model results are constrained using high-resolution digital elevation data and morphometric profiles extracted along the Atacama coast. Our findings emphasize the importance of lithological resistance, wave exposure, and platform geometry in shaping coastal forms. By adopting a cross-scalar framework, this study offers new insights into how dynamic erosive forces sculpt one of the world's longest and most striking desert coastlines. The results contribute to broader questions of landscape evolution under extreme climatic conditions and highlight the geomorphological complexity and scientific value of the Atacama Desert rock coast.

ALTITUDINAL BOUNDARIES OF KARSTIFICATION

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07B: Karst geomorphology, Dobson 1, February 3, 2026, 5:00 PM - 6:30 PM

Carbonate rocks cover 15.2% of the Earth's ice-free surface, making them one of the most widespread rock types. While previous research has explored the distribution of karst in relation to climate (e.g., tropical vs. temperate), age of carbonate/karst, and karst landscape types, few studies have quantified the development of karst features as a function of elevation. A global survey using ASTER GDEM satellite imagery enabled an analysis of karst distribution by altitude. As most carbonate rocks are marine in origin, the presence of carbonate karst decreases with increasing elevation. Roughly 24% of carbonate terrains (about 5.7 million km²) lie above 1,000 m, and only 6.2% (1.5 million km²) are found above 3,500 m. These areas represent 4.2% and 1.1% of the Earth's land surface, respectively. In the Western Hemisphere, high-elevation karst (>3,500 m) is mainly located along the Andes, while in the Eastern Hemisphere, it is concentrated on the Tibetan Plateau. At higher elevations, several factors hinder karstification: reduced atmospheric CO_2 and lower temperatures (which decrease CO_2 solubility), diminished soil cover (limiting epikarst development), and increased ice coverage that restricts infiltration. In Peru, high-altitude karst (>3,500 m) accounts for 37% (74.9 km²) of the country's total carbonate karst. Since 1989, climate-induced ice melt has reduced carbonate ice coverage by approximately 70%. Currently, large expanses of exposed limestone, free of soil and ice, are notably lacking in classical surface karst features such as dolines. Subsurface karstification appears to be primarily driven by hypogene processes, underscoring the contrasting roles of deep-seated versus surface-derived karst formation mechanisms at high elevations, and suggesting an elevation-dependent threshold for epigenic karst development.

Geomorphological consequences of urban expansion in hazard-prone areas: the 2023 Derna flood case

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The catastrophic flood that struck the city of Derna (northeastern Libya) on 10–11 September 2023, following the collapse of two upstream dams, caused more than 10,000 fatalities and widespread destruction. Over 30 million cubic metres of water and debris were abruptly released, resulting in one of the deadliest flood-related disasters of recent decades. Beyond the extreme meteorological trigger, the event reveals the cumulative effects of long-term anthropogenic pressure on a geomorphologically sensitive environment.

This contribution investigates the interaction between urban development and geomorphic dynamics within the Wadi Derna watershed, a steep and narrow catchment (575 km²) with short runoff concentration times and a natural predisposition to flash flooding. Over the past century, urban expansion in Derna has increasingly occurred on the lower sectors of the alluvial fan—an area historically exposed to episodic flooding and sediment reworking. This progressive land-use change has altered surface hydrology and significantly increased exposure and vulnerability to extreme events.

By integrating high-resolution satellite imagery from ESA’s Pleiades and SPOT 6/7 missions with geomorphological interpretation and digital elevation models (DEMs), we reconstruct the evolution of the urban landscape and assess the morphological consequences of the 2023 flood. A DEM of Difference (DoD) analysis allows precise quantification of erosion, sediment deposition, and topographic change, particularly in zones inaccessible to fieldwork due to damage or security constraints.

Framed within the GEOTRes project (PRIN 2022), this case study highlights the geomorphological implications of long-term, unregulated urban growth in hazard-prone environments. It underscores the necessity of integrating geomorphological knowledge with urban planning and remote sensing tools to anticipate and mitigate future impacts in vulnerable regions increasingly exposed to climatic and anthropogenic stressors.

Anthropic geomorphology in high-altitude Alpine settings: A multitemporal assessment

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05I: Human Footprint in River Basins AND Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 11:35 AM - 1:20 PM

High-mountain landscapes are particularly sensitive to human-induced modifications, which increasingly interact with natural geomorphic processes and contribute to the reconfiguration of slopes, sediment dynamics, and hydrological systems. In many cases, these transformations are not exclusively recent, but have a longer history linked to infrastructure development, tourism, and legacy land use.

This study focuses on selected sites in the Central Italian Alps—Cancano, Livigno, Stelvio Pass, and Cervinia—where the geomorphological imprint of human activity is evident across different temporal scales. Through the integration of remote sensing, historical aerial photography, archival research, and detailed field surveys, we reconstruct the evolution of anthropogenic impacts in high-altitude settings.

In the Cancano basin, early 20th-century dam construction altered fluvial morphodynamics and disrupted sediment connectivity. At Livigno and Stelvio, the expansion of ski resorts and related infrastructure since the 1950s has reshaped slope profiles, enhanced runoff, and triggered erosion and instability, particularly in paraglacial and periglacial environments. The Stelvio area also retains evidence of World War I engineering works—trenches, craters, and access roads—that continue to influence geomorphic responses.

In Cervinia, the interaction between the retreating glacier and the expanding touristic infrastructure provides a paradigmatic case of human–glacier co-evolution, with implications for slope stability, hydrological reorganization, and hazard exposure.

These examples, developed within the GEOTRes project (PRIN 2022), underscore the value of diachronic and multiscale approaches in assessing anthropogenic geomorphology. They contribute to a broader understanding of long-term human–landscape interactions and their relevance for contemporary landscape management in alpine environments affected by ongoing climate change.

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Is geomorphology sufficient to deciphering recent tectonic activity on intraplate faults?

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08D: Engineering Geomorphology, Dobson 3, February 5, 2026, 9:35 AM - 11:05 AM

Metropolitan France belongs to the intraplate domain, with low rates of deformation and seismicity. In 2019, a very shallow earthquake of magnitude Mw=5 shook the south of the country. The rupture broke the surface over a length of more than 4 km, reactivating as a reverse fault a former normal fault, unknown to be active. However, a series of paleoseismological trenches has shown that this fault and those associated with it in the same structural system, inherited from Paleozoic to Cenozoic histories, were activated during the last 25 ka.

While the kinematics of some recognized paleoearthquakes are consistent with those of the 2019 earthquake, the morphological signature of the faults remains clearly that of normal faults. This apparent contradiction can be explained by a combination of factors. Firstly, the cumulative offset during the extensional phases of these faults, reaching hundreds of meters, lead to the juxtaposition of highly contrasted lithologies, between massive limestones in the footwall and marls in the hanging wall: erosion thus exhumed the fault plane over several to ten meters, partially buried by the abundant accumulation of periglacial clasts derived from the limestone bar. Secondly, the moderate reverse offsets in the Upper Pleistocene/Holocene times are small compared with the scarp exposed by erosion. Recent tectonic inversion has therefore not yet succeeded in reversing the relief.
We conclude that morphology is a relevant tool for locating regional faults, as it is throughout the world, whatever the tectonic environment. It is thus a critical method for studies leading to the seismic hazard assessment because future earthquakes will be generated on the inherited structural canvas. However, this case study shows that only paleoseismology can decipher the kinematics and the timing of surface paleo-ruptures, in regions with a strong structural inheritance like the West European Platform.

Rapid socio-economic development drives differential channel adjustment in major Albanian rivers

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03A: Learned lessons about anthropogenic drivers in the river evolution, Auditorium, February 2, 2026, 4:00 PM - 5:30 PM

This study investigates the multidecadal hydromorphological evolution of three major Albanian rivers, known for high sediment loads and low channel fragmentation. In a context of limited environmental data, typical of many Balkan rivers, a combination of remote sensing, historical flow analysis, and GIS-based mapping was used to analyze channel changes over the past 60 years. Representative reaches were selected in each river system, characterized by distinct morphologies and degrees of human impact, to reconstruct active channel width trajectories from the 1960s to 2020.

The analysis reveals a general trend of channel narrowing across most of the reaches, though the timing, rates and magnitude of changes vary. Mountain reaches were generally less modified than lowland ones, where rapid socio-economic development is mostly concentrated since the early 2000s. Multi-thread, mid-course reaches show the most pronounced narrowing in the earlier period (1960–1990), whereas downstream reaches downstream of major sediment mining sites experienced stronger narrowing after 1990, together with locally relevant bed incision. This shift in temporal dynamics is linked to two dominant external drivers: reduced flow rates prior to 1990 and the intensification of in-channel sediment mining thereafter. The latter, largely unregulated to keep the pace of rapid infrastructural growth, which followed the fall of the totalitarian regime, led to increased morphological degradation and channel incision.

Statistical analysis confirms a decrease in monthly discharge until the early 1990s, with no clear trend afterward. The spatial distribution and intensity of sediment mining were mapped using multi-temporal high-resolution imagery, highlighting their concentration in downstream reaches. Overall, the study emphasizes the value of integrating historical imagery, hydrological data, and field observations to understand river evolution, especially in data-scarce regions. The findings show how rapid socio-economic development can drastically alter river dynamics, with implications for management, restoration, and hazard mitigation—common issues for Albanian and other Balkan rivers.

Deep learning in the shallows

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04F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 9:35 AM - 11:05 AM

Hāpua are coastal lagoons located at the mouths of braided, gravel bedded rivers which enter the ocean on mixed-sand and gravel beaches. They are characterised by freshwater dominance, a shore-parallel morphology, and are fronted by mixed sand and gravel barriers which intermittently close. Hāpua are globally rare, being only found on active margin coasts at high/low latitudes but are ubiquitous along the southeastern coast of New Zealand where they are of high ecological and cultural significance. The Canterbury Bight is an eroding coastline and contains 11 of the 29 hāpua in New Zealand.

Field work at hāpua is challenging, which means research has tended to focus on individual sites without integrating data/analyses on geomorphic change and its driving processes across multiple hāpua. As hāpua morphology changes daily – or even over tidal cycles, extracting useful data to quantify this change is time consuming and often impractical in the field. To address this, we have developed a deep-learning model capable of extracting hāpua surface water area, mouth state, and other morphometric variables using high-resolution, near daily frequency Planet imagery. In this approach we train a convolution neural network to automate the delineation of binary (wet/dry) masks to represent lagoon, barrier and tidally influenced river areas.

Our results show that CNN models trained with 90 scenes and a tile size of 10 pixels provide masks with the highest classification accuracy. From an 18-month analysis of hāpua imagery a strong relationship between lagoon surface water area and tidal prism is evident for the Rangitata hāpua. Results show that hāpua type lagoons do not fit into any existing inlet type class.

With increasing pressures of water abstraction, coupled with changing river regimes and sea-level rise, this novel approach will enable us to benchmark current conditions and better understand hāpua dynamics.

Holocene flood frequency at Vangsvatnet, western Norway, reconstructed from lake sediments

Dr Pål Ringkjøb Nielsen[1,2], Professor Jostein Bakke[1,2], Dr. Øyvind Paasche[2,3], Jan Magne Cederstrøm[1], Johannes Hardeng[1,2], George Young[1]
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10J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 2:30 PM - 4:00 PM

Instrumental records reveal an increase in precipitation in Norway over the past 120 years, with a marked rise after 1980 CE, leading to more frequent and severe floods—a trend consistent across Europe. Palaeoflood reconstructions from Southern Norway indicate non-stationary flood frequencies over the Holocene, with a notable regime shift around 4000 years ago. However, the seasonal drivers of these floods remain poorly understood. This study presents an 8000-year flood record from Lake Vangsvatnet, Western Norway, combining high-resolution computed tomography (CT) scanning, X-ray fluorescence (XRF), grain size analysis, and radiocarbon dating to differentiate between seasonal flood deposits (spring snowmelt vs. autumn rainfall).

The 11-meter sediment core reveals distinct flood layers classified as minerogenic (M), organic (O), and mixed (MO), linked to varying hydrological conditions. Historical discharge data (1892–2016 CE) validate the sedimentary record, with O-layers corresponding to spring/snowmelt floods and M/MO-layers to autumn/rainfall-induced events. The record shows fluctuating flood frequencies, with peaks at 6000–5300 and 1400 cal yr BP to present. A seasonal shift from rainfall-dominated to snowmelt-dominated floods occurred around 3100 cal yr BP, coinciding with regional cooling. The last 500 years exhibit the highest flood frequency of the entire record. These findings highlight the sensitivity of flood regimes to climatic and anthropogenic forcings. Under future warming, reduced snowpack may diminish spring floods, while intensified autumn rainfall could increase flood risks.

Holocene Glacier Variability in the Sub-Antarctic: Geomorphological and Sedimentological Insights from South Georgia and Kerguelen

Professor Jostein Bakke, Dr Fabien Arnaud, MsC Jarle Slerie Børve, Dr Talin Tuestad, Dr Henriette Linge, Dr Øyvind Paasche
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06G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 2:30 PM - 4:00 PM

Sub-Antarctic islands offer exceptional natural archives for understanding long-term cryospheric and climatic variability in the Southern Hemisphere. Drawing on decades of research, this study presents new reconstructions of Holocene glacier dynamics from South Georgia (54°S, 36°W) and the Kerguelen Archipelago (49°S, 69°E), based on integrated glacial geomorphological mapping, cosmogenic ^36Cl exposure dating, and lake sediment coring.

In South Georgia, glacier-fed lake sediments and moraine chronologies reveal a pattern of gradual glacier retreat since the Antarctic Cold Reversal (14.5–12.8 ka), interrupted by at least nine readvances over the past 10.5 ka. These fluctuations are linked to changes in summer insolation and modulated by shifts in the Southern Hemisphere westerlies (SHW) and the Southern Annular Mode (SAM). On Kerguelen, a 1200-year sediment record from a glacial threshold basin, supported by 17 new exposure ages, documents glacier advances during the Late Holocene, including a significant re-advance at 1.4 ± 0.3 ka.

The synchronicity of glacier advances across South Georgia, Kerguelen, and southern Patagonia suggests a hemispheric-scale response to SAM-like variability. The discovery of Early Holocene moraines on Kerguelen—previously undocumented—further enhances our understanding of glacier sensitivity to climate forcing in the Southern Ocean region.

This research highlights the importance of integrating geomorphological mapping with sedimentological archives to reconstruct glacier histories and enhance our understanding of past climate dynamics. These findings contribute to a growing body of evidence on the role of sub-Antarctic glaciers as sensitive indicators of atmospheric circulation changes, providing a critical baseline for assessing future cryospheric responses.

Understanding Natural Periodic Soil Movements in Long-term Monitoring Data

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Periodic signals in monitoring time series may originate either from sensor behaviour—particularly due to temperature sensitivity—or from actual, reversible movements of soil layers driven by variations in temperature and water content. Ideally, sensor-related influences can be minimized through calibration or correction procedures (a priori), but this approach is often complex and rarely fully effective—some residual effects almost always remain. As a result, periodic components are frequently removed during time series analysis without fully considering their origin. However, this process typically eliminates both sensor-induced artifacts and genuine cyclic soil responses. Consequently, such signals are often overlooked, with analytical attention focused primarily on long-term trends, velocity changes, or sudden displacements considered as main indicators of potential slope instability.

In our research, we shifted focus also toward analysing the periodic signals themselves across different monitoring methods—remote sensing, terrestrial geodetic techniques, and subsurface geotechnical instrumentation. After accounting for temperature-induced measurement biases, we concentrated on natural periodic movements in near-surface soil layers. Our findings suggest that both temperature and water content can act as key triggers for these movements.

Field monitoring confirms that temperature gradients can induce measurable near-surface soil displacements. Laboratory tests show that even minor temperature changes (~1–2 °C) significantly affect soil parameters such as shear strength, compressibility, viscosity, and hydraulic conductivity. These thermal effects can alter pore water pressures and generate mechanical stress and strain within soil masses, leading to seasonal fluctuations in slope stability. Such effects are particularly pronounced in slow-moving landslides or slopes close to failure, shallow slides (less than 5 meters), and in soils with fractures or high clay content, where thermally driven processes and enhanced heat transfer dominate slope behaviour.

Paraglacial geomorphology in the 21st Century: an overview

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10G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 2:30 PM - 4:00 PM

Our developing understanding of paraglacial landscape modification is here employed (1) to suggest a revised general model of paraglacial sediment transfer; (2) to test the validity of exhaustion models in representing the temporal trajectory of paraglacial sediment flux; and (3) to highlight the synergic relationship of glacial erosion and paraglacial processes over successive glacial/paraglacial cycles.

It is argued that the paraglacial sediment cascade model requires modification to take into account the connectivity of different components, mainly controlled by the coupling (or otherwise) of hillslope sediment delivery and fluvial sediment entrainment, itself largely conditioned by topography and sediment calibre. Dating of paraglacial rock-slope failures has shown that the timing of these rarely if ever conforms to a simple negative exponential exhaustion model. The trajectory of paraglacial sediment entrainment, movement and re-deposition by small-scale rockfalls, debris flows, hillslope runoff and rivers may broadly be approximated by exhaustion models but is strongly influenced by extrinsic circumstances such as extreme climatic events, climate change, seismic events and base-level (or sea-level) change that lead to rejuvenated sediment flux.

Finally, although most post-2000 developments in paraglacial geomorphology have focused on landscape modification associated with post-LGM deglaciation or recent glacier retreat, the implications of successive Pleistocene glacial/paraglacial cycles for long-term landscape evolution are now beginning to be explored, and are here illustrated with the respect to the relationship between interglacial rock-slope failures and the geomorphology of alpine-style ‘glacial’ landscapes.

Stream power mapping to predict river channel response to watershed urbanization

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Watershed urbanization increases runoff volumes and peak flows, often leading to changes in channel morphology including channel widening and planform change. Understanding changes in urban watershed hydrology over time can form the basis for predicting river channel response. The Stream Power Index for Networks (SPIN) tool is designed to model stream power continuously along a river network based only on topographic and land cover information, and an established relationship between watershed area and stream discharge. Adding a hydraulic geometry function based on total stream power predicts changes in channel width and specific stream power. Highland Creek, located in Toronto, Canada, experienced extensive land cover changes due to almost-complete urbanization since the late 1950s with urban area increasing from 30% in 1966 to 80% in 2017 in a watershed of 100km2 , with approximately five-times increases in peak flows caused by urbanization. The SPIN tool was used to predict the historical progression of the response of river channel width to urbanization from seven epochs of land cover change during the decades of expansion of urban land cover. These results were compared with measurements of channel width from aerial photos for the years coinciding with the land cover mapping epochs. The results show a progressive increase in stream power and channel width correlating with urban land cover at each epoch. Overall, the predicted results reliably modelled the spatial and temporal pattern and magnitude of channel response, although the effects of two large floods are an important but unpredictable component of the channel change history and timing, along with restrictions of actual channel widening because of channel engineering. The SPIN tool approach has great potential for application in the management of future channels within urbanizing environments, including locating morphologically vulnerable areas and anticipating the effects of planned interventions and channel control.

Temporal evolution of debris flow susceptibility in paraglacial alpine environments: a multi-decadal analysis from the Eastern Italian Alps

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

High-altitude Alpine regions exhibit heightened sensitivity to climate change, with pronounced effects on cryospheric dynamics and slope stability. Post-Last Glacial Maximum deglaciation has progressively expanded paraglacial domains, enhancing mass-wasting susceptibility across recently exposed terrain. Debris flows represent dominant geomorphic processes in these environments, affecting both proximal source areas and distal catchment sectors.

We present multitemporal debris flow susceptibility maps for the Valpiana Valley (Presanella Group, Eastern Italian Alps), developed through geomorphological analysis and statistical selection of causal factors. Considering the central role of debris flows in sediment transfer, we also evaluate topographic connectivity between source areas and downstream zones. Our analysis reveals substantial increases in debris flow susceptibility between 1983 and 2015, with higher susceptibility classes expanding across 35% of the study area.

Temporal changes exhibit distinct spatial patterns: screes and debris cones show pronounced susceptibility increases. High-susceptibility zones increasingly concentrate along established debris flow channels and unconsolidated sediment accumulations, contrasting with decreased susceptibility on exposed bedrock surfaces. Holocene glacial deposits demonstrate the most pronounced evolution, with 50% of the surface now affected by the highest susceptibility class.

Statistical analysis confirms that extreme rainfall events, particularly the 1987 episode, triggered positive feedback mechanisms through channel modification and sediment mobilization. Contributing area emerges as the primary controlling factor, with intensifying influence through time. These patterns reflect climate-driven destabilization of paraglacial landscapes and the growing dominance of debris flow processes in contemporary Alpine geomorphology.

Our results underscore the growing geomorphic instability of high-mountain paraglacial landscapes under ongoing climate change, emphasizing the increasing significance of debris flows in shaping these environments. Furthermore, the analysis of debris flow processes in uninhabited alpine settings offers valuable analogues for interpreting similar morphologies on Mars, thereby contributing to the understanding of extra-terrestrial slope dynamics and surface evolution.

Geo from the morphology and morphology from the geo: some New Zealand perspectives

Mr David Barrell[1], Dr Dougal Townsend[2], Ms Julie Lee[2], Dr Katie Jones[2], Dr Kyle Bland[2]
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13H: Quaternary Geomorphology and Landscape Evolution, Conway 3, February 6, 2026, 11:35 AM - 1:05 PM

Information on rocks and poorly-consolidated deposits has long been conveyed via geological maps. Making geological maps has been a core aspect of government-funded geoscience practice for the New Zealand Geological Survey, established 1865, and since the late 1980s, its successor institutions. Information on the nature and origin of landforms generally came from textbook examples, especially from the books and papers of famous New Zealand (NZ) geomorphologist the late Sir Charles Cotton. Geomorphological information has also been a relatively important, though typically implicit, component of soil maps.

Although seldom emphasised, geomorphology has been an important part of the NZ geological mapper’s toolkit, via the use of landform characteristics to infer the position of contacts between different geological units and the nature of the lithology. The regional-scale mapping of Quaternary geological units has been heavily based on landforms, thus getting the geo from the morphology. So even though primarily a geomorphological unit, the Quaternary geological units were always emphasised as deposits. The emergence of digital GIS maps has made it functionally easy to represent geological map polygons as geomorphologically-described units. But it can be surprisingly difficult to get a satisfactory morphology from the geo, because many different types of geological map unit do not have distinctively different landform characteristics.

Illustrations of interplays between geological and geomorphological mapping in NZ include a Southern Alps example where a traditional geological map, and a geomorphological map highlighting glacial landforms, each conveys different but complementary, mutually valuable, information. Another example is the conversion and re-framing of regional geological map polygons to produce a geomorphological map emphasising the coastal landform environment. In NZ urban areas, compilation of detailed geoscientific datasets is tailored to local geological conditions. Some places need companion geological and geomorphological maps, whereas elsewhere a single map characterising both geological and geomorphological information may suffice.

Morphology of the Philippine Rise from high resolution bathymetry: Implications for tectonics, planetary studies, oceanography, biodiversity conservation, and national identity

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07E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 5:00 PM - 6:30 PM

The Philippine Rise (Benham Rise), located in the northwest Pacific, is the only oceanic plateau completely mapped with multibeam echosounder. Swath bathymetry data, originally intended for delineating extended continental shelf under UNCLOS, revealed the morphology of large-scale undersea features making up the rise. These include a main body (>300 km in diameter) with a shield platform base, a caldera (>100 km in diameter) on its crest, and three spurs extending 100-200 km from its eastern side. Ridges, terraces, and numerous seamounts, hills and mounds are also present. Knowledge of the rise's detailed morphology paved the way to an enhanced understanding of the region's tectonic history, provided an Earth analogue for giant calderas observed on other planets, aided studies of ocean circulation, influenced the creation of a large marine protected area, and enabled the naming of undersea features. Coupled with geological and geophysical data, the Philippine Rise was identified to be a large igneous province formed by ridge-plume interaction. Comparison with Atira Mons' caldera on Venus showed many morphological similarities with the Philippine Rise's caldera. Oceanographers studied how its topography affect the Kuroshio Current. Conservationists and local government partners used morphology as basis to define boundaries for a 150,000 km2 ocean biodiversity conservation area. Undersea features were given names consistent with international standards and reflect local culture.

The Philippine Rise example shows that there is significantly more to discover and learn if we map the world's entire seabed.

Differentiating natural variability from human induced recovery. Geomorphology has a lot to offer, but we need a multidisciplinary approach

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06A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 2:30 PM - 4:00 PM

During the United Nations Decade on Ecosystem Restoration, there is growing global attention on the methodologies and outcomes associated with restoring degraded landscapes. Environmental markets play a key role by assigning economic value to certain ecosystem services, offering credits or financial incentives for activities that generate measurable environmental benefits. Geomorphology, the study of surface features and processes, is well positioned to support these initiatives. The physical landscape underpins improvements in carbon sequestration, biodiversity conservation, and water quality—three pillars of emerging environmental investment. However, a major challenge lies in distinguishing between natural variability and human-induced disturbance or recovery. This distinction is critical to ensure that credits and incentives reflect genuine ecological improvements.

In the Great Barrier Reef (GBR) catchments, decades of research have identified erosion "hotspots." Many of these areas are now undergoing active remediation. Yet, defining and quantifying success at the spatial and temporal resolutions required for environmental markets and natural capital accounting remains complex. This presentation will showcase how techniques—such as cosmogenic nuclide analysis (^{10}Be) and optically stimulated luminescence (OSL) dating—have been integrated with sediment flux monitoring to identify areas at high risk of anthropogenically accelerated erosion. Additional case studies will illustrate how climate-adjusted remote sensing data can assess vegetation dynamics, a key factor influencing erosion. While these methods offer valuable insights, they are resource-intensive and time-consuming. In contrast, government-supported operational or market-based programs for landscape restoration often prioritise consistency and scalability over innovation. As a result, we are often left asking more questions such as:

- At what spatial and temporal scales should we be measuring change?
- How do we balance empirical measurements with remotely sensed or modelled data?
- How should we account for the impacts of extreme events?
- And critically, what is the role of research in informing and supporting operational landscape repair programs?

Holocene Infill of a Large Structural Estuary: Westernport Bay

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05F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 11:35 AM - 1:20 PM

The morphodynamic evolution of estuaries is determined by hydrodynamics and sediment supply. In some large estuaries mouth morphology is strongly controlled by bedrock structures. These Large Structural Estuaries (LSEs) have relatively stable entrances over millenial timescales. While LSEs are morphologically similar to Barrier Estuaries, their morphological controls on hydrodynamics developed independent of Holocene estuarine morphodynamics. The infill of LSEs is poorly explored, but initial research suggests infill is determined by fluvial supply. Westernport Bay is a tide-dominated LSE on the microtidal wave-dominated coast of Victoria, Australia. It is distinguished from other LSEs by a low fluvial sediment supply and has been tectonically stable setting during the Holocene. The aim of this study is to explore the Holocene evolution of Westernport Bay to identify characteristic infill processes for LSEs under low sediment conditions, and by comparison, produce a generalised model of Holocene infill. 12 sediment cores were collected across the Upper North Arm of Westernport Bay. They were subsampled for radiocarbon dating, sediment grain size, and carbon content. The initial infill of Westernport Bay occurred via vertical accretion. Sedimentation rates increased when sea level fell during the Holocene Marine Regression (~3-1kya). The sediment showed an upward coarsening trend toward the top of the cores suggesting that wave-base winnowing is now occurring and sediment deposition has slowed. This is similar to other transport dominated estuaries on tectonically stable coastlines. However, a comparison of the evolution of several LSEs under different conditions suggests that distinct end-members arise due to local tectonics, geomorphologically forced local hydrodynamics, and relative fluvial supply. A conceptual model of LSE infill and end-members is presented.

Quantifying Subglacial Water Flow Using Glaciohydraulic Tremor: A Multi-glacier Analysis

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Glaciers and ice caps store over 68% of the Earth's freshwater, serving as critical reservoirs for over 1.9 billion people in downstream communities worldwide (Ciracì et al. 2020; Gleick, 1996). Accelerated melting driven by anthropogenic climate change disrupts subglacial hydrological systems, impacting ice movement, water flow, and bed erosion. Meltwater and precipitation drain through the ice into these networks, generating seismic energy upon interaction with the bed, known as glaciohydraulic tremor, which is detectable by seismometers on or near the ice (Gimbert et al. 2016). Tremor acts as a proxy for subglacial discharge, revealing trends in melt variability, sediment transport, and larger-scale glacier dynamics (Gimbert et al. 2016; Bartholomaus et al. 2015). Despite strong empirical correlations, the quantitative relationship between tremor characteristics and subglacial discharge remains poorly constrained, and existing theoretical models lack rigorous validation.

This project seeks to quantify the non-linear relationship between tremor amplitude and subglacial discharge using a statistical regression framework, while investigating how local factors, such as glacier size, source-receiver distance, and ice geometry, influence this relationship through multivariate analysis. These hypotheses will inform the development of an empirical model, evaluated alongside existing theories (Gimbert et al. 2016). The study employs an extensive dataset, integrating stream gauge records, weather station observations, Digital Elevation Models (DEMs), climate and hydrological modelling, and passive seismic observations from glaciers across Alaska and Central Europe. Ultimately, this research aims to advance the capacity to use seismic methods as a reliable proxy for subglacial discharge, offering valuable insights into large-scale glacier processes and enhancing our ability to predict glacier change.

The Decolon-ice-ation of Glaciology: An Indigenous, Feminist Analysis

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Modern glaciology has largely been shaped by exploration narratives and reductionist research methodologies, often rooted in Western colonial frameworks. This project reimagines glacial environments through the process of deep mapping, examining their significance across Indigenous ways of being, historical exploration, sociopolitical contexts, academic discourse, and the geohumanities. It will begin by probing my own positionality as a researcher, acknowledging the lands that sustain my personal livelihood and the environments that inspire my work. This project highlights existing gaps in cryospheric research, situating its broader importance within the geosciences and society. The intricate relationships embedded within glacial landscapes—rock, water (in all phases), life (of all scales), external influences, and environmental change — will be explored through a dynamic, holistic lens. Drawing from a systematic literature review and a non-systematic analysis of gray literature, this project will examine existing frameworks grounded in anti-colonial principles, Indigenous science, and community-engaged methodologies. It will consider how these values may remain embodied in cryosphere research, particularly in contexts where Indigenous presence, local knowledge, or community engagement is limited or absent. Limitations, assumptions, and biases of this work will be reframed through perspectives of harmony and hope. It will invite the audience into self-reflection and a broader call to action, advocating for a reimagined framework of glaciology research grounded in relational accountability, resurgence, and reciprocity. By unsettling dominant paradigms and honoring knowledge plurality, this work envisions the field of glaciology as grounded by relationality, embodiment, and justice.

How abrasive is a bedrock river?

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Rocky river beds are crucial sites for landscape evolution, as they represent baselevel heights. Here, bedrock is exposed to sediment impact abrasion due to missing protective cover. Such conditions occur where sediment availability is lower than transport capacity, being a general catchment pattern or a local phenomenon at steeper slopes downstream of covered bed sections. At rocky beds, different from alluvial sections preventing abrasion predictions due to unknown spatio-temporal bedrock exposure, grain trajectories could be assumed discrete. Thus, given discharge and sediment parametrizations, here bedrock abrasion potential is predictable.

Assuming different grainsize distributions (GSDs), lithology-specific abrasion is calculated across discharge recurrences by coupling a grainsize-resolved sediment transport model with a mechanistic total abrasion model. Abrasion efficiency peaks at specific water depths, independent of GSD's mean grainsizes (D50), while wider GSD shapes (decreased grain sorting) increase it. Usual GSD representation by single grainsizes (D50, or D84 in mountain rivers) misses common discharge's abrasion, and stream-power based predictions (USP) fail reproducing sediment-driven abrasion patterns. Instantaneous abrasivity from D50/D84 predictions start above daily to monthly discharges and rise by two orders of magnitude to millennial recurrences. Long-term predictions reveal potential bed-normal abrasion of 100s of meters ranging by factor five within the different GSDs.

This assessment assumes constant under-capacity conditions, fixed GSD feed and neglects bedrock surface evolution. Still, it shows a bedrock river's abrasion potential is predictable given rock strength, GSD and hydrologic regime. Total annual abrasion could exceed meters (equaling magnitudes of rock plucking) and already common discharges over months to years could abrade centimeters – consistent with longer-term bedrock river evolution studies. Predictions using a dominant grainsize (D50 or D84) neglect abrasion for common discharges, while USP modeling is unrealistic. The method allows long-term abrasion assessment for landscape evolution, but also addresses event-based evaluations of hazard potential for hydraulic structures.

The Irish continental margin: where seafloor mapping, blue sky and applied research meet

Professor Sara Benetti[1], Dr Aggeliki Georgiopoulou[2], Mr Benjamin Gibson[1], Dr Fabio Sacchetti[3]
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05E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 11:35 AM - 1:20 PM

The seafloor around Ireland has been mapped to an unprecedented level of detail for a maritime country with such a large marine territory. The Irish National Seabed Survey (2000-2006) and the INFOMAR programme (2006-2026) have now surveyed almost 100% of Ireland's continental margin and made available to the public, with funding and full support of the Irish Government, many marine geophysical datasets including multibeam echosounder (MBES) bathymetry and backscatter, shallow seismic profiles and groundtruthing datasets. These data are readily accessible to the research community. This contribution will show some of the extensive geomorphological mapping work that has been carried out in both shallow and deep water. We will visit the glacial landscape of the continental shelf and move into deeper water through canyons and channels, including the staggering Gollum Channel System in the Porcupine Seabight and the Donegal-Barra trough-mouth fan, to the Rockall Trough and its complex abyssal plain documenting the interplay of alongslope and downslope processes. We will then explore some examples of how these data have provided the background for the development for many more avenues of both fundamental and applied research in marine geoscience in Ireland.

1150

Multi-Scale Impacts of Climate Variability on Shoreline Change in Mediterranean and Black Sea Deltas

Mr Alexandru Berbecariu[1,2], Mr Florin Zăinescu[1,2], Mr Florin Tătui[1], Mr Bruno Castelle[3], Mr Florin Miron[1], Mr Alfred Vespremeanu-Stroe[1]
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08F: River Deltas: Dynamic Systems Under Climate and Human Forcings, Conway 1, February 5, 2026, 9:35 AM - 11:05 AM

Coastal dynamics along the Mediterranean and Black Sea basins are influenced by both wave climate and atmospheric oscillations. This study investigates the relationships (teleconnections) between wave power, climate indices and shoreline change between 1984 and 2022 across various erosional deltaic coasts, including Danube (Romania), Rhone (France), Ebro (Spain), Nestos (Greece) or Nile (Egypt). Using satellite-derived shorelines, wave power (kW/m) and multiple climatic indices (NAO, EA, EA/WR, SCA, MO), we applied both Pearson moving-correlations and wavelet spectral analyses to assess temporal relationships at different scales. Results show significant erosion across all study sites as coastal area losses reached 60% in the Danube Delta, 50% in Rhone, 18% in Ebro, respectively 10% in Nestos and Nile. An overall decline in coastal dynamics was observed post-2010. Wave energy and shoreline change display stronger correlations at multi-decadal scales, with localized climatic signals dominating at shorter timeframes. Notably, the Danube and Nestos deltas are showing higher correlations between wave variability and atmospheric forcing, suggesting a common Eastern Mediterranean–Black Sea climatic control. These findings highlight the necessity of a predictive regional climate index adapted to these semi-enclosed basins, an alternative approach being the development of localized climate indices to better capture and explain variability.

Soil organic carbon dynamics due to piping erosion

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Piping erosion affects both topsoil and subsoil, and it is often associated with gully development. Till now, there has been no research on the role of this subsurface process in soil organic carbon (SOC) dynamics. Therefore, this study aims to recognize the dynamics of SOC due to piping erosion in mid-elevation mountains under a temperate climate (SE Poland). In the study area, piping erosion occurs in grasslands and in young forests (<70 years old; formerly pastures). Soil profiles were done in three land cover classes: grasslands, young forests (<70 years old), and in old forests (>100 years old). Standard soil analyses were performed, i.e., soil texture, structure, consistence, porosity, bulk density, pH, exchangeable cations, sodium absorption ratio, SOC content, dissolved organic carbon (DOC) content, and total nitrogen content. The analysed soils represent Cambisols dominated by silt loam textures with the highest SOC values in the uppermost horizons. Soils both in old and young forests are more acid (pH <5 in the upper horizons) and contain more SOC (2.97%) compared to soils in grasslands (pH >5, SOC 1.78%). Although SOC concentration in grasslands is generally lower than in forests, its sequestration is usually higher due to the formation of mineral-associated soil organic matter. Piping erosion affects SOC-rich upper soil horizons and lower horizons that have a lower but more stable SOC pool. The eroded material is transported through the pipes to gully heads, and then to fluvial system. Piping, often associated with gully erosion, may have mainly a negative impact on SOC dynamics compared to surface soil erosion, which not only negatively impacts eroding sites but can also have positive effects on depositional sites.

The research was supported by a grant from the Priority Research Area ‘Anthropocene’ under the Strategic Programme Excellence Initiative at the Jagiellonian University, Kraków, Poland.

Unveiling the magnitude of soil piping at a regional scale: mapping pipe collapses using LiDAR-derived DEM (SE Poland)

Dr Anita Bernatek-Jakiel[1]
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02H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring AND Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 2:00 PM - 3:30 PM

Soil erosion is the most significant threat among all soil degradation processes and poses a risk to healthy soils. The study of subsurface erosion caused by soil piping is often restricted to the hillslope or small catchment scale due to the subsurface nature of the process and methodological challenges in detecting its associated landforms and features. The regional and global extent of soil piping remains largely unknown. However, the increasing availability of high-resolution, LiDAR-derived elevation data enhances our ability to analyze and understand this specific erosion process. Evidence of soil piping becomes visible at the surface when the roof of a pipe collapses, forming features known as pipe collapses (PCs), which can be identified on hillshaded digital elevation models (DEMs). This study aims to assess the magnitude of soil piping at the regional scale by mapping PCs in the Bieszczady Mountains (Carpathian Mountains, SE Poland) using a freely available LiDAR-derived DEM with 1 m resolution. Expert-based on-screen mapping identified over 11,400 PCs within the 2,212.80 km² study area. The density of PCs ranges from 0 to 122 PCs/km². This newly developed database enables a better understanding of the factors controlling soil piping and its role in landscape evolution. Soil piping contributes to gully development and is strongly influenced by land use and land cover changes in the study area. PCs are predominantly located on grasslands and in young forests (<70 years old), and often found above gully heads. The use of LiDAR-derived DEMs has made it possible to delineate the spatial extent of soil piping features at a regional scale which was not previously possible through traditional field-based geomorphological mapping.

"The study is supported by the National Science Centre, Poland within the project OPUS 29 (2025/57/B/ST10/01326)."

1110

Contribution of airborne LIDAR to the understanding of hydrosystems: example of the Montagne de Reims (northeastern France)

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04I: Human Footprint in River Basins, Conway 4, February 3, 2026, 9:35 AM - 11:05 AM

Airborne LiDAR is increasingly being used in geomorphology to study river mobility beams, slope dynamics and more. Nevertheless, interfluves, particularly in northeastern France, remain little studied despite growing LiDAR coverage. This presentation takes the Montagne de Reims, at the eastern end of the Île-de-France cuesta, as a starting point for analyzing the structure and evolution of the hydrosystem during the Holocene.

Although this 250 km² area has great potential for heritage enhancement, it remains largely occupied by private forests, limiting access to the field and overall understanding of geomorphological dynamics. The approach combines LiDAR data with a multi-scale, diachronic spatial analysis using GIS, supported by field observations, to discriminate hydro-geomorphological forms according to their genetic, historical and hydrodynamic criteria.

The results reveal a hydrosystem inherited from a multi-phase trajectory, shaped by the interaction between natural dynamics and human intervention. Geological controls explain aquifer disparities along the east-west axis, while quaternary legacies induce slope asymmetry and geomorphological processes such as landslides and karstification. On a historical scale, climatic and anthropogenic forcings condition hydrological contrasts between plateaus and valleys, influencing the hydrographic system.

By proposing a conceptual model of current hydrosystem functioning, this presentation illustrates the value of LiDAR-based geomorphology for understanding past and present interactions between environmental constraints and human uses. It is part of a wider reflection on the role of interfluves in the hydrosystem and proposes a reproducible methodological framework.

Multi-year observations of beach-shoreface morphodynamics at a macrotidal embayment in NW France: forcing mechanisms and timescales of geomorphic change

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02E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 2:00 PM - 3:30 PM

Sediment exchanges between the beach and shoreface are rarely quantified, meaning the understanding of forcing mechanisms and timescales, important for coastal management and to enable predictions, is currently lacking. For embayed beaches, the initial assertion of a mostly closed sediment cell implied that beach sediment eroded during storms is stored on the shoreface, before a progressive return to the beachface during low energy periods. This is increasingly challenged by new research highlighting the eventuality of sediment by-passing, as well as sediment inputs from deeper regions, during extreme events.

This study makes use of a multi-method dataset of beach topography and nearshore bathymetry at Porsmilin, a macrotidal embayment in NW France, with the general objective to improve our understanding of the forcing mechanisms and timescales associated with beach-shoreface sediment transfers. Covering 2003-2020, the survey period comprises several energetic winters. To help comprehend geomorphic change and environmental controls, morphological surveys were assessed in relation to waves and water levels derived from numerical models and field observations.
Our results demonstrate that beach and shoreface react differently to hydrodynamic forcing. Volumetric changes of the upper and lower intertidal zones have a seasonal component and mirror each other, indicative of a cross-shore dominant behaviour, while the middle intertidal zone presents reduced volumetric variations and no clear seasonal signal. Sediment budget at the event-scale (storms) is determined by the concomitance of various factors, including wave height, water level and pre-storm beach state. Multi-annual evolution is modulated by climate variability and essentially relates to erosion during the winter 2013-2014 and subsequent recovery, which was responsible for the most notable sediment transfers with the shoreface. Still representing a challenge, we show that careful management of measurement errors is critical to reconcile disparate datasets, enabling realistic quantifications of volumetric budgets from the dune to the depth of closure.

Characterizing and modeling roots of riparian seedlings

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Recent models integrating riparian vegetation feedbacks on fluvial morphology have highlighted the importance of the uprooting mechanism in reproducing biogeomorphological dynamics. Plants resist flow and sediment disturbance in fluvial settings, whereby their roots provide both anchorage and access to water. In particular, young seedlings can only survive if they develop a sufficient roots system to withstand the stresses during subsequent floods. However, accurate data on root structure and resistance remain scarce, particularly for young seedlings in highly disturbed environments, such as gravel bed rivers.

To address this gap, we conducted a field campaign on the Tagliamento River (Italy) to characterize the roots of Populus nigra and Salix spp. seedlings, the most common riparian plants in the region. We characterized root structure as a function of environmental conditions such as sediment grain size, groundwater access, and soil moisture. At each of seven sites, we carefully excavated ten plants of each species, selecting individuals of similar age (approximately 1–2 years) and preserving their entire root systems. For each seedling, we measured taproot depth, total root biomass, the number and length of lateral roots, stem diameter, and stem length. In addition, we used a load cell to pull out seedlings and measure their resistance to uprooting. We also measured the breakage resistance of individual roots for both species, accounting for variations in root diameter and moisture conditions.

Statistical analysis showed high variability in all measured parameters, with environmental conditions significantly influencing root characteristics. In particular, taproot depth was primarily related to groundwater level in gravel sites, while root biomass was more strongly related to plant age and sediment grain size. Sandy sites exhibited distinct traits with a greater number of shallower roots. We are currently using this dataset to support the development and validation of mathematical models that simulate riparian vegetation dynamics.

Predicting the (active) width of braided rivers

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12A: River and catchment evolution, processes, and management, Auditorium, February 6, 2026, 9:35 AM - 11:05 AM

Regime theories are effective tools for predicting the bankfull width of single-thread gravel-bed rivers, based on the assumption that bed shear stress slightly exceeds the threshold for bedload transport. However, applying regime width predictors to multi-thread braided rivers is more challenging because channel width is consistently underpredicted. Field and laboratory studies indicate that in braided rivers, only a small portion of the wetted width -referred to as the active width - is involved in sediment transport, or shows morphological change, over short time periods like that of a single flood event. In this study, we compile results from various laboratory experiments to test the hypothesis that regime-based width predictors better estimate the active width rather than the total channel width in braided rivers. Our dataset, which spans a range of stream power and degrees of flow confinement, confirms that regime width estimators align closely with active width measurements. Prior research has shown that active width is typically 15–40% of the wetted width suggesting that a corridor width at least three times the regime width is necessary to sustain a braided morphology for stream power conditions under which braiding could occur.

We further tested this finding taking advantage of a recently published dataset of historic trajectories of braided rivers in the Canterbury region, Aotearoa New Zealand (Barlow and Ashmore, 2025). On average, braided reaches exhibit channel widths greater than three times the regime width. In contrast, wandering reaches have widths roughly double the regime width, and single-thread reaches correspond closely to regime width. These findings offer a robust physical and theoretical basis for channel corridor design criteria that have been applied in restoration and conservation efforts for braided rivers in this region and are relevant to controls on the occurrence, and to conservation and restoration, of braided morphology more generally.

Towards Effective Debris Flow Mitigation: Mapping and Classifying Hazardous Fans with Remote Sensing

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Debris flows pose significant risks to life and infrastructure due to high velocities and long runouts. They are distributed near globally; however, some regions are more susceptible than others. Debris flows often occur repeatedly, with risk typically focused on debris flow fans. Debris-flow fans are morphologically distinctive and so can potentially be identified using geomorphic metrics derived from Digital Elevation Models (DEMs), although this is complicated by local interactions between fluvial and debris flow processes, which act to modify fan features. Globally, there is a lack of comprehensive fan inventories, which can limit debris flow studies to a local or regional level.
This study develops remote sensing methods to improve our ability to map and classify fans susceptible to debris flows. Current classification work has often been limited to well-studied areas (i.e., with validated debris flow histories) and arid regions. This study develops existing fan classification methods by adapting and extending them to apply to a range of different climatic and topographic regions. Once the fans are detected and mapped, their morphometric parameters are extracted to identify the dominant geomorphological processes and hazards.

We leverage cloud computing platforms to process datasets for semi-automated fan detection. Change detection and land use datasets support environmental context. Variables such as Melton's Ruggedness Number, basin area, length, and slope are extracted from existing fan inventories to identify thresholds to differentiate between debris flow and fluvial-dominated fans, which can be upscaled for wider regions.

Communities often choose to live on fans as it can be the only flat, fertile land in mountainous regions and can be elevated above main-river fluvial flooding. It is therefore essential to understand the dominant hazard, flood or debris flows, to inform hazard management. Dynamic exposure analysis using population and infrastructure spatial data can then identify key at-risk fans.

Finding needles in a haystack: Opportunities and challenges for semi-automated mapping of slow-moving landslides at regional scale using pixel tracking

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01H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring, Conway 3, February 2, 2026, 11:40 AM - 1:10 PM

Large, slow-moving landslides can be key drivers of landscape change, with implications for infrastructure, hazard management, land use, catchment sediment budgets, and ecosystem health. However, understanding their distribution across entire regions (hundreds to thousands of square kilometres) remains challenging due to the limited coverage (<1% globally) of landslide inventories and the time-consuming nature of manual mapping methods.

Synthetic Aperture Radar (SAR) approaches, especially Permanent Scatterers (PS) and other Interferometric SAR (InSAR) techniques, have become popular for detecting slow-moving landslides. However, these methods have several key limitations, particularly in steep non-urban terrain, including dependence on reflective features being present in each radar scan, and signal de-correlation due to vegetation or displacements exceeding the radar wavelength. Further constraints include limitations on capturing horizontal landslide displacements due to directional (line-of-sight and look angle) restrictions, and signal distortion on steep slopes due to layover effects.

Pixel tracking of multitemporal LiDAR datasets provides an alternative method for detecting and quantifying landslide displacements, offering some advantages over SAR-based techniques. The increasing availability and frequency of very high-resolution, regional LiDAR surveys presents an opportunity to quickly identify the presence and quantify the displacement of active slow-moving landslides using existing LiDAR datasets.

This study applies and validates a pixel-tracking workflow using multitemporal LiDAR datasets to detect and quantify active, slow-moving landslides across New Zealand's 8,694 km^2 Gisborne region, an area highly susceptible to landsliding. Despite limitations in areas with dense vegetation and low-quality early LiDAR, the method successfully identified large landslides and measured their displacements with far greater efficiency than traditional field or manual mapping approaches (hours to days compared to months or even years).

We discuss the potential benefits of pixel tracking LiDAR data compared with SAR, optical imagery, and manual methods for rapid, regional-scale landslide inventory development.

Sediment (dis)connectivity and denudation in Mediterranean drainage basins in eastern Spain

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Denudation and the relative shares of chemical and mechanical denudational processes are controlled by a range of environmental drivers, and are in most environments and landscapes worldwide significantly affected by anthropogenic activities and disturbances. Anthropogenic pressures can significantly affect the sediment (dis)connectivity in defined drainage areas. The three selected drainage basins in eastern Spain (Calpe region) are located in a Mediterranean, mostly mountainous and anthropogenically modified environment. The Quisi drainage basin has the highest share of urbanized surface areas and has, at the same time, a comparably high availability of fine-grained sediments. The Pou Roig and Mascarat drainage basins have large shares of terraced surface areas, with Mascarat being the steepest of the three drainage-basin systems. Our work includes the observation and monitoring of sediment-transfers, runoff and fluvial-transport events. In the field, we are using a combination of different observation, monitoring and sampling techniques, including different tracer techniques and sediment traps in stream channels, remote time-laps cameras, and event-based high-resolution field monitoring combined with frequent water and sediment samplings. Sediment connectivity is significantly reduced by extended terraced areas within the drainage-basins, particularly in Pou Roig and Mascarat. Sediment transfers, the intermittent runoff, fluvial transport and land-to-ocean fluxes are almost entirely controlled by pluvial events. High runoff during extreme rainfall-events poses a relevant hazard, particularly in the lower parts of the drainage-basin systems. Mechanical fluvial denudation shows a clearly higher spatiotemporal variability than chemical denudation, with the highest rates of mechanical fluvial denudation being measured in the Quisi drainage basin. Altogether, drainage-basin wide chemical denudation dominates over drainage-basin wide mechanical fluvial denudation which is explained by partly limited sediment availability, sediment deposition and short- to long-term sediment storage at numerous defined locations within the drainage-basin systems, and by the high solubility of the predominant marine limestones found in the drainage-basin areas.

Effects of environmental change on contemporary sediment yields in selected cold-climate environments in Norway

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01J: Denudational Dynamics and Hazards in a Changing Environment, Conway 5, February 2, 2026, 11:40 AM - 1:10 PM

It is widely stated that atmospheric warming increases erosion and sediment-transport processes in cold-climate environments, with these increases being mainly driven by cryosphere degradation. In this study we compare the effects of ongoing global warming on measured sediment yields in three different cold-climate environments in Norway: (i) partially-glacierized drainage basins (Bødalen and Erdalen, connected to the Jostedalsbreen ice cap, western Norway), (ii) one drainage-basin system with discontinuous permafrost (upper Driva, central Norway), and (iii) one boreal drainage-basin system free of permafrost (Selbusjøen, central Norway). Our study includes the multi-year (>10 yr) monitoring of fluvial solute and sediment transport using a range of different advanced techniques. In the partially-glacierized drainage basins mechanical denudation dominates over chemical denudation. Most sediment transport occurs during pluvial events in fall, followed by thermally-determined glacier melt in summer, and thermally-determined snowmelt in spring. An increasing frequency of extreme rainfall events leads to increased sediment yields whereas smaller amounts of wintry snow and the ongoing retreat of outlet glaciers are not causing a detectable increase of sediment yields. For the drainage-basin system with discontinuous permafrost it is found that global warming and the connected shifts in the ratio of snow and rain, the increased frequency of heavy rainfall events, and the continued thawing of permafrost have complex effects on denudation, with an increasing importance of pluvially-induced denudational events, a decreasing importance of snowmelt-induced denudation processes, and an increasing dominance of chemical denudation over mechanical denudation. Also in the boreal environment an increasing importance of pluvially-induced denudational events, a decreasing importance of snowmelt-induced denudation processes, and an increasing dominance of chemical over mechanical denudation can be observed. As a result, the different cold-climate environments respond differently to ongoing atmospheric warming, and a significant increase of mechanical denudation due to cryosphere degradation cannot be detected in our study areas.

Quantification of ice flow velocity patterns before and after large supraglacial landslides

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09G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 11:35 AM - 1:05 PM

Glaciers are widely recognised as indicators of climate change; however, they may also respond to sudden, non-climatic events such as large supraglacial landslides. These events have been documented across all major mountain ranges, yet quantitative data on glacier response to debris loading remains scarce and inconsistent.

This study investigates changes in glacier surface velocity before and after large supraglacial landslides using satellite data. Landslide deposits were first identified through manual mapping from high-resolution satellite imagery. To estimate the timing of these events, we analysed time series of medium-resolution satellite imagery (Sentinel-2, Landsat, ASTER) to determine a time window of occurrence. Surface ice flow velocities were then quantified using the Glacier Image Velocimetry toolbox applied to Sentinel-2 data for pre- and post-landslide periods.

The analysis focused on several glaciers in the Southern Andes, including Glaciar Oriental and Glaciar Cerro Balmaceda. For Glaciar Oriental, velocity estimates were based on 58 satellite images. Peak pre-landslide median velocities in the lower 2 Km of the glacier was approximately 116 m/year which dropped after the event to 83 m/year up-glacier from the landslide. Analysis for the lower 4 Km of the Glaciar Cerro Balmaceda, based on 25 images, revealed peak median pre-landslide velocity around 182 m/year, with a slight post-event decrease to 143 m/year.

Additionally, velocity patterns were examined across different glacier zones (e.g., accumulation, ablation, snout) to assess spatial heterogeneity in the response and to explore optimal approaches for reporting such changes.

Our results demonstrate that glacier response to supraglacial landslides is not uniform and may depend on event magnitude, glacier dynamics, and the location of debris deposition.

This research was funded by the National Science Centre, Poland, project number 2021/42/E/ST10/00186

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Geophysics-informed machine learning: future of river and catchment processes modelling?

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13D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 11:35 AM - 1:05 PM

Although there have been significant advances in monitoring Earth surface processes—driven by new surveying technologies, high-frequency sensors, and proliferation of data—physics-based models have struggled to keep pace and fully harness the potential of these rich datasets.
Physics-Informed Neural Networks (PINNs) embed governing physical laws, described by nonlinear partial differential equations (PDEs), directly into neural network training. This integration enables PINNs to learn accurate solutions from limited data by minimizing a loss function that balances observational data with PDE constraints, while keeping compliance with the governing PDEs. Although PINNs are increasingly being adopted to solve hydrodynamic and hydrological problems, their application in geophysical research remains limited. This is partly due to the challenge of obtaining reliable boundary condition time series at both the upstream and downstream ends of the model domain, which are essential for accurate internal predictions. Moreover, the complexity of geophysical processes—often involving multiple interacting boundaries across different spatial scales—make existing PINN frameworks inadequate for reliably modelling and predicting these systems.

Adapting PINN architectures to represent catchment processes across a river network is a clear example. Because of the localized nature of inputs, a simple PINN framework cannot effectively handle data from all sources to sinks. An interconnected PINN framework, as implemented in the development of the SED-PINN model, helps to overcome some of these limitations. This model links individual PINN structures for separate river reaches using appropriate loss functions at their boundaries, enabling the construction of a cohesive and integrated network model.

This presentation introduces the structure and real-world application of the SED-PINN model. It also discusses the current limitations of PINN approaches in geophysical studies and highlights potential pathways for advancing the technique to better capture the complexity of physical processes in future research.

Challenges of nature based solution implementation in Canterbury's braided rivers

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03A: Learned lessons about anthropogenic drivers in the river evolution, Auditorium, February 2, 2026, 4:00 PM - 5:30 PM

This presentation examines how private land ownership constraints limit nature-based solution (NBS) implementation across Canterbury's braided river systems, demonstrating the institutional and economic barriers to effective landscape-scale river management in privatised agricultural landscapes.

Canterbury's braided rivers are among the world's most significant examples of glacially-influenced river systems. The Canterbury Plains formed as alpine sourced rivers transported glacial sediments across the coastal plain, building successive alluvial fans over geological time to create the current landscape. These naturally dynamic rivers historically carried high sediment loads and migrated across wide braidplains.

European settlement fundamentally altered these systems through progressive channelisation and confinement. Stopbank construction narrowed the rivers to allow room for agriculture, significantly reducing the width of active braids. At the same time, new vegetation was introduced to promote confinement and channelisation. Willows and exotic weeds now occupy the majority of lowland braided river habitat, binding bed sediments and preventing natural gravel movement.

The naturally dynamic braided channels are now confined into single-channel systems, concentrating flow energy and increasing breakout risks during flood events. Herbicide application is used to manage vegetation, which would otherwise act to stabilise bed sediment and restrict bed mobility during high flow events. Economic drivers struggle to incentivise extraction of accumulated sediments that cannot redistribute naturally due to low gradients.

Contemporary management through implementation of NBS seeks alternative means to manage these dynamic ecosystems. However, implementation faces significant barriers, primarily related to adjacent private land ownership that constrains large-scale management. Acquiring property for stopbank retreat projects faces high costs and strong landowner opposition, especially where generational, improved farmland is involved. Projects are limited to piecemeal interventions where landowners are willing and funding is available.

This is an invitation for discussion on how we can shift from piecemeal interventions to integrated, landscape-scale strategies that balance ecological function with landowner realities.

Change of Rock Mechanical Properties Due to Wildfires – nationwide study in Czechia

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Wildfires are becoming increasingly frequent and intense as a result of ongoing climate change, affecting not only ecosystems but also the stability and integrity of rock masses in fire-prone landscapes. High temperatures associated with wildfires can alter the physical and mechanical properties of rocks, with significant implications for slope stability, weathering rates, and landscape evolution in affected regions.

In this study, we investigated the effects of thermal shock on rock mechanical properties in four lithological groups: sandstones, limestones, crystalline rocks, and volcanic rocks. For each group, samples were collected from 25 different locations across the Czech Republic to provide a representative dataset covering the country’s geological diversity. Cylindrical specimens were subjected to fast short-term heating (5 minutes) at target temperatures of 200 °C, 400 °C, 600 °C, and 800 °C. In addition, selected samples were directly exposed to flame to simulate the heterogeneous thermal exposure typical of real wildfire conditions.

After each heating step, changes in the propagation velocities of P- and S-waves were measured, allowing the calculation of dynamic elastic moduli. Our results reveal markedly different thermal responses across the lithological groups. In several cases, a surprising increase in wave velocity and rock strength was observed after heating to 200 °C, possibly due to the closure of microcracks or dehydration of clay minerals. However, higher temperature exposures generally resulted in progressive degradation of mechanical properties, including a sharp decrease in wave velocities and inferred moduli.

These findings highlight the complex and non-linear nature of thermal alteration in rocks and underscore the importance of considering lithology-specific behavior when assessing post-fire landscape stability and rock mass quality. Our results contribute to a better understanding of how wildfires, intensified by climate change, may accelerate rock degradation processes and reshape geomorphological systems.

BathyBoxes Aotearoa – hands on learning for seafloor mapping

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Aotearoa is a maritime country; 95% of Zealandia lies beneath the waves. Marine geosciences are inherently ‘out of sight’ as our study areas lie deep beneath the sea surface. Therefore, communicating the relevance and impact of marine research and how we collect data requires paying particular attention to conveying the significance of these environments, and the challenges that we face in researching them. Our ocean is already a busy place, and activity is increasing as new industries are explored and implemented. With increased activity comes the need to better understand the offshore space, and particularly our sensitive marine habitats.

Seafloor mapping is a critical tool for furthering our understanding of offshore hazards, ecosystem distributions, regulating underwater resource exploration and infrastructure, and ensuring safety of navigation. Furthermore, these maps provide information vital to understanding marine life, allowing us to characterize marine habitats and make decisions for solid, sustainable conservation measures. However, many people still have little idea how we go about mapping the seafloor.

Now more than ever we need to increase scientific literacy to enable informed decision making across all levels of society. To help address this, we have developed resources that can be used across a wide range of ages, backgrounds, and disciplines, to increase interest, awareness, and engagement in seafloor mapping. BathyBoxes combines hands-on learning, using 3D printed real-world examples of New Zealand’s diverse bathymetric landscapes, introducing the concepts of map drawing, and bilingual introductions to technologies behind modern-day seafloor mapping. Furthermore, the activity provides insights into why scientists explore these areas of the seafloor. The aim is for the BathyBoxes to be flexible in scope so that they can be utilised by educators in a wide range of activities. Here we present the development of the resources and some initial feedback from users.

Landslide mapping within Auckland's northern Future Urban Areas

Dr Kyle Bland[1], Dr Dougal Townsend[1], David Barrell[2], Julie Lee[1], Dr Katie Jones[1], Gokul Anand[1], Dr Ian Hamling[1]
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08D: Engineering Geomorphology, Dobson 3, February 5, 2026, 9:35 AM - 11:05 AM

Auckland, New Zealand's largest city, is rapidly expanding into previously rural areas. The city's designated northern Future Urban Areas (FUA), including Silverdale-Dairy Flat-Wainui and Kumeu-Waimauku, will soon see tens of thousands of new residents and associated infrastructure and industrial development. The bedrock geology of these areas includes variably volcaniclastic Early Miocene turbidite (alternating sandstone-mudstone) successions (Waitematā Group) and Cretaceous–earliest Miocene deep-marine sedimentary strata and sea-floor basalts (Northland Allochthon). Both units predominantly comprise engineering weak rocks and have propensities to slope instability. Sand-dominated Quaternary aeolian deposits are widespread in the west; these typically poorly consolidated engineering soils are also prone to slope instability.

Landslide mapping and susceptibility evaluations before development occurs reduces landslide risk by identifying and delineating areas characterised by slope instability, thereby helping inform land-use management, planning, and infrastructure development. When applied optimally, this supports informed choices about where to avoid construction, implement remedial measures, and allocate resources to mitigate risks, ultimately reducing exposure of assets to landslide-related damage.

On-going LiDAR-based geomorphological mapping including in the FUA has identified >7000 existing, largely pre-historic, landslides up to ~767,000 m² in extent. There is high-level correlation between bedrock geology and landslide occurrence. Most mapped landslides are in areas underlain by Waitematā Group strata, with the largest failures (up to ~1 km across) associated with thick, conglomeratic slope-canyon turbidite fills (Cornwallis Fmn / Helensville Conglomerate). Landslides are common but generally smaller in areas underlain by rhythmically alternating sandstone-mudstone of the Waitematā Group's East Coast Bays Formation, and on steeper slopes underlain by Quaternary aeolian sediments. Landsliding on low-angle failure planes typifies fine-grained Northland Allochthon strata. Collectively, these observations suggest that variable lithification and grainsize may play important roles in failure mechanisms and landslide size.

Initial observations from LiDAR-derived surface-difference maps and InSAR data show that some of these features are active.

Formation of Postglacial Lakes in the Central European Lowland During the Late Glacial–Holocene Transition

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Lake basins are among the most characteristic features of glacial landscapes shaped within the extent of the last continental glaciation. In general, the genesis of lake basins is associated with erosional and depositional processes that occurred during the advance and retreat of the last Scandinavian Ice Sheet. The vast majority of large lake basins in the young glacial regions of the Central European Lowland are tunnel valleys formed by the erosive activity of subglacial meltwater and/or glacial erosion (the depression formation phase). Immediately after their formation, these glacial depressions were filled with blocks of dead ice, which—under permafrost conditions and beneath a mineral cover—could be preserved for extended periods, in some cases exceeding 5,000 years (the conservation phase). The subsequent melting of the buried dead ice occurred under thermokarst conditions and was influenced by both global climate changes during the Late Glacial and local environmental factors (the buried ice melting and lake formation phase). The uneven and gradual melting of dead ice was the primary factor determining the varying ages of lakes—from pre-Allerød lakes, through those of the Bølling-Allerød complex, to lakes that formed only at the onset of the Holocene. A detailed understanding of the timing and processes of lake formation also provides an important basis for discussing permafrost evolution in glacial landscapes at the end of the last glacial period.

The presented research works are financially supported by the NCN Project, Opus 23, (UMO-2022/45/B/ST10/03167).

Permafrost Evolution in Areas Covered by the Last Scandinavian Ice Sheet: Paraglacial Transformation of Glacial Landscapes

Professor Mirosław Błaszkiewicz[1], Professor Michał Jankowski[2], Professor Barbara Woronko[3], Doctor Mateusz Kramkowski[1], Professor Agnieszka Noryśkiewicz[4], Professor Piotr Moska[5], Professor Piotr Hermanowski[6], Doctor Olaf Juschus[7], Master Weronika Danel[8], Professor Natalia Piotrowska[5], Student Bruno Garrett[1]
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12G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 9:35 AM - 11:05 AM

Although numerous structures associated with the presence of permafrost have been documented in areas within the extent of the last ice sheet in the Central European Lowland, many issues related to its evolution and actual role in the transformation of glacial landscapes remain unresolved. Our study area is located directly in the foreland of the Pomeranian phase of the last glaciation, in northern Poland. The research focused on networks of thermal contraction polygons, aeolian covers, and organic infillings within the floors of tunnel valleys. As a result of the analyses carried out, two main stages of periglacial transformation of this area were identified. The first occurred at the beginning of the Late Glacial period, during which thermal contraction polygon structures and the older aeolian series were formed. The second stage was associated with the Younger Dryas and the intense aeolian processes that took place during that time. Based on the dating of processes related to the melting of buried dead ice blocks within tunnel valleys, the final degradation of permafrost in the study area occurred at the transition from the Preboreal to the Boreal period. The coexistence of permafrost and a substantial amount of buried dead ice blocks allows for the use of the term “dead ice-rich permafrost” by analogy, particularly in the context of thermokarst processes, with “ice-rich permafrost” known from modern periglacial zones. This type of permafrost developed in the Central European Lowland during deglaciation, and its evolution and eventual disappearance significantly influenced the course of paraglacial transformation of glacial landscapes.

The presented research works are financially supported by the NCN Project, Opus 23, (UMO-2022/45/B/ST10/03167).

Variability of Shoreline Change in Nunavik Communities, Northern Québec, Canada

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The shoreline of Nunavik (Northern Québec, Canada) is undergoing rapid and spatially variable transformations, driven by the combined influence of natural geomorphic processes, climate change, and the historical establishment and growth of Inuit and Cree communities. This Arctic–subarctic region is strongly affected by glacio-isostatic rebound, leading to localized relative sea-level fall, while also experiencing dynamic permafrost conditions (ranging from degradation to aggradation), periglacial processes, and diverse hydrodynamic regimes — from microtidal conditions in Hudson Bay to hypertidal ranges in Ungava Bay. These physical drivers are further influenced by shifting patterns in sea ice and storm activity.

Since 2021, several coastal field campaigns have been conducted across Nunavik to monitor shoreline change and better understand local coastal dynamics. This study combines multiple data sources, including historical aerial photographs (1950s–present), UAV-based surveys, and field observations. Shoreline change analysis using the Digital Shoreline Analysis System (DSAS) has quantified both erosion and progradation trends. In parallel, high-resolution Digital Surface Models (DSMs) derived from LiDAR datasets (2010, 2015–2016, 2021) and UAV imagery have enabled the assessment of volumetric sediment changes across key sectors.

The 15 coastal communities of Nunavik exhibit markedly contrasting shoreline responses. Some communities (e.g., Umiujaq, Salluit, Tasiujaq) are affected by active erosion, while others (e.g., Whapmagoostui-Kuujjuarapik) exhibit long-term shoreline progradation. In Umiujaq, for instance, major storm events in 2017 and 2018 triggered shoreline retreat rates approaching 2 meters per year.

Importantly, the coastline is becoming increasingly anthropized, with expanding infrastructure often situated in hazard-prone zones. These findings underscore the urgency of localized, community-based shoreline monitoring and coastal risk management strategies. Despite growing environmental pressures, Inuit and Cree communities demonstrate strong resilience and adaptive capacity. Their local knowledge and collective governance practices are essential for guiding sustainable coastal adaptation in this rapidly evolving environment.

Coastal Dynamics of Arctic and Subarctic Emerging Coastlines: The Case of Nunavik, Northern Québec, Canada

Dr Antoine Boisson[1], Dr David Didier[1], Mr Denys Dubuc[1]
[1]Université du Québec à Rimouski, Quebec, Canada

02E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 2:00 PM - 3:30 PM

The Arctic and subarctic shorelines of Nunavik (northern Quebec) have long been shaped by postglacial emergence, driven by isostatic rebound following the retreat of the Laurentide Ice Sheet. Over thousands of years, this geomorphological uplift has led to the progressive progradation of land into the sea — forming raised beaches and marine terraces. In recent decades, however, this trend has slowed: the rate of isostatic uplift is gradually decreasing, although it still exceeds global sea-level rise in many areas.

Meanwhile, Inuit and Cree communities have established and expanded across these emerging landscapes — often on sandy spits, deltaic margins, or estuarine outlets. Historically, many key infrastructures were built on low-lying landforms perceived as stable. Today, this assumption is being challenged. Climate change is disrupting coastal stability by intensifying freeze–thaw cycles, altering surface runoff, accelerating glacier melt, and weakening permafrost. In addition, increasing storm activity and shifting sea ice regimes are further exacerbating local vulnerability.

Several communities are now experiencing visible geomorphic change, including accelerated erosion, the episodic flooding of low-lying terrain, and stress on buildings and essential services situated too close to the shoreline. These changes carry implications not only for physical landscapes but also for cultural heritage, land-use practices, and long-term planning.

This presentation draws on fieldwork conducted annually between 2021 and 2025, combined with geospatial analyses and instrumental monitoring in selected communities. It seeks to illustrate the transition from an emerging coastal system to one facing increasing climate-driven risks — highlighting the urgent need to integrate geomorphological processes, Indigenous land-use history, and adaptation strategies into northern planning frameworks.

Quantifying wildfire-flood impacts to a central California bar-built estuary

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05F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 11:35 AM - 1:20 PM

Debris flows after wildfires can significantly alter watershed processes and may be beneficial and (or) detrimental to aquatic biota at varying spatiotemporal scales. Bar-built estuaries (BBEs) naturally serve as sediment sinks, making them vulnerable to changes in hydrology and sediment dynamics. Despite numerous studies investigating post-wildfire impacts on watershed processes and a marked increase in fire disturbance in coastal watersheds, few studies have investigated sediment impacts in BBEs. To address this knowledge gap, we characterized sediment deposition patterns in the Scott Creek Watershed (central California, USA) directly after the 2020 CZU Lightning Complex fire and four years post-fire. We quantified fine-sediment deposition (pebble count transects) throughout the watershed, conducted RTK-GNSS grade bathymetric surveys within the estuary, and measured sediment deposition (sedimentation tiles) on the marsh plain adjacent to the estuary, to quantify changes in sediment characteristics and estuary morphology. We found substantial inputs of fine-sediment one year post-fire throughout the watershed (mean = 15%, min = -11%, max = 44%) that extended into the estuary despite below-average precipitation. Subsequent surveys revealed relatively large deposition rates on the marsh plain (mean rates = 11-19 mm/yr, ~7-13x greater than long-term Holocene rates). There was moderate net aggradation in the estuary channel one year post-fire followed by limited net bathymetric change in subsequent years. This suggests that although there were elevated sedimentation rates in the upper watershed and on the adjacent marsh plain, post-fire sediment that was transported to the estuary quickly exited the system.

Improvement of the SWAT+ model for sediment load routing in the Lake Opuha catchment

Ms Maria E. Borges[1], Dr Thomas A. Cochrane[1], Dr Markus Pahlow[1], Dr Arman Haddadchi[2]
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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Lake Opuha in New Zealand is an artificial reservoir used for hydropower generation and irrigation of nearby agricultural land. Accurate estimates of flow and sediment loads are essential for effective reservoir management, ensuring that water supply meets water quality requirements. This study uses the SWAT+ model to simulate erosion from catchment sources around Lake Opuha, with the aim of improving sediment routing through braided rivers into the reservoir by applying NIWA's suspended sediment transport model. The methodology includes: (1) using Sentinel-2 satellite imagery to detect landslides and update bare soil classes in the New Zealand Land Cover Database; (2) simulating sediment loads spatially and temporally with SWAT+; (3) analysing suspended sediment concentration and particle size distribution of the main tributaries to the lake; (4) calibrating the correlation between suspended sediment concentration and turbidity; (5) linking SWAT+ to the NIWA sediment transport model; (6) calibrating the model with observed data; and (7) evaluating the accuracy of sediment simulations using the improved model. The improved sediment routing capabilities in the model are expected to refine the prediction of sediment yields across the stream network and the delivery of sediments to the lake. These improvements will support more effective sediment management in Lake Opuha and help maintain water quality standards.

Expansion of sugar cane crops and their influence on soil loss and sediment accumulation rates in Paulista Peripheral Depression, Brazil

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Changes in land use and land cover (LULCC) have modified the Earth's surface, with emphasis on the replacement of native vegetation by sugarcane crops in southeastern Brazil, especially in the Paulista Peripheral Depression (PPD) – Paraná Sedimentary Basin. The sugar cane is normally used in the production of biofuels (ethanol), which are responsible for 42 % of renewable energy supply in Brazil. However, the expansion in the sugar cane crops have increased the soil loss and sediment accumulation rates (SAR), promoting landscape and geomorphic changes in several Brazilian watersheds. Here, we used the RUSLE model to understand the soil loss in a watershed located in the PPD (Claro Stream basin), considering different temporal scenarios 1990 and 2020. In addition, the SAR were characterized through the 210Pb sediment radiochronology (based on the CF:CS model) in a sediment core sampled on Claro Stream basin. The results indicated an increase in the sugar cane crops of 44.7 % between 1990 and 2020 in the study area, which increased the soil loss from 6.63 ton/ha at 1990 to 8.18 ton/ha at 2020, suggesting an increase in annual soil loss of 17.9 tons. In relation to SAR, the rates were 1.0 ± 0.1 cm/year from 1986 to 2011 and 3.1 ± 0.2 cm/year from 2016 to 2022. The period of significant changes in the rate of soil loss occurred between 2010 and 2015, same period where the increase in SAR was observed. Therefore, this study reinforces that the human-landscape systems associated with sugar cane crops are complex and increase the natural processes of soil loss and SAR, affecting the landscape evolution in PPD.

Late Cenozoic Ice-Sheet fluctuations in Southern Victoria Land constrained by cosmogenic nuclide dating and geomorphological evidence

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04G: Antarctic Geomorphology, Conway 2, February 3, 2026, 9:35 AM - 11:05 AM

Understanding the past dynamics of the Antarctic glacial system in response to late Cenozoic climate shifts is critical for assessing its sensitivity to current and future global environmental changes. Despite substantial progress, establishing robust chronological correlations between terrestrial geomorphological evidence, marine sedimentary records, and deep ice cores remains a significant challenge.

This study presents an integrated geomorphological, glacial geological, and geochronological investigation of key ice-free areas in Southern Victoria Land (SVL), East Antarctica. Our primary objective is to reconstruct the spatial and temporal evolution of the East Antarctic Ice Sheet (EAIS) through glacial–interglacial cycles, with a particular focus on outlet glacier dynamics and ice surface elevation changes along the Victoria Land coast.

This investigation is based on a systematic analysis of field data collected during several PNRA (Italian National Antarctic Research Program) expeditions, along a broad latitudinal transect in SVL, spanning from McMurdo Sound to the Convoy Range. Be-10, Al-26 and C-14 cosmogenic surface exposure dating of glacial erratics and striated bedrock surfaces is utilized to constrain the timing and extent of EAIS fluctuations with high chronological precision.

Selected sampling sites include low-elevation coastal areas along the Scott Coast, identified to refine the post Last Glacial Maximum (LGM) deglaciation chronology, as well as high-elevation nunataks adjacent to the EAIS margin, where geomorphological evidence indicates ice-level oscillations predating the late Pleistocene. These new datasets provide valuable constraints on the long-term behaviour of the EAIS and offer critical insights into Antarctica’s contribution to past and potential future sea-level changes.

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A European-wide quantification of carbon sequestration potential through beaver reintroduction

Lisa Boterman[1], dr. Annegret Larsen[1], dr. Matthew Dennis[2], dr. Jasper Candel[1]
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03K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 4:00 PM - 5:30 PM

Beavers (Castor fiber, Castor canadensis) are capable of modifying river corridors through dam construction, thereby altering the local hydrology, geomorphology and biogeochemistry of their habitat. One such impact of beaver dam activity is an increase in long-term carbon storage through the creation of anaerobic conditions reducing decomposition, the trapping of allochthonous organic carbon and sediments, or an increase in autochthonous carbon inputs from aquatic and riparian net ecosystem productivity. A century ago, Eurasian populations of these ecosystem engineers were reduced to c. 1200 individuals. Reintroduction, conservation efforts and natural spread have restored populations throughout Europe in recent years to number c. 1.5 million. This expansion provides opportunities for nature restoration and enhancing natural floodplain functioning, and subsequently for ecosystem services related to these. Conversely, this expansion also conflicts with anthropogenic land-use, and thus river management approaches require comprehensive knowledge on beaver dam impacts. Presently, there are no large-scale quantifications of potential carbon storage associated with beaver damming activity. This research postdicts the European-wide loss of floodplain carbon storage resulting from beaver eradication throughout the Holocene. Our approach is to (1) use archaeological findings and Holocene land use change data to identify palaeodistribution and (human-related) patterns in beaver eradication history; (2) model suitable beaver habitat zones across Europe using hydrological and geomorphological constraints; and (3) combine site-specific data on beaver-related carbon increase with European soil carbon maps for areas deemed suitable habitat within beaver palaeodistribution. By quantifying beaver-related carbon storage for their natural distribution, we aim to highlight the potential impact of continental-scale beaver reintroduction as a nature-based solution in the carbon sequestration and climate change mitigation context.

Learning from the landscape: Lessons from Turakirae Head, New Zealand

Dr Carolyn Boulton[1], Dr Kevin Norton[1], Ms Lucy Clayton[1], Ms Hanne Dansted[1], Ms Jade Robinson[1], Ms Gwendolyn Stone[1], Mr Tim Wildash[1]
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11D: Geomorphology Education for Disaster Risk Management, Dobson 3, February 5, 2026, 5:00 PM - 6:30 PM

In January 1855, the Mw 8.0-8.2 Wairarapa earthquake ruptured the Wairarapa Fault and Wharekauhau Thrust, which strikes offshore beneath Palliser Bay to the east of Turakirae Head. At Turakirae Head, the earthquake produced a maximum uplift of 6.4 m, resulting in an elevated beach ridge that wraps the headland. In total, the landscape contains 5 beach ridges, including a modern ridge created by post-1855 storms.

A new undergraduate exercise was developed to compare GNSS RTK measurements of uplifted beach ridges and intertidal platforms with elevation profiles extracted from a LiDAR-derived digital elevation model (DEM). In the field, students work in groups to obtain a GNSS RTK survey profile of successively elevated beach ridges. By interrogating a DEM with QGIS tools, the groups then measure the elevations of all the well-preserved beach ridges at Turakirae Head.

Results are combined with active fault maps, beach ridge ages, and paleo-earthquake ages to assess how seismic events variably impact the landscape. From the exercise, students learn the importance of on-site observations, the utility of digital tools, the difference between measurement accuracy and precision, and the limitations inherent in geological mapping, landscape preservation, and the paleo-earthquake record.

Tectonically, the Wairarapa Fault and Wharekauhau Thrust are known as upper plate faults, faults that lie on the tectonic plate overlying an active subduction zone. Earthquakes on upper plate faults represent significant seismic hazards, yet their frequency and potential magnitudes are still poorly understood because of earthquake rupture complexities. This new learning exercise gives students experience with a range of site evaluation tools and real, incomplete datasets. It also teaches students how to deal with uncertainties, a key skill for an informed workforce and resilient communities. In this presentation, we summarize the exercise and discuss the students' research results and reflections on learning.

Power Play: Using Stream Power to Restore Resilient Stream Processes As A Stormwater Strategy

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11I: Urban Streams: From Long Trajectories to Restoration Issues and Hazard Management, Conway 4, February 5, 2026, 5:00 PM - 6:30 PM

Catchment development, particularly the unmitigated expansion of impervious surfaces, accelerates stormwater runoff into streams, a process known as hydromodification. This intensifies stream evolution, often leading to incision and channel widening, which degrades riparian habitats and threatens infrastructure. Traditional management approaches typically focus on controlling runoff and erosion through channel armoring or detention facilities, with the expectation that these measures will allow stream recovery. However, in incised or confined reaches, concentrated stream power limits the effectiveness of flow control alone in restoring lost channel functions. As an alternative, the resilient stream corridor approach reconnects streams to their floodplains and restores both hydrologic and morphologic complexity in degraded areas. This strategy reestablishes natural fluvial processes that dissipate stream energy, lower flood stages, and extend time-to-concentration by increasing the connected floodplain width and surface roughness. Morphologically, the approach fast forwards stream evolution toward a more stable and ecologically functional condition that is easier to maintain. This concept aligns with the Stream Evolution Model by Cluer and Thorne (2014), where accelerated evolution moves impacted channels from Stages 3 or 4 to Stages 0 or 8. For over a decade, Wolf Water Resources has partnered with urban authorities and water management agencies to implement this approach as a practical hydromodification management strategy. Our stream power-based assessment and design tool enables agencies to assess, quantify, and track urban runoff impacts, linking them to targeted resilience actions that limit or reverse the effects of hydromodification. Compared to conventional hydraulic modeling, this method provides a more scalable and cost-effective way to evaluate risks, benefits, and costs at the catchment scale. These strategies have been successfully applied in the Pacific Northwest of the United States to guide urban stream restoration and inform project design, and to support the development of guidance frameworks for Auckland Council in New Zealand.

Martian Deltas: Experiments on the Impact of Sediment Density on Delta Morphology as a Proxy for Gravity

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02D: Planetary Geomorphology, Dobson 3, February 2, 2026, 2:00 PM - 3:30 PM

Martian deltas provide compelling evidence for past surface water activity and are key to reconstructing the planet's paleoenvironmental conditions. Understanding how these sedimentary systems formed under Martian conditions, and how they differ from terrestrial analogues, is essential for interpreting orbital and rover observations, including those from the Perseverance rover in Jezero Crater.

This study presents results from controlled flume experiments designed to simulate delta formation under reduced gravity. All deltas were created under identical conditions: a flat basin with 3 cm water depth, a constant water discharge of 300 L/h, and a sediment supply of 2 L/h. Martian analogue experiments used low-density nutshell grains (1350 kg/m^3) to increase sediment mobility, while terrestrial analogues used standard silica sand (2650 kg/m^3).

Previous studies have demonstrated that reduced gravity increases sediment transport capacity, particularly for coarser grains, and enhances suspended load (Braat et al., 2024). We therefore argue that using low-density grains in Earth-based experiments can approximate sediment dynamics on Mars. However, the morphological consequences of these dynamics have not yet been studied.
Our results show that deltas formed with low-density grains exhibit greater surface area and lower elevation compared to those formed with silica, under identical boundary conditions. This reflects a reduced equilibrium slope associated with increased sediment mobility, leading to minimal aggradation and rapid progradation. Furthermore, deltas in the Martian analogue experiments display more irregular shorelines, wider channels, reduced channel migration, and increased avulsion frequency.

These findings improve our ability to interpret Martian delta morphology from remote sensing data and allow for more accurate estimates of flow duration, sediment supply, and water volume. Such insights are essential for constraining the climatic history and habitability of early Mars and for informing future sampling strategies in planetary exploration missions.

The Use of High Frequency GPR for Monitoring the Spatial Distribution and Temporal Evolution of Wildfire-Related Hydrophobic Soil Layers.

Professor Frank H. Weirich[1], Dr. William Neumann[1], Mr. Frank A. Weirich[2], Dr. Jordan Brady[1]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

In many post-wildfire environments, one of the most significant impacts—beyond vegetation loss—is the formation of a shallow, water-repellent (hydrophobic) soil layer (HSL). It is well understood that the presence of this layer can greatly alter the hydrologic and geomorphic conditions in a watershed, often leading to substantially increased storm-induced runoff, heightened erosion rates, elevated sediment loads, and in some cases hyperconcentrated flows or debris flows.

Efforts by researchers to evaluate the presence, extent, and persistence of the HSL and to quantify the impact on post-fire watershed dynamics and recovery rates have proven challenging. To date, the most commonly used methods to detect the presence and extent of HSLs include the water drop penetration test (WDPT), the molarity of ethanol drop test (MED), and the mini-disc infiltrometer test (MIDI). All involve the observation of resistance to fluid passage (either water or ethanol) by the HSL as the fluid infiltrates into the soil. These methods are spatially limited, typically covering only a few square centimeters per test, and because they disturb the soil structure are not temporally repeatable.

Over a period of more than ten years, we have developed and refined a non-invasive geophysical approach using high frequency ground penetrating radar (HFGPR) to enable the delineation of HSLs. High Frequency Ground Penetrating Radar (HFGPR) radargrams provide high-resolution imaging, with sample intervals as small as 5 mm along the line —yielding over 200 measurements per linear meter and thousands of data points when adjacent and crossing lines are incorporated and processed for 3D analysis. The data density, interpretability, and repeatability of this method provides unmatched mapping of the depth, spatial variability, and temporal changes of the HSL.

The theoretical framework, methodology, and representative laboratory results and field-based case studies demonstrating the utility of HFGPR for post-fire watershed assessments are presented.

An assessment of the factors contributing to the Saint Sophia Debris Flow of Dec. 25, 2003

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03J: Landscape conditioning for cascading sediment hazards in Pacific steepland catchments, Conway 5, February 2, 2026, 4:00 PM - 5:30 PM

On December 25 a post-fire storm related debris flow in the San Bernardino Mts. near San Bernardino, CA. struck the Saint Sophia Church Camp located near the base of the mountains resulting in the destruction of the camp and 14 fatalities of which many were children. The debris flow was on the order of 5 meters in depth with a width 75 meters and a peak discharge on the order of 425 cms in the area of the church camp. It was generated in a watershed only 310 ha in size. A study was undertaken to evaluate the role of a recent wildfire, rainfall amounts and intensities from a postfire storm that impacted the watershed and initiated the debris flow, the topographic and geomorphic conditions of the watershed and channel upstream of the church camp, and land use changes over time associated with a highway crossing through a portion of the upper watershed in generating what became known as the St. Sophia Debris Flow. The results of this study indicate that occurrence of the wildfire, rainfall from a storm that impacted the watershed in the hours up to the occurrence of the debris flow, the steep terrain of the watershed and channel, the large quantity of sediment present in the channel areas upstream of the church camp that became incorporated in the debris flow all contributed to the initiation and size of the debris flow. However, the land use changes associated with the presence and development of the highway crossing the upper portion of the watershed contributed additional large quantities of material to the debris flow and as a result significantly further increased the size of the flow such that it reached a scale large enough to destroy the portion of church camp where the fatalities occurred.

Anthropogenic impact on hillslope processes in an outstanding coastal area with high geo-cultural values: some examples from Eastern Liguria, Italy

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Climate change and the relevant anthropogenic imprint on various landscapes at the global scale have often exacerbated hazard and risk conditions associated with geomorphic processes worldwide. As a result, sites of geomorphological and geocultural interests enjoyed by tourism are now addressing serious challenges for their conservation. Detailed geomorphological investigations are thus essential for geoheritage protection and conservation in both urban and rural environments. Earth surface processes and landforms have been severely modified by the development of settlements and infrastructure, particularly at two recent historical and socio-economic phases: the first began with the Second Industrial Revolution, in the first half of the 19th century, the second occurred with the Great Acceleration of the 1950s.

In this context, this research presents the preliminary results of an investigation developed within the framework of the Italian project of relevant national interest “GEOTRes – Geoheritage threating and resilience: mapping the impact of geomorphic and human processes in sensitive morphoclimatic environments”, funded by European Union – Next Generation.

The coastal stretch between Genova and Chiavari, in the central-eastern sector of the Liguria region was considered and three case studies were investigated in detail: i) the western sector of the Portofino Promontory; ii) the Castellaro cliff, in the municipality of Zoagli; iii) the slope on which the Sanctuary of N.S. delle Grazie in Chiavari stands. They represent three spots affected by ubiquitous instability located along a coastal slope, where the anthropogenic morphogenesis has most likely played a decisive role as a landslides factor.

In all these cases, the role of geological and geomorphological factors is clear, and equally evident is that of anthropic impact. This last is related to significant quarrying activity that led to new excavation and accumulation landforms and to an increase of geomorphological hazard.

Anthropocene geomorphological mapping within a small Mediterranean catchment for the comprehension of human impact on earth surface processes and landforms

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Even though the Anthropocene has not been officially recognised as a stratigraphic period, there is no doubt that processes on the Earth's surface are influenced by anthropogenic activities. On one hand, climate change seems to be causing an intensification of meteorological phenomena; on other hand, it cannot be denied that their ground effects are amplified by anthropogenic interventions. The identification of anthropogenic and human-modified natural landforms can therefore become a tool for the comprehension of the interaction between natural processes and anthropogenic constraints.

Within these issues, the research presents a prototype geomorphological map devoted to the Anthropocene, i.e. aimed at identifying and mapping anthropogenic landforms and modified natural landforms.

The catchment of the San Francesco stream, only 6 km2, facing the Ligurian sea, was chosen as case study. Despite its limited extent, it represents the mean geomorphological and land-use conditions of a wide Mediterranean coastal sector. This catchment is located in Rapallo (Eastern Liguria, Italy), a sea side tourist resort that has experienced in the 1955-1975 period a massive and sometimes irrational urban growth, so much so as to give rise to the neologism “rapallizzazione” (which can be translated as “rapallization”). The lower sectors of the surrounding slopes, historically modified through the construction of dry stone walls supporting agricultural terraces, were also affected in the last half century by the sprawl of residential and tourist settlements.

On site survey and remote sensing analysis have made the identification of both anthropogenic landforms, such as excavations, landfills, quarry activities and dumps, and modified natural landforms, such as the culvert of the final section of the watercourse or the masonry embankments of the middle and final sections, possible. These evidences result in a relevant impact of the human interventions on geohydrological risk scenarios and the related land planning and management issues.

Assessing the Geomorphic Consequences of Historic Agroforestry Abandonment in Northern Italy

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05I: Human Footprint in River Basins AND Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 11:35 AM - 1:20 PM

Agroforestry —integrating perennial and seasonal crops within a single agricultural framework—have shaped European rural landscapes from the Middle Ages (~1450 BP to 450 BP). These complex systems, grounded in traditional ecological knowledge, were progressively abandoned during the Great Acceleration, particularly in the mid-20th century. Their decline led to the erosion of long-standing land management strategies now recognised for their valuable ecosystem services, including soil stabilisation and biodiversity enhancement. This study investigates the geomorphological consequences of the abandonment of historic agroforestry systems in Northern Italy, with particular focus on how the transition from polyculture to monoculture has influenced erosion and sediment dynamics. Using digitised historical cartography and remote sensing datasets, we reconstructed Land Use and Land Cover (LULC) transitions over the past century. A spatially explicit model was implemented within a GIS environment to quantify the effects of these LULC changes on soil erosion risk and sediment connectivity. Preliminary results reveal an increase in sediment export and a reduction in sediment retention capacity in areas formerly managed through historic agroforestry systems. These findings underscore the geomorphic legacy of land-use change and emphasise the relevance of reintegrating historical landscape management practices into future erosion mitigation strategies. Ultimately, this research contributes to a deeper understanding of the long-term anthropogenic imprint on geomorphological processes and the loss of ecosystem functions associated with traditional agroecosystems.

The role of size-dependent particle abrasion in the generation of a grain size gap along gravel-sand transitions

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13B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 11:35 AM - 1:05 PM

Particle abrasion rates during bedload transport, expressed as percent volume change per distance traveled, are commonly assumed to be independent of size. However, experimental and field evidence suggest otherwise. Size-dependent abrasion, with high rates biased toward fine clasts, may contribute to the wear of fine gravel sizes observed along gravel-sand transitions. Here we introduce an analytical model of the evolution of the grain size distribution of bedload with distance downstream, supported by data from our own laboratory experiments and previously published data to evaluate the role of size-dependent abrasion in grain size evolution in the fine gravel range. In previous work, we performed tumbling wear experiments on multiple lithologies, including Bishop Tuff from the Long Valley Caldera in eastern California; limestone from north-central California; and sandstone from northern California. In addition to abrasion, which produces sand- and silt-sized wear products, we also observed particle fragmentation in some lithologies. We calibrated the sensitivity of the fractional wear coefficient to initial grain size for different lithologies, and developed an analytical model to explore the effect of size-dependent wear on the evolution of grain size distributions. We considered two cases of bedload evolution: (1) abrasion rates are constant across all grain sizes (i.e. Sternberg's Law), and (2) abrasion rates are size-dependent, where smaller particles wear faster than larger particles. Analytical modeling shows that the formation of a grain size gap below 5 mm is consistent, regardless of whether or not the abrasion coefficient alpha is constant or size-dependent. We find that rock strength, which in principle is independent of size, is a primary control on particle wear rates. The secondary effect of size-dependent wear for certain lithologies may, however, be a contributing mechanism driving the paucity of fine gravel in bed material and the evolution of a grain size gap at gravel-sand transitions.

Landscapes in motion: the Eastern Andean piedmont fluvial history recorded in the Guaviare River deposits, Colombia.

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02B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 2:00 PM - 3:30 PM

The sedimentary record of fluvial systems provides essential insights into how landscapes respond to climate change over time. While fluvial processes in temperate and arid/semi-arid regions are well documented, a notable research gap remains concerning Quaternary fluvial dynamics in tropical mountainous environments. This study focuses on the evolution of the piedmont zone of the Guaviare River basin in Colombia's Eastern Andean Cordillera (4°N), an area influenced by increased tectonic activity during the late Cenozoic. Geomorphological mapping and field surveys revealed four alluvial fan units (Q1 – Q4), eight terrace levels (Q5 – Q12), and two floodplain levels (Q13 – Q14) in the Upper Guaviare River. These deposits are predominantly coarse-grained and consist mainly of conglomerates and sandy conglomeratic facies (Gm, Gt, and Sgm). Optically Stimulated Luminescence dating data from quartz and feldspar grains indicate that the distributary fluvial system was active from at least 350 ka to 150 ka, and a significant shift to a tributary system occurred around 150 – 50 ka. Floodplain formation occurred during the early Holocene (~10 ka). Paleoenvironmental and palynological evidence, in addition to the luminescence ages, suggest that the transition from a distributary to a tributary system is linked to changes in precipitation in the northern tropical Andes, driven by shifts in the intertropical convergence zone (ITCZ) on an orbital scale. Periods of reduced rainfall, associated with a more northerly ITCZ position, supported alluvial deposition across both distributary and tributary systems. Tectonic activity, including faulting, is evident in alluvial fans dated to at least 250 ka and in river terraces dated to 110 ka. We are working to integrate cosmogenic nuclide data (^{10}Be and ^{26}Al) with luminescence dating to improve our understanding of long-term paleoerosion and denudation rates, and to refine our paleoenvironmental reconstruction of the Eastern Andean Cordillera. (FAPESP grants #2021/14947-6 and #2022/03007-5).

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Paraglacial adjustment of valleys in the southern Fraser River basin, British Columbia, Canada

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Maximum ages of fluvial incision and terrace abandonment were determined from multi-grain single-aliquot optical dating of overbank sand on the Fraser River around Big Bar and the 3rd order lower Nicola River in British Columbia, Canada. Potassium feldspar grains were dated given the uncertainty around the utility of quartz for optical dating in the British Columbia interior. Paraglacial incision of Fraser River reach is 180 m to bedrock and occurred 11.3 ± 1.5 ka to present. Paraglacial incision by the 3rd order lower Nicola River is at least 55 m to bedrock and occurred 8.5 ± 1.1 ka to present. The wider valley of the Fraser River mainly formed unpaired terraces, while the narrower valley of the lower Nicola River mainly formed paired terraces. Despite incomplete bleaching of feldspar grains in the narrower Nicola Valley associated with shorter grain travel distances and the proximity of samples to the valley side, both valleys exhibited similar patterns of incision rates: slower through the xerothermic interval and faster through the cooler and wetter mesothermic interval. Mesothermic (~8-4 ka) incision rates averaged 30 mm/a for Fraser River and 9.5 mm/a for Nicola River, this magnitude difference is expected given the larger basin size and higher flow power of the Fraser River. Higher mesothermic incision rates are attributed to cooler and wetter conditions and the development of forests. These factors increased slope stability and stream power whilst upland sediment supply decreased. In the Fraser River valley landslide dams and paraglacial fan sedimentation caused localized floodplain aggradation and paired terrace formation. It is not known when either river first incised to bedrock.

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The role of underbursts and proglacial lakes in Cordilleran Ice Sheet deglaciation

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09G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 11:35 AM - 1:05 PM

Recent releases of high-resolution elevation data obtained from LiDAR surveys covering the southern interior plateau of British Columbia, Canada have revealed a landscape dominated by previously unidentified meltwater corridors, ribbed and murtooized terrain, crevasse-fill ridges, spillways and proglacial lake derived landforms. Large meltwater corridors contain fill and large eskers attributable to underbursts. Smaller corridors contain minimal fill, curvilinear troughs and small eskers attributable to more steady-state flows. Ribbed and murtooized terrain contain evidence of glacitectonic activity and active ice. Delicate crevasse-fills and landform preservation are evidence of ice stagnation. Spillways record both lake-stage maintenance and catastrophic drainage. Lake stage evolution records ice margin retreat. In one sector of the CIS, we weave a story of deglaciation as much driven by meltwater activity in the form of underbursts and proglacial lake formation and drainage as it was by climate warming. Deglaciation resembles stagnation zone retreat.

Pleistocene Tunnel Valleys of Northern Germany and the North Sea: Geomorphology, Sedimentation, and Glacial-Regional Geological Interactions

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Tunnel valleys are large subglacial landforms formed by pressurised meltwater beneath retreating ice sheets. In northern Germany and the adjacent North Sea region, these buried tunnel valleys reach depths of up to 600 meters and display complex morphologies that reflect the interplay between meltwater drainage, ice-sheet dynamics, and underlying geology. This study presents a detailed geomorphological and sedimentological analysis of tunnel valleys using digital elevation models and high-resolution 3D seismic data from the offshore “GeoBasis3D” survey (2021).

Onshore, tunnel valleys are clustered into zones of similar depth and formed parallel to the direction of ice retreat. Zones with maximum incision depths correlate with the main subsidence axis of the North German Basin. While some tunnel valleys are aligned with neotectonically active faults—particularly where ice flow paralleled these structures – no systematic control by salt tectonics or pre-existing faults is observed.

Offshore seismic data reveal steep-walled tunnel valleys with undulating bases indicative of intense erosion by subglacial meltwater under high hydrostatic pressure. The infills exhibit a range of depositional features, including chaotic basal reflectors, erosional unconformities, and stacked parallel reflectors. These patterns suggest multiple infilling phases driven by fluctuating meltwater discharge and episodic reactivation during glacial retreat. Cut-and-fill structures indicate dynamic water flow and evolving drainage pathways. In some areas, the tunnel-valley fill and overlying sediments are displaced by crestal faults linked to underlying salt structures, evidencing Quaternary fault activity.

The results emphasize the geomorphic and stratigraphic complexity of tunnel valleys and their formation by high-pressure subglacial meltwater systems. A multidisciplinary approach combining seismic geomorphology, sedimentology, and structural geology is essential for reconstructing their development and for understanding past ice-sheet behaviour in glaciated sedimentary basins.

Hawke's Bay Flooding, but without the 1931 earthquake and coastal uplift

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06D: Dynamic Landscapes: Tectonic Geomorphology of Aotearoa New Zealand, Dobson 3, February 3, 2026, 2:30 PM - 4:00 PM

Geomorphological landscape formation of Hawke's Bay is extensively affected by braided river systems, sedimentation and erosion. The coastal plains of Hawke's Bay are prone to periodic flooding and have sustained severe flood damage during events such as the 1938 flood, Cyclone Bola and more recently, Cyclone Gabrielle. Little consideration has been given to the tectonic setting of Napier along the Hikurangi Subduction Zone when considering flood models.

The coastline and coastal valley of the Esk River was uplifted by as much as 2.5 m at the coast during the 1931 Napier earthquake, which had a magnitude of 7.8. The earthquake lifted the seabed and shallow marine beach deposits out of the ocean and formed what is inhabited, dry land on the present day. However, with this uplift, drainage features (i.e., rivers) which previously drained into the South Pacific Ocean unimpeded were also affected and in some cases (e.g., the Ahuriri River), the river flow was stopped or even reversed.

The uplift has caused extensive sedimentation along the coast, and a gravel spit – formerly the continental shelf - along much of the Napier coastline has caused many drainage features to become blocked and periodically displaced or realigned. Blockages, whether partial or complete, severely worsens the effect of flooding, unless the river mouths are opened, often manually, by using earthmoving equipment.

Our research used flood modelling and historic data for the Esk River to simulate a flood assuming the coastal uplift from the 1931 earthquake never took place. Results show a significantly more effective drainage system, with sediment loads and flood waters being conveyed into the ocean far more effectively.

The research emphasises the extent and severity of effects coastal uplift can have, and gives an indication of how much less damaging flooding could potentially have been without the coastal uplift.

Geomorphology and Ecological Civilization in China

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09F: Engaging the relational work of geomorphology, Conway 1, February 5, 2026, 11:35 AM - 1:05 PM

Moves towards ecological civilization present genuine hope for the wellbeing of humanity and Planet Earth. Emerging approaches to ecological civilization in China build upon long-standing sociocultural relations that work with nature and emphasize the role of rivers at the heart of civilization and society. Here we outline three geomorphic principles that underpin a dynamic landscape template as an integrating platform to conceive, design and implement moves towards ecological civilization: (1) a holistic lens manages the land to manage the river/catchment, applying process-based measures that manage from source to outlet and at scale; (2) a living river ethos works with rivers as adjusting systems, not stable/static entities; (3) adaptive management strategies strive to achieve proactive, realistically achievable goals, recognizing inevitable uncertainties in working with the evolutionary (emergent) traits of each river/catchment. These relations play out in inherently contextual ways, in sociocultural and biophysical terms. Recommendations and implications highlight prospects to build upon existing management approaches (happy river index, river chief system) to construct an ecological civilization.

Megadune migration teeny weeny preservation: : Late Pleistocene megadune dynamics and sabkha accumulation in the Rub’ Al-Khali, Saudi Arabia

Professor Charles Bristow[1], Professor Nick Lancaster[2], Professor Khalid Al-Ramadan[3], Dr Christina Neudorf[4], Dr Amanda Keen-Zebert[2]
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07H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 5:00 PM - 6:30 PM

Luminescence dating of a crescentic mega-dune and adjacent interdune in the eastern Rub’ al- Khali sand sea of Saudi Arabia are used to establish rates of megadune migration in the late Pleistocene and early Holocene and contemporary rates of sabkha accumulation for the first time. Despite their giant size, dune preservation is limited by the rate of sabkha accumulation, meaning that very little of the dune deposits would be preserved in the rock record. Luminescence dating of cross-strata deposited on the lee face of a 167 m-high mega-crescentic dune in the eastern Rub’ Al-Khali sand sea show that the dune accumulated rapidly during the period 15.3 to 9.47 ka, with peak accumulation and migration at 0.49 m/yr to the SSE between 11.97 and 11.46 ka. Sedimentary structures indicate that this was the result of strong northwesterly “Shamal” winds. During the same interval of the late Pleistocene and early Holocene, linear dunes in the northeastern UAE were also accumulating rapidly, indicating that the period 16 – 9 ka was characterized by regionally widespread dune formation and/or reworking.   The main dune has subsequently migrated to the SSE some 740 m since 9.47 ka, at an average rate of 0.08 m/yr, indicating persistence of the Shamal wind system for at least 20 ka, albeit at lesser intensity. Combining rates of megadune migration and wet sabkha accumulation reveal that despite their very large size only a tiny portion of the megadune might be preserved within the rock record.

Landslides in sensitive tropical soils: the case of Upolu, Samoa

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12J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 9:35 AM - 11:05 AM

The Samoan volcanic island chain covers an area 1400 km by 380 km, located in the southern part of the Pacific Ocean, aligned northwest to southeast between latitudes 13° and 15°S, and longitudes 168° and 171°W. The focus here is the island of Upolu, on which the capital city of the Independent State of Samoa, Apia, is located. Upolu is 75 km long and 1125 km2 in area, and with ~145,000 inhabitants, is easily the most populous of the Samoan Islands. Rainfall-triggered landslides are prevalent along Upolu's main roads, but detailed studies of factors pre-conditioning slopes to fail and slope failure mechanisms, are sparse. Upolu is formed from a large, ocean floor basaltic shield volcano, with 6 mapped volcanic formations from oldest to youngest: Fagaloa Volcanics; Salani Volcanic; Mulifania Volcanics, Puapua Volcanics; and, the Lefaga Volcanics. All formations are basaltic, except for andesites in the Fagaloa formations. On account of high rainfall, ranging from 3000 mm to 6000 mm per year, the landscape is a deeply dissected volcanic terrain, with the highest peak Mount Vaivai at 1113 m. The high, rugged volcanic terrain is susceptible to landslides including slumping, earthflows and rockfall. The residual soils are a product of chemical weathering of the volcanics, and landslides typically form along shear planes within the residual soils and highly weathered underlying rock. Geotechnical properties and behavior are typified by moderately plastic clays that can show a range of activities and sensitivities, at least part-dependent on the underlying volcanic formation. In summary, despite the possibility of large landslides in rock (e.g. Tuialamu Landslide), most landslides are shallow, in soil, but nonetheless cause significant disruption to roads, crucial links to delivering aid during disasters.

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Landsliding in Vanuatu and Fiji: a comparative study

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12J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 9:35 AM - 11:05 AM

Landslides, unlike some other geological hazards, occur globally and are triggered either by natural processes or human activities. Both Fiji and Vanuatu are volcanic islands in the southwest Pacific but exhibit varying hazard levels from earthquakes and volcanoes. However, both these countries are highly vulnerable to landslides due to their rugged topography, tropical climate, high rainfall amounts, and highly weathered volcanic materials. Indeed, the southwest Pacific region experiences numerous landslides annually, often rainfall-triggered, and these can be unpredictable and are often poorly understood. In Vanuatu particularly, population growth and land development has led to deforestation and undercutting of slopes for infrastructure, increasing the risk of slope failure. Nevertheless, landslides in Vanuatu are damaging, but are understudied, which limits the effectiveness of landslide mitigation strategies. This study compares and contrasts the properties of slope materials on landslide-prone slopes on Maewo Island, Vanuatu, and the southeastern region of Viti Levu, Fiji. Field studies of selected slope failures have been conducted at study sites to identify slope failure types and their characteristics. Coupled with this, in situ investigation of soil properties at each study site was also undertaken, including penetrometer and shear vane testing. Sampling of soils from landslide scarps occurred for laboratory testing, including particle size, Atterberg limits, and mineralogy. Soils from all the sampled locations plot below the ‘A-line’ on the plasticity chart and are classified as medium to high plasticity silts. Overall, the landslides investigated are a combination of failure types, exhibiting both slide and flow slope failure mechanisms, in clayey and silty cohesive soils. Preliminary results show no clear relationships between landslide morphology, type and material properties but this requires further study.

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Rethinking Erosion Management in the Face of Extreme Floods Across the Australian Tropics and Subtropics.

Assoc. Prof. Andrew Brooks[1], Mr John Spencer[1]
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07A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 5:00 PM - 6:30 PM

In recent years, extreme flood events—far exceeding the historical range of variability—have occurred with increasing frequency across the Australian tropics and subtropics. These events are initiating geomorphic processes such as large-scale landslides and severe channel and floodplain stripping, often at a scale not previously observed in these regions. The magnitude and intensity of these erosion processes are presenting significant challenges for land and water managers, who have traditionally focused on managing erosion driven by anthropogenic land use disturbances. Significantly, many of these extreme erosion events are occurring in largely undisturbed or protected landscapes, including the Queensland Wet Tropics World Heritage Area, Boodjamulla National Park in the southern Gulf of Carpentaria, and Nightcap National Park in northern New South Wales. Unlike more familiar erosion processes linked to human activity, these events cannot be directly attributed to conventional land use impacts. Nevertheless, they are contributing substantial sediment loads to downstream ecosystems, and have the potential to undermine the effectiveness of major investment programs—such as those targeting anthropogenic sediment sources affecting the Great Barrier Reef. In this presentation we present recent examples of extreme erosion associated with high-magnitude floods that are at a scale not reflected in the historical record. We explore the implications for river and catchment management and argue that a fundamental shift in erosion management thinking is needed to address the challenges posed by an emerging climate regime characterised by increasingly extreme hydrological events.

The Taphonomy of SedaDNA and its Potential for Fluvial and Catchment Ecological Restoration

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03K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 4:00 PM - 5:30 PM

The restoration or 'rewilding' of rivers and lakes and even small catchments, which generally involved manipulating biotic drivers, has traditionally used several palaeoecological techniques including plant macrofossils, microfauna and pollen. These, however, have well known limitations due to both taxonomic level and indeterminate source-areas. SedaDNA potentially offers answers to both of these limitations as well as expanding the organism groups substantially to animals, fish and invertebrates. But in order to fully utilize this new approach we need to understand the taphonomy of sedaDNA so that biases can be assessed and allowed for in baseline reconstruction. Taphonomy here includes aspects of transport, preservation and bioturbation in the sedaDNA record. In this paper we look at the spatial input of sedaDNA into a small lake within a small Boreal-zone catchment and variations in sedaDNA quality with changing lake and floodplain conditions and sedimentation. The taphonomic biases can theoretically come from spatial factors, such variations in sediment connectivity, local environmental factors such as pollution loading, and longer-term variations in sedimentation and land-use. One of the advantages of sedaDNA is that it can record aspects of taphonomy such as the appearance of bioturbating organisms. However, with comprehensive taxonomic data that is spatially constrained it becomes possible to investigate biotic interactions as well as construct past food webs and ecological dynamics. However, taphonomy poses limitations that may limit the depth and completeness of our reconstructions of ecological conditions and processes.

The topic is highly relevant today as our environmental policies seek to restore former catchment conditions, promote resilient ecological dynamics and biodiversity.

The Medieval 'rise' of floodplains: palaeoagronomy from sedaDNA, pollen and sedimentary chronologies

Professor Antony Brown[1,2], Dr Sam Hudson[3], Prof. Andreas Lang[4], Prof. Phil Toms[5], Dr Ben Pears[2]
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03I: Lowlands a place for humans? Geomorphic functionality and anthropomorphization of alluvial and coastal plains from past to future, Conway 4, February 2, 2026, 4:00 PM - 5:30 PM

In the lowland soft-rock landscapes that dominate the highly populated regions of the Globe floodplains are the major geomorphic sink for sediment eroded from catchments. In the early and Middle part of this interglacial (Holocene) most streams and rivers were in approximate balance in continuity terms with deposition balanced by channel erosion and sediment compaction, creating accommodation space. However, as both alluvial chronologies and lake sedimentation histories show, this balance changed in the late Holocene with floodplains becoming net sinks for sediment and carbon. This paper explores how new methods can help explain the interacting factors of climate and human catchment land use in the reconfiguration of catchment sediment flow dynamics that led in many cases to relative incision and channel stabilisation. In particular the emerging use of sedimentary ancient DNA (sedaDNA) on floodplains, whilst not as advanced as for lakes, can provide much more spatially and taxonomically precise data on human activities in the catchment. This crop and domestic stock data coupled with sediment flux and character is 'palaeoagronomy'. In Europe key questions are what drove palaeoagronomic trends including what the historians refer to as the Medieval 'cerealisation' of Europe, new crops, changing technology and even idealogy. Despite set-backs the population of NW Europe more than quadrupled from the 8th to 14th centuries CE with environmental repercussions. Here we use floodplain and coupled slope-system examples from the UK and the loess belt of Belgium. We also discus the particular problems for alluvial sedaDNA and how the preservation is related to sedimentology and floodplain hydrology.

The topic is highly relevant today as our environmental policies seek reduce soil and carbon loss from catchments, protect sediment and carbon stores and promote biodiversity. However, this is in a changing climate which might rejuvenate unprotected floodplains with wildlife and environmental quality results.

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Submarine landslides in southeast Australia, a case study of the Brooms Head Complex

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Submarine landslides (SMLS) are mass sediment transport features and are widespread along the south-east Australian continental margin (SEACM) despite the margin lacking many of the typical SMLS pre-conditioning factors that other continental margins like New Zealand's possess. The Brooms Head (BH) SMLS complex, recently mapped in full, presents a unique morphological case study of a SMLS site along the SEACM. The complex is ~3,417 km², and sits ~60 km south-east of Yamba, NSW. This study uses recently acquired bathymetry, seismic survey data, and sediment samples, to investigate the morphology, stratigraphy, sedimentology and tsunamigenic potential of the BH SMLS complex.

Morphology of the complex suggests a large sediment failure event occurred in geological past and, since then, erosional bottom currents have scoured the bottom of the continental slope within the complex. Sediment failure within the complex appears to be partially controlled by bedrock as well as a primary slip failure surface identified in a seismic survey across the site. A tsunamigenic assessment was conducted using a validated numerical model, Basilisk, with scenarios incorporating a range of sediment densities calculated from sediment samples along the SEACM. Two different failure scenarios were modelled which indicate that if either of these two sliding scenarios occurred and the sediment failed in one cohesive event, there is a significant tsunamigenic risk to the nearby coastline with models indicating varying extents of inundation that would be damaging to coastal populations and infrastructure.

The data indicates a dominant slip surface from which material has failed from, providing new insights into the reasons these features are observed on our margin. This case study of a SMLS complex along the SEACM contributes to the effort to better understand these erosional features and their tsunamigenic implications for the east Australian coastline.

Subaerial Morphological Change Detection for a Headland Bypassing Study in New South Wales, Australia

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08E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 9:35 AM - 11:05 AM

Headland bypassing is a sediment transport process connecting adjacent beaches and sediment compartments through the migration of sediment around a natural headland. Crowdy Head, located on the southeast Australian coastline, significantly protrudes from the coastline exposing it to the dominant southeast swell regime which drives a major sediment transport pathway in the region. Additionally, the site exhibits a discontinuous sediment pathway around the headland, due to the presence of a reef outcrop obstructing the sediment pathway, providing an interesting natural laboratory to study the bypassing process.

This project quantifies sediment volume and shoreline change to detect bypassing events using high-resolution Unmanned Aerial Vehicle (UAV) (Drone) LiDAR data combined with historical aerial LiDAR, photogrammetry, and satellite-derived shorelines which enables analysis of long-term beach morphology either side of the headland, a proxy for the detection of headland bypassing.
A six-week field campaign throughout July–August 2024 included repeat UAV-LiDAR surveys and in-situ deployment of hydrodynamic equipment. A high-energy swell event occurred during the campaign, with a significant wave height of 5.2 m recorded by a nearshore wave buoy moored offshore the headland. This event has enabled an opportunity to evaluate sediment transport under conditions suspected to be required for bypassing.

Preliminary analysis of annual mean shorelines and reference transects either side of the headland indicate no linear shoreline trend between 1988-2023 but a significant inter-decadal difference in shoreline position on the north side between the 1990s–2000s and 2000s–2010s. This suggest that shoreline variability at the site is likely driven more so by shorter-term and smaller-scale processes such as bypassing rather than by long-term processes.

This case study is one of a small number of case studies of headland bypassing along the NSW coastline and aims to link bypassing events with the hydrodynamic conditions that drive bypassing to inform coastal management in the region.

Revisiting Pockmark Geomorphology: Insights from High-Resolution ROV Mapping and 3D Seismic Imaging

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Pockmarks and similar seabed fluid seepage features are commonly described as circular to sub-circular depressions, typically spanning a few meters to several hundred meters in diameter and a few to tens of meters in depth. This understanding is largely derived from ship-based bathymetric surveys with horizontal resolutions on the order of tens of meters. However, recent high-resolution mapping using remotely operated vehicles (ROVs) equipped with multibeam echosounders, direct visual observations, and ultra-high-resolution 3D seismic imaging (6 m vertical resolution) reveals a far more complex and dynamic geomorphology.

Our investigations along the western Svalbard margin demonstrate that these features are not simple depressions, but intricate geomorphic systems. The pockmark interiors and perimeters host a mosaic of meter-scale pits, carbonate crusts, hydrate mounds, and soft, moaty sediment zones—often linked to active or past gas seepage and diverse benthic ecosystems. Subsurface imaging shows complex fluid migration pathways and shifting centers of seepage activity over time.

These observations not only challenge the traditional view of pockmarks as static fluid escape structures, but also underscore their significance in marine carbon dynamics. Pockmarks are key sites for the transport and transformation of carbon in multiple forms—methane, dissolved inorganic carbon, and carbonate precipitates. They represent dynamic interfaces where microbial, geochemical, and physical processes interact to mediate the flux of carbon between the seabed and the ocean.

This revised perspective has important implications for our understanding of seafloor processes, benthic habitats, and the role of cold seeps in the marine carbon cycle.

Assessing anthropogenic sinkhole hazard scenarios in the city of Napoli (Italy)

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05K: Identification, quantitative assessment and mapping of anthropogenic landforms in urban areas, February 3, 2026, 11:35 AM - 1:20 PM

Sinkholes are vertical and enclosed cylindrical or funnel-like depressions, often associated with karst environments or evaporite rocks, regardless of the existence of an internal drainage network. In urban areas, sinkholes are also related to the presence of manmade underground cavities and can be called “anthropogenic sinkholes.” A method aimed at different anthropogenic sinkhole hazard scenarios assessment has been developed to provide an instrument focused on cultural heritage or human life damage prevention. Such scenarios are evaluated considering the sinkhole diameter instead of the depth for two main reasons: i) more available data within the inventory, and ii) in urban areas, the sinkhole diameter can heavily affect the economical fabric (larger area impacted by interdiction). As the first step, the available sinkhole inventory has been divided into three different subsets based on user-defined thresholds. The three subsets are used to evaluate the spatial occurrence of sinkholes with different diameters employing an ensemble method approach: the sinkhole susceptibilities obtained with different machine learning algorithms and input data are combined using the weighted mean method to obtain a final product. Subsequently, the temporal occurrence probability is evaluated independently using the Poisson distribution analysis. By combining the three anthropogenic sinkhole susceptibilities with the temporal probability occurrence, different anthropogenic sinkhole hazard scenarios were obtained related to both magnitude and temporal occurrence. This methodology can be a useful tool aimed at studying the possible interactions between sinkhole dimensions and specific areas of interest or predisposing factors, although highly dependent on the quality and quantity of the inventory data.

Acknowledgments
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Geomorphological record of extreme flood events along dryland river deltas using drone photogrammetry: Bridging the gap between scale and resolution

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Along the arid tropical coast of Western Australia, the De Grey is a dryland ephemeral river associated with a tide-dominated delta. On February 14, 2025, the De Grey River has been directly hit by Zelia, a category 5 cyclone, leading to an extreme flooding event. Drone photogrammetry offers the opportunity to study the impact of this single flood event on the geomorphology of this depositional system by comparing pre- and post-cyclone surveys conducted in mid-2024 and mid-2025, respectively. A key technical challenge is to achieve very fine spatial and vertical resolution (<10 cm), while covering a large area.

Here, we present the tools and methods that were used to conduct pre- and post-cyclone drone photogrammetric surveys, using a post-processing kinematic (PPK) solution. 16 base stations / landmarks (i.e., known points with <1 cm accuracy) were created across the entire De Grey to ensure that each drone survey conducted was located within a 5 km radius of the closest base station. Drone surveys were then conducted using a fixed-wing Quantum Trinity Pro flying at an altitude above ground of 120 m, with photos overlap of 70%, while a PPK base station was recording at the closest landmark. Finally, surveys were post-processed in QBase and then loaded / processed in Agisoft following a consistent workflow.

Overall, an area of ~50 km² was covered and results show an average horizontal and vertical total error of 2 to 2.5 cm for a resolution of 1.6 cm/pix. Digital Elevation Models (DEMs) generated for each survey seamlessly blend together. The creation of differential sedimentation maps using DEMs pre- and post-cyclone at this scale and resolution offers unprecedented insights on the geological record of one single flood event across a dryland river delta, which can help to predict future changes along similar systems affected by extreme events.

Australia's Biggest Flood – Identifying floodplain process zones from nanosatellite mapping and bank erosion to improve dryland floodplain management.

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01A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 11:40 AM - 1:10 PM

The January 2023 flood event was the largest measured flood to impact the Martuwarra (also Mardoowarra) Fitzroy River (peak flow of ~50,000 m3sec-1), and the largest ever instrumented or measured flood in Australia. The size of the event raised questions about the impact on the river geomorphology, with this study using “Floodplain Process Zones” as a way to inform river management and discussion of development setbacks for the town of Fitzroy Crossing, which is located on the floodplain of this anabranching system.

Planet nanosatellites were used to map immediate post-flood depositions and in combination with LiDAR and a hydrodynamic model to map depositional “Floodplain Spill-Out Zones”, and more energetic high-velocity and deep areas to Australia Disaster Handbook ratings. Benchmarking of long-term, and 2023 event bank erosion, plus satellite mapping of lost riparian vegetation (662 ha lost) looked at dynamics at the river bank. It was found that 34% of the banks along the 76km study reach had bank erosion rates greater than 1m/yr, where bank erosion would exceed the historical floodplain development setback (50m), within 50 years. The 2023 event was also benchmarked against an previous palaeo-flood study (Wohl et al, 1994), and suggests events of this magnitude (~50,000 m3sec-1) are not unprecedented at a (multi) centennial frequency.

Despite extreme bed mobility (sediment mobile to at least 12m deep) and localised areas of bank erosion and significant loss of fringing riparian forest, the anabranching river geomorphology was relatively resilient to the “mega-flood”. The Fitzroy Crossing area has a complex river and floodplain, a complex social and historical context to where people live, and ongoing challenges that have been better informed by using geomorphology to support better floodplain and development management.

Evaluating River Corridor Change using the Natural Character Index: A Geomorphic-Based Tool for Integrated River Management in Aotearoa New Zealand.

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

How much has a river changed due to deliberate human intervention – and what does that mean for future river management? Understanding a river's geomorphic history is essential for managing its future, yet few tools offer a simple, consistent, scalable way to assess change. The Natural Character Index (NCI) is an objective approach that quantifies changes in large-scale river corridor geomorphology over time by comparing present-day, post-intervention characteristics (e.g. channel width, bar area, riparian vegetation) with historic, pre-modification conditions derived from aerial imagery and terrain data. The NCI offers a repeatable method for identifying the nature and trajectory of river corridor change, supporting evidence-based decisions in river restoration, hazard mitigation, and infrastructure decision-making.

In Aotearoa, earliest aerial imagery tends to capture pre-management river states, enabling NCI assessments to provide a first-cut evaluation of river evolution from pre- to post-intervention. The NCI is calculated as a ratio between a parameter describing the river's current form and function and the same parameter measured at a previous point in time. This provides a quantifiable metric to assess changes in both the extent and composition of river corridors, including shifts in river character and assemblages of large-scale geomorphic units.

Originally developed by Fuller et al. (2021) to assess the success of floodplain restoration and river recovery, the NCI assessment has since been applied across diverse river corridors – from Tairāwhiti to Southland – supporting a wide range of river management objectives. These include anticipating river responses to future interventions, evaluating the impacts of gravel extraction, understanding sediment-driven landscape evolution at the catchment scale, assessing post-cyclone river response, and defining 'Room for the River' for future planning. As pressures on river systems grow, the NCI provides a scalable foundation for integrating geomorphic understanding into national river management strategies.

Spatial variability of sediment provenance and erosion rates on modern deposits across eastern Andes to Amazonian lowlands

Ms Gabriella Campos[1], Mr Bodo Bookhagen[2], Ms Priscila Souza[1,3], Mr Caio Breda[4], Ms Anarda Simões[4], Ms Carolina Cruz[4], Mr Renan Brito[4], Mr Andre Sawakuchi[4], Mr Fabiano Pupim[1,3]
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11A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 5:00 PM - 6:30 PM

Reconstructing long-term landscape changes requires a proper understanding of the relationship between modern signals and their natural controls. In this context, this Master's thesis project investigates the spatial variability of sediment provenance and erosion rates in the eastern Andes through the analysis of modern fluvial deposits. Sediment provenance and erosion rates along the Amazon river latitudinal gradient from 3°N to 15°S will be estimated using luminescence sensitivity (from quartz and feldspar grains) and terrestrial cosmogenic nuclides (TCN, ^{10}Be and ^{26}Al). Samples were collected in the Iquitos and Huallaga regions of Peru, from major rivers of the Andes-Amazon system, including the Ucayali, Marañon, Napo, Madre de Dios, and Huallaga. In general, the luminescence sensitivity analysis on pure quartz samples yielded low sensitivity values, as expected for Andean-sourced sediments. Sensitivity values ranged from a few tens to <200 cts mg-1 Gy-1 in most cases. The lowest values (<25 cts mg-1 Gy-1) were observed for samples from Maranõn River. More spread and higher values in the range of 100 to 500 cts mg-1 Gy-1, which is still relatively low compared to other studies, were observed for samples from the Madre de Díos River. Luminescence sensitivity data on polymineral samples showed a negative correlation between IRSL1.2s/BOSL1s and BOSL1s, indicating an increase of quartz sensitivity with a decrease of feldspar content in the sediments. TCN analysis to estimate erosion rates is being obtained and should be available soon. We expect to find a negative correlation between OSL and the TCN data, i.e., where higher quartz sensitivity OSL values are associated with higher erosion rates. Both OSL and TCN data will also be compared to environmental variables to assess what controls their spatial variability and, thus, contributes to a better interpretation of the sedimentary and erosive processes in the Andes-Amazon River system. FAPESP #16318-1; #2022/03007-5

Laboratory Experiments on the Development of an Ice Tunnel from an Upstream Water Reservoir through Simulated Glacier Dam

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The hydraulic and glaciological conditions controlling floods from ice-marginal glacial-lakes remain poorly understood, despite increasing occurrences due to climate change. Many floods result from tunnels developing within the ice, allowing impounded water to discharge to the glacier margin rapidly. However, little is known about how ice tunnels evolve, models being constrained by limited field observations and the physical theory of ice melt with flowing water. This study explores the basic principles of the development of a simple linear ice tunnel using a laboratory flume. Sudden water flux from an upstream reservoir passes through an open circular tube within an ice block. Growth in the tube shape simulates the development of an ice tunnel within a glacial dam. The velocity at the tunnel entrance and the discharge through the tunnel were recorded as the head of reservoir decreased, enabling the assessment of the temporal development of the hydraulic gradient, and the tunnel roughness, size and shape for different water temperatures and flood durations. An increase in water temperature positively controlled the rate of rise of hydrographs. The Nikuradse equivalent roughness value increased from c., 10^-9 to 10^-4 m as the hydrograph progresses. For any given temperature and tunnel roughness, the surcharged wetted tunnel cross-sectional area increased logarithmically with time whilst velocity also increased on the rising hydrograph. As frictional melt induced form roughness, velocity declined, and the surcharged tunnel cross-sectional area increased to accommodate the discharge. Once a free surface occurred within the tunnel on the falling hydrograph limb, the open-channel wetted area decreased linearly with time. The initial circular tunnel enlarged to an ovoid as the surcharged discharge increased. Downcutting was pronounced once a free surface developed. Incorporating a time-varying roughness coefficient, the simplified Nye model reproduced the observed surcharged-tunnel discharge data well until the free surface develops.

Post-glacial development of limestone scree; the example of White Scar, south Cumbria, NW England

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Debris, accumulated from rockfall below a limestone cliff in the English Lake District, has been investigated to determine if the lithofacies and stratification styles hold clues to changes in the environment since deglaciation through to the present day. A range of methods were used to characterize the deposits, including particle size and clast shape characterization. The mineralogical composition of a calcite cement was determined by X-ray fluorescence and oxygen isotope analysis, whilst the structure of the cement was determined using scanning electron microscopy of freshly-broken cement surfaces. Two distinct facies occur: talus which is defined herein as largely-unsorted, well-packed, boulder to cobble-sized rock debris at the cliff base; and an overlying scree that is a looser accumulation of sorted, small, rockfall fragments, typically of pebble-size. Both of these facies have been subject to the diagenetic processes of compaction and, more importantly, precipitation of calcite cement along preferential drainage lines at the base of the deposits. The talus predominantly is a glacifluvial accumulation of poorly-sorted sub-rounded cobbles and boulders with a subsidiary admixture of angular cliff-fall boulders. A weakly-cemented matrix avers for largely phreatic former groundwater conditions at the cliff base. In contrast, the scree is a gravity accumulation of well-sorted rock fragments that is characterized by openwork void spaces as well as localized calcite cementation that, together, indicate a vadose drainage system occurs down the cliff face above the base. A red-coloured sandy-matrix within the scree is a wind-blown infiltration deposit of a locally-derived coversand and loess. The development of calcite cement can be related to warmer periods since deglaciation. After the deposition of the distinctive deglacial talus, there are no stratigraphic indicators (such as clast size changes) within the scree, that would indicate any variation in the climatic drivers of the weathering process that followed deglaciation until today.

Holocene glacial and periglacial geomorphology along the Subtropical Andes of Chile: Records from contrasting climatic settings

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

In cold mountain environments, moisture availability becomes the critical factor controlling the dominance of glacial or periglacial processes: where moisture is sufficient, glaciers dominate, whereas in drier regions, periglacial processes prevail (Haeberli & Burn, 2002). This relationship provides a valuable lens for interpreting past climate variability in the Subtropical Andes of Chile (30–35°S), a region highly sensitive to shifts in the Southern Westerly Winds (SWW) (Garreaud, 2009). The SWW are a primary driver of Holocene climate variability in the Southern Hemisphere (Lamy et al., 2010) so understanding their past variability through terrestrial archives is critical for reconstructing Holocene climate evolution and its causes. To investigate past climate dynamics and their spatial expression, we use glacial and periglacial landforms as climate proxies through detailed geomorphological mapping in two climatically contrasting end-member catchments: the semi-arid Piedra Valley (30°S) and the sub-humid San José Valley (34°S). High-resolution optical satellite imagery and field-based mapping reveal distinct landform assemblages that reflect climatic regimes. The Piedra Valley is dominated by periglacial features, notably multiple generations of rock glaciers, indicating repeated phases of permafrost creep. Moraines are restricted to lower elevations and enclosed by rock glacier lobes, suggesting that deglaciation was followed by extended periglacial conditions. Conversely, the San José Valley preserves large, well-defined moraine ridges from multiple glacial episodes, some of which show evidence of periglacial reworking. Talus and forefield-connected rock glaciers are also well developed, possibly reflecting alternating glacial and periglacial dominance through the Holocene. This observed alternation of landform types reflects shifting moisture availability under an overall cold climate over time, controlled by latitudinal variations in SWW strength and position. The resulting landform mosaics provide tangible evidence of Holocene climate variability, particularly in terms of changing moisture balance, and offer insights into the climatic sensitivity of subtropical mountain landscapes in the Southern Hemisphere.

Holocene chronology of glacial and periglacial phases in the Subtropical Andes of Chile

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06G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 2:30 PM - 4:00 PM

Despite advances in paleoclimatology, key questions remain about the nature of Holocene climate variability. One unresolved issue is how the position and intensity of the Southern Westerly Winds (SWW) varied during the Holocene, and how these shifts influenced the southern hemisphere high mountain cryosphere response. The Subtropical Andes of Chile (30–35°S) are ideally situated to track these changes due to their sensitivity to the globally important SWW (Garreaud, 2009). In this mountainous region, the cryosphere is highly responsive to climatic changes (Hock et al., 2019), and associated landforms such as moraines and rock glaciers serve as valuable paleoclimate archives (Haeberli & Burn, 2002). While moraines provide evidence of former glacier extents and are widely used to reconstruct glacial histories (Mackintosh et al., 2017), sequences of relict to active rock glaciers are diagnostic of periglacial processes and ice-rich permafrost, forming under cold and relatively dry conditions (Haeberli & Burn, 2002). Despite the widespread co-occurrence of these landforms in the Subtropical Andes (e.g., Azócar & Brenning, 2010; García et al. 2024), their chronological frameworks remain poorly constrained, limiting their contribution to Holocene paleoclimate reconstruction. To address this, we apply ^{10}Be cosmogenic exposure dating to both moraine boulders and surface blocks on rock glaciers in two catchments: the Piedra Valley (30°S) and the San José Valley (34°S). The selected moraines represent former glacial extensions, while rock glaciers, composed of multiple lobes of different generations, record phases of periglacial activity linked to colder and drier conditions. To date, this is the first application of cosmogenic exposure dating to both moraines and rock glaciers in the Subtropical Andes of Chile. The resulting age constraints, to be presented at the IAG International Conference, will establish a spatio-temporal framework of glaciation and periglaciation phases, shedding light on the region's paleoclimate from a southern hemisphere and global perspective.

From geomorphic chaos to restoration of mining waste rock deposits: The "Waste to Place" project in northern Sweden.

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02I: Living with geomorphic change, Conway 4, February 2, 2026, 2:00 PM - 3:30 PM

Of all anthropogenic activities, mining has one of the largest impacts globally, leaving behind various types of waste that can affect ecosystems and, consequently, society. One of the most extensive and visible legacies of mining are waste rock deposits, which are often formed into terraces according to traditional mine closure protocols. In contrast, a geomorphic approach, seeks to recreate small basins with channel heads based on fluvial principles and natural geomorphic evolution.
Although geomorphic restoration has shown apparent success in various sites, the objective of the exploratory 'Waste to Place' (W2P) project in northern Sweden is to assess the performance of this approach applied in a cold, paraglacial environment. The project involves the restoration of approximately 4 hectares of waste rock deposits at a mine site in northern Sweden, using geomorphic parameters derived from landscapes dominated by fluvial processes. However, the landscape in northern Sweden has been shaped predominantly by glacial activity and is continuously exposed to snow, ice, and rainfall throughout the year. Therefore, a new perspective is required to restore waste rock deposits in these environments—one that is grounded in local geomorphology and ongoing surface processes.

In this work, we highlight findings from two work packages of the W2P project. First, we examine the geomorphic characteristics of northern Sweden, focusing on the controls influencing channel head formation, their relationship to various paraglacial landforms, and the potential of these landforms to design basins and channels in geomorphic design. Second, we present the latest results from a comparative study of a geomorphic restoration site and a conventional waste rock deposit in northern Sweden, evaluating erosion and stability through multi-temporal UAV surveys using LiDAR and photogrammetry.

The outcomes of this research contribute to the adaptation of current geomorphic restoration methodologies to enhance geomorphic understanding and improve restoration design in paraglacial landscapes.

Complexity of an active temperate glacial landsystem at Te Anau, South Island, New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Glacial landform assemblages enable identification of distinct glacial landsystems that are diagnostic of palaeo-glaciological conditions, including the spatial and temporal evolution of ice flow configurations, meltwater drainage patterns, basal thermal regimes and internal dynamics. The availability of high-resolution topography generated from the national survey campaign of airborne LiDAR by Land Information New Zealand (LINZ) reveals a spectacular landform record that has hitherto remained undetected beneath dense forest canopies and throughout mountainous terrain across South Island. We undertook detailed geomorphological mapping from 1 m Digital Elevation Models (DEMs) derived from this LiDAR data to characterise the nature and behaviour of outlet glaciers of the Southern Alps icefield. On this poster, we showcase the exceptionally well-preserved evidence of extensive and repeated glaciations of the Southern Alps throughout the Quaternary, at Te Anau, documenting a variety of ice-marginal, subglacial, supraglacial, glaciofluvial and glaciolacustrine landform assemblages. At Te Anau, the southernmost sloping piedmont forelands comprise fluted till surfaces with low-relief ridges that lie transverse to the dominant streamlined patterns, interpreted as series of minor recessional push moraines. Contrastingly, the northernmost part comprises widespread evidence of palaeo ice-dammed lakes and glacifluvial deposition. Overall, this landsystem is typical of active temperate glaciers. The landform record is of ice-marginal oscillations that reflect a long term (multi-millennial) quasi-stationary ice lobe. However, there is considerable complexity; for example corridors of smoothed topography and attenuated mega-lineations near Te Anau that are superimposed and inset within occasional meltwater channels suggest intermittent fast glacier flow. Overall, the glacial landsystem at Te Anau reflects intensive glacial erosion, variable glacier flow speeds and high-volume debris transport and offers insights and perhaps an analogue for outlet glacier evolution in modern temperate regions such as Patagonia, Canada or southern Alaska for example.

Reconstructing mountain glaciers during the Little Ice Age across the Andes in the Deplete and Retreat project

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01G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 11:40 AM - 1:10 PM

Reconstructions of mountain glaciers during the Little Ice Age, which was the last period of regionally-synchronous glacier advance, deliver (i) a baseline from which numerical models of present day glacier extent can be initiated, (ii) quantitative context for the rapid changes to glaciers observed during the satellite era, and on the basis of both of those two, then (iii) greater confidence in projections of future mountain glacier changes. This presentation highlights the reconstruction of thousands of glaciers across the Andes during the LIA, in terms of length, area, ice surface, volume and mass change. Issues with the datasets and workflow used for the reconstructions will be discussed. Results will include glacier-specific examples, especially anomalies, sub-regional and inter-regional comparisons e.g. by latitude and continentality, and by groups e.g. terminus environment, all to show association of glacier changes with climate and local controlling factors. Comparisons comparing the long-term centennial-scale rate of changes with those of the last few decades will evidence an order of magnitude acceleration in glacier mass loss. Finally, examples drawn from completed and ongoing work across other world regions (e.g. Greenland, Southern Alps New Zealand, Himalaya, and Alaska, respectively) will highlight the utility of these LIA glacier outline datasets more widely for quantitative examinations of proglacial landscape development.

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Adaptive River Management in New Zealand: A Comparative Analysis of "Room for Rivers" Strategies Following Extreme Flood Events

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

New Zealand's dynamic river systems present an opportunity to demonstrate "room for rivers" management principles in practice, yet real-world examples remain limited. This research will establish a comparative study examining contrasting management approaches along the Pohangina River corridor following recent cyclone-related channel expansion.

Three reaches are analysed: a "leave-alone" reach downstream of Pohangina Village, characterized by natural bifurcations, high surface roughness from vegetation and gravel deposits, and allowance for channel migration; an intermediate reach with a mixed management; and a heavily constrained "managed" reach featuring bank armor, and narrow channels with low roughness coefficients. Using a quasi-experimental design, we quantify the geomorphic and hydraulic differences between adaptive versus restrictive management strategies.

Geomorphic Change Detection, using LiDAR-derived Digital Elevation Models (2016-2024, 2025, 2026), and high-resolution drone surveys measure erosion, deposition, and volumetric changes. Two-dimensional HEC-RAS hydraulic modelling simulates flood dynamics under roughness scenarios, quantifying stream power distribution and flow resistance patterns. Historical analysis using aerial photography and maps tracks long-term channel evolution under different management regimes.

This project represents a unique opportunity to demonstrate river resilience through strategic accommodation of natural channel migration, allowing a substantial area to adjust to new fluvial processes rather than forcing a return to pre-cyclone channel conditions. The willingness to establish flexible river boundaries challenges conventional council practices and positions this site as a potential exemplar for adaptive management. By documenting how surface roughness, vegetation patterns, and channel complexity influence energy dissipation and erosion risk, this research provides critical evidence supporting "room for rivers" implementation across New Zealand's managed landscapes, with implications for global river corridor management facing increasing flood risks.

A thousand-year record of strandplain progradation eroded within decades since port construction

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06I: Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 2:30 PM - 4:00 PM

Human actions predominantly at very local-scales have substantially altered pre-industrial sedimentary stores and fluxes (natural sedimentary budgets) causing global-scale impacts. In this study we investigate how the construction of a port in the 1950s interrupted the provision of sand to a prograded barrier (strandplain), resulting in severe recession and erosion of ridges formed in the past millennium. Prograded barriers are worldwide depositional landforms that develop along relatively flat coastal areas with positive sediment budgets. Along the Dutton Way coast, western Victoria, Australia, a low-lying narrow prograded barrier was formed along a carbonate-rich margin partially sheltered from the southwesterly waves of the Southern Ocean in the late-Holocene. Optically stimulated luminescence dating retrieved from the second landward most ridge revealed an age for barrier initiation of at least 2.74 ± 0.15 ka, whereas seven other samples retrieved from younger ridges and LiDAR data indicated the continuous development of the barrier sustained through an average progradation rate of 0.12 m/yr. Textural and elemental analyses suggested that sediment characteristics remained relatively the same through barrier evolution, whereas remote sensed imagery indicated that the shoreline retreated ~140 m in the decades following port construction, resulting in significant public and private real estate loss and erosion of ~1,000 years of depositional record. Rock armouring of the shoreline temporarily halted the receding shoreline, but eventually led to the loss of beach and further erosion of the adjacent coastline, propelling the construction of the longest seawall in Australia. The Holocene and recent history of the Dutton Way barrier demonstrate how engineering interventions can have a major adverse and fast effect on even coastlines subjected to positive budgets.

Extreme rainfall and coastal erosion: a case study of a tropical bay beach

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08E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 9:35 AM - 11:05 AM

Gonzaguinha Beach (GB), located in São Vicente Bay (SVB; Southeastern Brazil), has been suffering from a chronic process of coastal erosion. Although the effects of waves and sea level on SVB beaches have been addressed, the effects of extreme precipitation have been neglected. This work analyzes the effects of the 18-19/February/2025 rainfall on the GB coastline. Records were acquired from a rain gauge station near the SVB. PlanetScope images were used to calculate suspended particulate matter (SPM) concentration, as well as to extract the dry and wet shorelines. Erosional features were measured in situ for one month, and sediment samples were collected. It rained 144mm, of which 116.33mm in less than 1.5 hours. MPS concentration in SVB showed a slight variation, with median values of 1.31g/m³ for the 18th and 1.16g/m³ for the 19th. The wet shoreline showed stability, while the dry shoreline showed greater variation, indicating the occurrence of channelization. The area with dry sand decreased by 17.1% and with wet sand by 7.5%. Five erosion features were monitored, ranging in length from 11.0 to 42.3m and width from 2.6 to 13.6m, persisting for up to 3 weeks. All showed erosion scarps, ranging from 13 to 70cm. Sediments were classified as fine sand, with a low percentage of organic matter (<0.09%) and carbonate (<5.6%). The drainage outlets channeled the rain flow, and strong flows were developed, generating large erosion features. Most of them dissipated around three weeks, except for the widest and longest feature, where the erosion was so severe that the adjacent sidewalk structures were damaged. Extreme events can have devastating effects on coastal morphodynamics, as observed in this study, affecting the local economy, tourism, and the lives of the inhabitants of coastal towns.

Understanding sediment (dis)connectvity in Late Quaternary landscapes: A case study from the Alpine region

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Sediment (dis)connectivity is a key concept for interpreting landscape dynamics, but its temporal evolution across different climatic phases remains poorly understood.

This study explores how sediment connectivity evolved during critical periods of landscape development: the pre-Last Glacial Maximum (>30 ka), the Early Late Glacial (~17–14.7 ka), the Late Late Glacial (~14.7–11.7 ka) and the Holocene (11.7 ka–present). The study focuses on the Terragnolo Valley, an alpine catchment in the southeastern European Alps, shaped by late Pleistocene glaciations, both from local ice field and from the Adige trunk glacier (>1000 m thick). In this area, we will apply the sediment connectivity index (IC) developed by Borselli et al. (2008) and refined by Cavalli et al. (2013), considering how different forcing factors (e.g., glacial masses, topography, vegetation, anthropic modifications) influence connectivity across these timeframes. To simulate connectivity through time, we reconstruct high-resolution paleotopographies (5 m DTMs) for each target period using a combination of geomorphological mapping, stratigraphic data, and terrain modelling techniques.

The application of the index is complemented by geomorphological observations in the field. Special attention is paid to the delineation of buffers and barriers following the framework proposed by Fryirs et al. (2007), enabling a more realistic representation of past (dis)connectivity patterns. The SedInConnect software (Crema and Cavalli, 2018) is used to compute the connectivity index under modern conditions, while tailored modifications to the input parameters will allow for the analysis of connectivity in past landscapes.

The aim of this study is to shed light on the evolution of sediment connectivity in response to major climatic and geomorphic transitions, providing insights into the natural variability of (dis)connectivity in Alpine systems. Ultimately, these results will support efforts to contextualize current sediment flux patterns and inform management strategies aimed at preserving or restoring connectivity at source and at scale.

Development and application of a geomorphological approach to support debris-flow hazard zonation in alpine catchments

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12D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 9:35 AM - 11:05 AM

The sediment availability is a key factor governing the triggering and the volume of debris flows. A reliable assessment of sediment availability in a catchment is essential to provide input to numerical models used for mapping the inundation areas of debris flows. In the context of improving hazard assessment in alpine environments, a comprehensive methodological approach aimed at geomorphological characterization of potential debris-flow dynamics was developed and tested in the Camonica Valley (Italian Alps). The methodology, which aims to enhance the role of geomorphological and geomorphometric analyses as prerequisites for numerical modelling, involves the collection of field data, historical documents on past flow events, and morphometric data to define the dominant process affecting the study catchment (e.g. debris flow versus floods with bedload) and to assess the sediment volume available for mobilization. It includes the application of a GIS-based tool for the preliminary characterization at the regional scale of debris-flow susceptibility along the drainage network, the identification of sediment source areas through orthophoto interpretation and geomorphometric analyses, the assessment of catchment sediment connectivity, and finally, the evaluation of sediment availability through field surveys. The proposed workflow supports more consistent and transferable criteria for debris-flow hazard zonation and territorial planning in mountain regions.

Impact of landslides activity on changes in the composition of alluvia in stream beds on the example from Polish Carpathians

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07C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 5:00 PM - 6:30 PM

The relief of the Polish Carpathians has been strongly modified by mass movements, especially landslides. In an area of over 19,600 km2, there are more than 60,000 landslides and over 5,000 areas at risk of landslides, which accounts for more than 9% of the area of the Polish Carpathians. A large part of the Carpathian landslides are in direct contact with river and stream beds, which is why they are referred to as riverside landslides. Riverside landslides are more active than other landslides due to an additional activating factor in the form of fluvial erosion of landslide fronts. Another type of interaction is the change in particle size composition of the alluvium through colluvium supplied to riverbeds. This research considers the effect of active landslides on the change in particle size composition in the alluvium below the landslides. The effect of active landslides on the change in channel morphometry at the site of the resulting landslides was also determined. Material from the riverbeds and landslides was sampled twice, first immediately after a flood and second a year later after a period without a flood. The material was analysed using laser diffraction. The volume of colluvium supplied to the riverbed was measured using terrestrial laser scanning. The results show a significant effect of colluvium influx on the particle size composition of the alluvium by increasing the proportion of the very fine fraction: clay and silt. The highest proportion of material from landslides in the composition of alluvium was noted immediately below each given landslide. Further downstream this proportion decreased and then declined to zero after 190 to 450 m. Differences in the particle size composition of alluvium depending on the time of sampling were also observed.

Temporal and spatial variation in suspended sediment concentration in the small badlands catchment (Southern Tuscany, Italy)

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08H: New frontiers in the study of erosion processes and geomorphic dynamics in badlands, Conway 3, February 5, 2026, 9:35 AM - 11:05 AM

Badlands experience higher erosion rates than any other landform and often contribute disproportionately to sediment yield at the catchment scale. The Upper Orcia Valley, offers a representative setting for studying erosion in Mediterranean badlands. A small subcatchment was monitored by applying an integrated methodology combining dynamic - focused on sediment transported by runoff—and volumetric assessments—which track surface changes over time and volumetric approaches. This landscape combines agricultural land, forest, and bare or sparsely vegetated surfaces. The upper catchment hosts actively eroding calanchi—steep badland formations marked by dense drainage networks and rill, gully, and mass-wasting processes. These landforms contribute large volumes of unconsolidated sediment to the fluvial system.

SSY measurements covered the main hydrometeorological events of the 2024–2025 winter season. The winter monitoring campaign revealed a marked response of the system to rainfall and runoff events. Average water level reached 6.4 cm, with nephelometric turbidity 140 NTU and a suspended sediment concentration of 6.3 g/l.

Event-scale hysteresis patterns was analysed from the data, to evaluate the complex timing of sediment mobilization and delivery. The results revealed exceptionally high variability in hydrological and SSY parameters, providing valuable insights into stream behaviuor in the badlands areas. In addition, during one of the floods – on 26 February 2025 –6 water samples with suspended solids were collected along the longitudinal profile of the Scalonca stream. The results of this experiment will allow us to determine the variability of suspended solids concentration depending on the distance from the Calanchi landforms. Simultaneously, drone-based photogrammetry was used to create high-resolution digital terrain models for investigating the geomorphodynamics at the badlands hillslope scale.

These findings underscore the need to link hillslope and channel processes in badland systems. By combining surface-change detection with real-time sediment transport data, the study provides more holistic understanding of sediment dynamics in Mediterranean landscapes.

High-Resolution Late Holocene Climate Reconstruction from Lake Guynemer, Kerguelen Archipelago

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06G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 2:30 PM - 4:00 PM

As part of the SOUTHSPHERE/PALAS-2019 project, a 10.1-meter sediment core was retrieved from Lake Guynemer, a glacier-fed lake on the remote Kerguelen Archipelago in the South Indian Ocean. This site offers a rare and valuable opportunity to reconstruct high-resolution Holocene climate variability within the core belt of the Southern Hemisphere Westerlies. Radiocarbon dating indicates a basal age of approximately 1200 calibrated years before present (cal BP), with an average sedimentation rate of approximately 1.2 cm/year, suggesting an exceptionally detailed archive of past environmental change.

Preliminary analyses reveal that the core is varved, and high-resolution CT scanning has enabled the extraction of annual sedimentation rates. These data provide a unique opportunity to extend instrumental climate records and investigate year-to-year variability in glacier-fed sedimentation. The Lake Guynemer record complements geomorphological and sedimentological data from nearby sites, including moraine chronologies and lake records from Cartographie, Aphrodite, Athena, Hera and Lake "5", which together document Holocene glacier dynamics, temperature shifts, and atmospheric circulation changes across the archipelago.

The Guynemer core is central to the Southsphere project's broader aim of understanding the role of the Southern Westerlies in regulating Antarctic climate and ocean-atmosphere interactions. By integrating sedimentological, geochemical, and glaciological data, the project has generated quantitative reconstructions of glacier extent, summer temperature, and precipitation—key indicators of atmospheric dynamics, including the Southern Annular Mode (SAM), El Niño-Southern Oscillation (ENSO), and the Indian Ocean Dipole (IOD). The Lake Guynemer archive is particularly valuable due to its continuity and resolution, offering insights into natural climate variability, rates of change, and potential tipping points in the Southern Hemisphere. As the project enters its synthesis phase, the Guynemer record will play a pivotal role in refining our understanding of Holocene climate evolution in the Southern Ocean and its relevance for future climate projections.

Geomorphic and tectonic implications of raised Quaternary shorelines along the Tyrrhenian margin of the southern Apennines, Italy

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04D: Advances, challenges and future directions in Tectonic Geomorphology, Dobson 3, February 3, 2026, 9:35 AM - 11:05 AM

The southwestern margin of the Southern Apennines is shaped by extensional tectonics related to the formation of the Tyrrhenian back-arc basin, active since the Late Miocene. Quaternary deformation along this margin has produced a system of horsts and grabens, with subsidence reaching several thousand metres in the grabens. In contrast, the horst blocks experienced significant uplift, as evidenced by well-preserved marine terraces, with the oldest (Early Pleistocene) now located several hundred metres above sea level in the Cilento headland.

Numerous previous studies have yielded essential data on both exposed and buried paleoshorelines; however, the chronological framework for relative sea-level fluctuations remains largely based on local-scale reconstructions, with absolute dating still limited and unevenly distributed.

Detailed geomorphological and geological mapping integrated with Quaternary stratigraphy was conducted across key sites along the southern Apennines Tyrrhenian margin. This study integrates recent research from the past years and focuses on identifying, characterising, and dating raised marine terraces and buried paleoshorelines through field surveys of rocky coasts and alluvial-coastal basins, while also reinterpreting existing literature data at a regional scale. These new age constraints on late Middle to Late Pleistocene sea-level markers strengthen the reconstruction of vertical deformation patterns at both local and regional levels. This allows a refined understanding of Quaternary surface uplift patterns along the southwestern flank of the southern Apennines.

Morphodynamics of Mediterranean microtidal beaches presenting permanent megacusps under the influence of waves and strong offshore winds (Gulf of Lions).

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03E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 4:00 PM - 5:30 PM

This study focuses on low-microtidal emerged beaches (average tidal range ≈ 0.3 m) located along the French Mediterranean coast, characterized by permanent megacusps. The offshore wind (> 20 $m \cdot s^{-1}$ and gusts >30 $m \cdot s^{-1}$), due to its transport capacity and its predominance (73% of the time), can have an erosive effect of up to -0.3 m on the upper beach (situation 1). The resulting sand transport from the upper beach toward the shoreline leads to accretion on the beach face, causing a seaward advancement of the shoreline by several meters. Low-energy wave action (Hs < 1 m), either combined with offshore wind and the associated sediment transport from the upper beach toward the shoreline (situation 2), or occurring with a stable upper beach and no offshore wind forcing (situation 3), leads to accretion and a preferential advancement of the megacusp horns due to wave refraction. This is accompanied by slight erosion and potential retreat of the megacusp embayments. More energetic wave conditions (Hs > 1 m), either without wind or with only onshore winds, cause erosion of the lower beach through wave attack, combined with a strong swash that creates a higher berm and a steeper beach face in a more landward position (situation 4). Following short but intense storm events typical of the Mediterranean climate (situation 5), berm retreat is maximal and can reach a new remote position in central part of the beach. These events may also result in sediment deposition on the upper beach along the base of the dune. Thus, the alternation between storm episodes (shoreward transport) and periods of offshore wind (seaward transport) may control the relative stability of the emerged beach on an event time scale. Any changes in forcing, particularly in the context of climate change, will disrupt this balance.

Two millennia of human–environment interactions in the changing alluvial landscape of Ancient Bengal: A geoarchaeological study of Mahasthangarh (Bangladesh)

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11F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 5:00 PM - 6:30 PM

In Bangladesh, research on human-environment interactions remains limited, despite the fact that the history of Bengal is closely linked to its dynamic deltaic environment. Shifting river systems have played a crucial role in shaping landscapes and influencing human settlement throughout Bengal's history.

This presentation introduces the first geoarchaeological study conducted in Bangladesh, focusing on Mahasthangarh. The study examines environmental changes over the past 2,000 years and explores how these shifts affected human settlement.

Mahasthangarh was a major fortified city of ancient Bengal, founded around the 4th century BCE and thriving until the 13-14th centuries CE. It is located on the alluvial Barind Terrace beside the Karatoya River, which, though modest today, was a significant waterway in the past. Historical written sources and ancient maps indicate that the Karatoya has undergone many changes, while archaeological evidence indicates flood-related damage to parts of the site.

In 2022, the French-Bangladeshi Archaeological Mission launched a pioneering geoarchaeological study at Mahasthangarh. Focused on geomorphology, it aims to reconstruct human–environment interactions in response to the changing alluvial landscape. Early chronostratigraphic data provide a new framework for interpreting the site's archaeological record and past environmental conditions.

During the first millennium CE, the Karatoya was a branch of the ancient Tista River. Its stronger flow caused major flooding, damaging parts of the citadel. Despite this, Mahasthangarh flourished, particularly during the 7th–10th centuries CE under the Pala dynasty. From the 11th to 13th centuries CE, the river shifted, especially after an earthquake in 1255. This led to significant alluvial changes and likely contributed to the city's decline by the 13th–14th centuries. The Karatoya continued to change course until the late 18th century, when a Tista River avulsion led to its current reduced flow.

Stream Length Gradient Index (SL Index) to Longitudinal Profile of Rispna River in the Front of Lesser Himalaya, India

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07D: Tectonic Geomorphology for Mountainous Terrain, Dobson 3, February 3, 2026, 5:00 PM - 6:30 PM

Morphometric parameters serve as proxies for deciphering the geomorphic responses of fluvial systems to underlying topographic, tectonic, lithological, and climatic forcing, which often vary spatially along a river's course. In this context, empirical geomorphic indices are critical for unravelling morphogenetic processes. One such diagnostic tool is the Stream Length-Gradient Index (SL Index), conceptualized by Hack (1973), which facilitates the identification of tectonic perturbations and lithological controls along longitudinal stream profiles. This study implements the SL Index to analyze the morphotectonic framework of the Rispana River, situated the front of Lesser Himalaya, India. The methodology is grounded on a high-resolution digital terrain model (DTM), developed from 1:50,000 scale. The river's longitudinal profile was subdivided into two primary reaches and further resolved into 13 morphometric segments based on slope inflection points. SL Index values were computed for each segment and visualized through tabular and graphical representations to delineate spatial anomalies along the river continuum. The SL Index exhibited a range from 0.33 to 11.48, with elevated values concentrated in the upper mountainous tract and lower values prevailing in the downstream Doon Plain sector. Notably high SL values (11.00, 11.44, and 11.48) were associated with structurally resistant lithologies such as quartzite and dolomite, and with convex slope geometries, signifying first-order anomalies frequently correlated with knick point-induced waterfalls. The majority of the remaining segments manifested second-order anomalies, with one exception. Tectonically induced slope deformation, particularly along the Main Boundary Thrust (MBT), manifests as concave slope profiles, facilitated by gravitational mass-wasting processes. Overall, the longitudinal configuration of the Rispana River reflects a strong imprint of active tectonics, lithological heterogeneity, upper-reach slope dynamics, and sedimentary processes operative in the piedmont and Doon fan deposits.

Keywords: Longitudinal profile, Active tectonics, Morphometric analysis, SL Index, Rispana River, Geomorphic anomaly

Carving Cultures and Landscapes: Place-based geoscience education to unsettle geologic relations in the arid lands

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

To transform communities within the field and better serve those of the lands we study, place and reciprocal relations with land must be recentered in the training of geoscientists. While community knowledge of landscapes extends for millennia, there are many barriers to integrating scientific research with place-based knowledge that has long been undervalued and excluded within the academy. The devaluation of place-based knowledge deters many people with deep cultural ties to place from persisting within the field. This contributes to the position of geosciences as the least diverse STEM field and hinders the ability to meaningfully engage with communities experiencing problems of geoscientific significance.

Many of geoscience's shortcomings are directly tied to the historic value on placelessness for researchers and geoscientists who are expected to be rootless and mobile to study the Earth through neutralizing lenses. Engaging student affect by cultivating learning spaces where place-attachment is valued and recentering reciprocal relations with the land is a clear route to rejecting the inherited values of geoscientific study in academia. Place-based education (PBE) in geoscience has demonstrated the ability to engage more diverse groups in geoscience learning but little has been done to investigate the efficacy of PBE integrated with environmental justice and critical perspectives to transform relations between geoscientists and landscapes. Here, we present approaches in PBE in the American Southwest that infuse geoscience learning with human and other-than-human topics as inseparable components that construct the landscapes we study, live, and learn in. This work adopts methods used in 'land-education' proposed by researchers of Indigenous and post-colonial pedagogy. With water as a topic of convergence in the arid lands, interrogation of geologic and human relationships with water serve to emphasize the interconnectivity of human-Earth systems and place-building in lands where water is life.

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Resolving the drivers of rapid canyon incision in the Río Grande Rift through river profile and knickpoint celerity analysis

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Some of the most enigmatic landscapes shaped by the interplay of tectonics, climate, and volcanics are continental rift settings such as the Río Grande rift in southwestern North America. The Río Grande, the axial drainage of the Río Grande rift, is the fourth longest river in North America. Despite the large size of the Río Grande basin, its modern fluvial system may have evolved within just the last 500 kyr. However, the processes driving this young drainage evolution remain poorly understood. One hypothesis posits that climate-driven spillover of a large pluvial lake drove drainage area expansion and rapid incision of the 240 m deep Río Grande gorge at 400 ka. If this is true, then widespread incision on tributaries to the upper Río Grande with knickpoint celerities of 100 m/kyr would be expected. Another hypothesis is that the Río Grande knickzone has been propagating upstream in response to basin level fall when the river reached the Gulf of Mexico at ~1 Ma. Determining the relative importance of spillover (top-down) versus headward incision (bottom-up) processes is key to parsing tectonic vs. climatic drivers of landscape evolution in rift settings.
To resolve rates and test models of drainage evolution in the Río Grande basin, we performed a quantitative analysis of longitudinal profiles and knickpoint celerity over the past 500 kyrs. Preliminary results suggest that tributary relict profiles record transient responses to rapid baselevel fall following the proposed <400 kyr onset of gorge incision. These analyses show the dominance of Pleistocene climate cycles in driving rapid incision and upstream knickpoint propagation, while lithology modulates local rates of knickpoint celerity across tributaries. While rift tectonics create a template upon which river basins can develop, this study highlights the dominance of Pleistocene climate cycles in rapidly reshaping these drainage networks within the last million years.

Regulation and Response: Geomorphic Change in the Hume to Yarrawonga Reach of the Murray River

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09A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 11:35 AM - 1:05 PM

The Hume to Yarrawonga reach of the Murray River, extending approximately 200 kilometres downstream of Hume Dam, is a heavily regulated lowland river system that plays a critical role in water delivery to agricultural and urban users. Since the completion of Hume Dam in the 1930s, and particularly following intensified water extraction in the post-war period, the natural hydrological regime has been substantially altered. Historic high winter and spring flows have been replaced by elevated and sustained summer flows to meet irrigation demand, resulting in an inversion of the seasonal flow pattern and a reduction in flood frequency and magnitude.

These hydrological changes have triggered significant geomorphic responses. Prolonged high summer flows have increased shear stress on channel banks during periods of low vegetation stability, leading to accelerated bank erosion, undercutting, and slumping. Simultaneously, reduced overbank flows have limited sediment redistribution, contributed to bed degradation, and weakened riparian vegetation condition. The reach's historically dynamic anabranching network has become increasingly simplified, with widespread sedimentation, channel widening and contraction, and disconnection resulting from reduced floodplain inundation and flow variability.

A foundational study by Erskine et al. (1993) documented these impacts in detail and proposed management strategies, including modifying the duration of near-bankfull flows. Building on this work, a 2025 study provides updated evidence of continued morphological change, including measurable channel widening, increased anabranch disconnection, and a loss of geomorphic complexity. Despite environmental flow programs and riparian restoration efforts, the system continues to respond to the legacy of regulation, constrained by ongoing water delivery requirements.

This paper synthesises past and recent findings, including the 2025 study that provides updated evidence of continued channel degradation and anabranch disconnection, to explore the geomorphic legacy of regulation.

Mapping Fine-Grained Sediment Transport in Fluvial Systems Using High-Resolution Satellite Imagery

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Current understanding of fine-grained sediment transport dynamics in rivers remains limited, as most remote sensing studies have focused on coastal and lacustrine plumes - phenomena that occur under fundamentally different hydrodynamic conditions than riverine environments. These existing approaches are poorly suited for studying fine-grained sediment plumes within river channels, especially those with complex morphologies and where the occurrence of plumes can be unpredictable and highly transient, creating unique observational challenges.

This study develops a novel methodology to capture and quantify sediment plumes in river channels using high-resolution (3 m) PlanetScope imagery. Our technical approach addresses three key challenges: (1) detecting plume signals in narrow channels where water depth and local morphology affect surface reflectance; (2) capturing the complete spatial extent of plumes during flood conditions when turbidity can remain uniformly high; and (3) characterizing plume fronts despite the absence of visible plume tails in single-time-step imagery. We employ flow-path-aligned NDTI analysis to isolate plume fronts and quantify their spatial characteristics, developing new metrics that describe the transition from ambient to saturated turbidity conditions.

The methodology enables investigation of fundamental sediment transport processes during major events (such as outburst floods) when the entire river system transitions to high turbidity and fast moving, fine grained plumes can have the furthest reaching impacts. By focusing on plume front propagation patterns examine how dammed, braided, and canalized reaches differently influence: (a) the sharpness of turbidity transitions, (b) the downstream progression of plume fronts, and (c) the spatial distribution of sediment-laden flows. This approach provides the first dedicated framework for studying sediment pulse propagation through complete river networks using remote sensing.

Keywords: remote sensing, fluvial sediment transport, suspended sediment, PlanetScope, NDTI

Measuring beach pebbles and cobbles abrasion with RFID technology on a mixed sand and gravel beach, South Island, New Zealand

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08E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 9:35 AM - 11:05 AM

The measurement of in situ abrasion has been investigated since the early 20th Century and it is thought to represent a significant loss from coastal sediment budgets of mixed sediment beaches. Traditional methods of tracking pebbles or cobbles to assess abrasion have numerous shortcomings, however, Radio Frequency Identification (RFID) now makes it feasible to track and relocate tagged particles on a beach. In this study, RFID was used to quantify pebble and cobble abrasion on a mixed sand and gravel beach, South Island, New Zealand. A total of 228 greywacke pebbles and cobbles were tagged and released on two occasions on the study beach. Some of these pebbles and cobbles were relocated on the first two days after release and then again at intervals of months with a maximum recovery period of 15 months. Particles were weighed each time they were relocated to assess abrasion and their positions recorded to calculate the distance travelled from the initial release point. The mean daily abrasion rate of pebbles and cobbles was 0.02%/day, equivalent to 7.30%/year. A significant correlation was found between abrasion and transport distance and wave energy. These results contribute to the small database of abrasion rates for mixed sediment beaches. The study also provides detailed data on cross-shore and alongshore displacement, as well as burial depth. Comparison with previous studies from around the world suggests that a universally applicable abrasion rate for all mixed beaches is unattainable.

Mapping Future Landslide Risk Under Climate Change: Insights from the Dahan River Watershed, Taiwan

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07C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 5:00 PM - 6:30 PM

Landslides are among the most severe natural hazards, with their frequency and impact projected to grow under future climate change. In Taiwan, where over 70% of the land is mountainous or steeply sloped, intense rainfall associated with typhoons poses a serious threat to slope stability. This study assesses future changes in landslide probability within the Dahan River watershed by combining high-resolution climate projections with grid-based slope stability modeling, aiming to support community-level adaptation strategies.

Typhoon rainfall datasets were derived from the Meteorological Research Institute of Japan and dynamically downscaled using the Weather Research and Forecasting (WRF) model. A total of 335 events were analyzed, including 166 from the base period (1979 to 2003) and 169 projected for the late 21st century (2075 to 2099). These were input into the TRIGRS model to compute the factor of safety (FS) for each grid cell. Landslide probability was calculated as the proportion of events in which FS dropped below 1.0. Results show an increase from 14.0% to 22.4% by the end of the century, with higher risks concentrated upstream of the Shimen Reservoir.

To enhance practical relevance, model outputs were transformed into categorized impact maps that visualize current and future risk levels. These maps were shared with local stakeholders, including sediment management authorities and representatives from the Xiuluan Tribe, who confirmed their usefulness for early warning and planning. This study highlights the value of impact-based risk mapping as a tool for promoting consensus and action on climate-resilient landslide adaptation.

Transformation of Suspended Sediment Plumes from the 2021 Chamoli Disaster Through Complex Fluvial Systems

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02J: Mountain sediment cascades and landscape response to changing climate, Conway 5, February 2, 2026, 2:00 PM - 3:30 PM

The 2021 Chamoli disaster delivered an unprecedented sediment pulse into Himalayan river networks, providing a unique opportunity to study how extreme events propagate through fluvial systems. This work examines the downstream evolution of fine-grained sediment plumes from their origin in the landslide-affected headwaters through three critical environments: dam reservoirs, wandering and braided gravel bed river reaches, and engineered canals. Using satellite-derived turbidity observations, we reveal how natural and engineered controls collectively shape sediment transport dynamics during such high magnitude events.

In dam reservoirs, the sudden sediment influx interacted with standing water and operational infrastructure, creating distinct plume signatures that reflect both particle sorting and modified downstream delivery. Downstream braided reaches displayed complex redistribution patterns, where channel morphology likely enhanced dispersion through frequent flow divergence and convergence. The engineered canals presented fundamentally different transport conditions, where narrow, divided channels and regulated flows likely alter both the timing and distribution of sediment movement compared to natural reaches.

Across environments, plume travel speed declined from over 160 km/day upstream to 20 km/day downstream. Plume length also decreased: dams produced the longest plumes (up to 22.5 km), rivers intermediate (8–21 km), and canals the shortest (as little as 6.1 km). NDTI of flood water dropped from 0.11 to near 0 downstream.

These observations provide the first system-scale perspective on the Chamoli disaster’s sedimentary legacy, highlighting: (1) sediment retention and transformation at dams, (2) dispersion in natural braided channels, and (3) the unique transport regime of managed canal networks. Our findings establish a framework for understanding how extreme sediment pulses propagate through partially-engineered watersheds, with particular relevance for predicting sediment connectivity in the aftermath of future disasters. The study demonstrates how event-driven sediment pulses can serve as natural experiments to reveal fundamental transport processes across diverse fluvial environments.

Geomorphological Resilience of Yangtze-Influenced southeast China coast: Insights from Late Quaternary Sediment Source-to-Sink Patterns

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07F: Tropical coral reefs and reef-lined coasts AND Delta Geomorphology Observed from the Past to the Present: Interactions of Natural Processes and Anthropogenic Influences, Conway 1, February 3, 2026, 5:00 PM - 6:30 PM

The geomorphology and environmental conditions of the southeast China coast are significantly influenced by sediment discharge from the Yangtze River, a major river located to the north. Nonetheless, the extent to which the Yangtze River affects sediment transport processes from source to sink along the southeast coast remains unclear. Our recent findings in coastal/marine deposits from the late Quaternary period (MIS5e, MIS3, and MIS1) in Ningde Bay offer new perspectives on this issue. Provenance discrimination of the late Quaternary boreholes was carried out using sediment geochemical analysis and OSL dating of fine- and medium-grained quartz. The results indicate varying provenances during sea-level fluctuation, with distal Yangtze River origins during MIS5e, MIS3, and MIS1, and a local source during MIS4. The findings also suggest that the southward transport of Yangtze sediments along the southeast China coast has occurred since MIS5e. However, OSL ages of the finegrained quartz in the MIS3 deposit range from approximately 90 to 140 kyr, notably older than those of medium-grained quartz (40–80 kyr). This remarkable age discrepancy indicates that Yangtze-derived sediments previously deposited on the shelf of the East China Sea during MIS5 were reworked and transported southward in MIS3. This phenomenon can be elucidated by the insufficient supply of Yangtze sediments during MIS3, which could be linked to the weakened East Asian monsoon. This new source-to-sink pattern for the southeast China coast is characterized by a compensating mechanism of inner shelf old sediment in response to the inadequate supply of Yangtze sediments. This study contributes to a better understanding of the significant impacts of reduced Yangtze sediment input on its distal sedimentary systems over time.

Tectonic and Climatic Controls on Extension Rates Along the Xainza–Dinggye Rift, Southern Tibet

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04D: Advances, challenges and future directions in Tectonic Geomorphology, Dobson 3, February 3, 2026, 9:35 AM - 11:05 AM

Southern Tibet is undergoing active east–west extension despite continued north–south compression from the India–Asia collision, producing prominent north–south trending rifts. Understanding the rates of late Quaternary extension across these rifts is key to interpreting ongoing plateau deformation and landscape evolution. In this study, we examine the Xainza–Dinggye Rift (XDR) to assess whether its extension rates match those observed along the Yadong–Gulu Rift (YGR), where a clear northward increase in extension has been linked to interaction with strike-slip faulting. Using cosmogenic 10Be surface exposure dating and high-resolution topographic surveys at seven sites along the entire XDR—including areas affected by the 2025 Mw7.1 Tingri earthquake—we quantify vertical displacements across normal faults bounding the rift. Extension rates along the XDR are generally <1 mm/yr, significantly lower than those reported for the YGR (0.8 to 1.3 to 3 - 6 mm/yr), except at sites where surfaces are younger than the Last Glacial Maximum (LGM). This pattern suggests a post-LGM acceleration in extension, likely driven by glacial unloading and related lithospheric rebound. Our findings challenge the assumption of a constant 1.3 mm/yr extension rate across all southern Tibetan rifts, indicating that deformation is spatially variable and possibly concentrated in more mature, throughgoing rift systems. Notably, the absence of a northward increase in extension rate along the XDR may reflect its orthogonal orientation to the Himalayan Main Frontal Thrust, in contrast to more obliquely aligned rifts like the YGR. These results underscore the importance of fault geometry and glacial-interglacial processes in modulating late Quaternary extension and associated geomorphic development in the Tibetan Plateau.

The Importance of Gnammas as Ecological Habitats: Focusing on a Granite Dome in Korea

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Landforms have interacted with and co-evolved alongside organisms. However, in comparison to the well-studied processes of landform development and conservation, the role of landforms as habitats remains relatively underexplored. This study investigates the distribution of weathering landforms known as ‘gnammas’ and examines their ecological function as habitats through case studies in South Korea.

In Korea, there are at least 140 gnammas, with approximately two-thirds located on granite. At the summit of a 650-meter-high mountain in Gangwon-do, groups of fire-bellied toads (Bombina orientalis) inhabit these areas. For these frogs to reproduce, a hydroperiod of at least three months is essential. For two years, we monitored the habitat of the species, tracking changes in water level and quality as well as weather conditions. Our findings revealed that the water within the weathering pits rarely dried out, maintaining a minimum depth of 15 cm and a maximum depth of 42 cm. The frogs spawned in pools during late March and early May; however, they did not reproduce in all available pools. The most successful breeding habitats featured deeper water levels and favorable water quality indicators, including lower biochemical oxygen demand (BOD) and total phosphorus levels. Notably, sites with high concentrations of NH3-N were avoided by the frogs.

Gnammas not only serve as habitats for aquatic organisms but also provide a home for terrestrial plants. In the study area, we observed the growth of mosses, herbaceous plants, and shrubs within the weathering pits, with the soil primarily composed of sand, silt, and clay derived from granite. Our research illustrates how gnammas, formed by weathering on dry rock surfaces, evolve into vital habitats for a variety of organisms by effectively storing water and soil.

Eco-morphodynamic modeling of interaction between fluvial morphology and riparian vegetation

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02K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 2:00 PM - 3:30 PM

Since the 2000s, many Korean rivers have transitioned from “white rivers,” dominated by exposed sediment bars, to “green rivers” characterized by dense riparian vegetation. This transformation reflects not only anthropogenic alterations but also broader climatic influences. As climate change progresses, it is expected to further reshape fluvial landscapes by altering hydrological regimes and driving changes in the timing and extent of riparian vegetation. Variations in rainfall and temperature, in particular, directly influence germination timing, growth rates, and vegetation mortality, thereby affecting fluvial morphology through complex biogeomorphic feedbacks.
This study aims to enhance an eco-morphodynamic model to more realistically simulate the interactions between riparian vegetation and fluvial processes under climate variability. The model incorporates precipitation and temperature as key drivers of vegetation dynamics, affecting germination, growth, and mortality. By introducing climate-sensitive mechanisms into the vegetation module, the model captures changes in life cycle timing and growth patterns driven by hydrological and thermal conditions.

A comparative analysis between the enhanced model and its earlier version demonstrates the critical role of climatic variables in realistically simulating interactions between riparian vegetation and fluvial processes. These improvements enable the model to better capture potential shifts in vegetation phenology and spatial distribution under changing climate conditions. Ultimately, the results provide insight into how riparian and fluvial systems may co-evolve in response to climate variability, supporting more integrated approaches to river management and ecological restoration.

Loss of coastal dune resilience and deformation of wind due to planting pines

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03E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 4:00 PM - 5:30 PM

Black pine (Pinus thunbergii) is commonly found along the coastal regions of Korea and Japan. Due to its tolerance for coastal conditions, this species is often planted to establish coastal forests. Black pine is present in over 97% of the approximately 200 coastal dunes on the Korean Peninsula. These coastal forests are believed to protect the hinterland from strong winds, salt spray, and blown sands while stabilizing the coastal landscape and maximizing land use. This study analyzes changes in the dune landscape using aerial and satellite imagery since the establishment of these coastal forests, complemented by recent wind and shoreline data. It also explores the relationship between the trees on the dunes and their resilience. The findings indicate that the natural resilience of all dunes where coastal forests were planted has diminished. Specifically, the dunes on Daecheong Island in Incheon have experienced reduced wind speed and changes in wind direction due to the coastal forests developed in the late 1990s. In response, residents advocate for the restoration of the previous dune landscapes. Even in the coastal dunes on the East Coast that originated from beach ridges, planting pine trees has led to increased shoreline retreat and erosion. This is due to the trees fixing the dune surface and reducing its flexibility. Eventually, many artificial structures, including submerged barriers, were built to prevent coastal erosion, leading to adverse effects, such as causing further coastal erosion. In contrast, areas without pine forests have experienced the emergence of new dune formations and even an advance of the coastline. Forests on coastal dunes reduce onshore wind and aeolian sand transport. Consequently, they negatively impact the landscape, making it less adaptable to coastal changes, including those triggered by climate change.

Heathcote River Flood Management in Christchurch - A Post-Earthquake Case Study in Developing Resilience

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08B: Predicting and responding to geomorphic change: case studies from Aotearoa New Zealand, Dobson 1, February 5, 2026, 9:35 AM - 11:05 AM

The Ōpāwaho / Heathcote River catchment in Ōtautahi Christchurch has a long history of flooding, with major floodplain management schemes developed in 1985 and 1992. These proposed interventions included upper catchment storage, mid-reach channel works, property raising, and the Woolston Cut bypass. However, much of the strategy remained unimplemented due to a drier climate in subsequent decades.

The Canterbury Earthquake Sequence (CES) significantly altered the river's geomorphology. Ground settlement in the upper and mid-catchment and uplift in the lower reaches increased flood exposure across the catchment. An additional 101 dwellings were placed at risk of above-floor flooding in a 2% AEP event, with many more affected during frequent events. Riverside roads experienced recurring deep flooding, compounded by sea level rise impacts and increasing "sunny day" tidal inundation.

Following severe floods in 2013, 2014 and 2017, a renewed floodplain management strategy was urgently developed. Drawing on earlier studies, updated models, and extensive post-earthquake investigations, the strategy addressed frequent (10% AEP) flood risks under current climate and sea level conditions. The resulting $120 million programme included voluntary property purchases, targeted dredging, upper catchment storage, and bank stabilisation. Potential low stopbanks were ultimately not adopted due to community and Council concerns, realising that these were not a resilient option in this location.

The system has since been tested during multiple storm events over the past eight years, with no above-floor flooding observed despite events matching or exceeding post-CES flood magnitudes. In addition, one of the main flood management facilities has won multiple awards for its multi-value approach to flood management. This case study highlights the value of preserving long-term planning options, using post-disaster recovery to implement resilient infrastructure, and maintaining transparent, ongoing engagement with the community. The Ōpāwaho / Heathcote experience offers important lessons for flood management in geomorphically dynamic and climate-affected environments.

Geodiversity and geoheritage at the macro and microscales. Case study Western Carpathians.

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07I: Geomorphology for geoconservation, Conway 4, February 3, 2026, 5:00 PM - 6:30 PM

The Western Carpathians are a province of the Carpathian Region located in Central Europe. They lie primarily in Poland and Slovakia, but also extend into small parts of Hungary, the Czech Republic, and Austria. The Western Carpathians are characterised by a banded geological structure consisting of three main subprovinces: 1. The Outer Western Carpathians, composed of Carpathian flysch—alternating layers of sandstones, claystones, and shales; 2. The Central Western Carpathians, made up mainly of crystalline and metamorphic rocks, as well as carbonate rocks, sandstones, and shales; 3. The Inner Western Carpathians, composed of volcanic and carbonate rocks.

The region's geological richness is also reflected in a variety of landforms shaped by glacial, karst, volcanic, and fluvial processes. The main objective of this presentation is to highlight the geological and geomorphological diversity at both the macro scale—across the entire Western Carpathians—and the micro scale—within specific mesoregions of the highest Carpathian range, the Tatra Mountains.

The analyses were conducted using geodiversity maps created for this area, based on geological maps, a digital terrain model, and CORINE land cover data. The geodiversity map for the entire Western Carpathians reveals that the highest geodiversity corresponds to areas of high elevation, composed mainly of crystalline and carbonate rocks. However, more detailed maps show that within areas of average geodiversity, there can be zones of high geodiversity and vice versa. This indicates that while province-scale maps are useful for identifying areas with high geoheritage potential, detailed geoheritage analysis is only possible using more precise, fine-scale maps.

Tectonic geomorphology and Holocene uplift rates of the Lae Urban Area, Papua New Guinea

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04D: Advances, challenges and future directions in Tectonic Geomorphology, Dobson 3, February 3, 2026, 9:35 AM - 11:05 AM

Lae is Papua New Guinea's (PNG's) second largest city and is the home of PNG's largest port. Here, a convergence rate of ~50 mm/yr between the South Bismarck Plate and the Australian Plate is accommodated across the Ramu-Markham Fault Zone (RMFZ). The active structures of the RMFZ bifurcate immediately west of the Lae urban area, with one trace (the Wongat South Thrust) trending southeast through Lae City and connecting to the Markham Trench within the Huon Gulf. The geomorphology of the Lae urban area relates to the interaction between riverine (and limited marine) deposition and erosion, and range-building over the Wongat South Thrust. Flights of deformed river terraces imply repeated tectonic uplift events. Terrace riser heights are typically on the order of 2.5-3.0 m, indicating causative earthquake events of greater than magnitude 7.0. Preliminary dating of fluvial and marine terrace deposits indicates a recurrence for these events in the order of 300-400 years, at an uplift rate of ~12 m/kyr. The results of the tectonic geomorphology study form part of a PNGAus partnership project, and will inform future seismic hazard and risk assessments for the region.

Unravelling the Winds of the Past: Atmospheric Drivers of Beach Ridge Formation in Kati Thanda-Lake Eyre, Australia

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Palaeolake shorelines, formed by wave-piled sediment, are exceptional markers of ancient lake-stands, providing critical proxies for palaeohydrology. In dryland environments, where water is presently scarce and lakes are predominantly shallow and ephemeral, these proxies offer evidence of past wetter periods and potential insights into future hydrological scenarios. However, the atmospheric conditions responsible for the wind- and wave-storms that create beach ridges in shallow lakes remain uncertain. To investigate these conditions, we analysed the largest desert lake in the world, Kati Thanda-Lake Eyre (KT-LE) in Australia. We explored the factors behind ridge formation by combining wave modelling simulations driven by atmospheric reanalysis data with optically stimulated luminescence (OSL) dating of the lake's historical shorelines. Our analysis focused on 12 of the most intense wind- and wave-storms, selected from a dataset of over 1,000 identified windstorms recorded between 1950 and 2023. We found that significant lake waves are predominantly generated by a synoptic dipole pattern, characterised by a high-pressure gradient between a cyclone and an anticyclone over southern Australia, often amplified by the passage of an atmospheric front. This pattern produces high-magnitude (>10 m/s) southerly winds, driving waves that can exceed 0.75 m in significant wave height. Despite these findings, wave simulations based on historical water depth observations suggest that no single storm was likely responsible for the formation of KT-LE's modern beach ridge. This conclusion is further supported by OSL dating and high-resolution topographic analyses, showing composite barrier landforms with regressional features. The OSL chronology indicates that some sections of the modern barrier or paleo-shoreline are effectively "modern," while other locations preserve beach deposits that are centuries old. These findings suggest that the formation of the modern shoreline is most likely the result of cumulative sediment deposition over multiple windstorms, rather than a single large storm event.

Extreme runoff events over the last two millennia shape the shorelines of Kati Thanda – Lake Eyre

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02A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 2:00 PM - 3:30 PM

Thousands of ephemeral lakes characterise arid and semi-arid Australia. Under the current climate they only fill after extreme (daily or seasonal maxima) rainfall conditions, depending on their hydrometeorology, lake area, watershed areas and physiography. The largest, ephemeral Kati Thanda-Lake Eyre [KT-LE], drains 1.14 M km² (one seventh of the Australian continent), fills occasionally, but only after exceptional and widespread headwater or local desert rainfall like was seen in 2025, and previously in 1974. High-resolution topography was combined here with new chrono-stratigraphy of the palaeoshorelines of KT-LE, to reconstruct barrier and shoreline formation. The landforms investigated are all at or above the known modern maximum filling level (e.g. 1 – 2 % annual exceedance probability), therefore representing extreme storm coverage, rainfall quantities and runoff conditions which provide unambiguous evidence of lake-filling events equivalent to or larger than the historical maxima of 1974. The analysed modern or late Holocene barrier is a composite feature comprised of young (< 500 years) beach sediments over a proto barrier up to ~3,000 years in age and in some locations has formed on a much older underlying resistant poorly-sorted clay-rich sedimentary unit. Aerial photographs, stratigraphy and chronology indicate that the 1974 historical maxima effectively reworked significant parts of the Holocene barrier, redeposited overwash deposits and extended longshore spit recurvature. The net result was the formation of a barrier overwash and subsequent regressive berm sequence that dominates the modern shoreline morphology. In contrast, older shorelines that were deposited episodically over the last 5000 years have differing orientations to the modern barrier and are significantly smaller in volume but indicate larger filling events than 1974. These sedimentary archives, whilst discontinuous, add to our capacity to evaluate late Holocene climate change and extreme rainfall event occurrence within context of the observational record.

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Statistically derived hydroclimatic debris-flow trigger threshold model

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02C: Addressing Uncertainties in Landslide Prediction Across Spatial and Temporal Scales, Dobson 2, February 2, 2026, 2:00 PM - 3:30 PM

Debris-flow occurrence on the south coast of British Columbia, Canada is commonly associated with intense rainfall and rain-on-snow events. Infrastructure managers and emergency planners have an interest in receiving warning prior to occurrence of damaging debris flows to reduce life loss risk, and economic and reputational damages. For a section of the Trans Canada Highway in the lower mainland of British Columbia that is subject to debris-flow hazards, records of debris-flow impact to the highway were combined with hydroclimatic parameters such as precipitation, snow, snow water equivalent and temperature to create a probabilistic model. First the dataset was reduced to eliminate low precipitation days where no debris-flows occurred using a two parameter peaks over threshold analysis. Several statistical models were considered; however a logistic regression was chosen as it produced interpretable results, out performed other models and provided probabilities rather than a classification. An initial model was developed to test the significance of parameters prior to developing a two-dimensional probability matrix. Several variable pairings were tested to determine which set would be most useful. Statistical models that accepted more than two variables as inputs were considered but were deemed challenging to visualize or implement operationally. The chosen model uses 1-hour and 48-hour precipitation to determine the probability of one or more debris flows impacting the highway during a given storm. The model was then interpreted and simplified to produce an easily digestible tool that can be used as part of a geohazard management system by infrastructure managers and emergency planners.

Persistent control of channel dynamics by active faults in an alluvial river

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11A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 5:00 PM - 6:30 PM

Fluvial controls by tectonic processes operating between millennial/orogen and annual/reach scales are relatively unexplored. We use a time-series of six surveys of thirty monumented cross-sections, collected over twenty-two years, to evaluate change in bed material storage (bed change) in a gravel bed river within an active New Zealand forearc basin. The 16-kilometre study reach crosses four active oblique strike-slip faults and several folds. We analyse metrics of bed change and relate spatial patterns to surface deformation interpreted from a 1 m LiDAR-derived elevation model. Incremental changes between surveys at the same station are noisy, but over the 22-year time period, patterns of net and total bed change show spatial coherence with intersecting geologic structures. At cross-sections immediately upstream of faults aggradation and channel widening is generally observed coinciding with back-tilting. Along areas of more distributed deformation (e.g. anticlines) we observe maximum net incision. We conclude that bed change compartmentalisation by active geologic structures along this alluvial river is detectable, spatially coherent, and persistent during an interseismic period. These tectonic controls on alluvial channel dynamics persist and have implications for channel and hazard management.

Using geomorphological drivers to inform Nature Based Solution optioneering – a case study from the Waipoua River.

Ms Selene Conn[1], Ms Khendra Harvey[1]
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05A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 11:35 AM - 1:20 PM

A geomorphic study of the Waipoua River was conducted for Greater Wellington Regional Council to better understand the processes driving flooding and erosion issues in Masterton. This Stage 1 assessment used a modified River Styles framework to identify key factors such as connectivity, stream power, and bed level trends, pinpointing areas sensitive to changing conditions. It also highlighted geomorphic drivers such increased flood peaks caused by deforestation, artificial confinement and gravel resource exhaustion, which informed the Nature-Based Solutions (NBS) explored in Stage 2.

The Stage 2 Geomorphic Assessment and NBS Feasibility Study aimed to address symptoms of these geomorphic drivers, including sediment runoff, rainfall runoff, and artificial confinement (e.g., stopbanks and river-edge willows). The goal was to identify catchment specific NBS to reduce flood peaks. Four NBS options were prioritised for the Waipoua Catchment based on their geomorphic effectiveness and likely flood reduction potential, which considered river character, geomorphic sensitivity, and expected geomorphic responses to interventions. These options included hillslope revegetation, distributed retention storage, channel realignment, and floodplain re-engagement. Each was tested using hydraulic modelling.

While flood risk reduction from the NBS was modest, with limited impacts peak discharges, the potential co-benefits were significant. For example, afforestation could reduce sediment runoff over decades, supply large wood, enhance ecological conditions (e.g., stream shading and habitat creation), and improve cultural value. Ultimately, allowing the river space to recover naturally emerged as a key driver of geomorphic recovery. This approach focuses on enabling the river to choose its own path, restoring its form and function over time.

This work highlights the importance of understanding geomorphic drivers and response to change in creating holistic approaches to catchment and river management.

Assessing geomorphic risk or geomorphic effects in the Auckland Region - A Practice Guidance Note

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02I: Living with geomorphic change, Conway 4, February 2, 2026, 2:00 PM - 3:30 PM

There are existing provisions in the Auckland Unitary Plan (AUP) that intend to protect Auckland's rivers from development impacts, or infrastructure / developments from flood and erosion risk. Yet despite this, new developments and infrastructure are still being placed close to actively adjusting rivers, or effects assessments undertaken without consideration of geomorphic trends / processes. This has led to unintended adverse outcomes, with the costs to remedy borne by the rate payer.
To address this, Auckland Council Healthy Waters are developing a Practice and Guidance Note (PGN) that sets out criteria and processes to assess the risk to developments, buildings and infrastructure from fluvial processes, as well as assessing the effects of an activity on the physical stream environment.

The overarching purpose of the PGN is to increase industry understanding of geomorphic assessment methods, and provide a more consistent approach to determination of geomorphic risk / effects.
The proposed approach centres on geomorphic sensitivity, as a nested hierarchy focusing on catchment scale drivers (catchment landuse, connectivity, hydrology and historic change), and reach scale processes (river character and behaviour, evolutionary trajectory, sediment flux, and erosion susceptibility), in order to determine geomorphic sensitivity.

This is then used to either inform the geomorphic risk (in terms of managing natural hazards to developments or infrastructure from fluvial processes) or the geomorphic effect (in terms of managing the effect of an activity on the river system).

The requirement for geomorphic risk or effects management is then related to the effects management hierarchy provided in the National Policy Statement for Freshwater Management, starting at effect avoidance before moving to minimisation, then remediation, then offsetting or compensation.

The PGN provides a decision making process for determining geomorphically appropriate interventions, tied to the evolutionary trajectory, drivers of change, or the geomorphic processes contributing to geomorphic degradation / risk.

Extracting fire histories from inland dunes; a new proxy of environmental change and human impact

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

As the climate warms, wildfires are increasing in frequency and severity. Current paleofire records come primarily from charcoal preserved in wetlands, bogs, and lakes. This creates a gap in understanding fire histories of arid and semi-arid environments, where such archives are rare or absent. Patton et al. (2023) developed a new method of reconstructing fire histories using charcoal from coastal dune foot slope deposits. They were able to create a Holocene fire record that matched charcoal records from swamps and lakes in the Cooloola Sand Mass of SE Queensland, Australia. The goal of this study is to use charcoal in dune foot slope deposits at Thundapurty Lagoon, Queensland, Australia to create a paleofire record, testing the method in an arid inland environment. Thundapurty Lagoon is a shallow lake in the Channel Country of SW Queensland, Australia. Longitudinal (desert) dunes occur within 500m of the lagoon and these dunes provide a target for dune foot charcoal analysis. Dune charcoal records will be compared with charcoal records from lake cores from this site, to determine if the dune foot charcoal method is applicable in longitudinal dunes. To achieve this, detailed soil and geochronological investigations will be undertaken. The latest available results will be presented.

Mangrove carbon accumulation in an Australian coral reef environment

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09C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 11:35 AM - 1:05 PM

Spatiotemporal patterns of mangrove organic matter dynamics remain poorly understood, particularly in coral reef settings of the Southern Hemisphere. Because mangrove organic matter accumulation is influenced by accommodation space and varies according to geomorphic setting, spatial variation in carbon stores should reflect global variation in long-term sea-level history in different settings. This study examined mangrove above- and below-ground organic matter accumulation along gradients of tidal position, forest age and height at Low Isles, a low-wooded island of the Great Barrier Reef, Australia. This region has experienced millennia of relatively stable sea levels. Below-ground organic matter accumulation was quantified using measurements of sediment composition, 210Pb age-depth modelling, analysis of 239+240Pu and 236U bomb-pulse radionuclides and 14C dating. Above-ground biomass production was quantified using drone-derived LiDAR data and historic aerial imagery. Mangroves established on Low Isles within the past 200 years, accumulating ~50 cm of below-ground organic matter above the reef platform in the oldest forest. Sedimentation rates, dominated by mangrove organic matter, were greatest in the older, tallest forest, at the highest intertidal positions with rates of 4.2 (3.6 – 5.2) mm yr-1 compared to the intermediate forest at 1.7 (1.4 – 2.1) mm yr-1. Above-ground biomass accumulated linearly as mangroves expanded across the reef platform. Above-ground biomass production rates peaked in the youngest forest, exhibiting a different spatial pattern to below-ground biomass production which was more rapid in the oldest forest. Despite comparatively high above-ground biomass stores which are becoming increasingly asymptotic with forest ageing, mangrove substrates remain relatively low in the tidal frame. This implies considerable vertical accommodation space remaining for below-ground organic matter accumulation and thereby carbon storage, although this may be limited should rates of sea-level rise accelerate as projected. This study indicates that mangrove below-ground carbon stores are constrained by sea-level history.

Crater-Associated Irregular Cellular Structures (CAICS) on Mars: A New marker for the detection and the study of Debris Covered Glaciers

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Debris-covered glaciers are prevalent in Mars' mid-latitudes (30◦–60◦) and represent a total ice volume of ~4.2×10^5 km^3 – approximately twice the total volume of glaciers on Earth. The debris cover means their ice content cannot be estimated directly, and instead it is inferred from radar data or surface morphology. Both techniques have limitations meaning current ice-volume estimates are likely underestimates.

In this study, we examine Crater-Associated Irregular Cellular Structures (CAICS) - to assess their potential for detecting debris-covered glaciers, as prior studies reported their association. Their spatial proximity to craters indicates an impact-related formation process. The goals of this study are to document the morphological characteristics of CAICS, their spatial distribution and determine the nature of their association with impact crater ejecta and debris-covered glaciers.
We found over 400 craters with CAICS in the northern mid-latitudes using images from NASA's CTX camera which has global coverage at 5 m/pix. CAICS range from hundreds meters to a few kilometers in size and can extend over tens of kilometers. We find CAICS consistently form within the ejecta of impact craters. Using orbital images at 25-50 cm/pix from NASA's HiRISE, our morphological analyses support that CAICS form only over debris-covered glaciers and could partly result from 1)a subsidence or 2)a sublimation/melting of the ice underlying the ejecta-interacting surfaces.
We propose CAICS as a novel proxy for detecting debris-covered glaciers even in the absence of visible surface flow features. Using this proxy we can refine Mars' surface ice volume estimates - crucial for future human exploration and better understanding martian climate. CAICS can also give clues on the dynamics of debris-covered glaciers and can serve as stratigraphic markers to constrain their depositional periods. Also observed in the southern hemisphere, CAICS provide a new tool to enhance our understanding of debris covered glaciers on Mars.

"Cyroclasticflows" on Mars – granular flows driven by the sublimation of ices

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01D: Planetary Geomorphology, Dobson 3, February 2, 2026, 11:40 AM - 1:10 PM

Martian gullies are alcove-channel-fan systems that are undistinguishable from debris-flow systems on Earth. Therefore, they have long been hypothesised to be formed by the action of liquid water and brines. However, over the past decade, the formation hypothesis of these landforms has shifted away from a water-driven process and towards a CO2-driven process, related to the seasonal sublimation of CO2 ice. Over the last years, we have conducted three experimental campaigns (at the Open University, UK, and Aarhus University, Denmark) at varying scales to explore the feasibility of the CO2-driven granular flow hypothesis. From our experimental results we can conclude that CO2-driven granular flows can occur on Mars under specific environmental conditions, that the sublimation of very small amounts of CO2 ice very efficiently fluidizes sediment, that the flow dynamics of these flows are akin to terrestrial water-driven debris flows and pyroclastic density currents, and that these CO2-driven granular flows are effective erosive agents, likely even more efficient than terrestrial water-driven debris flows.

More recently, we have investigated if the sublimation of water ice can also promote sediment mobility along a slope under Martian conditions. The rationale behind this campaign is the existence of pseudo gullies around the equatorial latitudes on Mars. The formation of these underdeveloped gully systems cannot be explained by a CO2-driven process due to the absence of CO2 ice at these latitudes. However, H2O ice is observed around these latitudes, even in close proximity to the pseudo gullies.

During this presentation, we will discuss our most recent results on these "cryoclastic flows" (a term mirroring the term pyroclastic flows). Furthermore, we will discuss the implications of these processes on Martian geomorphology during the late-Amazonian; when and where are/were these processes active, do/did they interact with other cryospheric processes on Mars, and if so; how?

Rapid mass movements with permafrost molards in Alaska and their response to a changing climate

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06J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 2:30 PM - 4:00 PM

Alaska's mountainous regions host a wide variety of rapid mass movements and are subject to permafrost conditions varying from continuous to isolated. Hence, unsurprisingly our research has revealed many mass movements mobilise the permafrost, as they contain permafrost molards. Permafrost molards derive from initially ice-cemented blocks which are displaced from a zone of permafrost in the source area by the mass movement. They are typically conical mounds of debris and result from the loss of the ice which cements the initial blocks. They are found within the deposits of mass movements and can even sometimes overshoot the main deposits. We have identified particularly high concentration of mass movements with molards (~1 per 50 sq.km) in the south east part of the Talkeetna Mountain range in south-central Alaska, which will be the focus of this presentation. By using satellite and aerial remote sensing data, we show that the frequency of mass movements that contain molards has increased in recent decades. Molards occur in failures mobilising a variety of ice-cemented materials in the region, including weak/altered bedrock, loose soils or talus, and rock glaciers. The failures do not have a preferential season of occurrence. Further, we use specific case studies to demonstrate the variety of mass movements that contain molards and how the patterns of molard-distribution depend on the type of mass movement – these observations are key for distinguishing permafrost molards from other types of hummocky ground associated with mass movements. Finally, we use digital image correlation techniques to quantify and examine the patterns in precursor motion and also to evaluate post-failure movements in permafrost-related landslide zones. Our observations give important insights into the influence of global climate change on the state of the permafrost in the Talkeetna Mountains, which may be applicable to other areas with mountain permafrost.

Sediment bombs: extreme sediment-rich flows in the Himalaya

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12D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 9:35 AM - 11:05 AM

The Himalaya have been affected by a number of extreme sediment events over the past five years. These events had very different causes, triggers, and magnitudes, but all involved flows with high sediment concentrations that transited trunk channels over distances of tens to hundreds of kilometers, and had remarkable similarities in their geomorphic and sedimentary signatures. Using high-resolution satellite data, including DEMs derived from stereo satellite imagery, we can increasingly constrain the sources and volumes of sediment involved in these events and estimate how sediment concentration changes over the course of each event, while techniques such as environmental seismology can provide information about the temporal evolution of these events. Combining these remote data with field observations of event deposits and erosional and depositional features, we can try to link the properties and behaviors of extreme flows to their evolving sediment concentration during downstream propagation. Understanding the controls on sediment recruitment and flow bulking, and the impacts of high sediment loads on flow propagation and properties, are of key importance for better anticipation of mountain hazards. In several of the Himalayan valleys that have experienced recent sediment-rich flows, we find clear evidence for similar past flows, highlighting that these are not unique events. On longer timescales, understanding the deposits and landforms created by sediment-rich flows is key for interpreting the geomorphic record of past events and evaluating their role in mountain landscape evolution.

Monitoring the Northern Ireland Coastline: progress from ground zero

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09E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 11:35 AM - 1:05 PM

A variety of systems of coastal monitoring have been developed in support of coastal management in various parts of the world. Their origins are diverse as are the methods used and the use to which data is ultimately put. The objective here is to describe a trajectory from a very low starting point to a well-established monitoring system and the examine the strengths and weaknesses of such systems.

Despite being a well-known centre for coastal geomorphological research since the 1970s, Northern Ireland (NI) lacked any formal monitoring of its physical coastline until the present decade. Pressure from NGOs and local government for data to inform coastal decision-making (in the 1990s) led to recommendations for monitoring to be undertaken and this ultimately gained cross-party political support (in the 2010s). Following this long gestation period, progress has been rapid since the decision by the NI government to establish a monitoring system. Co-ordinated by the Department of Agriculture, Environment and Rural Affairs, the Northern Ireland Coastal Observatory has now been established and populated. This open GIS-based resource hosts a variety of data specifically commissioned to provide baseline and regularly updated datasets. It includes a temporal series of national scale coastal Lidar surveys (including dedicated post-storm surveys), nearshore bathymetry (both lidar and satellite-derived), an analysis of historical shoreline position derived from historical maps and air photos, with a non-specialist interpretation tool for users. Other datasets are being added and the user interface is being enhanced.

A key challenge is to present data in a way that is accessible and useful to non-specialists, whether they be government employees, interest groups or interested citizens. This case study illustrates a pathway to regional scale coastal monitoring and dissemination from initial public pressure to ultimate government action that can be implemented over a short timescale, given adequate resources.

Comparison of earthquake- and rainfall-induced landslides in Fiordland, New Zealand

Mr Charles Cox[1], Dr Simon Cox[2], Professor Andrew Gorman[1], Dr Chris Massey[2]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

In Fiordland, New Zealand, numerous landslides occur simultaneously during significant temporally spaced earthquakes, but individual landslides occur more regularly in response to heavy orographic rain events. Landslides triggered by two Fiordland earthquakes were mapped using Google Earth Pro satellite imagery (eye altitude of 1.5–2.5 km, enabling ± 50 m precision) then translated into an ArcGIS Pro dataset and classified with multiple data attributes. There were at least 1852 landslides (total area = 37.6 km^2) triggered by the 2003 Mw 7.2 Secretary Island earthquake, but only 313 landslides (total area = 3.7 km^2) as a result of the larger 2009 Mw 7.8 Dusky Sound earthquake. The 2003 and 2009 earthquake-induced landslides are distinctive in terms of density distribution, magnitude-frequency relationships, and source area characteristics. It is hypothesised that observed differences in stress drop, energy release rates, and local topography during these events translated to differences in ground motion and landslide triggering. The manually mapped earthquake-induced landslides are examined against equivalent data derived from a remotely sensed Global Forest Change dataset. Relative differences in both density and magnitude–frequency in 2003 and 2009 are comparable, providing confidence that the remote sensing of forest loss in Fiordland provides a reasonable proxy for landslides. It enables the punctuated earthquake-related events to be placed in a wider temporal context of continuous decadal-scale rainfall-induced landslides. While rapidly devastating large areas of Fiordland, earthquake-induced landslides only account for 18% of the total forest loss and background landsliding in the region over the 22-year period from 2001–2022.

Reaching new heights for a change: Advancing 3D landscape monitoring with satellite photogrammetry and aerial lidar in the Southern Alps

Dr Pascal Sirguey[1], Dr Simon C. Cox[2], Ms Clare N. Lewis[3], Ms Ellorine Carle[4], Mr Aubrey Miller[1]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Photogrammetry, now over 150 years old, has long formed the backbone of topographic information for remote regions such as Aotearoa New Zealand's Southern Alps / Ka Tiritiri o te Moana. Despite its age, modern computer vision techniques, analytical modelling, and high-performance computing have revitalised photogrammetry, enabling the restitution of both historic and contemporary stereo imagery into dense, high-resolution elevation models, even in challenging alpine terrain.

At the same time, airborne lidar has revolutionised landscape-scale topographic mapping with highly accurate measurements. However, its episodic collection limits temporal resolution and constrains the monitoring of dynamic processes. Meanwhile, photogrammetry has reached new heights through advances in satellite platforms, which now offer sub-metre spatial resolution and unmatched potential for regular repeat acquisition at competitive cost. Combined with improved mission continuity, this makes satellite photogrammetry a compelling method for landscape-scale 3D monitoring of alpine dynamics.

We present MAP²3D, a semi-automated workflow for generating accurate digital surface models (DSMs) from aerial and satellite stereo imagery, enabling 3D change detection at high spatial and temporal resolution. MAP²3D's operational capability was demonstrated through rapid post-event analysis of major landslide activity in the Aoraki / Mount Cook region in 2022, using Pleiades stereo imagery. This contributes to a unique time series of surface elevation change spanning 2008–2022, now further enriched by the region's first full aerial lidar survey in 2024. Together, these data reveal the extent of glacier retreat, rockfall, and landscape reorganisation in this iconic high mountain environment.

This integrative geospatial approach illustrates how topographic mapping with high spatiotemporal resolution can unlock the dynamics of alpine landscapes. By blending historical aerial, satellite photogrammetry, and lidar-derived models, we demonstrate a reproducible framework for high-resolution 3D landscape monitoring in remote and data-scarce terrain.

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Coastal sediment dynamics, and impacts associated with anthropogenic climate change

Mr Charlie Cox[1], Professor Andrew Gorman[1], Associate Professor Pascal Sirguey[1], Professor Wayne Stephenson[1]
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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Better constraints on sediment dynamics of the coastal zone, extending from terrestrial regions near the coast to the shallow shelf, are critical for understanding how these regions can be affected by changing climate. In New Zealand, approximately 65% of the population lives within 5 km of a coastline. Coastal suburbs, port facilities, transportation and utilities infrastructure, biodiversity, and recreation activities are all either directly or indirectly impacted by coastal change. Erosion is important for the viability of onshore land-use and inundation risk to coastal communities, whereas deposition can exacerbate river flood hazard, performance of stormwater and wastewater systems, and affect ports and shipping channels. Sea-level rise is poised to accelerate changes to the coastal environment that have not been witnessed since the beginning of settled human life, with multiple and costly impacts on society and infrastructure. It will affect the long-term viability of many New Zealand coastal communities. This work will characterise sediment source-transport-sink processes in the Otago coastal region of New Zealand over a range of spatio-temporal scales, with the goal of understanding how the coastal environment is responding to anthropogenic actions and transitory sea-level change. Towards this goal, imagery from Sentinel 2 MSI has been bulk processed in Google Earth Engine, and Normalised Difference Turbidity Indices have been created with short temporal resolutions for recent years. Initial results show interannual variability of relative turbidity along the Otago coast, specifically the South Otago shelf. Examination of extreme events, such as periods of large rainfall or swell, show fluxes of sediment leaving local rivers, and estuaries, as well as sediment being mobilised and transported from local beaches. Investigation into these sediment budgets and system dynamics will incorporate assessment of shoreline advance/retreat and landscape elevation changes using differential LiDAR.

Acceleration of landscape change in the Southern Alps during the past decade

Dr Simon C. Cox[1], Dr Pascal Sirguey[2], Ms Clare N. Lewis[3], Ms Ellorine Carle[4], Mr Aubrey Miller[2]
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09G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 11:35 AM - 1:05 PM

The elevation and position of landscape features, and changes over time, can be defined by photogrammetry and repeated high-resolution digital elevation models. A new change detection system (MAP²3D – see poster session) uses a semi-automated pipeline to build high-resolution digital surface models (DSM) from satellite or aerial imagery, and/or LiDAR elevation models (DEM). Automated surface processing enables precision and accuracy sufficient to define sub-metre scale changes in models of difference (DoD). Displacement of features over time is quantified through a feature-tracking algorithm using multiple hillshade models. Operational rapid response to natural events is possible whenever cloud-free stereo-imagery can be obtained.

Topographic changes in Aoraki-Mt Cook region have been quantified with MAP²3D products spanning epochs between 2008 and 2022. Dramatic snowfield retreat and glacier down wasting is revealed by these data, along with smaller scale rockfall and landslides. A GIS map of landforms and inventory of 920 landslides has been constructed, including previously unnoticed collapses >$10^5 m^3$, and numerous deep-seated slope failures (reaching 2.1Gm^3 in Murchison valley). There are 119 slow-moving slope failures and 536 rapid rock avalanches, toppling or debris flow events. Attributes pertaining to source volume, slope susceptibility, runout and deposit thickness provide information on the magnitude, frequency, and spatial reach of landslide-related hazards. The region's productivity of hazardous collapses shows a near fourfold increase from 57 during 2009-2012 (n=57) to 2013-2017 (n=295) and 2018-2023 (n=208). Although potentially enhanced by dynamic stress and increased moment from large South Island earthquakes, many small-moderate (10^2-$10^4 m^3$) collapses appear directly linked to areas of slope creep or de-buttressing induced by glacial recession. Intense precipitation events, snowfield melting, and glacier down wasting are now prevalent due to our changing climate. Regardless of direct cause or effect, the central Southern Alps is clearly destabilised, and rates of landscape change accelerated, locally elevating the level of hazard.

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The hidden ice of the Dry Andes – new insights from ongoing permafrost research in a semi-arid high mountain catchment

Prof. Dr. Lothar Schrott[1], Mrs Manon Cramer[1], Mrs Tamara Köhler[1], Mrs Diana Agostina Ortiz[1], Mrs Melanie Stammler[1], Mr Christian Halla[1], Dr. Rainer Bell[1], Prof. Dr. Jan Blöthe[2], Dr. Dario Trombotto Liaudat[3]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The ongoing decline of the mountain cryosphere is expected to intensify due to current climate change. In the Dry Andes of South America, where glacier and snow coverage are limited, seasonal frozen ground, debris-covered ice, and permafrost likely play a crucial role in sustaining local water availability. Global permafrost models and field reconnaissance suggest a wide vertical extent of the periglacial belt, stretching over 1500 m in elevation. Recent multidisciplinary research aimed to assess the spatial distribution and hydrological significance of permafrost in a representative mountain catchment, the Agua Negra catchment (30°S latitude, Argentina), where the lower permafrost limit lies at ~3700 m asl. Above this altitude, the landscape is largely shaped by periglacial processes. Geomorphological mapping and statistical modelling indicate that ~80% of the area is covered by block- and talus slopes (incl. protalus ramparts), with varying potential for ground ice preservation. Rock glaciers, while well-studied, cover only ~4% of the area. Geophysical measurements (electrical resistivity and seismic refraction tomography) confirm ground ice in rock glaciers, supported by repeated photogrammetric analysis of UAV and Pléiades Tri-Stereo imagery showing interannual surface changes linked to permafrost activity. Geophysical surveys on less-studied periglacial landforms demonstrate that talus slopes and protalus ramparts may also exhibit strong signatures of partly ice-rich and moderate permafrost content, while blockslopes, despite their spatial dominance, show weak and partly no permafrost signatures. Therefore, focusing solely on rock glaciers may significantly underestimate ground ice storage in this part of the Dry Andes. Near-continuous discharge time series (since February 2022) from different locations within the catchment and repeated isotopic and hydrochemical sampling reveal heterogeneous discharge dynamics with varying cryospheric runoff contributions. Future hydro-geomorphological investigations aim to further quantify the role of permafrost thaw in catchment-scale hydrology and improve predictions of water availability under continued cryospheric change.

Absent kinematic response of Dry Andean rock glaciers (Argentina, 2019-2025) to warming trend: stable permafrost next to declining glacial domain?

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rock glaciers are characteristic periglacial landforms in the Dry Andes. Here, monitoring is scarce or limited in duration and rock glaciers are characterised by high hydrological significance, high density in occurrence and large size. The aridity and almost cloud-freeness is beneficial to optical imagery-based investigation. Satellite-based rock glacier surface change monitoring presents a powerful alternative to, e.g., UAV-based monitoring, enabling access to more and otherwise physically restricted sites.

We present a 6-year Pléiades-based horizontal and vertical surface change monitoring of 47 rock glaciers in the Rodeo basin (Dry Andes, Argentina; 2019-2025). Tasked for austral summers, panchromatic, (tri)stereo Pléiades imagery at 1m resolution was taken 2019 and annually 2022-2025. We validate with 78 DGNSS measurements and compare against UAV-based surface changes for Dos Lenguas rock glacier (2016-2024). We find rock glacier vertical surface changes of low magnitude to strongly contrast with negative vertical surface changes on glaciers. For rock glacier velocities, we identify three categories: fast (0.57 to 1.38 m/yr) and large (> 0.24 km2) rock glaciers located at higher elevation (> 4380 m asl) and lower slope (< 15.12°), fast (0.35 to 1.23 m/yr) and small (< 0.03 km2) rock glaciers located at higher elevation (> 4700m asl) and high slope (> 24.05°), and slow (0 to 0.19 m/yr) and small (< 0.08 km2) rock glaciers located at lower elevation (< 4090 m asl) with variable slope. We do not find rock glaciers to increase in velocity over time.

We highlight the importance of large(r) scale rock glacier surface change monitoring for understanding regional patterns of the kinematic behaviour of the rock glaciers present – particularly in arid areas such as the Dry Andes. At the cost of spatial resolution Pléiades imagery can contribute to closing gaps on the kinematic behaviour of rock glaciers in data-scarce regions of the Earth.

The hidden ice of the Dry Andes – deciphering permafrost occurrence in high Andean periglacial landforms using geophysics

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02G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 2:00 PM - 3:30 PM

Periglacial landforms are key features of high mountain environments, playing a critical role in subsurface water storage and runoff contributors. In the Dry Andes of Argentina, where glacier cover is sparse, ice-rich permafrost has primarily been studied on rock glaciers but remains an understudied component among other periglacial landforms of the mountain cryosphere. Global permafrost models indicate that the periglacial belt in the Argentine Andes spans a vertical range of ~1500 m. In the semi-arid Agua Negra catchment (30°S, 69°W), ~80% of this periglacial belt is composed of block- and talus slopes (including protalus ramparts), while rock glaciers account for only ~4%. To assess permafrost occurrence and ice content, electrical resistivity tomography and seismic refraction tomography were applied. Within the PermArg project, this geophysical approach confirmed significant ice volumes in the Dos Lenguas rock glacier, reinforcing their role as frozen water reservoirs. Building on these findings, the HyPerm project expanded investigations to widespread but less-studied landforms. South-facing talus slopes and protalus ramparts (4300–4700 m asl) showed strong geophysical signatures of ice-rich permafrost, while others suggested degrading or discontinuous permafrost. In contrast, blockslopes, despite their spatial dominance and high elevation (4900–5500 m asl), exhibited geophysical evidence consistent with permafrost absence. This highlights the importance of studying these widespread landform types and environmental characteristics on catchment wide permafrost distribution and ice content assessments. Understanding this spatial heterogeneity is critical for refining permafrost models, as permafrost extent in the Dry Andes may be overestimated by global models but underestimated in national inventories that focus solely on rock glaciers. Future work will integrate seismic monitoring to assess active layer dynamics and correlate permafrost conditions with seasonal runoff patterns. In light of climate change, understanding the contribution of thawing ground ice to streamflow is essential for anticipating hydrological shifts in these vulnerable high-altitude catchments.

Detection of cryptotephra in sedimentary profiles using reflectance spectroscopy

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Explosive volcanic eruptions often blanket landscapes with tephra deposits that, if found, serve as valuable geochronological markers for landform development and sedimentary archives. However, tephra layers are commonly obscured and go undetected, especially when ash fallout from smaller or more distant eruptions is thin, or where ash has been mixed into host sediments by post-depositional reworking. Detecting these invisible trace ashes, termed ‘cryptotephra’, can greatly expand the scope of tephrochronology in geomorphological and stratigraphic investigations. Here, we use reflectance spectroscopy to detect cryptotephra within sedimentary landforms in western Canada. We first experimentally determine the visible to short-wave infrared (VSWIR) reflectance patterns of field-derived tephra and host sediments from alluvial, glacial, paleosol, and aeolian deposits. These data are used to build a tephra-detection model that distinguishes concentrations as low as 16 wt% based on key absorption features of hydrated, Fe-bearing glass in tephra. Ash-concentration profiles from two field outcrops at Abraham Lake, Alberta, reveal an otherwise-indistinguishable cryptotephra (17 wt%) from the Mount St. Helens Yn eruption, along with evidence of syn- and post-depositional mixing. To test reproducibility, we apply the model to a tephra-bearing alluvial fan in northwest Argentina, where we again detect reworked cryptotephra in an incised fan section. Our findings demonstrate that field-based reflectance spectroscopy can (i) rapidly screen for cryptotephra in sediments and landforms; (ii) quantify tephra abundance in mixed or reworked deposits; and (iii) facilitate more-detailed terrestrial tephrochronology than traditional approaches.

Surface ages of alluvial fans in the southern Central Andes recorded by ground- and space-based hyperspectral reflectance

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04B: Distributary landforms: past, present and future, Dobson 1, February 3, 2026, 9:35 AM - 11:05 AM

Alluvial fans preserve crucial records of landscape responses to climatic and tectonic forcing, but only if their deposits can be accurately mapped and dated. Unfortunately, modern methods for estimating the absolute ages of alluvial fans are costly and difficult to apply across large areas. Alternatively, fan surfaces undergo physical and chemical weathering as they age, and qualitative weathering indicators have long been used as field-based proxies for mapping fan deposits and organizing their relative chronologies. Many weathering processes can be detected using reflectance spectroscopy, and so an opportunity exists to test whether remotely-sensed data can quantify the weathering state of sedimentary landforms and be calibrated as a chronometer. Here, we test these ideas using 12 alluvial-fan surfaces flanking the Sierra de Aconquija, northwestern Argentina, for which existing cosmogenic nuclide exposure ages span 3 to 320 ka. We collect hyperspectral reflectance measurements of fan sediment, using both handheld and satellite-based sensors, and characterize weathering-driven changes in mineralogy. Across orders of magnitude in spatial scale, we detect systematic changes in the abundance of primary minerals and secondary clays and iron oxides. We quantify these signals using principal component analysis and metrics targeting specific weathering products. We detect a gradual, sub-linear, and quantifiable increase in absolute weathering state with fan-surface age, which can indeed serve as an accurate chronometer. Surface signals are corroborated by the downward accumulation of weathering products in subsurface profiles. We also show how hyperspectral imagery can be used to produce a calibrated map of alluvial-fan surface ages across the local basin, at high spatial resolution. Our findings highlight the important geomorphological applications of hyperspectral data for (i) quantifying the pathways, products, and rates of weathering over 1–100 kyr timescales; (ii) estimating the relative and even absolute ages of sedimentary landforms; and (iii) enhancing mapping efforts.

Flow history effects on grain clustering and bifurcation stability on a large gravel-bed river

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Large gravel-bed rivers across Nepal's alluvial plains experience regular dynamic shifts in course and flow patterns. This can cause sudden changes to flow distribution at bifurcations (locations where a river splits into two branches). These shifts can significantly affect ecosystems, infrastructure, and local communities. This study investigates two key questions: (1) Do short-succession high-flow events influence flow distribution at bifurcations? (2) Do gravel-bed structures, such as grain clusters, play a role in stabilising bifurcations?

Using three decades of satellite imagery and river discharge hydrographs, we examined a major bifurcation on the Karnali River, Nepal. The analysis revealed that phases of significant change in flow distribution at the bifurcation were often preceded by monsoon seasons featuring two large flood events (greater than 1-in-2 year). We propose that the first flood disrupts surface armouring, enabling increased sediment mobility, grain reorganisation, and changes to flow paths during the second flood, indicating a monsoon flow-history dependent threshold.

Grainsize and clustering data from gravel bars along the river were analysed to compare the differences between the two branches. Evidence of larger grainsizes and clustering at the bifurcation indicate that the bifurcation zone itself acted as a morphological anchor point within the system.
To explore these dynamics further, we use the Caesar-Lisflood Landscape Evolution Model to simulate the impact of flood sequences and intensity, and sediment transport on bifurcation behaviour. Understanding how historical flow sequences influence bifurcation stability may offer valuable insights for flood forecasting and the sustainable management of river systems in regions that experience seasonal flow patterns.

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Impact of anthropogenic river confinement on river morphology and flood dynamics in a sediment-rich himalayan rivers

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05K: Identification, quantitative assessment and mapping of anthropogenic landforms in urban areas, February 3, 2026, 11:35 AM - 1:20 PM

In recent decades, rapid urbanisation has increased land pressure and led to river encroachment in many cities globally. Flood protection measures such as embankments and river training walls are built in an effort to reduce flood hazards and expand development. While such structures may prevent frequent, small-scale flooding up to their design capacity, they can encourage further development in flood-prone areas, increasing exposure to larger floods that exceed the design capacity of the structures. The combination of rapid urbanisation and climate change-driven increased frequency and intensity of extreme floods raises concerns about the long-term sustainability of embankments as a primary flood mitigation strategy. In addition, river morphology and sediment transport are often omitted from embankment design.

Using field data collection and numerical modelling, this study investigates how embankments and sediment transport influence river morphology, channel capacity, and flood inundation in the Nakkhu River, Kathmandu, Nepal. Through the simulation of various extreme flood scenarios, we show that embankments are effective for managing low to moderate flows. However, in rivers with moderate to high sediment loads, channel confinement alters sediment transport, potentially increasing downstream flood risks and compromising embankment stability during extreme events.

Drawing on documented inundation from an extreme rainfall event that occurred in Kathmandu in September 2024, this research highlights the need for urban floodplain management strategies that consider sediment dynamics, river morphology, and the increasing unpredictability of flood hazards to develop sustainable and resilient infrastructure for effective flood risk reduction.

Scaling Roughness: Critical Reflections on its Role in Geomorphometric Connectivity Analyses

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Roughness is a fundamental concept in Earth surface sciences—every process that acts on the terrain either encounters or generates rough surfaces (Smith, 2014). While significant progress has been made in formulating and quantifying roughness, challenges remain in its practical geomorphometric application. In particular, the increasing popularity of sediment (dis)connectivity frameworks—supported by digital terrain model (DTM)-based indices and graph-based approaches—has spurred a widespread, and sometimes uncritical, use of surface roughness metrics.

Here, we reflect on one widely used DTM-based index of connectivity (Cavalli et al., 2013), in which roughness can be used as a weighting factor representing impedance to sediment fluxes. Roughness is calculated as the standard deviation of residual topography over a moving window, but the choice of window size and DTM resolution significantly influences its geomorphic meaning. We recall and showcase how, across scales, roughness shifts from a proxy of flow resistance at fine resolutions to a representation of broader morphological gradients at coarser scales—eventually acting more like slope, thus favouring rather than impeding flow. This drift in meaning can lead to conceptual misuse of the metric and unintended analytical outcomes.

Using case studies from the central and eastern Italian Alps (Camonica Valley and Friuli Venezia Giulia region), we demonstrate this scale-dependent behaviour in complex alpine settings. The increasing availability of tools for roughness calculation and connectivity assessment, though valuable, should not substitute critical geomorphological reasoning. Our goal is to raise awareness around scale-related issues and encourage thoughtful, context-specific application of roughness metrics in geomorphometry.

We hope to stimulate discussion within the community toward more robust and meaningful uses of roughness in geomorphometric analyses.

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Evolution of fluvial terraces in the Andes-Amazon transition: a case study from the Huallaga River, Peru

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The uplift of the Andes has significantly influenced South America's climate and river systems, especially those draining the western Amazon. Therefore, understanding the geomorphological and sedimentary evolution of fluvial systems in the transition zone between the Andes and the Amazon should consider tectonic and climatic factors. Here, we investigate the geomorphological and sedimentary evolution of the Huallaga River (Peru) through geomorphological mapping, sedimentological characterization, and luminescence dating. Luminescence dating was used on sediments from the fluvial terraces and the Juanjuí Formation in the Juanjuí region, located on the eastern edge of the Peruvian Andes. Preliminary geomorphological mapping results indicate the presence of four distinct fluvial terrace levels, designated Q1-Q4, elevated 0-190 m above the current riverbed. In general, terrace deposits are characterized by thick (10-75 m) sedimentary layers composed of conglomerates supported by a fine sand matrix. The Juanjui Fm, supposedly of Pliocene-Pleistocene age, consists of polymictic conglomerates with a sandy matrix. The clasts are of igneous and metamorphic rocks that were deposited in a fluvial to alluvial fan environment. Our luminescence ages from feldspar grains range from 100 to 300 ka, with a significant number of saturated aliquots. These ages, until now interpreted as minimum ages, are older than those previously reported for the terraces and the top of the Juanjuí Fm in the anticline of Bellavista. This discrepancy may be related to the location of the dated sequence, which is in a syncline in this research. Tectonic subsidence created accommodation space for thick accumulations of terraces and Juanjuí Fm conglomerates. Therefore, subsidence may have resulted in the exposure of older sediments than those found at the top of the anticline, as dated in a previous publication. This work is in progress; mapping is being refined and more luminescence data are being generated. FAPESP 2023/16031-4; 2022/03007-5.

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Shared approaches to drive more sustainable management practices in geo-hydrological risk reduction in cross-boundary contexts

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The actions for the geo-hydrological risk reduction know no administrative boundaries and must nowadays be stronger and shared to respond comprehensively to the actual climate change scenario. In susceptible regions such as North-Eastern Italy and Slovenia, where rivers and torrents traverse national boundaries, it is imperative to establish collaborative solutions to improve watershed management and safety infrastructure and human life. Consequently, the only possible approach is to share varied perspectives and expertise that facilitates the development of collaborative solutions built on a deeper understanding of common challenges is through cooperation among public authorities, stakeholders, and research entities. Using multi-temporal High-Resolution Topography data (HRT) and GIS (Geographic Information System) environments makes it much easier to analyse sediment dynamics in rivers and torrents and assess how these systems interact with watershed control structures over time. The TORRENT project aims to prioritise maintenance interventions and improve watershed management techniques by establishing standardised international methods for monitoring the state and functionality of torrent and river control projects, as well as evaluating the long-term effectiveness of structures through sediment dynamic analysis. Enhancing coordination in this manner will facilitate the establishment of an innovative shared database for watershed management initiatives and comprehensive geo-hydrological risk assessment utilising advanced technology and standardised data collection protocols. To show the combined methodology's applicability, the TORRENT project offers common tools (e.g., the maintenance priority index) and guidelines to support watershed management challenges in Slovenia and Italy and aims to transfer the strategic approach to any basin in neighbouring countries.

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Can geomorphometry support the design and management of watershed control structures?

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07A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 5:00 PM - 6:30 PM

Nowadays, Nowadays, thanks to advances in remote sensing techniques, it is possible to perform frequent surveys at increasingly lower costs and with resolutions that effectively capture the evolution of ongoing dynamic processes. High-Resolution Topography data (HRT) and Geographic Information System (GIS) environments are essential for geomorphometric analyses that can be carried out at both temporal and spatial scales, useful to support the planning and design of watershed control structures. Indeed, through multi-temporal Digital Terrain Models (DTMs), geomorphometric indices, and field validation, it is possible to obtain information that is very suitable for assessing the effectiveness of past interventions, understanding the interactions between sediment dynamics and existing control structures, identifying critical issues, and implementing strategies to improve the management and the future planning in catchments. This research conducted geomorphometric analyses in various Italian catchments equipped with watershed control structures and highlighted the importance of sharing and effectively transferring the acquired knowledge to decision-makers. This can be achieved through clear communication, concrete examples, and user-friendly tools that can help to mitigate the geo-hydrological risk and promote more sustainable resource management.

Acknowledgments
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The role of abandonment and degradation of agricultural terraces in sediment provenance of a Mediterranean catchment

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13J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 11:35 AM - 1:05 PM

In mountainous regions of Mediterranean Europe, the abandonment and subsequent afforestation of terraced agricultural landscapes -coupled with the rising incidence of wildfires driven by climate and land-use changes- are altering the stress-response thresholds of these systems, thereby reshaping their inherent landscape sensitivity. The lack of maintenance of the walls can trigger collapses, which may constitute a sediment source. In this study, we investigate the sediment sources in Can Cabrit Creek, a Mediterranean catchment (0.68 km^2) affected by abandonment of terraces and recurrent wildfires (i.e., 1994 and 2013). Applying the sediment fingerprinting technique, three potential sources were sampled: i) terrace surfaces (sheet erosion), ii) terrace wall collapses (mass wasting) and, iii) non-terraced hillslopes. Colour parameters, spectral intensity, absorbance and fallout radionuclide caesium-137 analysis are being performed. Exploratory analysis reveals the capacity of these parameters to discriminate the potential sediment sources. However, further analysis will incorporate geochemical properties, carbon and nitrogen content, and particle size distribution to improve source discrimination. Three sediment cores from the check-dam located at the downstream part of the catchment are also being analysed and will be used as target in un-mixing models to quantify the relative contribution of each source. The analysis is being performed at 2 cm intervals to assess temporal dynamics of sediment sources as well as deposition rates considering the impact of 2013 wildfire, as the check-dam was built in 2007. During the session, the implementation of this experimental design will facilitate the presentation and discussion of key results and conclusions, enhancing understanding of erosion processes in abandoned terraced landscapes under climate change effects -such as recurrent wildfires and intense rainfall- and clarifying the role of terraces in the sediment cascade, including their function as sediment buffers and feedback effects of their degradation.

Successful Floodplain Restoration: From Engineering via Science to Effective Monitoring

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01I: Living with geomorphic change, Conway 4, February 2, 2026, 11:40 AM - 1:10 PM

The Water Framework Directive is a legally binding instrument in Europe that aims to restore water bodies to good ecological health. A key provision is that all transverse structures must be passable for migratory species. This has often resulted in technical solutions, such as fish ladders. However, where space and funding were available, longer bypass watercourses were also constructed. This presentation focuses on the restoration project 'Dynamisation of the Danube Floodplains between Neuburg and Ingolstadt in Bavaria'. The centrepiece of this project is an 8 km watercourse that bypasses a hydropower station via a 1,200 hectare riparian forest, enabling species to migrate upstream.

Having existed for around 15 years, the bypass has developed into a habitat where adult fish spawn, young fish grow up, and certain species live permanently, not only serving the migration of species (mainly fish), but also providing a habitat for them. This success story has become known and recognised beyond the region. But is it enough to simply let the water flow?

The restoration area must serve many purposes, e.g. those of nature conservation. It is not only the fish that are in focus, but the floodplain itself is also the subject of restoration. To achieve the goals of comprehensive floodplain restoration, it is not enough to divert water permanently from the Danube through the floodplain forest. This new side arm allows water managers to conduct ‘ecological flooding’ (sometimes named ‘controlled floodings’) when the Danube's discharge conditions are favourable. During this process, large volumes of Danube water enter the floodplain forest, mimicking the annual flooding of previous years.

The presentation will emphasise the possibilities and constraints of this comprehensive restoration measure, focusing on bridging the gap between engineering and ecological sciences, and demonstrating the potential for long-term monitoring of success.

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Coastal plain landscape geoarchaeology, Sofala and Inhambane provinces, Mozambique

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Plentiful evidence exists for widespread late Pleistocene human settlement throughout southern Africa, from rich archaeological sites in Eswatini, Malawi, South Africa, Zimbabwe, and elsewhere. Comparatively less evidence exists from neighboring Mozambique. This poster is the result of geoarchaeological field survey to identify and characterize potential new archaeological sites in the Save River Basin, Sofala and Inhambane Provinces. Research methods include archaeological field survey, soil-landscape analysis, excavation, regional geomorphological characterization, and development of a qualitative site identification and prediction model to guide future reconnaissance. Methods were employed and evaluated in both established and novel localities near Muave, Vila Franca do Save, Jofane, and Chessungalane during field campaigns in 2023 and 2024. The regional landscape may be characterized as a low-gradient, heavily weathered coastal plain, with coarse, shallow soils and limited potential for preservation of archaeological materials. Despite these common conditions throughout the Save basin, there are two landscape settings that hold significant promise for identifying stratified archaeological sites of late Pleistocene age (~20 to 300 ka): 1) alluvial valley fills along upper and middle reaches of medium-sized watersheds; and 2) cliff-top dune sediments atop isolated remnant hillocks (koppies in the regional vernacular). Sites previously identified in these localities are in various stages of ongoing excavation, and future field survey will target these landscape settings selectively. Elsewhere throughout the study area, abundant artifact scatters and occasional concentrations of Middle- and Late-Stone Age materials reveal likely extensive human settlement dating back into the late Pleistocene. Challenges for identifying sites in other open-air localities include long-term weathering, oxidation of shallow soils, bioturbation by soil fauna, and rapid landscape denudation by sheet and rill erosion. These geomorphological factors account for a relatively limited archaeological record elsewhere in the region.

Let the riverscape grow! Application of riverscape-scale rewilding principles restores lateral connectivity and promotes geomorphic recovery.

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04A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 9:35 AM - 11:05 AM

The placement of in-channel large wood is widely used in process-based river restoration. Where naturally recruited large wood is lacking within degraded streams, it can be placed to reinstate natural fluvial processes. This can encourage a river to self-heal with minimal restoration interventions. Its use is becoming more widespread within Scotland, as long-term land management approaches have diminished the supply of riverscape wood available for natural recruitment to the channel. Restoration of riparian woodland is therefore often carried out alongside in-channel large wood placement to re-establish wood supply. Despite extensive application of these restoration efforts across Scotland, evidence on geomorphic responses to large wood placement and recruitment, and riverscape rewilding is lacking, as post-restoration monitoring is rarely carried out. We use a decadal-scale morphological dataset of Allt Lorgy, Scotland to assess the evolution of post-restoration riverscape wood dynamics of a “working with natural processes” restoration approach. Geomorphic change and geomorphic units are mapped using automated geomorphic analysis tools, in-channel large wood is mapped using orthomosaic aerial imagery and regenerating riverscape trees are mapped using LiDAR. Results demonstrate that process-based restoration which incorporates in-channel large wood enhances lateral connectivity and geomorphic recovery in a gravel-bed river with high recovery potential. Natural processes are reinstated through the placement of large wood. Diagonal bar complexes are augmented, channel widening is encouraged, and diverse geomorphic unit assemblages are forced. Post-restoration, natural recruitment of large wood increases, with in-channel storage occurring on diagonal bar complexes. Patches of regenerative native tree growth occur across the riverscape, predominantly on disturbed ground, facilitated by deer fencing of the scheme. Findings support the application of riverscape-wide rewilding principles in Scotland to encourage the restoration of self-sustaining, resilient riverscapes.

Where and How do River Channel Changes Modulate Future Flood Hazard: A global picture

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Lowlands are dynamic environments where geomorphological processes and human activities converge to shape both opportunity and risk. Here we present a Global Flood Model (GFM) framework, developed as part of the EvoFLOOD project, in which future flood depths and extents along the world's river network are driven by both changes in hydro-climate and changes in channel conveyance capacity and floodplain connectivity as forced by geomorphic processes.

We use the new GFM to compare high-resolution flood simulations (across return periods ranging from 1 in 5 to 1 in 1000 year events) for multiple future climate scenarios, both with and without the effects of geomorphological change.

We use these GFM outputs (creating 'flood maps of difference') to isolate where, for what return period events, and under what climate change scenarios, geomorphological perturbations substantially alter inundation patterns. That is, we present a new geography highlighting regions where (and where not) geomorphological changes have a major role in controlling flooding. We then evaluate our findings in relation to global datasets including the new Global River Topology (GRIT; ref 1) and the Global River Classification (GloRiC; ref 2) to analyse the geographic and geomorphic controls underlying these differences. This enables the identification of those regions and river types/environments most sensitive to geomorphically-modulated flood hazard.

Our results demonstrate that geomorphic functionality is a critical yet underrepresented component in most prior global flood hazard assessments. This work therefore enhances our ability to understand and manage flooding in highly populated lowlands, providing a framework for linking flood modelling with geomorphic theory to inform more resilient and adaptive planning in the face of climatic and environmental transformation.

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Urbanisation, Resource Demand and Environmental Risks: The Critical Impacts of Sand Mining on the Lower Mekong River System

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04I: Human Footprint in River Basins, Conway 4, February 3, 2026, 9:35 AM - 11:05 AM

By 2050, over two thirds of the world's population will live in cities. This urban growth is fuelling huge demand for sand, which is often mined from rivers. However, sand mining poses numerous risks. For example, the increased height of riverbanks may trigger landslides, while deepened channels modulate flood wave transmission.

Here we present data from the Lower Mekong River (LMR) that: (i) quantifies the relationship between regional urban development and sand demand, and (ii) highlights how sand mining has generated a broad (extending for hundreds of kilometres) and deep (bed degradation of several metres) anthropogenic 'footprint', transforming the morphology of the LMR channel system. We also show how these changes are affecting the LMR's hydrological functioning. Specifically, each year the LMR's seasonal flood forces an unusual reverse flow up the Tonle Sap River tributary, filling the Tonle Sap Lake (TSL), a major lake-wetland system designated as a UN Biosphere Reserve. The TSL thereby acts as a major flood water retention basin. Our model results show that riverbed lowering along the LMR has, in the last 20+ years, resulted in a reduction of the flood-season water flux into the TSL by up to 47%. This loss of flood storage within the TSL means that transmission of (monsoon season) flood waters into the Mekong delta has increased by 14%, while dry season flows released back from TSL into the delta have declined by 12%.

Anthropogenic transformation of the LMR's morphology has, and continues to, fundamentally shifted its hydrological functioning, shifting the risk profile for millions of people. This highlights, within the context of a rapidly urbanising planet, the need to consider material flows of sand between rivers and cities as a critical component of contemporary river systems. These flows are shaping the evolving exposure to environmental risks as 'river cities' grow.

A Legacy of Submarine Slope Failure in Seismic Reflection Data Along the Active Hikurangi Margin, Aotearoa New Zealand

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06E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 2:30 PM - 4:00 PM

Documenting and characterizing past submarine landslides is fundamental to understanding their distribution and frequency through time, and critical to assessing the associated hazard. The widespread availability of marine geophysical data at the active Hikurangi subduction margin, east of Aotearoa New Zealand, provides an excellent basis to map regional trends in landslide occurrence. We present a database that documents mass transport deposits (MTDs) in 30 marine geophysical surveys, encompassing ~45,400 line-km of 2D seismic profiles. We map and characterize 737 MTDs, showing ariations in size, location and style of failure, which we attribute to changes in geomorphic setting from north to south. Mass transport deposits in the northern Hikurangi margin, characterized by a high taper wedge and seamount subduction, show a broad range in size, with the highest proportion of MTDs displaying blocky or intact nternal architecture. The central margin, characterized by lower wedge taper, hosts the most MTDs (51%), albeit with the thinnest (on average) and clustering within interridge basins. The southern Hikurangi margin hosts widespread submarine canyons and the largest (on average) MTDs, based on area and thickness. We demonstrate the importance of seismic archives in providing new insights into MTD reservation and discuss the bias between seafloor geomorphology and subseafloor seismic data in quantifying MTD occurrence. Our findings support the interrogation of the varied and complex causes of submarine landslides along active margins generally, as well as regions prone to cascading geohazards and landslide-induced tsunami.

Designed adaptation: A multidisciplinary framework for nature-based riverscape planning

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11I: Urban Streams: From Long Trajectories to Restoration Issues and Hazard Management, Conway 4, February 5, 2026, 5:00 PM - 6:30 PM

Urbanized riverscapes are vulnerable to changing flow and sediment regimes with consequences of increased flooding and habitat degradation. The conventional engineering solution in this situation involves gray infrastructure, including concrete lined trapezoidal channels and flood prevention structures, retention and detention ponds, and closed subgrade piped systems. Gray infrastructure is failing to mitigate flooding under changing climate conditions, particularly in coastal regions, and it is well understood to eliminate essential, natural ecosystem functions and services. This study presents a multidisciplinary, flexible framework for adaptive riverscape planning that integrates synthetic 3D river design, real-world topographic data, and hydro-morphodynamic modelling to yield better solutions compared to gray infrastructure while also enhancing stakeholder engagement.

Improved design decision-making applications are demonstrated by revising specific river features in the planning phase and presenting a rendered perspective image to showcase a nature-based solution action for flood mitigation in urbanized contexts. Using a coastal site as a case study, three continuous river-design scenarios, with proposed landscape plantings, were developed upstream from a flood-prone urbanized site. Synthetic rivers were merged with real-world topography to investigate hydrologic, hydraulic, and geomorphic performance under flood conditions. We found each design scenario improved flood mitigation potential and responded differently to simulations and metrics applied. Scenario 1, designed with a conventional Natural Channel Design method, underperformed compared to other approaches. Scenario 2 was the preferred design for increasing water retention and geomorphic form variation while scenario 3 was a multi-thread design approach that performed best at decreasing peak runoff rates and mean flow velocities.

Modelling Erosional Dam Breach & Downstream Flood Exposure from Cascading Multi-Glacial Lake Outburst Processes in the Eastern Himalayas

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Abstract: Rapid retreat of glaciers due to global warming has led to the expansion of glacial lakes, heightening the risk of glacial lake outburst floods (GLOFs), which pose severe threats to lives and infrastructure in downstream regions. In the Sikkim Himalayas, the Gurudongmar Lake Complex (GLC) consists of four lakes holding approximately 148×10^6 m³ of water, with an enlargement rate of 74 ± 3%. This study integrates a two-dimensional erosion-based moraine-dam breach model using TELEMAC 2D and SISYPHE with one-dimensional inundation modelling in HEC-RAS to assess the impacts of multi-lake GLOFs under varying scenarios. Simulations based on remote sensing and field data revealed that in the most extreme case – an 80% overtopping breach – peak flood discharges could reach up to 8882.0 m³/s, releasing a total water volume of 59.4×10^6 m³. Flood heights under these scenarios could significantly exceed those observed during the South Lhonak GLOF event of October 2023, intensifying risks for downstream communities. The assessment of 19 settlement sites using a 15×15 m fishnet revealed that Thangu Valley and Chungthang town are most vulnerable, with potential inundation levels and infrastructure exposure highest in these areas. Combined breaches, such as the sequential failure of lakes GL-2 and GL-1 or GL-3 and GL-1, further amplify the flood risk, underscoring the complex dynamics of multi-lake outbursts. This research provides critical insights into moraine-dam erosion processes and downstream flood impacts, offering a robust framework for hazard mitigation in the Eastern Himalayas and similar glaciated terrains.

Keywords: Glacial lake outburst floods (GLOFs); Erosion dam breach model; Hydrodynamic flood modelling; HEC-RAS; Exposure assessment; Sikkim.

Rainfall-Induced Landslide Susceptibility through Soil Mineralogy and Microstructural Assessment in Namchi, Sikkim Himalaya

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06J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 2:30 PM - 4:00 PM

Landslides pose a significant hazard in the mountainous terrain of Namchi, Sikkim Himalaya, India. This study investigates landslide susceptibility of the area, belongs to a geologically sensitive region composed of the Gondwana Supergroup and the Daling Group of rocks, where frequent landslides are primarily triggered by extreme rainfall events. A combination of Logistic Regression Modelling, X-ray Diffraction (XRD) and Scanning Electron Microscopy (SEM) analyses has been carried out to develop landslide susceptibility map, determine the soil mineralogical composition and assess its potential for chemical weathering and examine micro-structural characteristics. The logistic regression model indicates a sharp increase in landslide probability when daily rainfall exceeds 20 mm. A high Al/Si ratio suggests significant chemical weathering of parent rocks leading to the formation of clay minerals. These clay minerals absorb water, reducing slope instability. SEM analysis revealed microstructural alterations, including particle disaggregation and fungal growth, attributed to rainwater infiltration. These alterations reduce soil cohesion and increase pore water pressure, both of which significantly increase the likelihood of landslide hazard. The integrated findings from the mineralogical and SEM analyses highlight that rainwater infiltration accelerates both chemical weathering and microstructural degradation, ultimately compromising slope stability in the study area. This research highlights the importance of ongoing monitoring of rainfall patterns and soil properties to effectively manage and mitigate landslide risks in the Namchi area.
Keywords: Landslide susceptibility; Extreme rainfall events; X-ray Diffraction; Scanning Electron Microscopy, Sikkim.

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Controls on channel pattern change of the Juri River, Northern Chittagong–Tripura Fold Belt, India and Bangladesh

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07D: Tectonic Geomorphology for Mountainous Terrain, Dobson 3, February 3, 2026, 5:00 PM - 6:30 PM

The northern Chittagong-Tripura Fold Belt (NCTFB) is characterised by five westerly convex anticlines with intervening synclines evolved from a remnant arc system during the Pleistocene. The north and west-flowing Juri River (128 km) originates from the Jampui Range of the NCTFB, crosses the Patharia and Harargaj anticlines before flowing into the Kusiyara of the Meghna System in the Bengal Plains. Analysing maps and images, this study examines the river's profile characteristics, planform changes, and their underlying causes during 98.5 years.

The Juri was digitised for four survey/imaging years: 1907–34 (Survey of India 'inch' maps), 1961–62 (Corona photos), 1975 (Landsat-1 MSS), and 2017 (Resourcesat-2 L4-fmx). Based on meander belt curvature and changes in its course, the river was divided into 12 reaches. Reach-specific sinuosity indices (SI) were calculated for the four time points. An ALOS PALSAR 12.5-m elevation model of the region was utilised to detect structural controls on drainage through profile analysis.

The convexity along the Juri's long profile indicates regional instability at the upper course of the river near Jalabasa, where it created a rapid. In the mid-course, a decrease in channel sinuosity in the upstream and an increase in sinuosity in the downstream reaches of the two anticlinal axes indicate upliftment. The active nature of the anticlines is also supported by GPS and earthquake data of the region. However, the observed channel planform changes recorded from the region cannot be linked to the decreasing trend of rainfall during the last 120 years.

Cosmogenic chlorine-36 constraints on Holocene glacier change in Iceland

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Understanding temperature variability during the Holocene is critical for constraining baselines of natural climate variability. Temperate mountain glacier extent is limited most significantly by summer air temperature, thus geological records of past glacier length changes represent a useful proxy for this climatic variable. Iceland's maritime glaciers with their high sensitivity to temperature and precipitation changes serve as robust indicators of climate variability in the North Atlantic region. Previous reconstructions of Iceland's Holocene glacier and climate history have relied primarily on marine sediment cores, terrestrial geomorphological evidence, and glaciological modelling. These proxies highlight a correlation between glacier fluctuations and regional climate variability and suggest notable glacier retreats during early and mid-Holocene warm periods.

Here, we present cosmogenic chlorine-36 measurements from four outlet glaciers of the Vatnajökull ice cap in Iceland that test and further constrain the occurrence of past glacier minima during the Holocene. Unlike the more commonly used method of cosmogenic surface exposure dating of moraines, which constrains the timing of past glacier advances, our application targets the remnant cosmogenic signals of prehistoric exposure events preserved in freshly exposed proglacial surfaces. Our data thus tests for the occurrence and constrains the duration of past glacier retreat events and, thereby, warmer times during the Holocene. Our results support the hypothesis that Icelandic glaciers were smaller than present for several millennia during the Holocene and when combined with existing datasets of Icelandic climate, our new results allow us to reconstruct both glacier advance and retreat through the Holocene.

Multitemporal hydro-sedimentary legacies shaping urban stream dynamics: insights from the Morbras river, Paris Urban area, France

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11I: Urban Streams: From Long Trajectories to Restoration Issues and Hazard Management, Conway 4, February 5, 2026, 5:00 PM - 6:30 PM

Urban rivers in temperate European floodplains are strongly impacted by increasing urbanisation. While the hydrogeomorphological alteration of these rivers is becoming better understood, recent research indicates that this alteration is heterogeneous and follows multiple trajectories. In the Paris region, urban transformations appear to overlap or combine with changes inherited from a long history. The concept of “river trajectory” emphasises the importance of understanding rivers' history and contrasts with a fixed vision based on arbitrary reference states or isolated objectives. Instead, it advocates for integrating past dynamics and current constraints to inform future projects. The aim is therefore to understand how the influence of the hydro-sedimentary heritage of urban rivers has shaped their current functioning in order to inform ecological restoration. The goal of this study is to characterise river forms and processes that have successively shaped river forms until today. This requires shifting the analysis timescale to incorporate a historical trajectory dating back to the Neolithic period, when rivers began to be transformed by human activities. The study focuses on the Morbras, an urban river located in the Paris suburbs. The methodology combines high-frequency surveys of current forms with geoarchaeological analyses conducted at four sites, allowing the reconstruction of channel evolution before and after successive hydraulic works. The results reveal longitudinal heterogeneity, which leads to fragmented hydrosystems. Four river metamorphoses have been identified: autogenous sedimentation in the Middle Holocene, which disappeared due to the gradual silting of the valley floors at the end of the Iron Age; the impact of Middle Ages hydraulic engineering the Middle Ages; the effects of urbanisation after the 18th century; and finally, ecological restoration is currently contributing to a new transformation of rivers, raising questions about the direction and scale of future projects.

The Interrelationship between Geodiversity and Biodiversity: A Didactic Approach in Paraná State Parks

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The concepts of biodiversity and geodiversity are intrinsically linked. Biodiversity encompasses all living organisms, while geodiversity denotes the natural variety of geological, geomorphological, soil, and hydrological features. In addition to other ecological functions, geodiversity fundamentally shapes biological diversity and evolutionary processes. Field work serves as an essential didactic tool in Higher Education Geography, integrating theoretical knowledge with practical observation to foster critical understanding. Since 2016, two-day field works have been conducted in Paraná State Parks to explore geo-biodiversity interactions. The results consistently demonstrate the profound influence of geodiversity on biodiversity. In State Park Vila Rica do Espírito Santo, fertile soils derived from mafic rocks (e.g., Latossolo Vermelho, Nitossolo Vermelho) dictate distinct forest structures, from dense primary forests in interfluves to water-adapted species in lower slopes. In Guartelá State Park, its high geodiversity, particularly the canyon carved by the Iapó River in Furnas Formation rocks, profoundly controls local flora and fauna. Here, low-fertility Neossolo litólico supports grassland vegetation on interfluves, while high humidity near water bodies favors riparian forests. Additionally, a relict of Brazilian savanna, with adaptations to specific soil and climatic conditions, and rupestrian fields are observed. These findings confirm that variations in relief, soil type, and geological characteristics directly shape vegetation composition and structure, underscoring the importance of understanding these interactions for sustainable environmental management and conservation. Field studies confirm the pedagogical value of integrating these concepts for a holistic view of natural resource dynamics.

Integrating Geodiversity into Conservation Planning: A Case Study of the Brazilian Amazon Biome

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08I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 9:35 AM - 11:05 AM

Brazilian environmental legislation has traditionally focused on biodiversity conservation, often neglecting or only indirectly addressing geodiversity. Moreover, it serves as a crucial foundation for sustaining biodiversity. This study aims to analyze the spatial distribution of geodiversity within the Brazilian Amazon Biome, emphasizing the importance of incorporating geodiversity into conservation strategies. The research utilized existing geodiversity index maps for the region, which classify areas based on the diversity and complexity of geological, pedological and geomorphological elements. These maps were overlaid with polygons representing officially designated Protected Areas to assess the degree to which geodiversity is currently protected. The analysis revealed that a substantial portion of areas with high geodiversity remain outside the boundaries of existing Protected Areas, highlighting a significant gap in the current conservation framework. In response, the study proposes new priority areas for conservation, selected based on geodiversity criteria. This approach aims to complement existing biodiversity-based conservation strategies by integrating abiotic factors into territorial planning. By underscoring the value of geodiversity as an essential component of natural heritage, the research advocates for more comprehensive environmental policies. It calls for the expansion and adaptation of protected area networks to include both biotic and abiotic elements, especially in ecologically critical regions such as the Amazon. Ultimately, the study contributes to a broader understanding of environmental conservation, promoting a more holistic perspective that acknowledges the interconnectedness of all natural systems.

Metals pollution in bottom sediments from the Bortolan Reservoir, Poços de Caldas Volcanic Caldera, Brazil

Professor Diego de Souza Sardinha[1], PhD Letícia Hirata Godoy[1], PhD Rodrigo Leandro Bonifácio[2], PhD Heber Luiz Caponi Alberti[2], PhD Paulo Henrique Bretanha Junker Menezes[1], PhD Antônio Donizetti Gonçalves de Souza[1], MsC Student Eveline Ramos[1]
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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Ribeirão das Antas Stream Basin occupies approximately 70% of the Poços de Caldas Alkaline Massif (PC), drains decommissioned, abandoned and active mines, agricultural uses, point and nonpoint pollutant sources, urban land use, decommissioned landfill and sewage station. In the lower course, is dammed and forms Bortolan reservoir, opened in 1956 with a 7 million m3 capacity, flooding 3.45 km2. The core sampling occurred in 2023 using a Kajak Sediment Core sampler at one representative point (21°46’62.87” S and 46°37’57.27” W, with an altitude of 1237 m) located close to the spillway or lake area (11 samples from 2.5 to 52.5 cm), at the water depth of 8.0 m. The near-surface and deeper layers of the sediment core were discarded due to the likely mechanical mixing in the first and last few centimeters of the core. The samples were delivered to the National Nuclear Energy Commission (CNEN) for Al, Cr, Cu, Mn, Ni, Pb, Th, U, Zn, As and Hg analysis by FAAS, ICP-MS and ICP-OES. The metals con-centrations in the sediment core showed a greater abundance of Al, followed by Mn, Zn, Th, Pb, U, Cr, Cu, Ni, As and Hg. The concentrations of Mn, U and Cu were practically constant in the sediment core, with following ranges respectively: 1,520.0-820.0 (mean: 1,197.3 ± 257.8 mg.kg-1); 33.0-25.0 (mean: 28.0 ± 2.7 mg.kg-1); and 18.3-13.7 (mean: 16.2 ± 1.5 mg.kg-1). However, Al, Cu, Ni, Pb and Zn presented higher concentrations at depths of 12.5 cm: 107,000.0 mg.kg-1, 18.3 mg.kg-1, 10.6 mg.kg-1, 52.2 mg.kg-1 and 226.7 mg.kg-1, respectively. As and Cu concentrations were higher at depths of 52.5 cm (8.7 and 18.30 mg.kg-1). The concentrations of Pb, Zn and As are intermediate to TEL and PEL values, indicating potential toxicity with a low probability adverse effect on the biological community.

Sedimentation Rate and 210Pb Sediment Dating in the Bortolan Reservoir, Poços de Caldas Volcanic Caldera, Brazil

Professor Diego de Souza Sardinha[1], PhD Letícia Hirata Godoy[1], PhD Rodrigo Leandro Bonifácio[2], PhD Heber Luiz Caponi Alberti[2], PhD Paulo Henrique Bretanha Junker Menezes[1], PhD Antônio Donizetti Gonçalves de Souza[1], MsC Student Eveline Ramos[1]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Ribeirão das Antas Stream Basin occupies approximately 70% of the Poços de Caldas Alkaline Massif (PC), the largest alkaline magmatism in South America. In the lower course, is dammed and forms Bortolan reservoir, opened in 1956 with a 7 million m3 capacity, flooding 3.45 km2. The reservoir is used to electricity generation flow regulates, industrial, mining, agro-industrial and tourism. The core sampling occurred in 2023 using a Kajak Sediment Core sampler at one representative point (21°46’62.87” S and 46°37’57.27” W, with an altitude of 1237 m) located close to the spillway or lake area (11 samples from 2.5 to 52.5 cm), at the water depth of 8.0 m. The near-surface and deeper layers of the sediment core were discarded due to the likely mechanical mixing in the first and last few centimeters of the core. The samples were delivered to the National Nuclear Energy Commission (CNEN) for 210Pb and 226Ra submitted for analysis by gamma spectrometry. Dating and sedimentation rate were carried out using the constant initial concentration model (CIC). The radiochemical data from the sampled sediment core were on mean 289.9 ± 28.9 for 210Pb and 196.4 ± 18.3 for 226Ra. The mean unsupported 210Pb concentration at the sediment was 134.4 ± 93.4 Bq.kg-1. Measurements done on bottom sediment core samples allowed estimating a sedimentation rate of 1.55 cm.yr−1 or 15 mm yr−1 between 1989 and 2021. The results can provide new insights into the relative importance of sedimentation rate in an artificial lake created in river valleys by building dams across rivers and especially for those located in similar geographic areas in Brazil and around the world.

From Rockfalls to Retreat: Unravelling Coastal Cliff Dynamics in Taranaki, Aotearoa, New Zealand

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Coastal cliffs experience continuous erosion punctuated by large, episodic failures that can result in cliff top retreats of several meters. Despite their importance, the rate, magnitude, and spatial distribution of these abrupt events remain poorly understood. Traditional methods that average retreat rates over space and time often obscure these sudden events, leading to oversimplified projections that may misinform hazard and risk management. A comprehensive, quantitative record of coastal cliff change is essential to accurately determine erosion rates and to elucidate the geological controls and environmental drivers of cliff erosion—a necessity for forecasting the impacts of climate change and sea-level rise.

In Taranaki, where coastal erosion and landsliding occur at among the fastest rates in Aotearoa New Zealand, our study aims to bridge this knowledge gap. To capture a representative sample of episodic cliff failure events, larger regional spatial areas (km's) of coastline are monitored, in a space for time substitution. This reveals the spatial patterns and mechanics of erosion, including frequency – magnitude relationships.

Our study targets three key sites with differing geological and environmental settings: 1. — soft rock sedimentary cliffs of Waitoetoe - Mimi in north Taranaki, 2. volcaniclastic conglomerate rock cliffs of Bell Block in Taranaki, and 3. soft rock sedimentary cliffs of Manutahi in south Taranaki. We have collated information on environmental and geologic information (including structural controls), to assess controls on frequency – magnitude patterns. This information is used to accurately inform the rates and mechanics of coastal cliff erosion, and therefore improve the fundamental basis for coastal cliff retreat models.

Tracking the Evolution of a Large Landslide and Its Impact on Hillslope-to-River Sediment Transfer

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06C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 2:30 PM - 4:00 PM

Large catastrophic landslides play a critical role in shaping alpine landscapes, contributing significantly to sediment transfer from hillslopes to river systems, and posing substantial hazards to infrastructure and communities. Predicting when and how these failures occur, especially the transition from creeping to catastrophic failure, is challenging due to the complex interactions between non-linear displacement trends, internal mechanical properties, and external environmental stressors. Here we investigate these controls and their impact on sediment mass balance in a paraglacial, seismically active setting by examining the Alpine Gardens–Mills Creek landslide complex in Fox Glacier Valley, New Zealand.

Seven high-resolution topographic surveys (ALS, APM, SPM), combined with GNSS, meteorological, and geophysical monitoring, were used to quantify erosion, deposition, and landslide dynamics from 2017–2022. Finite element analysis was performed to further investigate the controls and drivers of landslide movement.

Alpine Gardens is a reactivated, moderate-velocity, reactivated compound rock/debris slide with ancillary debris flows originating from its toe. It moves downslope as one block with a consistent trajectory, with velocity variations moderately correlating with rainfall. The basal slide surface is likely at the colluvium–bedrock interface. Its movement de-buttresses adjacent slopes, triggering five debris avalanches from Craig Peak and surrounding areas. Between 2017 and 2022, we observed 13.9 million m^3 of erosion from Alpine Gardens, 980,000 m^3 from Mills Creek, 4.3 million m^3 of fan deposition, and 10.6 million m^3 delivered to the Fox River valley. Displacement rates and sediment flux peaked between June 2018 and June 2019, declining thereafter.

This study highlights the cascading geomorphic consequences of compound landslides in paraglacial terrain, and the value of long-term, multi-sensor approaches to capture their full sedimentary and hazard impacts.

Multiproxy signatures of geomorphic dynamics on a complex subarctic slope in Nunavik

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13G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 11:35 AM - 1:05 PM

This research on slope dynamics in the Nunavik region (northern Québec) focuses specifically on a segment of the northern slope of Lepage Island, at Clearwater Lake. The area is characterized by a subarctic climate and features active geomorphological processes. The aim of this study is to document the different geomorphic contributions to a slope that consists of a coarse debris talus in the apical zone, followed by a forested slope below a flat area, with particular attention to slope dynamics and recent geomorphological activity. Fieldwork included (i) topographical profiles of the slope, (ii) an inventory of the morphometric properties of the rock debris, and (iii) visual estimation of the vegetal cover on the clasts. Dendrochronology methods were also used to identify the periods of disturbances in black spruce growth, and suggested recurrent surface instabilities since 1790 CE. Results show that the upper part of the slope is dominated by large and coarse boulders with continuous vegetation cover, indicating little recent geomorphological activity on the majority of the slope, despite recurrent evidence of snow-avalanche dynamics. In contrast, the lower part shows signs of destabilization, notably after 1980 CE. Results indicate that current geomorphological processes, such as snow avalanches, rockfall or landslides, are limited nowadays, although there are local signs of past readjustments and recent disturbances.

Soil Loss Estimation in Dikrong River Basin, North East India using the RUSLE Model

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05I: Human Footprint in River Basins AND Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 11:35 AM - 1:20 PM

Soil erosion is one of the most significant land degradation problems, posing a critical environmental hazard worldwide in modern times. The Dikrong River Basin in Northeast India, covering an area of 1,406.25 km², has been exposed to severe soil erosion due to agricultural and industrial activities, intense monsoon rainfall, deforestation, and gradually increasing unscientific land management practices. It is of utmost importance to assess and map soil erosion-prone areas for effective management of the basin. The RUSLE is the most commonly used empirical model for calculating the average annual soil loss of any river basin. The present study utilises remote sensing data integrated with a Geographical Information System (GIS) technique and the Revised Universal Soil Loss Equation (RUSLE) model to assess the annual average soil loss in the Dikrong River Basin for 2010 and 2025. The spatial analysis of the annual soil erosion rate was obtained through the integration of environmental variables in a GIS-based raster method. Different parameters such as R (Rainfall erosivity factor), K (Soil erodibility factor), LS (Slope length and steepness factor), C (Cover management factor) and P (Support practice factor) were computed to assess their effect on average annual soil loss in the said basin. It has been estimated that the average soil loss in the Dikrong River Basin in 2011 was 2.13 t ha-1 yr-1, which increased to 5.04 t ha-1 yr-1 in 2025. Datasets such as ALOS PALSAR DEM, Landsat TM, and Sentinel satellite data, as well as soil maps and gridded rainfall data, have been widely used in the analysis. The study's findings will undoubtedly assist planners in planning and managing the basin for the benefit of society.

Analyzing surface elevation changes of active rock glaciers on intra- and inter-seasonal scales. Case studies from the Swiss Alps

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rock glaciers play an important hydrological role in high mountain watersheds, by storing and releasing water in freshwater ecosystems on different time scales. In particular, water stored in ground ice represents a valuable long-term water resource under the influence of climate change. In fact, rock glaciers have slower ice melt rates than glaciers, as the ground ice benefits from the insulation effect of the uppermost coarse blocky layer. Quantifying changes in ground ice content is challenging, as only borehole data – which are costly and offer only point-based information – provide direct observations of thermal state within rock glaciers. However, indirect measurements, such as the morphodynamics analysis, can offer valuable insights into potential changes in ice content. This research therefore aims to quantify surface elevation changes of three rock glaciers located in the Swiss Alps (Monte Prosa, Ganoni di Schenadüi and Piancabella) and to investigate the processes involved in order to detect thickness losses related to ground ice melting. Changes in surface elevation of rock glaciers were measured through repeated Unmanned Aerial Vehicle and differential Global Navigation Satellite System surveys on both intra- and inter-seasonal scales. High-resolution orthomosaics and Digital Elevation Models (DEMs) were obtained using Structure from Motion photogrammetry. Horizontal displacements were calculated through image correlation, whereas changes in surface elevation were quantified with DEMs of difference (DoD). Monitored rock glaciers show thickness losses at both intra- and inter-seasonal scales, characterized by a spatially heterogeneous distribution. During the warm season of 2023, Monte Prosa and Ganoni di Schenadüi rock glaciers were characterized by thickness losses (up to -0.6 m) in the upper part and low horizontal velocities (< 1 m/a) in the lower part. These results may be interpreted as evidence of the probable influence of ground ice melting on the subsidence observed in their rooting zone.

Active rock glaciers as hydro-chemical disruptors of freshwater ecosystems: insights from the Swiss Alps

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07G: Cryosphere Processes and Mountain Hydrology, Conway 2, February 3, 2026, 5:00 PM - 6:30 PM

In the current context of climate change, rock glaciers are key water reservoirs in high mountain regions, serving as aquifers through the temporary storage of both liquid and solid water. Rock glaciers have slower ice melt rates than glaciers, as the ground ice may benefit from the insulation effect of the uppermost coarse blocky layer. Although ground ice melting represents a valuable long-term water resource, its contribution to the runoff from rock glaciers is currently small. From a water quality perspective, however, ground ice melting is disrupting the hydrochemistry of rock glacier springs through the release of high solute concentrations. As permafrost degradation, and thus solute export from rock glaciers, are expected to increase under the influence of climate change, it is essential to better understand the involved processes to predict future impacts on freshwater ecosystems. To this aim, the physical-chemical proprieties of water emerging from two active rock glaciers located in the Swiss Alps were analyzed at both intra- and inter-seasonal scales. Electrical conductivity was monitored continuously at the rock glacier springs, whereas chemical composition was measured in samples manually collected three times during the warm season (i.e., in early summer, late summer, and early autumn). Electrical conductivity showed a significant intra-seasonal variability, characterized by a clear increase throughout the warm season. Chemical composition of rock glacier springs was dominated by sulfate and calcium ions, while all trace element concentrations were below the limit of quantification, on both intra- and inter-seasonal scales. These results suggest a probable influence of ground ice melting on water quality of rock glacier springs, through the remobilization of solutes accumulated and stored over time in the ice. Since the investigated watersheds are composed of poorly alterable rocks such as granite and orthogneiss, the solute origin was attributed mainly to atmospheric fallout.

Monitoring Slow-Moving Landslides in the French Alps: Insights from Remote Sensing and Field Surveys

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04C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 9:35 AM - 11:05 AM

Alpine landscapes are profoundly shaped by both past and ongoing slow-moving landslides, which pose significant hazards to human settlements and infrastructure. Effective risk mitigation requires detailed characterization and continuous monitoring of these mass movements. Remote sensing techniques, particularly InSAR (Interferometric Synthetic Aperture Radar), combined with aerial imagery and field surveys, offer valuable tools for this purpose.

This study focuses on the La Traversaz landslide, located on the slope opposite the Col du Télégraphe in the municipality of Saint-Michel-de-Maurienne, in the French Alps. This site represents a compelling example of an active landslide with complex geomorphological features and notable societal relevance.

InSAR data were employed to assess ground deformation patterns across the landslide body, revealing spatially variable movement rates (in mm/year) and temporal evolution through time series. These data allow for the identification of active zones within the landslide and contribute to the understanding of its kinematics.

In parallel, historical and recent aerial imagery, acquired via both airplane and UAV (Unmanned Aerial Vehicle) platforms, were analyzed to detect morphological changes over time and improve spatial resolution in mapping efforts. These remote observations were further validated and complemented through detailed field surveys, which provided ground-truth data on the direct impacts of the landslide on infrastructure, as well as indirect consequences on local communities. This integrated approach highlights the importance of combining multi-temporal and multi-source datasets to enhance landslide monitoring and risk assessment in alpine environments. The La Traversaz case study underlines the role of geomorphology in interpreting landslide dynamics and supports the development of more effective strategies for hazard mitigation in mountainous regions.

Source-to-Sink Dynamics in the Piedmont Zone of Apennines (Italy): Climate and Tectonic Controls on Fluvial Terraces Since the Middle Pleistocene

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Understanding source-to-sink systems, such as rivers and their drainage basins, is essential to reconstruct landscape evolution and to assess the interplay between tectonic activity and climate fluctuations over geological timescales. In this study, we investigate the response of the fluvial systems in the Marche Piedmont Zone of the Apennines (Central Italy) to climate and tectonic forcing since the Middle Pleistocene. This region, uplifted since the Middle-Late Pliocene due to the eastward propagation of the Apennine compressional front, presents a well-preserved sequence of fill-type fluvial terraces. These geomorphic features serve as sensitive recorders of both tectonic uplift and Quaternary climatic oscillations. Through sedimentological analysis and luminescence dating of terrace deposits from three representative river valleys, we obtained eleven new chronological constraints extending back to the Middle Pleistocene. High-resolution LiDAR-derived Digital Terrain Models were used to semi-automatically extract and classify river terrace treads based on topographic parameters, enabling an updated mapping and altimetric analysis. By integrating these results with existing data from nearby river systems, we identify differential uplift patterns across the region and refine uplift rate estimates. Moreover, the timing of terrace formation aligns with glacial stages, indicating that sediment delivery to valley floors was enhanced during colder periods, driven by vegetation decline and slope destabilization. This research highlights how fluvial archives provide critical insights into the complex feedbacks between tectonics, climate, and sedimentary processes within actively deforming mountain belts.

A Remote Sensing-Based Framework for Soil Erosion Early Warning Signals in Darab County

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03H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 4:00 PM - 5:30 PM

This study provides a comprehensive evaluation of soil erosion dynamics in Iran's Maharlu watershed by integrating multi-sensor remote sensing with machine learning. Using 20 years of Landsat imagery (2005-2025) processed via the Google Earth Engine platform, the research combined this data with field measurements for robust validation.

Analysis of spectral indices revealed clear erosion patterns. The Normalized Difference Vegetation Index (NDVI) showed a strong negative correlation with erosion ($R^2 = 0.89$), while the Normalized Difference Soil Index (NDSI) was the most powerful predictor of bare soil exposure ($R^2 = 0.91$). Among the machine learning models tested, the Random Forest algorithm performed best for mapping erosion susceptibility.

The temporal analysis identified a critical regime shift in the watershed's erosion in 2009, linked to land use and precipitation changes. Early-warning signs, such as increasing autocorrelation and variance in the data, signaled a decline in the watershed's resilience. Spatially, distinct erosion hotspots were found. Significant vegetation degradation occurred along wetland margins, while northern agricultural areas showed progressive topsoil exposure.

In conclusion, the integrated remote sensing and machine learning framework proved highly effective for precise erosion monitoring. The study successfully identified key drivers, predicted risk, and delineated high-priority zones for intervention, offering a transferable model for proactive watershed management in semi-arid regions.

Human-induced topographic changes impact geomorphological and hydrogeological hazards: case study from Europe's largest quarry-dump site (Rome, Italy)

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05K: Identification, quantitative assessment and mapping of anthropogenic landforms in urban areas, February 3, 2026, 11:35 AM - 1:20 PM

The city of Rome, with its long history of urban development, presents a clear urban–rural gradient that offers a valuable context for studying human-induced changes to geomorphological processes. This study focuses on the Malagrotta area, a major site of quarrying and dumping activities since the 1980s, to investigate the impacts of anthropogenic topographic modifications on erosion, sediment transport, and hydrological dynamics.

We used multitemporal digital elevation models (1894, 2002, 2023) and slope–area analysis to identify geomorphic process domains and quantify landscape changes. Additionally, hydrogeomorphological anomalies were mapped, including alterations to surface drainage and signs of groundwater emergence. GIS-based hydrological modeling and aerial photo analysis allowed for the reconstruction and comparison of drainage networks across time, highlighting significant changes. We also assessed groundwater-surface interactions by comparing excavation depths to regional water table levels, integrating topographic data with hydrogeological maps from institutional databases.

The results reveal extensive topographic transformation: nearly 30 million m^3 of material were removed between 1894 and 2002, with an additional 7 million m^3 extracted from 2002 to 2023. Dumping and infill contributed 26 million m^3 and 14 million m^3, respectively, over the same periods. Convergent morphologies were associated with excavation zones, while divergent patterns characterized filled depressions. High-slope quarry escarpments showed increased susceptibility to erosion and landslides. Hydrological indices indicate altered drainage behavior and elevated flood risk.

This study demonstrates how long-term anthropogenic activity reshapes geomorphic and hydrological systems, underscoring the need for integrated, geomorphologically-informed planning to reduce erosion, landslide, and flood hazards in rapidly evolving peri-urban landscapes.

Linking alpine sediment sources to fluvial systems: insights from a suspended sediment monitoring network in the Swiss Alpine Rhine catchment

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Sediment erosion and transport processes on alpine hillslopes cover a wide range of phenomena, from sediment production by frost cracking and subglacial abrasion to overland flow erosion, landsliding and other gravitational mass movements. Understanding the connectivity between hillslope sediment sources and the fluvial system is crucial for the management of river ecosystems and flood risk, whereas quantifying this relationship remains challenging, particularly at large catchment scales.

Our study establishes links between local sediment sources and the river system of the Glogn catchment (380 km²), a tributary to the Swiss Alpine Rhine basin. The catchment encompasses diverse geomorphological settings including deep-seated landslides, steep incised gorges, and undisturbed as well as strongly altered river sections.

We combine erosional landscape feature mapping, rapid mass movement inventories, and a novel distributed riverine monitoring network to trace sediment pathways from hillslopes to rivers. The monitoring network measures suspended sediment fluxes and provides insights into the temporal dynamics of alpine erosion-transport coupling. Distinct signatures in suspended sediment fluxes reflect the varying influence of different erosional processes across the catchment, revealing seasonal patterns in sediment connectivity.

When transferring the methodology to the entire Swiss Alpine Rhine catchment (approx. 4300 km²), we observe strong variations in suspended sediment fluxes between the tributaries. We attribute them to heterogeneous lithologies and different anthropogenic activities in the subbasins.

By characterizing dominant erosion triggering conditions and quantifying present-day erosion rates, we establish a framework to estimate temporal sediment connectivity along transport pathways. The study contributes to a comprehensive understanding of how alpine catchment geomorphology controls the dynamics of sediment delivery to the river network, which is imperative for the sustainable and safe management of river basins.

Identifying hydroclimatic triggering conditions for rapid alpine mass movements: (machine) learning from the past and projecting into the future

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13C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 11:35 AM - 1:05 PM

Gravitational mass movements in alpine regions pose significant risks to population and infrastructure. The complex physical processes that condition and trigger phenomena such as shallow landslides, debris flows, and rockfall are challenging to simulate, particularly at large scales. This study develops a data-driven approach to model the temporal dynamics of mass movement susceptibility in alpine catchments and contrasts current hydroclimatic triggers against their projected changes in a future climate.

We focus on the inhabited regions of the Swiss Alpine Rhine catchment (approx. 4300 km²), utilizing a 25-year dataset (1999-2023) of hydro-meteorological drivers and over 1000 recorded shallow landslides, debris flows, and rockfalls from the national inventory of natural hazards. Our framework leverages spatially distributed datasets, i.e. national climate and snow cover data as well as terrain and soil information, from which we derive additional indices such as snow melt, soil moisture and freeze-thaw-cycles.

The methodology employs deep learning algorithms to decode the temporal dynamics of hydrogeomorphic catchment variables that govern the predisposing and triggering of mass movements. With this framework, we can simulate the temporal variations in susceptibility within the catchment at 1×1 km spatial and daily temporal resolution. Characterizing modelled periods of high susceptibility based on their hydroclimatic fingerprints allows us to identify the dominant triggering conditions. We further demonstrate how warming temperatures and changing precipitation patterns affect the temporal distribution of these conditions.

Our results disclose the seasonally varying contributions of various hydro-meteorological drivers to the initiation of alpine mass movements and identify different patterns for shallow landslides, debris flows, and rockfall events. This approach reveals new insights into how the hydrogeomorphic catchment state influences predisposing and triggering conditions of mass wasting events and supports improved risk assessment for alpine hazards under climate change.

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Sedimental structures on a urban microtidal Mediterranean beach in presence of vegetal biomass during storm events and pandemic lock-down

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The unexpected co-occurrence of intense riverine flooding and a major sea storm in December 2019 created an opportunity to observe the interaction between vegetal debris and sediment dynamics along Poetto Beach, a microtidal urban beach in the Gulf of Cagliari (Sardinia, western Mediterranean Sea). More than 85 tonnes of reed debris (Arundo donax) and seagrass rests, mostly Posidonia oceanica, were deposited on the beach berm as a result of this event. In an unusual turn of events, the subsequent COVID-19 lockdown halted beach cleaning and maintenance, allowing natural morphodynamic processes to act on this material without anthropogenic disturbance.
Under these conditions, a series of storm events progressively reworked the vegetal deposits, initiating the formation of distinctive sedimentary structures composed of sand, reeds, and seagrass remains. These formations, developed on the berm and upper foreshore, were shaped and stratified by repeated wave action from varying directions. As they evolved, they became increasingly integrated into the beach profile, producing a permeable structure capable of modulating water infiltration and attenuating wave energy.

Wave and coastal video monitoring data highlight that these sedimentary structures played a significant role in preventing beach flooding, even during storms with higher wave energy than previous events known to cause flooding. This evidence suggests that the presence of such structures enhanced beach resilience, functioning as a passive buffer system during storm events.
This case highlights the geomorphological importance and protective function of vegetal sedimentary structures formed through natural processes. The findings support the adoption of non-removal strategies as a viable, nature-based approach to increase beach resilience and mitigate flood risks in urban coastal environments.

Magnitude of the 2025 extreme floods in the Kati Thanda-Lake Eyre basin, Australia, in a historical context

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

In late March 2025, extreme rainfall in the drylands of the Australian interior triggered major floods that inundated large parts of the desert. Rainfall totals within just a few days surpassed the average annual precipitation for large dryland regions, exceeding 500 mm. Floods in the upper Kati Thanda-Lake Eyre (KT-LE) basin, one of the world's largest internal drainage systems, reached record levels. However, the vast size of the basin complicates predictions regarding which portions of these floods will reach the terminal point. Given the sparse stream gauges and the difficulty of measuring discharge where river widths span many tens of kilometers, how can we determine the flood magnitude and the volume of water that will eventually fill the lake? In this work, we quantify the spatial extent of river flows as a proxy for flow volume, allowing us to place it in a historical context. To achieve this, we utilized MODIS satellite imagery from 2000 to 2025. Our analysis shows that the 2025 flood exhibited the most extensive surface water coverage in the basin over the past 25 years, with a maximum inundated area of approximately 30,000 km², comparable to the size of Belgium. This area surpasses the previous maxima recorded during major flood events in 2010 and 2011 by about 12%. In 2025, all three of KT-LE's major tributaries experienced extensive flooding, with Cooper Creek emerging as a significant source of surface water. This pattern contrasts with previous large flood events, which typically activated only parts of the basin, usually dominated by either the Diamantina or Georgina rivers. Will the 2025 flood be larger than the 1974 floods in the lake? Answers will be revealed during the 2026 IAG conference.

Multidecadal Changes in Global River Positions

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03H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 4:00 PM - 5:30 PM

Rivers play a central role in shaping the Earth's surface and ecosystems through physical, chemical, and biological interactions. The intensity and locations of these interactions change as rivers continuously migrate across the landscape. In recent decades, human activity and climate change have altered river hydrology and sediment fluxes, leading to changes in river position, or migration. Climate warming, increasing flood extremes, and human-induced land use changes have slowed river migration rates in some cases while accelerating them in others. However, a comprehensive perspective on and understanding of these recent changes in the rate at which river positions shift is lacking.

To address this knowledge gap, we created a continuous global dataset of yearly river positions and migration rates over the past four decades and analyzed trends. The global annual river positions were detected using Landsat-derived surface water datasets and processed in Google Earth Engine, a cloud-based parallel computation platform. The resulting river extents and centerlines reflect the yearly permanent position, corresponding to the rivers' location during base flow. This approach improves the representation of position changes derived from geomorphological rather than hydrological processes. To robustly analyze river position changes across different patterns and complexities and at large scales, we developed and applied a global reach-based quantification method.

Results show that while alluvial rivers maintain stable positions in certain regions, others exhibit trends in the rates of position change. For instance, the Amazon Basin, which has experienced significant deforestation and hydrological modifications, has shown increased rates of river position change in recent decades. In this presentation, we will discuss the advantages, limitations, and applications of the global yearly river position dataset, offer insights into the changing rates of river position, and highlight current and future impacts on one of Earth's most vulnerable hydrologic systems.

How do climate oscillations affect alluvial fan morphology in the South Island of New Zealand?

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04B: Distributary landforms: past, present and future, Dobson 1, February 3, 2026, 9:35 AM – 11:05 AM

The Interdecadal Pacific Oscillation (IPO) influences the hydrologic cycle of the South West Pacific. Phase changes of the IPO have been shown to affect average annual rainfall and river discharge in New Zealand's South Island. Nonetheless, there is limited research exploring how these perturbations in the IPO affect alluvial fan morphology in the South Island. Here, I compare morphometrics of 28 South Island alluvial fans with rainfall data of their corresponding catchments and the IPO record. My sample of 28 alluvial fans was mapped from historic aerial photographs and satellite imagery. For each year of available imagery, I mapped active alluvial fan channels and land cover types in the corresponding source catchments. Using these data, I explore the relationship between alluvial fan morphology and the hydrologic cycle as it pertains to natural climate oscillation. Understanding how climate oscillations affect alluvial fan morphology in the South Island of New Zealand has implications for future flood and avulsion mitigation and forecasting on alluvial fans.

Natural and Human Induced Erosion Rates and Processes at the Cheltenham Badlands, Ontario, Canada

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08H: New frontiers in the study of erosion processes and geomorphic dynamics in badlands, Conway 3, February 5, 2026, 9:35 AM - 11:05 AM

The Cheltenham Badlands is a 37 hectare landscape of deeply eroded gullies and rills situated on well-weathered Silurian aged red shales in southern Ontario, Canada. The site affords the opportunity to observe both natural and human-impacted erosion rates over the last four decades. Topographic, terrestrial LiDAR and structure-from motion surveys show that between 1973 and 2025, maximum lowering (degradation) in the main portion of the property was up to 3.8 m with average annual rates of lowering varying between 0.7 and 2.5 cm per year. Specific sediment yield at the site is approximately 27,000 tonnes per square km per year or at least two orders of magnitude larger than “normal” rates for this otherwise forested mid-latitude climatic region. The illite and chlorite rich clay-shales of the badlands are subject to moderate swelling and then shallow surface cracking during dry conditions followed by surface wash and gully wall debris flows. Until 2017 the area was subject to very heavy human foot traffic with no regulation. Closure of the site to foot traffic allowed for assessment of “natural” erosion rates. Preliminary results from the May 2025 survey indicate that approximately 470 m^3 of sediment was eroded which is equivalent to 1.1 cm/yr of lowering. Much of the eroded material (65%) is deposited in the low gradient gully bottoms at the site outlet where aggradation rates average 0.8 cm/yr. While significant natural erosion continues at the site, the data suggest that closure to foot traffic has resulted in a demonstrated reduction in sediment loss thereby supporting the significant site conservation plans that restricted access to observation platforms and vegetated side trails. The overall pattern of landscape development is aggradation in gullies and downwasting of ridges in low gradient areas and gully deepening and backwasting in the upper steep regions of the badlands.

UAV Digital Photogrammetry for the geomorphological analysis and mapping of lateral spreads that evolve into block slides

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Small Uncrewed Aerial Vehicle Digital Photogrammetry (UAV-DP) is transforming landslide geomorphological studies by offering a cost-effective and efficient technique to collect high-resolution images for terrain analysis. Investigating lateral spreads and block slides is particularly challenging due to their slow evolution, requiring long-term monitoring and detailed surveys that are often risky, time-consuming, and expensive. This study assesses the effectiveness of a commercial small drone (0,3 kg) in examining gravity-induced landforms related to lateral spreads and block slides in northern Malta (Mediterranean Sea). The outputs of UAV surveys permitted to map hundreds of persistent joints generated from lateral spreads and tens of thousands downslope megaclasts transported by block slides across coastal parts of north Malta, where slow-moving landslides are abundant. The results of this mapping research can be useful for the analysis of the mechanisms of these complex slow-moving landslides and offer valuable information for landslide hazard assessment

Exploring the Geoheritage of Southern Malta (Central Mediterranean Sea): A Path toward Sustainable Tourism through the Promotion of Geosites

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The Island of Malta (Central Mediterranean Sea) exhibits a great variety of landscapes and landforms, including coastal, structural, karst, and gravity-induced features. The identification and evaluation of geosites are crucial for safeguarding this geodiversity and promoting its value. Geosites also present valuable opportunities for the development of geotourism, which can contribute to the local economy. Tourism is the major pillar of Maltese economy, with one of the highest GDP contributions from tourism in Europe.

This research investigates how geoheritage and geotourism can support sustainable tourism practices and the conservation of geomorphological features, focusing specifically on the southern part of Malta. In contrast to the more frequently visited northern sector, known for its sandy beaches, southern Malta is less visited and known by tourists.

A quantitative assessment of potential geosites was performed using a methodology adapted to the specific characteristics of the area. The outputs permitted to identify 18 potential geosites. Of these, four were highlighted as top priorities and recommended for inclusion in a proposed geotourism trail that integrates geomorphological and cultural assets. Additionally, this study marks the first application of this assessment approach in the southern part of Maltese archipelago and demonstrates its potential for broader use across Malta.

Challenging Coastal Process Models: Boulder-Cobble Beaches in Low-Energy Environments, Tasman Bay, New Zealand

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02F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 2:00 PM - 3:30 PM

Boulder-cobble beaches are typically associated with high-energy wave environments worldwide. However, in eastern Tasman Bay, these beaches are found in relatively low-energy wave environments that have persisted throughout the Holocene. The boulder-cobble beaches at Nelson, Cable Bay, Croisilles Harbour, and Greville Harbour have traditionally been interpreted as spits formed by longshore drift processes. New data, however, suggest that this interpretation needs to be re-evaluated.

These beaches, which are exposed only at low tide, form a gently sloping platform that extends seaward for several hundred metres, reaching depths of over 20 metres. Clast counts reveal that the beaches consist of poorly to moderately sorted boulders, cobbles, and pebbles, with some boulders exceeding 1 metre in diameter. Landward of the boulder-cobble platform lies a gravel ridge, composed mainly of pebbles, which remains exposed at high tide. Interestingly, the boulder-cobble beaches do not conform to the globally recognized relationship between beach-face slope and particle size, whereas the gravel ridge does. Wave simulations—including those modelling cyclone scenarios in Tasman Bay—do not predict the longshore transport of boulder-sized clasts on either the beach face or in the intertidal/subtidal zone.

The evidence suggests that these beaches are remnants of ridges that have eroded in situ and have been subsequently modified by sea level rise and episodic high-energy wave events. These wave events can transport boulders shoreward but cannot consistently transport them along the shore. The overall shape and position of the beaches appear to be primarily controlled by antecedent geology, with only minor influence from contemporary coastal processes. This study has broader implications for the understanding of boulder-cobble beaches in other parts of the world.

How do waves undercut coastal cliffs? A laboratory investigation of notch development from wave impacts and abrasion.

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01F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 11:40 AM - 1:10 PM

Coastal cliffs are undercut through wave impacts and abrasion processes, but a detailed mechanistic understanding of the driving processes is lacking. We conducted controlled laboratory experiments using a vertical homogeneous, erodible rock simulant, with synchronized measurements of wave properties and impact forces. Sediment-laden bore impacts were used to explore the importance of abrasion processes. Three distinct stages of notch evolution were identified. Initially, swash uprush and vortex formation promote a shallow, wide notch through positive feedback. As erosion progresses, upward growth ceases, and backwear and downwear dominate. Eventually, sediment accumulates on the notch floor and reduces further erosion via negative feedback. Maximum erosion occurred at intermediate grain sizes, highlighting the importance of the momentum of the sediment particles and the abrasive mechanism. To explore wave impact controls on coastal cliff erosion we studied breaking, broken and unbroken impacts against the cliff. Experiments with focused wave groups reveal that large impacts occur within a narrow phase window. In irregular wave tests, ~30% of waves broke on or near the structure, but not all led to large ground acceleration. Amplitude modulation in irregular waves generated larger impacts than regular wave tests. Reanalyses of field data confirm that the most violent wave impacts and ground shaking occur at intermediate wave heights and water depths. While the average offshore wave profiles for large impacts were nearly identical, the resulting ground motion varied substantially, underscoring the complexity of impact dynamics and the potential for sea-level rise to shift impact regimes. Ongoing experiments are exploring the importance of different wave breaker types in terms of basal notch development. Collectively, the experiments provide new mechanistic insight into how wave-cliff interactions drive notch formation and, ultimately, influence long-term cliff stability.

Monitoring Accelerated Post-Fire Weathering of Carbonate Rocks Using Handheld 3D Scanners: A Case Study from Biokovo Nature Park (Croatia)

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

High-intensity wildfires can trigger accelerated post-fire weathering of carbonate rocks. While the effects of intense wildfires on carbonate rocks have been widely investigated, field-based studies that quantitatively evaluate exfoliation rates remain limited.

In this study, we present preliminary results from the application of handheld 3D scanners (3D-HS) for field-based monitoring of post-fire weathering rates in carbonate rocks. The study was conducted within Biokovo Nature Park, a karst mountain region that was affected by an intense wildfire in August 2024. Three carbonate boulders of different lithologies (one carbonate breccia (B) and two limestones (L1 and L2)) were scanned in February and May 2025 using an Artec Eva 3D-HS with a resolution of 0.1 mm. In addition, all flakes that had detached from these boulders were collected and weighed using a laboratory balance, while the largest flakes were scanned using an Artec Spider 3D-HS. To enable seasonal and annual monitoring of post-fire weathering, all scanned boulders were marked with red reference triangles, facilitating accurate alignment of successive 3D models. Preliminary results indicate that all three carbonate boulders were affected by rapid post-fire weathering, primarily through exfoliation, with flakes ranging in thickness from a few millimeters to several centimeters. The total mass of collected flakes ranged from 1519.72 g for carbonate breccia (B), to 1695.56 g for the first (L1), and 3432.71 g for the second (L2) limestone boulder. The largest flake was collected from the L2 boulder, with a weight of 503.55 g and a volume of 155.105 cm^3. The use of 3D-HS has proven to be an effective and repeatable method for monitoring accelerated post-fire weathering of carbonate rocks at the sub-centimeter scale. Preliminary findings from this study indicate that the applied methodology may be crucial for better understanding of carbonate rock weathering dynamics in karst fire-affected environments.

Apparent Hack's Law in River Deltas

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04B: Distributary landforms: past, present and future, Dobson 1, February 3, 2026, 9:35 AM - 11:05 AM

River deltas are densely populated, ecologically vital landscapes threatened by rising sea levels. Distributary Channel Networks (DCNs) disperse sediment to build deltaic land, yet their relationship remains elusive. Inspired by Hack's Law that shows watershed drainage area scaling with channel length in Tributary Channel Networks, we analyze a global dataset of DCNs and discover a similar scaling between distributary channel length and nourishment area, the land-building counterpart to drainage area. Despite this apparent global scaling, we find two distinct local land-building patterns: Uniform Delta Networks consistently follow Hack's Law, while Composite Delta Networks exhibit a scale break, transitioning from space-filling growth around the delta apex to linear growth near the coast. This unrecognized growth pattern offers insights into where delta restoration projects may be most effective.

DEBRIS-FLOW PROCESSES MODELING WITH NUMERICAL SIMULATION: AN APPLICATION ON THE COAST OF SÃO PAULO STATE, BRAZIL

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13C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 11:35 AM - 1:05 PM

Debris flows are hydrogeomorphological processes that develop along drainage networks and involve generally dense fluids, composed of materials of different grain sizes and variable amounts of water. Mathematically, they can be described as a one-phase fluid composed of an interstitial liquid and a granular fluid that constitutes the solid phase and has proper rheological properties. Several numerical models have been elaborated in the last years to measure, identify, predict, and monitor debris-flow processes with more accuracy. One of these is RAMMS (Rapid Mass Movement Simulation), which describes the frictional behavior of debris flow using the Voellmy relation. This work aims to show the results of the numerical simulation with the RAMMS model of the debris-flow events that occurred in 1967 in a mountain area in the Serra do Mar in Caraguatatuba region (São Paulo State, Brazil) using calibrated input parameters. The area is inserted in the Serra do Mar Mountain range, an escarpment region on the eastern margin of the Brazilian highlands, which has been known to be the most landslide and debris-prone location in Brazil. The inputs were viscosity, DEM, landslide scars as release areas, the density of the debris-flow material, duration of the debris-flow process, erosion information, and orthophotos. The modeling results were compared with the deposit area mapped in aerial photos, which established zones of iso-thickness of the materials. The simulations of the different scenarios showed that the materials mobilized by the landslides in the escarpments of the tributaries of the Santo Antônio and Guaxinduba rivers were channeled in the thalwegs and advanced downstream, where slopes lower than 5º prevail. The results showed a good correlation between the area and thickness of deposition modeled and observed, and the fieldwork and the retro-analysis studies revealed that the Serra do Mar debris flows have a predominantly granular rheological flow.

Utilization of airborne LiDAR data at the landslide rescue operations of the 2024 Noto Peninsula Earthquake, Japan

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The 2024 Noto Peninsula Earthquake, Japan caused numerous landslides, and much damage has been reported. We provided technical support for safety management at several landslide rescue operations. In this research, we present examples of technical support using airborne LiDAR data at landslide rescue operations. The airborne LiDAR data used in this research were measured by NAKANIHON Air Co., LTD.

The landslide that occurred in Ichinose, Wajima City, one of the landslide rescue sites where we provided technical support, was a large-scale landslide with a length of over 1,000 meters. A part of the ridge had collapsed, and a large amount of sediment had moved. Landslide dams had formed in the middle of the landslide, making it difficult to safely manage rescue operations.
There was a house at the end of the landslide that had been washed away from upstream, and rescue operations were carried out to dig upstream from the end of the landslide. The difference between the pre- and post-disaster aerial LiDAR data were calculated, showing that the house was washed away by approximately 130 m and that sediment had deposited more than 10 m deep where the house had originally been. Aerial LiDAR data analysis also revealed that as of February 4, about a month after the earthquake, the rescue operation site was about 100 m horizontally from the original house location, and that it was difficult to safely dig the site because the amount of sediment deposited increased as the digging proceeded. In addition, a drone was regularly flown to monitor the landslide dam in the middle of the landslide to see if there were any significant changes in water volume.

Airborne LiDAR data are valuable to assist in guiding rescue operations. The problem is how to acquire data quickly after a disaster.

Utilization of drone LiDAR in landslide rescue operations

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04C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 9:35 AM - 11:05 AM

At the site of landslide rescue operations, it is necessary to consider the risk of secondary disasters such as mudflows caused by slope recollapse or landslide dam failure in order to operate safely. However, safety management immediately after a disaster often has to rely only on visual information, making it difficult to conduct rescue operations at night. Drone LiDAR can rapidly acquire detailed topographic data and can be used not only during the daytime but also at night. In this study, drone LiDAR was conducted both during the day and at night to consider the operational issues and to study the use of the acquired data for rescue operations.

Drone LiDAR during daytime and nighttime was conducted on landslide topography in Nishiigawa, Miyoshi City, Tokushima Prefecture, Japan. The results of the comparison of daytime and nighttime drone LiDAR data showed that almost the same detailed topographic data could be obtained. However, nighttime operation is difficult without advance preparation. This is because the drone's ground altitude must be carefully controlled in order to measure the slope. It is also important that the drone in flight be visible from the takeoff/landing location.

Drone LiDAR data can be used to map and analyze detail topography to help manage the safety of rescue operations. Especially when the landslide scarp is clear, the distance and angle from the landslide scarp to the rescue operation point can be calculated. This makes it possible to estimate the time required to evacuate to a safe area in the event of a secondary landslide at the landslide scarp. If the difference between pre- and post-disaster topographic data can be calculated, it is possible to identify areas where the topography has changed and to calculate the amount of erosion and sedimentation.

Catchment disturbance and response: understanding changing flood frequency in two contrasting New Zealand catchments

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10J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 2:30 PM - 4:00 PM

In New Zealand, river behaviour, catchment erosion and flood frequency reflect interactions between complex sub-tropical and sub-polar climate drivers, underlying geology, frequent seismic and, in places, volcanic activity, and more recently (700 yr BP – present), human activity. Floodplain environments and meander cut-offs provide sediment archives of river activity, providing an opportunity to improve understanding of flood frequency and system response to disturbance. We apply a multi-proxy approach (particle size, CT scanning, ITRAX-XRF, magnetic susceptibility) to characterize sedimentary records and identify flood deposits in two contrasting catchments. We use sediment fingerprinting to link catchment sources with core material using LA-ICP-MS and quantitative XRF. The Whanganui River, North Island, is confined by steep, narrow valleys for much of its western and lower reaches, which are a product of high rates of Quaternary uplift and weak bedrock. A valley meander cut-off at Atene provides the Whanganui sediment archive. Here, a 12 m sediment core spans the mid-Holocene to present, capturing changes in system connectivity, flood frequency and impacts of the 1718 ± 5 Cal yr BP Taupō eruption. Constrained by 23 radiocarbon dates that underpin the high-resolution chronology, periods of increased flood frequency associated with negative Southern Annular Mode-like conditions have been identified, suggesting the strength and position of the South Westerly Wind Belt is a key driver of flood frequency in New Zealand. The Ōreti River rises in the eastern Southern Alps and drains resistant greywackes and schists in an unconfined floodplain setting. Infilled meander cutoffs provide sediment archives in the lower Ōreti floodplain, with core lengths of ~2.5 m. Radiocarbon dates provide basal ages for the cores, supported by pollen and elemental relative age data. This archive records Polynesian and European arrival, and shows, increased sedimentation rates and flood frequency, which are consistent with catchment clearance.

Beach-foredune erosion patterns from coastal storms: A case study from a southeastern Australian beach

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04E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 3, 2026, 9:35 AM - 11:05 AM

Beach and foredune stability are influenced by storm type, magnitude and frequency, which drive spatial and temporal variability in erosion, sediment transport, and post-storm recovery. A potential increase in the latitudinal extent of tropical cyclones may trigger different coastal responses compared to other storm types. Coupled with increases in storm frequency and intensity, these changes may reduce recovery windows between events, resulting in long-term erosion, recession and greater inundation risk. This study examines the impacts of Tropical Cyclone (TC) Alfred compared to other storm events using high-resolution LiDAR data collected from remotely piloted and crewed aircraft. TC Alfred was an uncommon event that reached temperate, mid-latitude sections of the Australian coastline, providing insight into how its impacts differ from storms driven by other climatic systems. Ten airborne LiDAR survey datasets captured between 2010 and 2025, including pre- and post-TC Alfred, are analysed to examine morphological changes and identify storm wave related drivers of erosion and recovery. Post-storm erosion patterns are examined across a range of factors, including shoreline orientation, antecedent beach–foredune morphology, and storm characteristics, as well as wind. Local nearshore wave records are used to analyse parameters (Hs, Dp, Tp) from the past 15 years and compare them with observed morphological responses. Results reveal spatial variability in the immediate impacts of different storm events, with volume losses of $-27\ m^3/m$ in the north and $-11\ m^3/m$ in the middle of the embayment following TC Alfred (2024). Temperate-origin storms in 2025 caused similar losses across the north ($-15\ m^3/m$) and mid ($-12\ m^3/m$) sections, while the southern section remained relatively stable across both events. These findings highlight the importance of high-resolution coastal monitoring to improve understanding of localised storm impacts and recovery processes. These insights support coastal modelling, planning, and management strategies in a changing climate.

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Severe coastal erosion in southeast Australia, driven by tropical cyclone Alfred.

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04E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 3, 2026, 9:35 AM - 11:05 AM

Tropical cyclones (TCs) can trigger large-scale erosion of beaches and foredunes, yet the controls on the magnitude and spatial variability of these impacts—particularly within temperate regions where TCs are infrequent—remains poorly understood. Here we integrate regional and localised high-resolution Lidar, in-situ and modelled wave data for northern New South Wales (NSW) to quantify beach erosion caused by Tropical Cyclone Alfred. TC Alfred impacted eastern Australia in March 2025, and generated easterly offshore waves exceeding 8 m (H max >12m; Tweed offshore buoy) and the storm persisted for almost a week (5.7 days, 3rd – 9th March). The magnitude of measured beach-foredune volume change varied from -140 m3 m-1 to +20m3 m-1 at a regional scale (100's km). To within the same embayment, volume change varied from -120 m3 m-1 to +20m3 m-1. It is hypothesised this spatial variability may be interrelated to (i) alongshore gradients in storm wave energy flux, (ii) local shoreline orientation relative to incident wave direction, (iii) site proximity to the cyclone centre, and (iv) the extended period the TC remained offshore, which may have led to the offshore transport of sand from the beachface to the surf zone and the development of offshore bars as energy conditions (e.g. increased wave height) increased with the storm sitting offshore (i.e., pre-conditioning some beaches with bars before the TC system migrated onshore). Although erosion was locally severe, impacts could have been enhanced by other coincident environmental drivers (e.g. king-tide levels, and a more rapid landfall speed), which fortunately did not occur. Our findings can be used to help prioritise remediation efforts, and guide more tailored management moving forwards, but highlights the need to reassess TC impacts in temperate regions under a changing climate.

Ice segregation drives frost cracking in Alpine rocks

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Frost weathering is a key mechanism of rock slope failure in periglacial environments and for landscape evolution. As alpine rock types are characterized by crack-dominated porosity and high rock strength, frost weathering observations from low strength and grain supported pore-space rocks cannot be transferred. We conducted two laboratory experiments on limestone samples from the European Alps.

In Test-1, we exposed Dachstein limestone samples with saturation levels between 30 and 100 % to diurnal and sustained (seasonal) freezing cycles while monitoring frost cracking with acoustic emission (AE) and quantifying rock damage with micro computational tomography (µCT). To differentiate between potential mechanisms of rock damage, thermal- and ice-induced stresses were simulated and compared to AE activity. Our measurements revealed that rock damage occurred along existing cracks and highlighted that frost cracking was more effective under repetitive diurnal frost cycles than under sustained freezing conditions (Mayer et al., 2024).

In Test-2, we tested the influence of initial crack density and saturation on frost cracking efficacy in Wetterstein limestone samples with similar properties compared to Dachstein limestone. We exposed the rock samples to seasonal freezing conditions, monitored AE as a proxy for cracking and modelled ice pressure and thermal stresses to differentiate cracking triggers. We found that initial full saturation is not a singular prerequisite for frost cracking and observed higher cracking rates in less-fractured rock. Temperature controlled the efficacy of frost cracking and was highest at rock temperatures below −7°C (Mayer et al., 2023).

In summary, frost cracking in high-strength alpine rocks with crack-dominated porosity operates differently than in low-strength grain supported rocks as rock damage occurs along pre-existing cracks independent of initial saturation levels due to high permeability and connectivity of the cracks.

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Climatic factors drive spatial and temporal distribution of rockwall erosion in the European Alps

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10G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 2:30 PM - 4:00 PM

Rockfall is a key process of alpine rockwall erosion. We investigated the (1) spatial and (2) temporal distribution of Holocene to present rockfall activity in the Hungerli Valley, Swiss Alps using remote sensing and geophysical investigations. We related our findings to past glacier distributions, and to patterns of modelled permafrost and frost cracking intensity for current and paleo conditions. We reviewed published erosion rates from the European Alps to test regional validity of our findings.

(1) We found a trend of increasing erosion with elevation. We explain this, through modelling, as an elevation-dependent increase of frost cracking intensities, permafrost distribution and glacier retreat. This suggests that the effects of periglacial and paraglacial processes increase with elevation (Draebing et al., 2022).

(2) Cirque rockwall erosion was constant from 2016-2023 while the proportion of rockfall from rockwall areas deglaciated since 2011 and deglaciated since the Little Ice Age decreased over time. We explain this as a shift over time in the importance of rockfall drivers, from paraglacial to periglacial drivers (Draebing et al., 2025). Paleo (Holocene) erosion rates were two orders of magnitude higher than present. Our modelling explains this as an elevational shift of permafrost and frost cracking with increasing intensities during colder phases of the Holocene (Draebing et al., 2024).

Overall, our findings suggest that periglacial activity increasingly influences the rates and patterns of erosion of alpine rockwalls following deglaciation. These findings help to explain why paleo erosion rates exceed present rates throughout the European Alps (Draebing et al., 2024) and suggest there are elevation-dependent trajectories of erosion in a warming climate (Draebing et al., 2022).

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Influence of rainfall on landslide occurrence under future climate conditions:insights from Cyclone Gabrielle and design storms for Aotearoa New Zealand

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12C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 9:35 AM - 11:05 AM

Cyclone Gabrielle made landfall on February 2023 and triggered more than 800,000 landslides in the North Island of New Zealand, leading to significant infrastructure damage and loss of life. With climate change projected to increase the frequency and intensity of extreme rainfall, understanding how dynamic rainfall patterns modulate landslide hazard is crucial. Current hazard assessments often rely on static susceptibility models or regional rainfall thresholds, lacking integration of explicit rainfall inputs to modulate susceptibility. This study addresses three objectives: (1) Quantify landslide spatial patterns and their initiation based on rainfall intensity variations; (2) Establishing empirical relationships between rainfall and landslide intensities; (3) Project landslide susceptibility and intensities under a +2°C warming scenario using Cyclone Gabrielle-like storm simulations as a contemporary analogue for a future extreme event. We develop a landslide hazard model integrating high-resolution rainfall metrics with susceptibility and intensity analysis. Using Generalised Additive Models calibrated to the Gabrielle inventory, our results demonstrate a linear relationship between maximum 24-hour rainfall and landslide occurrence up to ~300 mm per day, beyond which probabilities plateau. Contrary to prior studies, high pre-event cumulative rainfall decreased susceptibility and intensity, raising questions regarding the role of antecedent moisture conditions in hillslopes affected by extreme precipitation events. Topographic variables (e.g., slope) dominated spatial susceptibility, while the total area of landslide sources was jointly controlled by rainfall intensity and slope. Under a +2°C warming scenario, a Gabrielle like design storm can be expected to increase the number of landslides in affected regions, as well as expand the extent of the region most affected by landsliding. Our predictions suggest that future landslides cluster within or near existing high-susceptibility areas, compounding hazard in these areas. Findings quantify significant increases in landslide hazards due to climate change, providing critical data for prioritising adaptation strategies in vulnerable regions.

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Urban gully expansion in tropical cities of Africa

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Urban gullies (UGs) are a growing problem in the Global South where rapid urbanization takes place. Their formation and growth cause substantial damage such as destruction of roads and buildings, displacement of people, and sometimes casualties. These impacts are particularly pronounced in tropical cities characterized by intense rainfall and sandy soils. In such environment, UGs can exceed hundreds of meters in length and reach depths and widths of several tens of meters. Urban gully expansion often begins with rapid gullyhead retreat which slows over time as the contributing area reduces and runoff at the gullyhead decreases. However, lateral expansion often persists, thereby continuing to pose a threat to nearby infrastructures and populations. Although this process has been observed, its quantification remains understudied and poorly understood. This research aims to address this gap by analyzing the expansion of UGs and their interaction with the surrounding urban environment.

The study covers nine cities in the Democratic Republic of Congo and Angola, where we mapped the extent of over 100 UGs through time using very high-resolution satellite imagery in Google Earth. More specially, we assessed the expansion of UGs with near-annual observations for at least five years. Using this data, we estimate potential runoff accumulation through a set of proxies that account for contributing area, land use, and rainfall intensity. These factors help explain the spatial and temporal patterns of UG expansion and offer valuable insights into how urban development influences gully dynamics.

Mapping and modelling urban gully occurrence and dynamics at the scale of Africa

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02J: Mountain sediment cascades and landscape response to changing climate, Conway 5, February 2, 2026, 2:00 PM - 3:30 PM

Gully erosion in cities leads to the destruction of infrastructure, displacement of populations, and, in some cases, loss of life. While the processes driving urban gully (UG) development are similar to those of rural gullies, the urban context, characterized by impervious surfaces, complex infrastructure and dense populations, enhances their severity and societal impact. This problem is expected to intensify in the future with continued urbanization and climate change. However, this emerging geo-hydrological hazard received hitherto very little research attention. While several studies report on the occurrence, development, and impacts of UGs, they remain limited to specific local case studies. To address this gap, this study aims to better understand the spatial patterns and to model UG development at the scale of Africa, a continent where urban growth is rapid and typically unplanned.

Through the geomorphological interpretation of very high-resolution satellite imagery from Google Earth, we document over 4,000 case of UGs and their extent through time across Africa. This dataset is spread over 12 countries, with UGs predominantly located in (sub-)tropical regions, e.g. in D.R. Congo, Angola, Republic of Congo, Nigeria, and Mozambique. Using this data, we present a novel modelling approach that simulates UG development over time at a 1 km resolution. The model integrates a probabilistic component to assess the spatial occurrence of UG and a component to estimate areal extent and expansion rates. Preliminary results highlight the critical roles of topography, rainfall intensity, soil characteristics, and urban infrastructure (e.g. built-up density and road networks) in driving UG dynamics. Coupling these simulations with population data, we obtain a first assessment of exposure and displacement risks at continental scale. This dataset and model represent critical initial steps toward understanding, mitigating and preventing the risks of UGs in Africa, both now and in the future.

Using past Irish mountain glaciation to improve our understanding of abrupt climate changes in the terrestrial North Atlantic

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Following the last ice age, global temperatures warmed by roughly 6ºC over a period of approximately 10 kyr. In the North Atlantic region, proxy records indicate that this warming was interrupted by multiple abrupt, high-amplitude reversals during which temperatures returned to near ice age cold. These abrupt events are thought to be driven by changes in North Atlantic ocean circulation and may be important analogues for future regional change. Understanding these rapid climate shifts is thus important for accurately projecting future climate. However, there exist few terrestrial climate records from the North Atlantic region during this interval, limiting our understanding of these climate events and their impacts.

Mountain glaciers respond rapidly to changes in climate; mapping and dating their former extents can provide information on the timing and magnitude of past climate change. In Ireland, immediately downwind of the North Atlantic Ocean, glaciers once occupied mountain ranges across the island after the British-Irish Ice Sheet receded and are an ideal proxy for reconstructing past regional conditions following the last ice age. Here we present new glacial landform mapping from selected field sites in eastern Ireland where existing ^{10}Be surface-exposure data are sparse. At these sites, we have collected new cosmogenic ^{10}Be exposure ages from multiple moraine successions, specifically targeted to support the reconstruction of a high-resolution terrestrial paleoclimate record. The resulting chronologies will serve as the basis for later glaciological modelling to establish the climate conditions associated with the dated glacial positions. The results of this work will provide quantitative data useful for improving both climate and glaciological models, and will help us to better understand North Atlantic climate variability.

Insights into the behaviour of Northern Hemisphere Pleistocene ice sheets gained from the glacial landform record

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08G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 9:35 AM - 11:05 AM

Glacial landforms hold a wealth of information about the evolution of large mid-latitude ice sheets during the Quaternary. Streamlined subglacial lineations retain information about past ice flow, subglacial meltwater routes contain information about ice sheet hydrology, and ice marginal landforms that are eroded or deposited along glacier margins delineate former ice marginal positions. Thus, the rich landform record found beneath former Pleistocene ice sheets provides an important archive of palaeo-ice sheet behaviour that can be used to reconstruct the evolution of ice sheets over long timescales. This study focusses on the glacial landform record across different sectors of three northern Hemispheric Pleistocene ice sheets: the central sector of the Cordilleran Ice Sheet in British Columbia, Canada; the north-west sector of the Laurentide Ice Sheet in the Northwest Territories, Canada; and the Scandinavian Ice Sheet across Norway, Sweden and Finland.

We present glacial landform mapping from each of these ice sheets with a particular focus on ice-marginal landforms. We discuss the similarities and differences in the distribution of these landforms and investigate what these landforms tell us about ice margin dynamics and the thermal regime of the ice sheets. We find similarities between the mountainous regions beneath the Cordilleran and Scandinavian ice sheets, both of which were important during ice inception and the final ice sheet demise. We also find similarities, particularly in the distribution of hummocky moraines, in the polar regions of the Laurentide and Scandinavian ice sheets (above 60°N). Finally, we consider that differences in the ice marginal landform record may arise due to variations in large-scale ice sheet dynamics with the three ice sheet sectors varying in terms of ice volume, timing of retreat, influence of marine or lacustrine terminating margins and their dynamic response to coalescent ice sheets.

Exploring the Fluvial Legacy of Strike-Slip Faulting from Models to New Zealand's Faulted Landscapes

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Strike-slip faults produce iconic tectonic landscapes. Geomorphic hallmarks of horizontal fault motion, such as offset and elongate rivers, beheaded channels, shutter and pressure ridges, and sag ponds can provide valuable information about fault location, sense of slip, and slip rate. To date, however, most such geomorphic features lie within or adjacent to the fault zone, with fewer studies focused upstream from faults. In this study, we take a systematic look at the fluvial and catchment wide response to strike-slip fault motion using numerical landscape evolution modeling and comparison to field sites in New Zealand. We modeled five different slip rates (1, 5, 10, 15, and 20 mm/yr) with otherwise constant bedrock river erodibility and hillslope diffusivity. We find that modeled horizontal fault motion induces a persistent state of landscape disequilibrium brought about by river lengthening alternating with abrupt shortening due to stream capture. Our results show this "strike-slip capture cycle" imprinted into the landscape in the form of perturbed longitudinal channel profiles that include migrating knickpoints and knickzones. Channels across the slip-rate cases demonstrate these transient features but also show differences between slow and fast slip cases in terms of the magnitude of perturbation to channels. The faster slipping simulated landscapes experience a higher frequency of captures, with less time between events for the channel to equilibrate through knickpoint migration and ultimately, more irregular, undulating profiles. To consider these findings in real and more complex landscapes, we analyze a suite of rivers that drain active strike-slip faults across a range of rates in the Marlborough Fault System, South Island New Zealand and the Tararua Range, North Island New Zealand.

Comparison of ground-based and low-altitude photogrammetry for quantifying geomorphological effects of trampling

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02H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring AND Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 2:00 PM - 3:30 PM

Recreational trails are common infrastructure elements in protected natural areas, facilitating access and supporting activities such as hiking, biking, and horse riding. However, intensive trail use often leads to degradation, with trampling by visitors representing one of the most significant impacts. Trampling alters soil properties (e.g., compaction) and can modify surface microrelief, particularly in unvegetated trail sections.

Traditionally, the geomorphological effects of trampling have been assessed using profile measurements or topographic surveys (e.g., GPS, total stations), which are time-consuming and yield spatially limited results. This study explores the use of structure-from-motion (SfM) photogrammetry—based on both ground-based and UAV-acquired images—as a rapid and high-resolution alternative for monitoring trampling-induced changes.

Data were collected under experimental conditions to quantify the effects of trampling on bare soil surfaces representative of trail treads. The study plot measured 30 m in length and 1.5 m in width and had a uniform slope. Controlled trampling was performed through unidirectional (downslope) passes, with increasing intensity: 50, 100, and 200 passes. After each trampling stage, image datasets were acquired using both a handheld camera and a UAV. These were processed via an SfM workflow to generate high-resolution digital elevation models (DEMs) and orthomosaics. Elevation products were compared across image sources and trampling intensities to quantify surface changes. Additionally, incision was measured in four cross-profiles (sampled every 0.1 m), and soil compaction was assessed at 0.3 m intervals to validate the remote sensing results.

The results indicate that light trampling (≤50 passes) had minimal impact on surface morphology and soil compaction. However, substantial changes were observed after 100–200 passes, with significant incision and increased compaction. round-based and UAV-derived photogrammetry showed good agreement with control measurements, confirming their value as tools for efficient monitoring of trail surface transformation.

This study was supported by National Science Centre in Poland (2021/43/B/ST10/00950)

Fracture Limited Erosion Model –FLEM– Quantifying coastal cliff retreat rates in France with textural and topological fracture network analysis

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02F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 2:00 PM - 3:30 PM

Coastal cliff retreat rate has been correlated to the macroscopic resistance of rock massifs. What justifies this relationship? We contend that fractures (i.e. any discontinuities between otherwise continuous masses of rock) underly this correlation, and control erodibility. We propose the conceptual Fracture Limited Erosion model (FLEM), that defines the presence of rock fragments delimited by fractures, inherited from the geological history of the site. The orientation and spatial extent of fractures determines (i) the fragment dimensions and (ii) the causal relations of erosional processes in dynamic geomorphic settings. We relate the FLEM to the erodibility and macroscopic resistance of the rock massif. To test this hypothesis, we must clearly describe the properties of a fracture network. The distribution of both orientation and length of fractures control the form and connectivity of the fracture network. The density and clustering of fractures controls the distribution of block sizes, which are eventually released from the cliff face. To quantify the characteristic dimensions and distributions of releasable fragments, we estimate indicators of (i) texture (lacunarity) and (ii) network topology (nodes and branches) using outcrop orthophotos and 3D point clouds of fracture networks. We explore the FLEM along three French coastal cliffs: sub-horizontal chalk cliffs along the macrotidal coast of Normandy, English Channel; plunging stratified turbidite cliffs between Ciboure and Hendaye, Bay of Biscay (mesotidal); and sub-horizontal calcarenite cliffs below the town of Bonifacio, Corsica, Mediterranean Sea (microtidal). In these coastal domains, the FLEM facilitates studying the evolution of (i) the erosion processes; (ii) the location of erosion scars; (iii) the shape of the erosion front; and (iv) the cliff-platform profiles. Additionally, this model may further detail the state variables associated with erodibility and its response coupled with climate change in coastal and continental domains.

Slow but wow: How plants create solifluction lobes as living landforms

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Solifluction, the slow downslope movement of soil due to freezing and thawing, affects periglacial hillslopes around the world. Recent research showed that plants living on periglacial hillslopes interact with solifluction processes and potentially promote the development of solifluction landforms such as turf-banked solifluction lobes. How does this work and do different plant species create different landforms?

We investigated the development of turf-banked solifluction lobes using laboratory experiments, field measurements and remote sensing. First lab experiments, currently running, test if turf-banked solifluction lobes can initiate from small scale perturbations of creeping soils by plants, as suggested by previous research (e.g. Eichel et al., 2017). Field data from moraine slopes in Switzerland shows that small (<0.15 m) risers initiate on creeping soils around Dryas octopetala L. prostrate dwarf shrubs, a key alpine ecosystem system engineer species. Following riser initiation, riser height and tread length develop with increasing uprooting and flow resistance of the ecosystem engineer species, suggesting a close co-development. Coupled field and remote sensing investigations of >40 solifluction lobes in Turtmann Valley (Switzerland) show that with increasing vegetation cover, lobes become narrower, especially when colonized by extensively spreading D. octopetala (van Etten et al., in prep.). In contrast, wider lobes dominate when tussock-forming, dense, but non-spreading Festuca grasses occur. Together, our results suggest a self-organized co-development of turf-banked solifluction lobes and ecosystem engineering plants, creating living landforms with distinct topographic signatures on periglacial hillslopes.

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Grow to the flow: Alpine plant species adapt their growth and morphology to active soil erosion processes

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06J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 2:30 PM - 4:00 PM

Climate change intensifies soil erosion processes on mountain slopes around the world. Mountain plants can reduce soil erosion rates by increasing soil stability and creating flow resistance. However, we know little about how plants respond to frequent erosional processes. Can alpine plant species adapt their morphology and linked functional traits, such as number, size and arrangement of stems, leaves and roots, to better survive and affect soil erosion processes?

Using a semi-natural soil erosion experiment in Utrecht University Botanic Gardens over two growing seasons, we explored how five different alpine plant species reacted to regular runoff and rainsplash soil erosion. Our results showed that, compared to a stable control, all species on the eroding slopes invested more into their root systems in comparison to their above ground biomass (lower root-shoot ratios). On eroding slopes, above ground biomass was located closer to the ground (lower vegetation height), and, for most species, made up by stiffer stems, providing a higher flow resistance. Analysis of root area ratios and root orientation showed that most species invested in additional roots in the upper 10 cm which grew more parallel to the soil surface. Thus, by growing more densely where soil erosion happens, roots provided increased protection. For two investigated alpine dwarf shrubs, we found contrasting growth responses. While arctic-alpine Dryas octopetala L. adapted a slow-growing, stress tolerant strategy on eroding slopes, Australian-New Zealand species Muehlenbeckia axillaris (Hook.f.) Endl. focused on quick expansion, possibly resulting from evolutionary adaption to extraordinarily high erosion rates in its natural habitat. Root tensile strength did not significantly differ between the treatments, indicating that this is a stable trait that can be safely used on a species level. Our results help to select best species for soil erosion mitigation, improving protection of mountain and other hillslopes in a changing climate.

The changing fortunes of a mudbelt: why seafloor mapping matters

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

For over fifty years, the inner continental shelf of the southwest coast of South Africa has been considered a continuous mudbelt, formed by southward transport of terrestrial muds from South Africa's largest river, the Orange River. Despite its potential significance as a blue carbon reservoir, there has been no attempt to map the mudbelt using modern geophysical techniques. Using a combination of newly acquired ultra high resolution sub-bottom data, vibracores, and multibeam bathymetry, the stratigraphy of the mudebelt is revisited.

These data reveal a significant sediment body comprising prograding clinoforms that spans an along-coast length of over 200 km. Two significant depocenters are found in association with the Berg and Olifants Rivers. We interpret these as laterally extensive subaqueous deltas that overlie a bedrock and gravel surface. Cores show the delta front to be sand-dominated, while muddy sands and muds are confined to the nearshore along the landward edge of a bedrock outcrop. There presence and age suggest they are the modern subaqueous prodeltas of the Berg and Olifants Rivers, with the mudbelt now occupying only a fraction of what was previously mapped.

High-energy littoral processes and north westerly directed longshore drift have removed most prodelta muds, transporting them north. The sandy material remains as a submerged relict feature bearing geomorphological similarity to modern wave-dominated deltas. Based on these new results, our study thus proposes the reclassification of the “mudbelt” as the Berg-Olifants subaqueous delta.

Understanding Debris-Flood Processes in Steep Mountain Channels of Southwestern British Columbia, Canada

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12D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 9:35 AM - 11:05 AM

Debris floods - described as rapid water flow heavily charged with sediment - present significant hazards in steep, mountain channels. These events are triggered by various factors, including heavy rainfall, rain-on-snow events, dam breaches, and oversaturated debris flows, and are often exacerbated in post-wildfire landscapes. Debris floods are common in British Columbia and typically occur in steep creeks and on their alluvial fans, posing safety and economic risks to communities and infrastructure in these areas. Despite their significance, debris floods remain poorly understood compared with other creek hazards, such as debris flows, and are challenging to model in practice. In this study, we targeted specific knowledge gaps in sediment transport, bank erosion processes, and channel response associated with debris floods in southwestern British Columbia (SWBC), a fast-developing region increasingly impacted by climate-change related extreme precipitation and post-wildfire conditions. Here, we present findings from an ongoing field-based investigation into recent debris-flood events. Field data was collected over 10 catchments in SWBC, and included channel dimension measurements, morphological classifications, bank erosion extents, vegetation distributions, and deposit characteristics including extents, thickness, grain sizes, sorting, and sedimentary structure. Upper watershed influences - such as wildfire extents, vegetation losses, and sediment sources - were also investigated. Drone-based LiDAR data collected at selected sites was used to derive high-resolution digital elevation models. The combination of detailed ground-based geomorphic mapping and remotely-sensed data was used to reconstruct channel cross-sections, erosion and deposition volumes, and bulking factors, which are key but highly uncertain inputs into debris-flood models in practice. By linking detailed geomorphic mapping with specific gaps in current debris-flood modelling frameworks, this work provides significant empirical data to inform debris-flood modelling, refine hazard maps, and improve risk assessment.

Contrasting Geomorphic Response to Dam Removals on Two Gravel-Bed Rivers

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10A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 2:30 PM - 4:00 PM

Dam removal is an intentional perturbation that can help restore the natural geomorphic functions of a river, including floodplain connectivity, sediment and large wood transport, and aquatic habitats. We investigated the geomorphic response of two gravel-bed rivers in the northwestern United States to the removal of dams of different heights, reservoir sediment retention, and large wood supply. Removal of the 64-m high Glines Canyon Dam on the Elwha River in western Washington in 2014 released a 20-Mt pulse of sand and fine-gravel sediment and large wood. Although it had created 3 km of aggradation upstream, the removal of the 3-m high Nelson Dam on the Naches River in central Washington in 2022 did not release a sediment pulse.

We used aerial and terrestrial lidar, orthoimages, and ground surveys to quantify changes in channel morphology, sediment-size distribution, and large wood before and after the dam removals. On the Elwha River, channel braiding, sediment size, and number of log jams responded rapidly to the sediment pulse and reached new steady states within two years. Channel sinuosity and log jam area continued to evolve eight years afterward. Lateral channel migration that mobilized the coarse sediment armoring the channel prior to dam removal facilitated restoration of a multi-thread channel capable of continued channel evolution. On the Naches River, dam removal did not result in immediate, measurable changes in channel pattern or sediment transport. Although the difference in sediment size upstream and downstream of the dam site gradually decreased, coarser sediment downstream continued to impede channel mobility three years after dam removal. Restoration of more dynamic and complex river systems following removal of small dams without large releases of stored reservoir sediment may ultimately be achieved, but is more dependent on flood discharges capable of eroding and replacing armored gravel bars.

Modern techniques used in quantifying badlands on arable lands in Eastern Romania. Case study: Moldavian Plateau

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Badlands are a universal issue regarding the sustainability and agricultural land yields across the Globe. Soil erosion (sheet and linear erosion) poses significant issues in fertility loss, through the removal of the top soil. Out of all erosional phenomena, gullies have been some of the most troublesome geomorphologic processes, both from an erosional and a depositional perspective. Using modern techniques for indexing, quantifying and monitoring these gullies is a crucial step in understanding their development under these specific hydro-climatic conditions, and taking appropriate measures, and applying policies for mitigating their effects. Out of all the different gullies, a distinct category has proven to have significant relevance, through their particularities. This special form of erosion encompasses gullies formed on soils containing significantly high contents of salt. Therefore, these soils are subjected through surface runoff, as well as underground processes which involve dissolving the salt content and water flows under the surface. Measuring and monitoring these specific gullies has been an undergoing study, for several years, and modern equipment and methods have been deployed for precise results, both from a spatial resolution perspective (centimeter level geo-spatial layers), and temporal resolution (on a mostly yearly basis). Out of all the methodologies applied, lidar data is the most relevant, both on a large scale, and on a local scale (using a high-accuracy RTK drone with a lidar sensor). In addition, complementary layers derived from Structure From Motion techniques (SFM) have also been included in the analysis. Results reveal different evolution particularities on salt-based erosional processes, with their own sets of issues.

Our legacy: how human impact takes on climatic changes to control floodplain dynamics in the Upper Rhine area

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03I: Lowlands a place for humans? Geomorphic functionality and anthropomorphization of alluvial and coastal plains from past to future, Conway 4, February 2, 2026, 4:00 PM - 5:30 PM

While the dynamics of central European fluvial systems were originally controlled mainly by climatic changes, human impact has fundamentally altered the catchments' sediment dynamics. During the Middle to Late Holocene, a transition occurred to anthropogenically controlled fluvial systems. It is evident that these systems respond uniquely to simultaneously occurring natural and anthropogenic forcings and there is no synchronous European or even catchment onset of floodplain transformation with concurrent triggers. The transition got stored in floodplain sediments as these record both past river dynamics and human activities (e.g., settling, mining, logging).

Since insights from the meso-scale rivers are largely lacking, two rhenian tributaries were studied with a higher (Kinzig river, Black Forest, Germany) and lower (Fecht river, Vosges, France) socio-political and socio-economical impact (mining, timber drift and raft). We use geophysical surveys, sedimentological investigations, luminescence dating, and geochemical analyses to study floodplain stratigraphies and heavy metal contaminations.

Our sedimentological data reveal distinct phases of floodplain accumulation (Kinzig: 0.1 mm/a for Late Pleistocene/Early Holocene till 9.00 ka, 0.3 mm/a for Mid/Late Holocene 9.00-0.82 ka, 1.1 mm/a for modern 0.81-0 ka). Additionally, floodplain sediment contaminations and historic land use seem closely related as suggested by the timing and rise in sediment contaminations (Kinzig: enrichment factors of Ba, Pb, Cu peaking at ca. 2.5, 4.0, 3.0). Preliminary results from the Fecht also point to increasing accumulation rates over a similar time span.

Hence, cross-referencing floodplain stratigraphy with land use history supports our understanding of a gradual shift to an anthropogenically dominated fluvial system. Our findings suggest a close link between the sediment contaminations, historic land use and local mining records. The fluvial transition occurred in the Kinzig after human settlement in the Upper Rhine plain, finding higher anthropogenic impact on floodplains over the last ca. 2500 years as found in the unprecedented accumulation rates.

Bridging geomorphology and management: sediment fingerprinting as a decision-support tool in Mediterranean catchments

Professor Joan Estrany[1], Dr Josep Fortesa[1], Dr Miquel Mir-Gual[1], Mr Francisco Cuello-Llobell[1], Mr Jaume Company[1], Mr Alexandre Moragues[1], Dr Miquel Tomàs-Burguera[1], Ms Margalida Ribas-Muntaner[1], Dr Julián García-Comendador[1]
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07A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 5:00 PM - 6:30 PM

In Mediterranean island environments, where catchments are small, flash-flood prone, and subject to intense human pressure, managing sediment dynamics is essential for system resilience. In the Balearic Islands (Spain), the RiscBal initiative integrates geomorphological research with real-time monitoring, applying sediment source fingerprinting as a practical decision-support tool. This presentation outlines how long-term hydrosedimentary datasets -generated through nested monitoring networks from micro- to catchment scales- support efforts to quantify and manage land degradation. Combining traditional instrumentation with advanced technologies such as turbidity probes, spectrophotoradiometers, and LoRa/NB-IoT telemetry, RiscBal-Control (https://riscbal.uib.cat/stationList.html) enables high-frequency, spatially distributed data collection across ca. 100 hydrometric and meteorological stations. These data support real-time risk assessment and guide strategic interventions. Sediment fingerprinting is applied to understand system responses to flash floods and anthropogenic pressures such as terrace abandonment, urbanisation, and wildfires. This enables the identification of dominant sediment sources and erosion risks under varying land-use and climatic scenarios, aligning the RiscBal's approach with the Water Framework Directive and recent EU guidelines on integrated sediment management. The RiscBal-Control system exemplifies how geomorphological knowledge can inform operational decisions, engage stakeholders, and enhance public understanding of landscape processes through citizen science (https://visor.riscbal.uib.cat/map). Embedding sediment fingerprinting in a real-time, multi-scalar framework provides the basis for integrated sediment budgets that inform both catchment-scale and coastal management strategies. This approach also considers that calcareous Mediterranean environments, such as the Balearic Islands, primarily derive beach sediments from biogenic carbonate sources, especially Posidonia oceanica meadows. However, upstream changes -affecting freshwater flow, nutrient dynamics, and sediment delivery- can influence coastal stability. This is especially relevant in regions where tourism, the primary economic driver, relies on the conservation of both inland and coastal environments, particularly in transitional zones such as coastal wetlands. Accordingly, comprehensive sediment management approaches are essential to enhance resilience across these interconnected systems under climate change.

Rock Glacier Distribution in Svalbard, Iceland, and Northern Norway: Insights from Updated Inventories and Geomorphological Distribution Modeling

Professor Bernd Etzelmüller[1], Karianne Lilleøren[1], Julie Røste[1], Line Rouyet[2], Hanne Christiansen[3], Ole Humlum[3]
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03G: Open session on rock glaciers dynamics, Conway 2, February 2, 2026, 4:00 PM - 5:30 PM

Rock glaciers are key indicators of permafrost presence in alpine and Arctic regions. In the Nordic Arctic they are predominantly found in the high relief landscape of Svalbard, Iceland and Northern Norway. This presentation offers insights into rock glacier mapping and distribution, utilizing high-resolution aerial imagery and INSAR measurements, coupled with machine learning algorithms.

In Norway and Iceland, permafrost varies from discontinuous to sporadic, with active rock glaciers concentrated in some high-altitude areas. Most rock glaciers here, however, are relict formations, primarily located in early deglaciated coastal areas that experienced permafrost during the Pre-Holocene.

In Svalbard, permafrost is largely continuous. Our research identified over 1100 active rock glaciers, mainly clustered in the western parts of the archipelago, which remained largely ice-free throughout the Holocene. Approximately 90% of these rock glaciers originate from talus slopes, while about 7% are linked to ice-cored moraines deposited on slopes. Around 30 observed rock glaciers show signs of ice melt and possible degradation, primarily in the westernmost coastal areas.

Iceland and parts of Northern Norway exhibit a similar distribution pattern, with roughly one-third active and two-thirds relict rock glaciers. The relict landforms are today inactive and were formed during colder pre-Holocene periods. In Iceland and northern Norway, active rock glaciers are confined to mountainous regions today, possibly forming during the Neoglaciation after the Holocene Thermal Maximum.

This analysis evaluates distribution patterns of rock glaciers in relation to geological and topo-climatic factors. We applied statistical tools to explore these factors and assess the feasibility of applying predictive models across Norway, Iceland, and Svalbard. The results offer intriguing prospects for understanding permafrost distribution in mountain and high-Arctic environments over time and space.

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Constraining frost weathering potential, erosion, formation and subsurface processes in plateau blockfields in Norway and Svalbard

Dr Maria Peter[1], Prof Dr Chantel Nixon[2], Prof Dr Ola Fredin[3], Prof Dr Bernd Etzelmüller[4], Prof Dr Sebastian Westermann[4], Prof Dr Jane Lund Andersen[5], Dr Annina Margreth[6]
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02G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 2:00 PM - 3:30 PM

Plateau blockfields are regolith-covered summits in periglacial mountain environments, whose origin, age and evolution are highly debated. They exhibit a unique stratigraphy, with often larger blocks and air-filled pores at the surface and a fine-grained matrix supporting fewer blocks below, sometimes featuring sorted circles and stripes from frost sorting.

We present a multi-method and space-for-time approach to illuminate past and present frost weathering-rates, subsurface processes, the emergence and evolution of this landform. We simulate frost weathering potential for three blockfields in Norway and Svalbard, based on measured near-surface temperatures and climate reanalysis products, and stratigraphic observations and find that for blockfields with dry and cold climate and with permafrost frost weathering is limited while in warmer and wetter settings with often changing wet snow precipitation and freezing cycles during winter blockfields experience higher frost weathering. Further, a fine-grained matrix stratigraphy dramatically increased frost weathering potential (10 to 100 times higher) compared to stratigraphies with large blocks and air-filled voids. To look further into the formation and evolution of these blockfields, we apply cosmogenic nuclide dating (^{10}Be, ^{26}Al) and inverse modeling to sediment and block samples from two excavation pits at a coastal plateau-blockfield at the westcoast of Norway, finding that the clasts generally possess fewer nuclides than the sediment samples, that erosion rates across the profile remain very low (1.5 m/Ma at present and ≤ 5 m/Ma the last 600 ka) and that the ratios of ^{10}Be and ^{26}Al point to a complex burial and erosion history with a very short glacial cover (16 ka in total the last 1 Ma) for this particular blockfield. We conclude that plateau-blockfields definitely can represent erosion-resistant land surfaces or landforms, depending on the climate and the initial stratigraphy, but also where, relative to former Quaternary ice sheets, they are located.

Impact of Rapidly Changing Permafrost Conditions on Geomorphological Processes and Landscape Evolution in Mountain Regions: Insights from Norway and Iceland

Professor Bernd Etzelmüller[1], Paula Snook[2], Ketil Isaksen[3], Juditha Aga[1], Karianne Lilleøren[1], Sebastian Westermann[1]
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04J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 9:35 AM - 11:05 AM

Mountain permafrost is widespread in the Nordic regions, including Iceland and Svalbard. The deepening of the active layer and changes in the thermal state of permafrost play a critical role in geomorphological processes, ultimately influencing landscape development. Global warming significantly impacts geomorphological dynamics in the high-mountain areas of the North. Here, we explore examples of rock-slope deformation and failure during the Late Glacial and Holocene periods, alongside effects on frost weathering and rock wall erosion in Norway and Iceland. We also examine possible pathways of accelerated warming and its implications for mountainous environments. Long-term modelling has revealed dramatic shifts in permafrost distribution in mountainous terrain between the Weichselian deglaciation and the Holocene Thermal Maximum (HTM), during which most permafrost in Norway and Iceland likely degraded. Following this period, during the neo-glaciation, permafrost re-established, reaching its peak during the Little Ice Age (LIA). Subsequently, another phase of degradation became evident, especially in Norway and Svalbard, with lesser impact on Iceland.

Currently, systematic long-term monitoring in Norway, Svalbard, and Iceland documents a significant warming and degradation of permafrost, marked by the formation of taliks in response to climate change over the past 20-30 years. These changes have severely impacted rock-slope stability and deformation rates. In Norway, contemporary rock-slope deformation rates are heavily influenced by changes of the ground thermal regime since the LIA. Our data have been utilized to calibrate a 2D rock wall temperature model for Norway, offering unique insights into permafrost distribution within mountainous regions and how ground temperatures respond to climatic forcing. This modelling also evaluates the potential for frost weathering.

Collectively, these observations provide new insights into how the ground thermal regime influences geomorphological processes and shaping landscapes in high-mountain environments.

The glacial landsystem of former mountain icefield outlet glaciers in the Gillespies Beach-Waikukupa River area, South Island, New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Glacial landform assemblages enable identification of distinct glacial landsystems that are diagnostic of palaeo-glaciological conditions, including the spatial and temporal evolution of ice flow configurations, meltwater drainage patterns, basal thermal regimes and internal dynamics. The availability of high-resolution topography generated from the national survey campaign of airborne LiDAR by Land Information New Zealand (LINZ) reveals a spectacular landform record that has hitherto remained undetected beneath dense forest canopies and throughout mountainous terrain across South Island. We undertook detailed geomorphological mapping from 1 m Digital Elevation Models (DEMs) derived from this LiDAR data to characterise the nature and behaviour of former outlet glaciers of the Southern Alps icefield. We showcase the exceptionally well-preserved evidence of extensive and repeated glaciations of the Southern Alps outlet glaciers in the Gillespies Beach-Waikukupa River area throughout the Quaternary, documenting a variety of ice-marginal, subglacial, supraglacial and glaciofluvial landform assemblages. Spectacular latero-frontal moraine loops and associated breach lobe moraines have been developed in this area as glacier lobes have partially overridden ice-contact fans and ramps. Active recession from major latero-frontal moraines is documented by complex sequences of partially overridden minor recessional push moraines. Exposures through this landform assemblage along the coast provide a stratigraphic signature of the progradation and superimposition of ice-contact fans/ramps and supraglacial debris loads, including recognisable Waiho Loop type moraine construction associated with slugs of rock slope failure material transported from the Southern Alps mountain front over time.

Aeolian denudation of Martian crater rims

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03D: Planetary Geomorphology, Dobson 3, February 2, 2026, 4:00 PM - 5:30 PM

Mars is an active, geomorphologically diverse world whose landscape is evolving through aeolian processes to this day. Modelling of atmospheric circulation on Mars has been based in part on mapping of the orientation of aeolian bedforms such as dunes and ripples. This approach has produced finely detailed global maps of wind direction at the surface where these bedforms exist. However, the provenance of the sand which makes up these bedforms is not well understood. Are they all just reworked sand from an erosional regime that ended long ago? Is the Martian north pole's cycle of advance and retreat almost exclusively responsible for modern increases in the sediment budget? Or do modern conditions allow for aeolian erosion of hard rock, such as that from impact craters? This study analyses the rims of 25,419 craters on Mars to identify evidence and patterns of aeolian erosion. Geographical patterns of features such as the orientation of prominent peaks and low points on the crater rim will be analysed. Active aeolian bedforms will be used to identify local relationships between known wind directions and crater rim morphology. A global map of crater rim feature orientations will be produced. This global map of crater rims will be compared to the GCM and other models to identify any relationship between the methods which may suggest a modern aeolian erosional regime acting on Martian craters. This will open the door to future work on calculating what, if any, contribution aeolian modification of craters make to the Martian sediment budget today.

NEW MIS 3/2 (OTIRAN) GLACIAL HISTORY FROM LAKE WANAKA, SOUTH ISLAND (OTAGO), NZ: NEW INSIGHTS INTO SOUTHERN SOUTH ISLAND GLACIATION

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05G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 11:35 AM - 1:20 PM

The timing and extent of glaciation in the Otago region is poorly resolved. Glacial chronologies are now well established many parts of South Island, but there is a dearth of recent information from the glacial systems of Otago. Glaciofluvial, paraglaciofluvial and lacustrine sediments are amenable to dating with OSL. We investigated several sites along the southern margins of Lake Wanaka near Wanaka township (Beacon Point, Glendhu Homestead, Kirimoko Crescent). We describe aggradation gravels, delta foreset and topset beds, mass flow deposits of glacial origin and thin ice contact units. Cumulatively we record four cycles of glacial advance and retreat: Otira 2 at 42k-38k, Otira 3 at 38k-36k, Otira 4 at 32k-29k and a partially constrained Otira 5 interval with a well represented sedimentary record. These new data add significant new detail to the glacial history of this area. In particular it adds at least three new sequences between the inferred MIS 4 Luggate Advance and the Last Glacial Maximum. These advances appear roughly coeval with the composite Otiran record complied from Canterbury Valleys and the Mackenzie Country. Additionally, the Lake Wanaka chronology agrees with the observation that the Southern Alps and West Coast (Kumara-Moana glacial sequence) appear to have asynchronous glacial cycles.

The geomorphology and landscape of Cephallenia island: A virtual field trip

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Cephallenia (Kefalonia) island is a natural geomorphological laboratory. It is an ideal region where one can study and comprehend different geomorphic processes, including fluvial, coastal, karstic and hillslope processes, in combination with recent neotectonic movements and climatic changes. As such, it was selected for a virtual field trip (VFT) covering different topics of geomorphology. A number of sites has been ostensively selected, representing all the aforementioned geomorphic processes and environments. The VFT is a set, consisting of a descriptive booklet in the form of a pdf, a GIS-based story map and webmap, as well as a series of 360º-photos, incorporated into a virtual reality application, allowing users to virtually visit the island, as if they were actually there. The VFT is developed in the framework of the Erasmus+ project “Tracing Climate Change” (TRACE) and the CIVIS Blended Intensive Programme “Interplay of Landscape, Tectonics and Climate Change in the Mediterranean context”. The aim of the VFT is to introduce students to theoretical and applied geomorphology and how different types of processes interact with each other, in order to shape the Earth’s relief.

Geospatial database of supraglacial landslides

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Supraglacial landslides can significantly influence glacier dynamics by altering ice flow, modifying ablation rates, and affecting overall mass balance. The magnitude of these impacts depends on multiple factors, including landslide size (area, volume, thickness), location relative to glacier geometry, and the morphological characteristics of the deposit.
The aim of this study is to develop a global spatiotemporal database of supraglacial landslides. As an initial step, we focused on establishing the geodatabase structure and performing baseline mapping and classification.
The database includes information on the estimated timing of landslide occurrence, geometric parameters, and spatial relationships between deposits and glacier zones. Mapping was conducted by two independent operators using a systematic workflow: extracting glacier outlines from the Randolph Glacier Inventory (RGI), identifying landslide locations through point-based mapping, manually vectorizing landslide outlines from high-resolution satellite imagery, identifying source areas when visible, and calculating morphometric parameters. Occurrence time windows were estimated using time series of medium-resolution satellite imagery (Landsat, Sentinel-2, ASTER).
We tested this approach in five study areas representing diverse environmental and tectonic settings: the Karakoram, Southern Andes, New Zealand, and Iceland. In total, over 900 supraglacial landslides were mapped. Landslides were classified by area into three size categories: small (<0.5 km^2), medium (0.5–5.0 km^2), and large (>5.0 km^2).
The resulting database provides a foundation for analysing the spatial and temporal distribution of supraglacial landslides. Key research questions include whether there is evidence of a recent increase or decrease in the frequency of these events, and whether their distribution is spatially clustered or largely random. This work lays the groundwork for understanding the geomorphological significance and broader climatic implications of supraglacial landsliding.
The research was funded by the Polish National Science Centre, Poland - Project number 2021/42/E/ST10/00186

Quantification of proglacial landscape changes based on time-series of high-resolution UAV data, SE Iceland

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11G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 5:00 PM - 6:30 PM

Proglacial areas are dynamic environments that contain valuable indicators of modern process-form regimes and thereby serve as exemplars for reconstructing past glacial activity (palaeoglaciology) as well as key indicators of geomorphological responses to ongoing climate warming. Systematic, repeat surveys of landforms evolving on glacier forelands enable the quantification of landscape change rates and enhance our understanding of the underlying processes. This study mapped and quantified the short-term evolution of proglacial landscapes using high-resolution UAV data. Here, we synthesise results from data collected between 2014 and 2025 across several glacial forelands in southeast Iceland: Breiðamerkurjökull, Kvíárjökull, Fjallsjökull, Hrútárjökull, and Svínafellsjökull.

Annual and biannual UAV surveys document a range of landscape transformations, including: (1) the development and collapse of supraglacial outwash fans forming kame-and-kettle topography; (2) the emergence and degradation of ice-cored eskers; (3) the formation and modification of annual push moraines; (4) the evolution and decay of ice-cored moraine complexes; and (5) the reconfiguration of proglacial drainage networks and associated erosional processes. Rates of elevation change vary from a few centimetres up to nearly 1 m a^{-1}, depending on landform type and process activity.

Quantifying these transformations reveals not only the role of de-icing but also the influence of fluvial erosion and gravitational mass movements during the paraglacial phase of landscape change. Our findings highlight the importance of high-resolution UAV monitoring for understanding the controls on landform development and for interpreting evolving and ancient deglacial landscapes. Moreover, we demonstrate that modern proglacial areas are highly dynamic and capable of modifying initial landforms significantly due to the extent of buried glacier ice and the efficacy of glacifluvial and slope processes.

The research was funded by the Polish National Science Centre, Poland - Project number 2019/35/B/ST10/03928

Geomorphological heritage in an urban World Heritage Site (Genoa, Italy)

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The coastal city of Genoa is the sixth biggest city in Italy, home of the second largest harbour of the Mediterranean. It is characterised by a long and complex history, starting from pre-roman times. The city gained importance in the period between the late Middle Ages to late 18th century, when it was the capital of a maritime republic with naval power. From the unification of Italy (1861) onwards, the city grew in size due to industrial development, and expanded well beyond the limits of the historical centre. Part of the historical centre of Genoa, has been included in the Strade Nuove-Palazzi dei Rolli UNESCO World Heritage Site since 2006.
The topography of the historical centre Genoa is complex and rugged, involving the foothills of the Ligurian Apennines and the lower stretch of the Bisagno stream valley. However, similarly to other Mediterranean cities, the complex stratification of urban phases across more than two millenia of history has strongly affected the original natural landscapes and landforms. Some of the natural features that have been modified or erased can still be read in the landscape, while artificial landforms can be recognised. Some of these are characterised by high heritage value, because they allow to investigate the complex relations between anthropogenic action and the natural landscape. Drawing upon previous works regarding the geomorphological setting of the historical centre of Genoa, this research presents a first preliminary inventory of its geomorphological heritage. Particular attention has been given to urban geomorphosites strictu senso, i.e. “the sites that can help to understand the interaction between geomorphology and urban development”. In addition to this, three thematic “urban trails” were identified, which connect some of the identified geomorphosites and can constitute itineraries of interest to raise awarness on the geomorphological heritage of Genoa amongst the general public.

Geomorphological mapping of ground and underground anthropogenic landforms in a fully urbanised small catchment (Genoa, Italy)

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05K: Identification, quantitative assessment and mapping of anthropogenic landforms in urban areas, February 3, 2026, 11:35 AM - 1:20 PM

The reconstruction of the geomorphologic landscape in an urban environment is a complex activity, not only because urbanisation covers the natural landforms, but also because anthropogenic modifications have occurred in successive, often centuries-long phases.
In this multifaceted framework of analysis, in which anthropic landforms exist side by side with modified natural ones, there are also underground landforms represented by artificial cavities such as tunnels, water channels, places of worship, quarries, etc.
The analysis of the landscape in the urban environment therefore requires a multidisciplinary approach, with contributions also from the geographical, historical, archaeological and architectural sciences.
While the first extensive anthropic modifications on the land date back to protohistoric times, the most significant ones in the urban environment are relatively recent. Two historical moments are the most evident in terms of anthropic impact on the landscape: the second industrial revolution, towards the beginning of the 19th century, and the great expansion of the 1950s.
This research reports the preliminary results of the reconstruction of the geomorphological features of the Rovare stream basin (approximately 2.5 km2), located in the central-eastern sector of Genoa. Over the last century, this small area has undergone extensive morphological modifications through excavations and embankments carried out for the construction of buildings and infrastructures, including the St. Martin hospital and the homonymous Genoese university campus, as well as extensive residential quarters.
Through multi-temporal cartographic comparisons, collection and review of archival data, in-situ observations, remote sensing surveys and the analysis of stratigraphic logs, it has been possible to identify, map and quantitatively assess the anthropogenic landforms that have been shaped since the 19th century, including underground cavities represented by watercourse culverts, air-raid shelter and technological tunnels.
Therefore, detailed geomorphological maps of urban landscapes represent an indispensable and basic tool for proper management and planning of the urban environment.

Morphological and Habitat Mapping of Seamounts and Guyots along the Salas y Gómez Ridge

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07E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 5:00 PM - 6:30 PM

Located off the coast of South America, the Salas y Gómez Ridge is a vast volcanic chain stretching over 2,000 km across the southeastern Pacific. It comprises hundreds of seamounts and guyots, isolated by the Atacama Trench, the Humboldt Current System, and a significant oxygen minimum zone. This unique region boasts exceptional marine biodiversity and some of the highest levels of endemism on Earth. The morphology of seamounts plays a crucial role in shaping ecological patterns and guiding sustainable resource management in this setting. However, the benthic structure of these features, particularly guyots, remains poorly understood.
As part of the 2024 Schmidt Ocean Institute expedition “Unexplored Seamounts of the Salas y Gómez Ridge”, conducted aboard the R/V Falkor (too) in collaboration with ESMOI (Chile) and the University of Texas Rio Grande Valley (USA), selected seamounts along the ridge were surveyed using high-resolution Multibeam Echosounder (MBES) mapping and remotely operated vehicle (ROV) dives. The cruise, which took place from 24 February to 4 April 2024, aimed to investigate the geomorphological and ecological characteristics of these unexplored submarine features.
MBES data were processed to generate detailed and complete morpho-bathymetric and backscattering maps of six guyots and four seamounts, which were quantitatively analysed using a machine-learning approach to characterise submarine landforms and associated sedimentary environments. These analyses were complemented by seabed visual classifications (derived from 22 ROV dives) to investigate the correlations between the detected morpho-acoustic facies and the distribution of benthic megafauna.

This study enhances our understanding of the geomorphological controls on deep-sea biodiversity in the southeastern Pacific Ocean, providing valuable insights for identifying conservation priorities and informing marine spatial planning.

Unveiling Lagoonal Geomorphology in a Maldivian Coral Atoll Setting: A Multisource Mapping Approach from Magoodhoo Reef, Faafu Atoll

Giulia Galimberti[1,2], Dr Luca Fallati[1,2], Dr Andrea Giulia Varzi[1], Dr Fabio Marchese[3], Professor Sebastian Krastel[4], Professor Aaron Micallef[5], Dr Luca Saponari[2], Professor Paolo Galli[1,2]
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07F: Tropical coral reefs and reef-lined coasts AND Delta Geomorphology Observed from the Past to the Present: Interactions of Natural Processes and Anthropogenic Influences, Conway 1, February 3, 2026, 5:00 PM - 6:30 PM

The island of Magoodhoo is situated on a discontinuous reef system along the southwestern marginal rim of Faafu Atoll in the Maldives. Over the past few years, a multiscale, multisource data acquisition campaign has been conducted with the aim of producing a continuous and detailed geomorphological and habitat map of the entire reef system. The mapped area includes the island itself, shallow-water reef flat zones, backreef and lagoonal areas, and the deeper ocean-facing slope. Elevation data were derived from multiple sources, including satellite-derived bathymetry, 3D optical models generated via UAV-based photogrammetry, and high-resolution multibeam echosounder surveys, from which backscatter data were also collected. Remote sensing was complemented by in situ observations: ROV video transects were conducted in both forereef and lagoonal sectors, and ground-truth data were collected along the reef flat.

The resulting geomorphological map extends to depths of approximately 120 m on the oceanic side and 60 m within the lagoon. The ocean-facing slope is characterized by terraced morphologies shaped by Late Pleistocene to Holocene sea-level fluctuations. Within the lagoon, we identified various reef-associated sedimentary features, including patch reefs and depositional landforms, as well as a sequence of narrow, sinuous crests in the deeper sector. These crests, obliquely aligned and stepping progressively seaward, likely represent remnants of a former reticulate lagoonal reef system that has been partially buried by more recent sediments. Together, these features reflect the dynamics of sediment transport and island development and contribute significantly to habitat heterogeneity.

Our findings highlight the value of integrated mapping approaches for understanding the geomorphological and ecological complexity of coral reef systems, with particular emphasis on lagoonal environments.

Carbon dynamic chain of rapid uplift of the northern Tibet Plateau and global cooling

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08C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 9:35 AM - 11:05 AM

The uplift of the Tibetan Plateau (TP) has long been hypothesized to link with the desiccation of Central Asia and global cooling through the carbon cycle. However, its validation has been hindered by a lack of convincing records. Here, we synthesize records from recent advances in studies on the uplift of the northern TP and aridification of the Asian inland, as well as our new deep drilling data. The results show that the northern TP underwent accelerated stepwise rapid uplift starting at approximately 15 Ma, 8–7 Ma, 3.6 Ma, and 1.2–0.5 Ma. This process caused a synchronous acceleration in erosion of the northern TP and drying of the Asian inland, manifested as increased dust input, loess accumulation, desert expansion, and ecological transformation from forest to forest-steppe, then to steppe and desert. Confirmed by numerical modeling, we proposed a carbon dynamic chain to support raising the northern TP to drive global cooling, i.e. fast rise of northern TP - enhancing bending and strength of the westerly jet - expanding TP glaciers - increasing erosion and silt production - drying of the Asian inland - increasing dust storm and nutrients - booming the biological activities and productivity in the Pacific Ocean - accelerating carbon burial - fast cooling the Arctic region and formation of the ice sheet - further increasing TP glaciers and Asian inland aridity and dust storm - further global cooling.

Understanding the formation of lacustrine littoral landforms in drylands : insights from a process-based modelling approach of Kati Thanda-Lake Eyre

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02A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 2:00 PM - 3:30 PM

Dryland lakes are influenced by a variety of conditions over variable time-scales, from short term flooding to long lived highstands. This is particularly true in ephemeral lake systems where intermittent water presence creates unique conditions. Kati Thanda-Lake Eyre, is a large, shallow ephemeral lake of the arid centre part of Australia. The lake exhibits a high diversity of wave related geomorphological features such as beach ridges, erosional cliffs and sand spits (May et al., 2022). These relicts indicate that despite the lake's predominantly dry state, periods of water presence and wind related activity have generated sufficient wave energy to transport sediment and shape distinctive littoral landforms (Xue et al., 2025).

The capacity for waves and currents to carry energy sufficient for sediment transport and shoreline modification depends on specific combinations of water depth, fetch length, wind velocity, and duration of exposure (Bouchette et al., 2010; Zăinescu et al., 2023). To understand the forcings conditions in cause of the formation of these preserved shore-related features, we employed a numerical modelling approach using the Delft3D suite. The model incorporate historical and modeled climate data, paleolake and recent water level reconstructions, and topo-bathymetric surveys to recreate realistic conditions. Thus, we conducted a process-based modelling approach on various scenarios of water level, flood duration and meteorological conditions to identify potential large scale patterns, and threshold parameters necessary for sediment transport and morphological change in ephemeral and dryland lakes. In this presentation, we will investigate how numerical modeling can support and contribute to the accuracy of palaeo-hydrological interpretations of paleo-shorelines as a complement of empirical and field based observation. Our modelling approach is expected to provide new insights into past climate and future impacts of climate variability on the evolution of terrestrial hydrosystems in large wind-driven waterbodies (Nutz et al., 2018).

Olwolgin Cave, Roe Plain, Nullarbor – a recently formed cave with saline anoxic water and high CO2 air pockets

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06B: Karst geomorphology, Dobson 1, February 3, 2026, 2:30 PM - 4:00 PM

Olwolgin Cave, Roe Plain, Nullarbor – a recently formed cave with saline anoxic water and high CO2 air pockets

Olwolgin Cave (5N-1851) is a remarkable, shallow, water-filled cave on the coastal Roe Plain of the Nullarbor. It has ~15km of passage accessible only to divers, including an enormous flat roofed room 130 x 30m only 4m beneath the ground surface. Olwolgin lies <25km from the coast on a plain mostly 20–30m above sea level, so it would have drained during the ~120m sea level fall ~20,000 years ago. If the large chamber had been present at this time the thin limestone roof would have collapsed, as it would have been unable to support such a large span. This indicates that the cave probably formed since sea level reached its present elevation <8000 years ago.

The water in the cave is very saline (40–60,000 µS/cm), but does not contain seawater, it has a different composition, with higher NO_3, Ca and HCO_3, lower K levels, and lighter oxygen and hydrogen isotope values. The stable isotope data suggest that Olwolgin water represents evaporated rainwater that fell during high intensity storms. Water in Olwolgin is more saline than that in other Nullarbor caves, probably due to the input of dry deposition of seaspray, reflecting the cave's proximity to the coast. The water is also more acidic than that in other caves (pH ~6.5), and almost anoxic, with very low dissolved oxygen. Air pockets have low oxygen and high CO_2 levels. Because Olwolgin lies only a few meters below ground surface, tree roots penetrate into the cave, mats of tree roots and microbial films grow across the water surface. Decay of this organic material removes oxygen from the cave water and releases acidity and HCO_3, contributing to the high CO_2 content of the air pockets

The role of landslide events during canyon formation: Pegasus Canyon offshore New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Submarine canyons incise deep into continental shelves and slopes across the planet. These systems act as major conduits for sediment transfer by gravity-driven downslope processes from land to the deep sea, and play a crucial role in shaping continental margins. However, due to their infrequent, unpredictable, and hidden nature, the timing, extent, and distribution of large sediment transport events within canyons remains poorly constrained. Pegasus Canyon, a submarine canyon located between 100 m and 1800 m water depth on the Chatham Rise east of New Zealand, provides a unique opportunity to investigate the role of landslide events during canyon formation, and evolution in a canyon system that is strongly influenced by changes in sea-level during glacial-interglacial cycles.

In early 2025, a suite of geophysical data (high-resolution 2D seismic reflection and sub-bottom profiles/Parasound) and geological samples (sediment cores) were collected in and adjacent to Pegasus Canyon by RV Sonne during cruise SO310. We make use of this data to investigate the history of landslide deposits present in Pegasus Canyon and determine how stratigraphic control on landslides impacts on canyon formation.

Our extensive network of seismic and Parasound data reveal mass transport deposits (MTDs) distributed widely within the canyon thalweg. These deposits are generally covered with metres to decimetres thick stratified drape meaning that most of these MTDs were not recently deposited. Conversely, the interfluves bounding the canyon are characterised by thick stratified deposits interrupted by MTDs. The seismic data enable us to map the extent of MTDs in the thalweg and interfluves, allowing us to assess temporal and spatial evolution of Pegasus Canyon. Preliminary age data from sediment cores further constrain the temporal evolution of the canyon. Our results provide critical information for better understanding the associated geohazard potential in and adjacent to Pegasus Canyon.

Dust, climate, and geomorphic Change: A 400 ka loess record from Matmata (Tunisia)

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Tunisia experiences a complex interplay between continental and maritime influences, further modulated by the position and intensity of the westerlies. Consequently, understanding patterns and drivers of climatic change in the region is critical for capturing future climatic trends across North Africa. However, terrestrial paleoenvironmental records from North Africa are often limited to archaeological sites, paleolake margins, and dunes which often preserve only an episodic Quaternary record.

Loess deposits on the Matmata Plateau (Tunisia) offer an opportunity to study long term environmental and climatic shifts. Past research suggests that aeolian dust deposition began ~70 ka and continued until early Holocene. The Matmata landscape evolved in response shifts in surface processes, driven by alternating wet and dry climatic phases. Consequently, local geomorphic and depositional factors must be well understood before extracting broader climatic signals.
We present the results of Optically Stimulated Luminescence (OSL) dating, combined with grain size and magnetic susceptibility analysis to reconstruct the timing of deposition and environmental history of Mamata loess. The chronological analysis shows that loess was deposited semi-continuously for the last 400 ka. However, there are a number of potential gaps in the sequence, most notably at 143 – 45 ka and potentially after 24 ka. Interestingly loess deposition appear to continue throughout the interglacial periods and is absent in the dryest phases. Grain sizes are dominated by coarse silts and very fine sands with fluctuations in grain size distributions corresponding to glacial–interglacial cycles. Magnetic susceptibility further reflects localised variations in moisture availability across the plateau.

Loess provenance and transport mechanisms: Emphasising fluvial and local inputs in the Danubian region over Saharan contributions

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06H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 2:30 PM - 4:00 PM

Sediment provenance is a powerful tool for understanding Quaternary sediment system dynamics and transport pathways. This is especially true for loess–palaeosol sequences, which serve as key terrestrial archives of environmental change. To fully understand provenance shifts, a range of geochemical and mineralogical proxies should be employed to capture range of potential sediment sources. Moreover integrating loess provenance with chronological data allows for the quantification of rates of process such as dust transport and deposition processes, dust fluxes, and sediment generation mechanisms over the longer term —essential components in reconstructing wider landscape evolution.

Loess provenance along the Middle and Lower Danube have been relatively well studied using bulk chemistry techniques and recently significant insights were gained through single-grain techniques such as detrital zircon U–Pb dating. However, uncertainties remain—particularly concerning potential Saharan contributions to Central European loess. While some bulk sample and single grain studies suggest negligible input from the Sahara, others yield inconclusive results. In contrast, modern dust monitoring indicates relatively frequent Saharan dust incursions into the region. This ambiguity limits our understanding not only of loess formation but also of past atmospheric circulation and transport patterns.

In this study, we expand upon our previous work on loess provenance in the Danube corridor, which focused on detrital zircon U–Pb ages and Hf isotopes (Fenn et al., 2022), by incorporating Sr–Nd isotope data from Danubian loess deposits. The results are compared with isotopic signatures from potential source regions, with a particular focus on North Africa, to evaluate possible Saharan contributions. Our findings suggest that Saharan input is unlikely and that local geomorphic sources—especially fluvial sediments—play a far more significant role in sediment supply, supporting earlier work on the fluvial origins of loess in the region.

Hydrogeophysical Characterisation of Fossilised Solution Pipes in Coastal Calcarenites of Apulia, Italy

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05B: Karst geomorphology, Dobson 1, February 3, 2026, 11:35 AM - 1:20 PM

Solution pipes are vertical, cylindrical karst features that develop by focused vertical percolation of meteoric water through porous carbonate bedrock. They are typically associated with diagenetically immature rocks and may become cemented and infilled, transforming into fossilised features. Although solution pipes are reported globally, their subsurface extent, especially in sediment-covered areas, remains poorly understood due to the limitations of traditional surface mapping. This study applies Electrical Resistivity Tomography (ERT) to detect and characterise solution pipes along the Melendugno coast in Apulia, Italy. A combination of five 2D and four 3D ERT profiles was conducted using Schlumberger, Dipole–Dipole, and Mixed Dipole-Gradient arrays. These measurements were integrated with detailed field mapping and sedimentological analyses, including microfacies and grain-size characterisation. ERT successfully identified both exposed and buried solution pipes, which typically range from 0.3 to 1 m in diameter and extend to depths of up to 2 m. The pipes display higher resistivity values than the surrounding calcarenites, indicating infill with low-permeability material and suggesting limited current infiltration. Stratigraphic and petrographic analyses reveal alternating porous and cemented calcarenite layers, with porosity values ranging from 20% to 35%, influencing both the preservation and hydrological behaviour of the pipes. Pipe-fill sediments are predominantly fine-grained, with variable quartz, calcite, albite, and clay content, contributing to reduced permeability. The integration of geophysical and sedimentological data demonstrates that the detected pipes no longer act as active infiltration pathways but instead influence local infiltration patterns by redirecting flow through the more porous host rock. These findings highlight the utility of ERT in resolving the internal structure of near-surface karst features and provide new insights into the hydrological and geomorphological evolution of coastal carbonate systems under changing climatic conditions.

EVOLUTION OF ALBEDO AND SPECTRAL REFLECTANCE IN ANTARCTIC ICE: IMPLICATIONS FOR THE STUDY OF ICE ON MARS, MOONS AND PLUTO

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01D: Planetary Geomorphology, Dobson 3, February 2, 2026, 11:40 AM - 1:10 PM

The study of ice and snow spectral reflectance in terrestrial polar regions provides valuable insights for understanding ice-covered surfaces on other planetary bodies. In this work, we analyze VIS–NIR spectral data (300–1100 nm) collected with a cosine receptor at Buenos Aires and Pirámides glaciers, both located in Hope Bay (Antarctic Peninsula), during January and February 2025. Spectra were acquired over several days, targeting various snow and ice types: fresh snow, compacted névé, contaminated snow/ice, red snow, and glacial ice. These data allow us to evaluate the temporal evolution of albedo and reflectance in response to sublimation, grain size changes, and dust deposition—processes crucial for interpreting icy surfaces on Mars, Europa, Enceladus, and Pluto.

Preliminary results indicate that sublimation-driven grain growth reduces reflectance in the NIR range (0.7–1.3 µm), analogous to the aging of Martian polar ice. Dust deposition markedly decreases albedo in the visible range (0.4–0.7 µm), similar to dust accumulation on Martian seasonal caps. Red snow exhibits distinct spectral features associated with biological activity, potentially serving as a reference for detecting biosignatures in extraterrestrial icy environments. Glacial ice shows recrystallization patterns that modify its spectral behavior, comparable to surface renewal processes hypothesized for Europa, Enceladus, and Pluto.

Based on these findings, we propose a spectral evolution model describing how ice reflectance evolves over time under environmental influences. This model improves the interpretation of remote sensing data from space missions, including CRISM (Mars Reconnaissance Orbiter), MVIC and Lorri (New Horizons), VIMS (Cassini), and future observations from Europa Clipper. By integrating Antarctic field data with planetary spectroscopy, we aim to refine our understanding of the age, composition, and dynamics of extraterrestrial ice deposits, contributing to landing site selection for future exploration missions.

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The ‘management perimeter’, a methodology for effective conservation of geomorphological heritage

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The conservation of geomorphological heritage poses several issues, that derive from its specificities – particularly, the dynamic dimension, that is, their state of activity. In many cases, elements of geomorphological heritage (i.e. geomorphosites) interact with active geomorphological processes which come from outside their perimeter. These active processes can contribute to the functionality of the geomorphosite itself, or, in other cases, they can constitute a risk factor in respect to its conservation.

In any case, the perimetration of a geomorphosite can be an issue, as the strict delineation of the landforms may be not enough to ensure its conservation and prevent it from degradation. In this research the identification of a ‘management perimeter’ (MP) is proposed for each geomorphosite. The extent of the MP depends on the intrinsic characteristics of the geomorphosite and the surrounding geomorphological context: it is delineated by identifying the active processes which influence the evolution of the geomorphosite, and including the whole area on which they act.
The methodology was tested on two study areas: the Liguria region (North-western Italy), and the Hérens valley (Valais canton, Switzerland). The former is a Mediterranean coastal region, while the latter is a high mountain valley in the Alps. Thus, the two areas are characterised by very different geomorphological setting, and consequently, by a wide variety of geomorphosites. Several examples on how to delineate MPs are given, by means of detailed geomorphological mapping of selected sites.

The proposed methodology, based on geomorphological evidence, could allow for effective management of geomorphosites. In addition to this, the results of this research highlight the systemic dimension of geomorphological heritage, and emphasise how a systemic look can strengthen the geoconservation effort.

Geoheritage monitoring for geoconservation at the Dolomites UNESCO World Heritage Site (Italy)

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08I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 9:35 AM - 11:05 AM

The Dolomites (Italy) are included in the UNESCO World Heritage List due to their exceptional natural beauty and aesthetic importance (criterion vii), and because they represent major stages of earth's history, significant on-going geological processes and geomorphic features (criterion viii). This makes up for a very rich and varied geoheritage worthy to be recognised and preserved. The geoheritage of the Dolomites is subject to several threats, both natural and anthropogenic. Similar to other high mountain regions, this area is very dynamic from the geomorphological point of view and subject to the effects of climate change. Moreover, the Dolomites are among the most visited mountains in the world, with strong anthropogenic pressure due to tourism and related activities. Thus, monitoring natural dynamics and anthropogenic pressures can give indications on the conditions of the sites, especially those at high risk of degradation. This study proposes a methodology for monitoring the conditions of the Dolomites' geoheritage, by means of the analysis of specific geoindicators. The methodology was tested on several sample sites, representative of different types of geological interest: stratigraphic, geomorphological, paleontological, volcanological, and structural. The work included two main phases: i) identification of the risk factors, both natural and anthropogenic, for the selected sites; ii) the first assessment of the geoindicators, constituting the basis for the ensuing monitoring programme. This methodology can provide guidelines for monitoring geosites in the UNESCO World Heritage Site of the Dolomites, as well as – with adaptations depending on the context – other geosites in the World Heritage List, in Geoparks and other protected areas.

The effect of human activities on slope transformations: case study from the Tatra and Gorce Mts in Poland

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05I: Human Footprint in River Basins AND Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 11:35 AM - 1:20 PM

Slopes subjected to human activities, both in terms of tourism and as a result of forestry works, undergo numerous geomorphological transformations. As a result of removing vegetation, morphodynamic zones within slopes develop, which are unevenly modeled. The aim of the research was to indicate the regularities of slope transformations undergo human pressure in the forest and alpine mountain zones. The research was conducted in selected footpaths and forest roads in the Tatra National Park (TPN) and Gorce National Park (GNP) where significant human pressure take place. In the TPN the number of visitors in 2000 was almost 2.8 mln and in 2024 was 4.9 mln what was 132 and 231 people per ha, respectively (TPN statistics). The research was carried out on the basis of geomorphological mapping, cyclic comparative measurements within 23 cross-sections and analyses of orthophotomaps from 2003, 2015 and 2021, with a resolution of 0.25 m, 0.25 m, and 0.05 m, respectively.
Studies have shown that slopes within tourist footpaths in the alpine zone are characterized by greater morphological diversity compared to forest roads. Within the forest roads numerous zones of active modeling of cutslopes and formation of braided road network were identified. Research has shown differences in the rates of surface lowering across cutslopes and roadbeds in the Western Tatra Mts and in the Gorce Mts. The recession rate for cutslopes in the Western Tatra Mts was up to 6 times greater than that for roadbeds. In the Gorce Mts, the corresponding value was up to 14 times greater.

Wave Overwash Hazard Prediction on Coastal Rock Platforms.

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10E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 2:30 PM - 4:00 PM

Wave overwash on Australia's coastal rock platforms poses a distinct public safety threat, accounting for a disproportionate share of coastal injuries and fatalities. In the state of New South Wales (NSW), 25 percent of coastal drownings occur on rocky shores, despite significantly lower visitation than at sandy beaches. These hazards are intensified by the dynamic and often deceptive nature of overwash events, where tides and waves interact with complex platform morphology to create dangerous conditions that are difficult to anticipate. Despite the clear risk, few efforts have been made to predict overwash on rock platforms, and existing approaches remain site specific.

This research presents a novel application of machine learning to predict wave overwash on coastal rock platforms. A world-class dataset of hydrodynamic, morphological, and overwash observations collected at the Figure Eight Rock Platform in Royal National Park, NSW, Australia, is used to train models that forecast inundation frequency and extent under a range of ocean conditions. The machine learning approach captures complex non-linear relationships between wave forcing and platform characteristics, helping to identify the dominant drivers of overwash. This method offers a more accurate, adaptable, and potentially transferable approach to overwash prediction. Model outputs are evaluated against an existing empirically derived threshold-based forecast currently used in operational settings at the Figure Eight platform.

This work establishes a foundation for predictive overwash modelling on rocky coasts using data-driven techniques. While this study focuses on a single site, the modelling approach is intended to support future applications at other rock platforms by identifying key input requirements for reliable site-specific forecasting. Ultimately, this will contribute to the development of a decision-support tool to inform the planning and communication activities of surf lifesaving and emergency services.

The importance of non-photosynthetic vegetation cover in stabilizing linear dunes

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10H: Shaping Arid Landscapes: Unraveling the Complex Interactions Between Wind, Sediment, and Vegetation in a Changing Climate, Conway 3, February 5, 2026, 2:30 PM - 4:00 PM

Linear dune fields are often vegetated, with aeolian sand movement restricted to dune crests. Dune mobility can increase when vegetation cover is reduced during periods of drought, after heavy grazing pressure, or after fire. After rainfall, vegetation growth decreases dune mobility but increases the fuel load, which can determine the extent of fire events. Desert plants grow after rainfall by increasing photosynthetic foliage, but as moisture availability reduces, the foliage dries, and cover becomes dominated by cellulose or non-photosynthetic vegetation. This dynamic relationship between dune mobility, rainfall, photosynthetic vegetation (PV), non-photosynthetic vegetation (NPV), and fire, has been investigated across the linear dunes of Australia. The cover of PV and NPV were derived from Landsat and MODIS satellite imagery, using a spectral unmixing model and a large database of field measured plots. Dune mobility was assessed using commercial high resolution satellite imagery, which also showed the effects of fire. Monthly rainfall was spatially interpolated from weather station recordings, and large fire events were examined from the MODIS burned area product. Time series of Landsat PV and NPV, available since 1988 at a seasonal temporal resolution, show vegetation dynamics with 30 m pixels, suitable for analysing the susceptibility of dune crests to aeolian transport. Time series of MODIS PV and NPV, available since 2000 at a monthly temporal resolution, can be easily analysed across larger areas, allowing the dynamics of whole dune fields to be examined. Correlations between PV, NPV, and burned area with rainfall across a range of lag times shows variability across the linear dune fields of Australia. The MODIS products are also available globally, allowing new insights into vegetated linear dunes around the world, and reinforcing the importance of non-photosynthetic vegetation cover in stabilizing linear dunes.

Using multiple cosmogenic nuclides to constrain the British-Irish Ice Sheet in Pembrokeshire (Wales) during the Last Glacial Maximum (LGM)

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

There is considerable debate surrounding the southern limit of the British Irish Ice Sheet (BIIS) particularly in Pembrokeshire, Wales. This is partly due to differing interpretations of the sedimentary and geomorphic record, but a lack of detailed geochronology of regional LGM ice extent is also a major barrier. In Pembrokeshire, proposed LGM ice limits trace the northern flanks of the Preseli Hills suggesting that southern Pembrokeshire may have remained ice-free. However, significant uncertainty remains regarding the interaction between the Irish Sea Ice Stream and the Celtic Sea lobe, and the maximum extent of the Welsh Ice Cap. This project addresses these uncertainties by using multiple in-situ cosmogenic nuclides 10Be, 36Cl and 14C in lithologically varied samples across Pembrokeshire to further our understanding of the region's deglaciation history. Cosmogenic nuclides can determine the maximum time a bedrock surface or glacial erratic has been exposed. However, it is possible that exposure may have been intermittent over this time (e.g. complex exposure history) or that the previous exposure signal has been retained (i.e. it has not been removed through erosion under the most recent ice advance), an effect called 'inheritance'. The issue of nuclide inheritance within samples can yield anomalously 'old' exposure ages common in more erosion resistant lithologies prevalent across the Pembrokeshire coastline and therefore it acts as a key scientific constraint surrounding LGM ice sheet reconstruction.
Cosmogenic nuclides with a short half-life (e.g. in situ 14C) will be integrated into the project to date short timeframe changes in ice dynamics. For glaciations < ~ 20-30ka, in situ 14C, with a half-life of 5.7 kyr, can be used in conjunction with longer-lived nuclides such as 10Be to identify inherited signatures in samples. This project will provide a much-needed understanding of ice sheet dynamics across the region, advancing understanding of complex landscape processes.

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Exploring sediment dynamics of the Pilbara (Western Australia) using multiple nuclides 26Al/10Be and 53Mn in an iron rich landscape

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The Pilbara in Western Australia is an ancient, semi-arid landscape with vast iron deposits. Recently, analysis of two in situ cosmogenic nuclides - 10Be and 26Al, (with half-lives of 1.4 Ma and 0.7 Ma respectively) has been used to detect complex exposure histories of stream sediment through the differential decay of the two nuclides. Variations in the paired cosmogenic ratio 26Al/10Be in detrital quartz from fluvial sediments can record long storage times, reworking of sediments and non-surface sources of sediment. This study uses cosmogenic nuclide concentrations of 10Be and 26Al in detrital samples to quantify basin-wide denudation rates and sediment fluxes in the Pilbara. A step-wise series of corrections were conducted for topographic shielding, lithology and apparent sediment burial. Results from paired nuclides indicate that mean basin denudation rates in the Upper Fortescue catchments are between 0.83 - 3.02 m/Ma measured in quartz sediments. Complex exposure of the samples is used to unpick landscape processes of sediment burial and reworking or complex exposure resulting from production rate attenuation at depth in slowly eroding bedrock (e.g., <5 m/Ma). Sub-surface rock then becomes exposed probably through spalling of large blocks from cliff surfaces along escarpments and gorges in the area.

The potential for lower denudation values are then explored for iron rich sediments using 53Mn. This cross-check becomes important in a region that has distinctive banded iron formation comprising iron rich layers that can extend for hundreds of kilometers. This study has demonstrated that paired cosmogenic-nuclide approaches are powerful geomorphic tools for interpreting landscape dynamics and sediment pathways – even within this lithologically challenging iron-rich landscape. A combined approach provides a useful baseline level or erosion, as well as useful geomorphic insights into modern day fluvial dynamics in a region that is undergoing significant and often irreversible landscape modification through open-pit mining.

The geomorphic legacy of the archaeological tells in the lowland of north-eastern Italy from late prehistory to modern time

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Tells are anthropogenic landforms produced by overlapping phases of construction and activity in the same area, resulting in a gradual rise of the living ground above the surrounding landscape. These cultural features are characteristic of various societies worldwide, with prominent examples in the Middle East and Central Asia, but prehistoric tells are also documented in Greece and the Balkans. Recent geomorphological and geoarchaeological investigations in the lowlands of north-eastern Italy documented the occurrence of tell-like settlements of significant dimensions, corresponding to major ancient urban centres such as Padova, Este, Adria, Altinum, Concordia and Aquileia.

The comparison between detailed LiDAR-derived DEMs, stratigraphic coring, archaeological excavations, palaeoenvironmental and geochronological investigations led to recognize that tells in NE Italy mainly bloomed in the area during the Iron Age and Roman era.

The ancient settlements extended for 0.5-1.2 km2 and rise 2-4 m over the surrounding natural lowlands, where groundwater table is rather close to the surface and could crop out in the winter season leading to difficult occupation of the plain. Alluvial and coastal plains may also be occasionally flooded during major floods and sea surges.

When documented, the basal portion of the tells date to later Bronze Age (i.e. 1350-950 BCE), but their development and rising phase generally occurred during the Iron Age and the Roman period (950 BCE – 5th century CE). An important legacy in the landscape is represented by the Roman remains, which shaped the tell upon which the Medieval and modern cities later developed. These transformations often interacted with natural processes and human intervention for water management. In the cases of Altinum and Aquileia the sites have been largely abandoned in the early Middle Age, leaving large areas available for modern detailed investigation of the ancient stratigraphy, —an extraordinary circumstance in the context of the northern Italian plains.

Evidence for marine highstands in northern Adriatic Sea during MIS 5

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02E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 2:00 PM - 3:30 PM

The deposits and landforms of the marine highstand occurred during the Last Interglacial (i.e. MIS 5.5, 132-116 ka) are key markers for reconstructing geomorphological evolution and geodynamics, particularly in the Mediterranean, where sea level arrived few meters above the present one. Recently several long stratigraphic cores and their palaeoenvironmental analyses were carried out along the coastal plain facing the northern Adriatic Sea, between Venice and the Istria Peninsula, and they highlighted the occurrence of lagoon deposits above the coastal unit formerly attributed to MIS 5.5. The detailed facies analysis rather indicates that these lagoon deposits, found at an elevation between -32 and -550 m, may refer to the MIS 5.3 (103-98 ka), when the global sea-level curves hypothesize a maximum highstand around 18-20 m below the present level. The new discoveries rises several issues about the reliability of global reconstructions over large sectors of northern Mediterranean. Moreover, these data point to the Northern Adriatic as key area for detailed investigations about the subtle changes of sea level that occurred since the Last Interglacial, especially thanks to the existence of very low-gradient shelf and the formation of lagoons. Highstand deposits attributed to MIS 5.3 strongly change the estimations of subsidence experienced by the area of Venice in the late Quaternary.

Extreme flood events in Nepal Himalayas, their hydrogeomorphic responses: focus on the Aug. 13, 2023 Kagbeni hyper-concentrated flood (Mustang District)

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08J: Responses of geomorphic processes and earth surface systems to extreme weather and climate events, Conway 5, February 5, 2026, 9:35 AM - 11:05 AM

Climate change impacts on mountain processes and morpho-dynamics is drawing increasing attention worldwide. In the southern Himalayan Range, recent trends of global warming are reflected by more frequent disastrous (hyper-concentrated) floods (with fatalities), triggered by three recurrent factors: (i) glacial lake outburst floods (GLOFs), (ii) rock- and ice collapses from high mountain walls, and (iii) abundant precipitation. In contrast, in the drier northern High Himalayas, floods have previously been exceptional events, with sporadic spells crossing the orographic barrier, but they seem to be becoming more frequent.
We report on an extreme flood (August 13, 2023) that affected the Jhong khola watershed and the village of Kagbeni (Mustang District, Nepal), in the northern leeside of the Annapurna-Nilgiris Himalayas, usually unaffected by monsoon rains. This unusual hyper-concentrated flashflood was caused by landslide lake outburst(s), as confirmed by CHIRPS (rainfall) data and InSAR (landslides) analysis. Landslide dam(s) and induced-lake outburst(s) were triggered by several storms. The flood propagated rapidly downstream with geomorphic impacts (bank erosion, sediment deposition, landside reactivation), representing transported sediment volumes of 647,000 m3, followed by re-incision (215,000 m3). In Kagbeni village (at the confluence of the Kali Gandaki River), aggravating factors (narrow bridge deck, riverbed embankments) caused significant damage to property and infrastructures, fortunately without fatalities.
We show how climate change has become a real problem and a threat to communities, particularly in developing countries such as Nepal, where hydro-geomorphological processes are not sufficiently considered and management of watersheds is inadequate, particularly at the level of floodplain limits. We recommend some adaptations that would not only improve the regular functioning of rivers, but also encourage local communities to take better account of the effects of climate change, so that they can anticipate future extreme events and better prepare to manage them efficiently.

Multi-cascade hazard assessment in small Mediterranean catchments: integrating flash-flood vulnerability and sediment connectivity

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11J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 5:00 PM - 6:30 PM

Floods are the most common natural hazard in Spain, causing 539 fatalities in the last 25 years. Due to their economic and social significance, European and Spanish legal frameworks aim to reduce the negative effects of floods. However, emerging challenges such as multi-hazard cascade effects linked to sediment transport complicate flood dynamics, particularly in flash flood scenarios where sediment transport dynamics play a key role in altering channel morphology and increasing hazard during catastrophic floods. Under this context, more work is needed to have better understanding of risk, especially at small catchment scale (i.e., <500 km^2), the most common in Mediterranean insular environments. This study analyses the flood exposure and sediment-related processes, assessing physical, demographic, and infrastructural vulnerabilities for T10, T100 and T500 years return periods at 39 catchments (ranging from 3 to 319 km^2) in the Balearic Islands (Spain), where 223,033 inhabitants (18% of population) lives in T500 return year period flooding area. Discharge and water velocity data from hydraulic models, combined with the sediment connectivity index, were analyzed to identify preferential flow paths and deposition areas. This analysis was used to assess flood probability and the exposure of road infrastructure, as well as population vulnerability based on cadastral information (i.e., basements and ground floors). It also included the estimation of population and surface areas exposed to pedestrian and vehicle drag thresholds. Additionally, the vulnerability of public facilities, tourist establishments, transport infrastructure, and industrial areas was evaluated in relation to preferential flow area, with data extracted for each element across different return periods. This approach aims to support flood risk management providing vulnerability indicators at catchment scale. Results will be integrated into flood risk management tools such Civil Protection Plans and the Balearic Flash-Flood Early Warning System.

Coral reef developmental diversity on the inner shelf of the central Great Barrier Reef

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07F: Tropical coral reefs and reef-lined coasts AND Delta Geomorphology Observed from the Past to the Present: Interactions of Natural Processes and Anthropogenic Influences, Conway 1, February 3, 2026, 5:00 PM - 6:30 PM

On the inner shelf of the Great Barrier reef, the morphological development of tropical coral reefs has been studied in detail. However, given the vastness of the system, not enough work has been done to conclusively assess trends in development. Moreover, very few developmental studies have been conducted on submerged reefs, which have followed a different developmental trajectory to their emerged counterparts, even though they sometimes occur in close proximity. The presence of submerged reefs when proximal to emerged reefs is seemingly paradoxical, as they have experienced similar environmental conditions and thus theoretically the same controls on their growth. Investigating how and why reefs develop differently can inform an understanding of the geomorphic sensitivity of reef structures and the potentially large variability in that sensitivity. Hence, we have conducted geomorphological investigations on proximal submerged and emerged reefs whose development has not yet been investigated on multi-millennial timescales. This was done primarily to assess the drivers of reef geodiversity, but also to increase the robustness of the reef development dataset on the Great Barrier Reef. We mapped the morphology, classified the contemporary benthos and palaeoecological constituents and identified the heterogenous developmental trajectories of the reefs. The digital elevation modelling demonstrated that destruction and sediment export are likely to affect reef growth. The contemporary and palaeo reef builders demonstrated that coral morphology and taxonomy may drive reef growth rates. The chronostratigraphies and facies indicated distinctly different evolution and building materials for the structures, including variable hiatuses, growth rates and matrix and framework compositions, which are likely key drivers of the geodiversity observed in the present.

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Integrating Geomorphology and Disaster Risk Management: Insights from the EUMA Project

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11D: Geomorphology Education for Disaster Risk Management, Dobson 3, February 5, 2026, 5:00 PM - 6:30 PM

This contribution presents insights from the EUMA Project (Creating a European Higher Education Network for Master's Programmes in Disaster Risk Management), funded under the EU’s KAPP Call (Knowledge for Action in Prevention and Preparedness) for the period 2024–2025. EUMA represents a novel and strategically developed postgraduate initiative that addresses the increasing complexity and frequency of natural hazards by integrating advanced geomorphological science with state-of-the-art Disaster Risk Management (DRM) training. The outcome of this initiative will be a new Master’s programme coordinated by the University of Vienna and scheduled to launch in October 2026. It reflects a broader ambition to align scientific excellence with the practical demands of professionals and practitioners in the field of DRM.

At the heart of the EUMA curriculum lies a transdisciplinary educational model, combining academic rigour with applied learning. The programme places strong emphasis on scenario-based simulations, in-situ hazard assessments, and case study analysis. These components aim to equip professionals and practitioners with the critical skills needed to evaluate multi-hazard risks, interpret dynamic geomorphic processes, and implement effective adaptation strategies. Special attention is paid to the role of geomorphology in understanding landscape evolution, hazard cascades, and spatio-temporal risk patterns in vulnerable regions.

This contribution reflects on the programme's development process, outcomes from stakeholder consultations, and experiences from associated workshops and pilot trainings. It also examines the value of such postgraduate programmes for working professionals, especially those seeking to enhance their capabilities in applied risk governance, emergency planning, or environmental assessment.

By bridging the academic and operational spheres, EUMA exemplifies a forward-looking approach to postgraduate education. It demonstrates how geomorphological knowledge can be translated into practical competencies, contributing to a more resilient and informed workforce able to respond to the challenges of an increasingly hazard-prone world.

Surface landforms with subsurface karst morphology of Mount Sedom salt diapir

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06B: Karst geomorphology, Dobson 1, February 3, 2026, 2:30 PM - 4:00 PM

Mount Sedom diapir, which is one of the few places on Earth where rock-salt is partly exposed and well-preserved because of the extreme aridity of its setting. The relief and surface features of the diapir generally reflect its parent-rock geological structure, stratigraphy and lithology on one hand, and recent erosion and dissolution on the other hand. These features are commonly aligned along parallel strike-oriented lines forming banded terrain. The overall surface deformation was measured, demonstrating an absolute uplift rate reaching ~7-8 mm/yr. The extruded volume rate of Mt. Sedom bedrock is estimated to be 48,000±12,000 m3/yr. Subtracting erosion and dissolution, the ridge mass increases by 70,000+20,000 metric tons per year, inducing a young (Holocene) and steep landscape. The surface landforms are compared with subsurface geology exposed in caves. They include lines of sliding faults, dissolution furrows, sinkholes of dissolution and collapse origin, karstic shafts, and an irregular disrupted drainage system dominated by blind valleys. The diapir rock-salt is covered by residual caprock, in its turn partly overlain by less consolidated hardly-soluble sediments and gravels. Terraces of abrasion and regressing lakeshore of the Dead Sea appear along the ridge margins. Exposed salt outcrops are relatively rare and undergo rapid dissolution, demonstrated by karst features which range from ponors to the longest salt caves known globally. The extreme solubility of the underlying salt influences the surface and subsurface landscape, inducing high permeability along fractures, and promoting runoff capture into the underlying salt.

Managing catchment-scale sediment (dis)connectivity and switches to enhance geomorphic river recovery

Professor Kirstie Fryirs[1], Professor Gary Brierley[2], Associate Professor Timothy Ralph[1], Professor Ian Fuller[3]
[1]Macquarie University, North Ryde, Australia, [2]University of Auckland, Auckland, New Zealand, [3]Massey University, Palmerston North, New Zealand

09B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 11:35 AM - 1:05 PM

Globally, rivers systems are under considerable and increasing threat from multiple anthropogenic stresses, including different types of direct (e.g. channel engineering) and indirect human impacts (e.g. land cover and land use changes) that alter sediment dynamics, and budgets, in catchments and rivers. (Dis)connectivity relationships determine the source, timing and rates of sediment flux in catchments and thus the potential for geomorphic river recovery. However, in most river and catchment management plans the role of sediment (dis)connectivity is overlooked and rarely embedded in real-world management practice, despite sediment flux being a primary control on what is manageable and can be achieved on-the-ground.

Case studies from contrasting landscape settings with differing sediment cascades and (dis)connectivity relationships in Australia and New Zealand present very different sediment ‘problems’ to managers. Here we use the concept of switches that regulate the operation of blockages in the sediment cascade (called buffers, barriers and blankets) as a basis to inform catchment-scale sediment management plans that have a specific emphasis on geomorphic river recovery. We consider which switches should be left alone, which switches can actually be managed on-the-ground, how many switches need to be managed, and whether managing these switches will have the intended at-scale impact on the sediment cascade to enhance geomorphic river recovery.

Reference

Fryirs, K., Brierley, G., Ralph, T., Fuller, I.C. 2025. Managing sediment (dis)connectivity in rivers and wetland systems. In Poeppl, R., Parsons, T. and Keesstra, S. Connectivity in Geomorphology. Cambridge University Press. pp314-354. https://doi.org/10.1017/9781108903196.018

Same but different: Using generic geomorphic principles in place-based riverscape management on two continents

Professor Kirstie Fryirs[1], Professor Joe Wheaton[2]
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04A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 9:35 AM - 11:05 AM

This invited presentation will be a fun, tag-team conversation where Kirstie and Joe share their insights in an engaging, panel-style format. With a rolling, dynamic slideshow, they'll show how geomorphology plays a vital role in managing riverscapes, no matter where you are.

Whether we use them directly or indirectly, geomorphic principles shape how we understand and manage riverscapes. What changes from place to place is how we interpret, apply and communicate them in different contexts.

Kirstie brings deep experience from eastern Australia, while Joe's work is rooted in North America. Together, they draw on a wealth of international experience. They'll explore some geomorphic principles and how they play out across diverse settings:

*Why wouldn't you? Respect geomorphic diversity and work with the riverscape in front of you, not the riverscape you see on a computer screen.
*Knowledge is your best friend - Build understanding of the physical template as the foundation of everything!
*It's all in the planning - Don't just measure it because you can. Use condition and monitoring measures that provide a relevant signal.
*Be a detective – Understand evolutionary trajectory to identify and treat causes not just symptoms. The past holds the key.
*Fit-for-purpose - Work with geomorphic processes to design nature-based solutions.
*Give it some space – to flood, erode and move.
*Relieve the pressure. Relieve limiting factors to recovery. Rivers have remarkable self-healing capacities and will do the hard work for you, just nudge it along.
*Best bang for buck - prioritise based on recovery potential. Working with river recovery pays off.
*Know when to opt-out and leave it alone – if the river is self-healing and recovering, let it be, it's a win.
*Be ready – when it happens it will happen quickly (maybe a natural disaster strikes or a funding golden goose lands).

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Waipaoa River, Aotearoa New Zealand: Changing connectivity and catchment-scale sediment cascades.

Professor Ian Fuller[1], Professor Gary Brierley[2], Ms Brenda Rosser[3], Professor James Brasington[4], Dr Jon Tunnicliffe[2], Dr Mike Marden[5], Dr Sam McColl[3]
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03J: Landscape conditioning for cascading sediment hazards in Pacific steepland catchments, Conway 5, February 2, 2026, 4:00 PM - 5:30 PM

High rates of erosion in the 2208 km2 Waipaoa River catchment have been the defining management issue since the mid-twentieth century. Erosion was dramatically enhanced by forest clearance for pastoral agriculture in the late nineteenth and early twentieth century, primed by a combination of highly erodible lithologies, steepland terrain, regular intense storm events, and slopes undercut during postglacial river incision. Catchment connectivity relationships in the Waipaoa have been profoundly altered. Simultaneous sediment inputs from deforested slopes deliver sediment directly into tributary and trunk stream channels, causing significant bed aggradation and channel infilling. Gullies initiated mid-twentieth century overwhelm receiving streams, forming alluvial fans and represent the single largest long-term sediment source to the system. In the upper catchment, widening of aggraded channels contributes more sediment, particularly through bank and valley-side erosion. The fine-grained nature of sediment supplied by lithologies in the upper catchment accentuates downstream delivery of materials, resulting in channel contraction and floodplain accretion in the lower Waipaoa. Efforts to mitigate erosion by afforestation have been successful in some headwater tributaries, with channel degradation beginning, but this process generates additional sediment that is conveyed downstream. We use a combination of LiDAR and river channel cross-sections to demonstrate contemporary longitudinal patterns of connectivity in the Waipaoa River and assess the prospective river futures of this anthropogenically altered system. We also report initial findings on the impacts of Cyclone Gabrielle in February 2023.

Mapping complex, nested, and interconnected landslides in Western Canada

Mr Andrew Funk[1], Mrs Colleen Fish[2], Ms Celeste Melliship[1], Ms Megan van Veen[3], Mr Michael Porter[1]
[1]BGC Engineering, Vancouver, Canada, [2]University of Newcastle, Callaghan, Australia, [3]BGC Engineering, Ottawa, Canada

05C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 11:35 AM - 1:20 PM

The Peace River Valley in Northeastern British Columbia, Canada, is home to frequent and extensive landslides that formed as the Peace River downcut through a sequence of glacial deposits and into the underlying shale bedrock. Landslide types range from deep-seated, compound slides in glaciolacustrine and bedrock materials, to shallow earth flows from remobilized colluvium. The large, deep-seated landslides pose the greatest risk to in-valley infrastructure due to their size, and potential for rapid mobilization. These deep-seated landslides typically move very slowly, although slight accelerations can indicate pre-cursory activity prior to a rapid reactivation and mobilization. The shallow earth flows, which often blanket the larger slopes, are typically more active and can obscure the geomorphic surface expression of deeper-seated landslide features, complicating slope interpretation and monitoring efforts. This presents a significant challenge for geohazard management in a river valley that hosts critical infrastructure including hydroelectric facilities, transmission lines, pipelines, roads, private properties, and agricultural land.

Various projects have been completed that involve detailed geomorphic mapping for characterization of key landslides and hazards that could impact infrastructure in the region, such as highways and transmission lines, and to support public and worker safety around hydroelectric facilities and reservoirs. The mapping methodology included tracing linear features (e.g. surface drainage, cracks/scarps, and bulging deposits), and polygonal features (e.g. sag ponds, benches, steep scarps), which provided the basis for separating relatively small, shallow landslide features from larger and deeper-seated landslides. Geomorphic maps and interpreted landslide maps were produced for ease of communication.

The geomorphic mapping exercises supported interpretation of landslide volumes, extents, and failure mechanisms. This enabled geohazard practitioners to design and implement surface (GNSS rovers, lidar change detection, InSAR) and subsurface monitoring systems to verify interpretations, monitor ongoing movement, and detect early signs of potential rapid reactivation.

SEA CLIFFS AND SHORE PLATFORMS IN THE NORTHERN AND CENTRAL ADRIATIC SEA (MEDITERRANEAN SEA): RESULTS OF THE SEALAND PRIN PROJECT

Assoc. Prof. Stefano Furlani[1], Dr. Federica Ceccotto[2], Prof. Stefano Devoto[1], Prof. Francesco Troiani[3], Dr. Matteo Mantovani[2], Prof. Marco Menichetti[4], Dr. Davide Torre[3], Prof. Daniela Piacentini[3]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Sea cliffs and shore platform represent an integrated coastal system influenced by marine and subaerial processes. The formation of shore platform involves waves attack at the cliff foot which results in cliff retreat. The debris is then removed by waves, leaving behind a gently sloping rock surface that extends from the cliff base to the sea. The width of the shore platform is closely related to local factors, such as lithology, exposure to wave energy and the relative sea level history.
The use of remote sensing techniques in support of traditional field surveys has significantly improved the study of sea cliffs and shore platforms. To investigate the evolution of two case studies within the Adriatic Sea, the “SEA-LAND” Project of National Interest we employed a range of remote sensing techniques and field-based observations, both in the emergent and submerged conditions, together with bathymetric and GNSS surveys. Both the surveyed sites are carved in terrigenous rocks, but they show different exposure, height and width of the shore platforms.
Results of the explorations show that the recent evolution of the cliff/platform system is driven by a combination of subaerial and marine processes strongly linked to local recent, but also instantaneous sea level variations.

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Plunging cliff: an overlooked landform

Assoc. Prof. Stefano Furlani[1]
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01F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 11:40 AM - 1:10 PM

Plunging cliffs are a distinctive morphotype of rocky coasts. They are sea cliffs that descend into deep waters well below low-tide level, without any shore platform at or near sea level. In the Mediterranean Sea, these morphotypes cover extensive stretches of coastline and, in some regions, such as the eastern Adriatic, are even the dominant landform. Due to their steepness and logistical challenges involved, investigations and studies of these cliffs are quite rare.
As part of the swimming/snorkeling survey programme called Geoswim, 23 sites across the Mediterranean, totaling 229 km of coastline, were explored by swimming. The characteristics of these morphotypes vary in term of height above sea level, depth at the base of the submerged cliff, and slope, which ranges from approximately 40° degrees to nearly vertical, overturned walls.
A systematic analysis of the surveyed plunging cliffs in the Mediterranean Sea has revealed that they are always formed on highly resistant rocks. Their morphometric features differ depending on scale and are primarily influenced by the structural setting of the areas where they occur. Conversely, their evolution appears to be unaffected by wave exposure, as the great depth at the cliff base reflects incoming waves reducing erosive effects.

Erosion, revegetation, and sediment discharge in a landslide disturbed catchment by the 2018 Hokkaido eastern Iburi earthquake, northern Japan

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03J: Landscape conditioning for cascading sediment hazards in Pacific steepland catchments, Conway 5, February 2, 2026, 4:00 PM - 5:30 PM

The M 6.7 Hokkaido eastern Iburi earthquake, occurred in September 2018 at a depth of ca. 35 km, caused numerous landslides in the hilly area of ca. 20 km N-S and ca. 20 km E-W in the western edge of the Yubari Mountains. Some of the distinct features of the earthquake-induced landslide event were the extremely high density of landslide occurrence, which created the large area of bared slopes, and the large amount of sediment which accumulated at the footslopes and in the stream valleys. The large amounts of sediment at the footslopes and in the stream valleys, as well as soils and sediments remaining on the bare slopes, are supposed to be eroded and discharged from the catchment over time. Some of the key questions here should be how the catchment responds to such altered (disturbed) geomorphic conditions, and how long it takes to reach a steady state of sediment discharge after disturbance, given the geo-ecological conditions in northern Japan.

An important finding through field-based observation of a disturb catchment was that revegetation on bared slopes appeared slow, which was at least partially attributed to strong solifluction in early winter and early spring. Slow revegetation seemed affecting steady erosion of and efficient sediment transport through gullies on the bared slopes.

We report our 2-year measurement of solifluction, gully erosion and revegetation processes on the bared slopes, and 5-year monitoring of sediment discharge at the outlet of a ca. 5 km² landslide disturbed catchment, which should provide useful field-based data for examination of: 1) the mechanism of erosion and sediment discharge (in other words, slope and stream connectivity) on the disturbed slopes by landslide under the geo-ecological conditions in northern Japan, and 2) catchment-scale geomorphic response to the major landslide event over time.

The CoMMa Toolbox: a semi-automated toolbox for seabed mapping

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Accurate, consistent mapping of seabed features such as cold-water coral mounds, pockmarks, and drumlins is critical to understanding marine geomorphological processes and habitat distribution. The Confined Morphologies Mapping (CoMMa) Toolbox is an ArcGIS Pro Python toolbox designed to support semi-automated mapping and characterisation of such features from digital elevation models (DEMs).
CoMMa is structured around three toolsets that allow, respectively, (1) pre-processing of the multibeam data and calculating local topographic parameters; (2) delineating confined features; and (3) characterising the features by extracting detailed morphometric attributes. The toolbox provides a flexible, standardised workflow that encapsulates and refines existing methodologies, offering an adaptable solution across a variety of mapping scenarios.
To evaluate the reliability of CoMMa's automated delineations, its outputs were compared both qualitatively and quantitatively against manual digitisation by five expert geomorphologists using a synthetic DEM containing 150 coral mounds of known morphology. Results show that the best-performing CoMMa outputs fall within the range of expert manual interpretations, confirming the tool’s robustness and applicability.
The semi-automated workflow delivers visually unbiased, rapid, and consistent delineations that can be further refined manually if needed. Therefore, significantly improves the efficiency of large-scale seabed mapping projects, crucially needed for academic, industry and government sectors. In addition, the extracted morphometric attributes can support analyses of spatial patterns, geomorphological development, and environmental interactions. When integrated with datasets such as current velocity or sediment transport, CoMMa-derived outputs can also inform predictive models of habitat distribution.
The CoMMa Toolbox is openly available via GitHub (https://github.com/ricarosio/CoMMa/) with comprehensive documentation. It runs entirely on Esri ArcGIS Pro geoprocessing tools, requiring no additional Python packages.

Pacific Ocean volcanic edifices: Insights from the Trans-Pacific Transit Expedition

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07E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 5:00 PM - 6:30 PM

Large areas of the Pacific Ocean remain poorly mapped, limiting our understanding of seafloor processes and submarine landform evolution. As part of the INKFISH Open Ocean Program, the Trans-Pacific Transit (TPT) Expedition set out to address this gap by acquiring extensive multibeam echosounder (MBES) data across six voyage legs between Ensenada (Mexico), Hawaii (USA), and Tahiti (French Polynesia). Covering ~374,000 km², the newly collected bathymetry reveals detailed morphological features of previously unknown or poorly resolved volcanic and tectonic structures.
A total of 1,346 volcanic edifices were identified, rising from depths of 3,200–6,500 m below sea level. These features range from 200 to nearly 3400 m in height and include 902 mounds, 310 hills, and 134 seamounts, with morphologies varying from conic to flat-topped. Surrounding terrain includes ridges, fracture zones, and abyssal plains.
To facilitate consistent and reproducible geomorphological mapping, we used the CoMMa Toolbox, a semi-automated Esri ArcGIS Pro workflow for delineating seabed features and extracting morphometric attributes (e.g. average slope, maximum vertical relief, circularity, aspect variability, etc.). Additionally, the MorVolc MATLAB toolkit was used to characterise volcanic morphology. Cluster analyses of the morphometric data enabled classification of volcanic edifices into distinct morphotypes, offering insight into their formation and evolutionary histories. These morphotypes are also expected to influence local biodiversity, with implications for marine habitat mapping.
This contribution highlights the role of high-resolution mapping and automated analysis tools in advancing submarine geomorphology and demonstrates the value of large-scale MBES datasets in revealing the complexity of seafloor landscapes.

Geomorphological dynamics affecting the vulnerability and resilience of permafrost coasts near Iqaluktuuttiaq (Cambridge Bay, NU), Canada

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rising sea levels, shrinking sea ice cover, and increasing air and ocean temperatures caused by climate change are particularly affecting the Arctic where permafrost coasts are highly sensitive to these changes. Canada has the longest coastline in the world, largely due to the Arctic archipelago. However, there is very little information on coastal dynamics for the Canadian Arctic Archipelago, and circumpolar erosion models focus on the Arctic Ocean. In addition, coastal and periglacial dynamics are generally studied separately, which greatly limits our understanding of coastal erosion in environments with permafrost coasts. This project aims to understand temporal and spatial changes in coastal dynamics by assessing the contribution of periglacial and coastal processes near Iqaluktuuttiaq (Cambridge Bay, NU), in the central Canadian Arctic. Results showed that both erosion and progradation processes were occurring at the study area and varied depending on the type of coast, permafrost conditions, and wave dynamics. In general, areas with marine terraces and ice-rich permafrost eroded more rapidly, while environments with gently sloping beaches or sediment input (e.g., rivers) were more stable or prograding. In ice-rich environments, coastal processes also varied over time: before spring breakup, when sea ice is still anchored to the coast, periglacial processes dominate (periglacial-dominated); then there are interactions between coastal and periglacial processes during most of the thaw season and open water period (coastal-periglacial dominated); and finally, coastal processes dominate in the fall when storm events increase and soils refreeze (coastal-dominated). In coastal areas where permafrost is ice-poor, coastal processes tend to dominate throughout the open water season. This study not only contributes to improve the characterisation of coasts and their spatial variability in the Canadian Arctic Archipelago, but also shows the importance of considering the temporal variability of geomorphological processes when describing coastal dynamics in periglacial environments.

Coastal gullies formed by piping on a permafrost marine terrace near Iqaluktuuttiaq (Cambridge Bay), Nunavut, Canada

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13G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 11:35 AM - 1:05 PM

Piping is the formation of subsurface tunnels (pipes) due to sediment removal by groundwater flow, which can lead to surface collapse and gully formation, thus transitioning from subsurface to surface erosion. While piping occurs across various climates, its formation in periglacial environments and its impact on these landscapes remain poorly documented. This study examines the morphology and environmental conditions of gullies that formed on a permafrost marine terrace near Iqaluktuuttiaq (Cambridge Bay), Nunavut (Canada), and provides the first conceptual model linking piping to gully formation in a periglacial environment. Nineteen gullies were surveyed along a 430-m coastline with a 2-4 m high bluff experiencing accelerated coastal erosion. Field observations, remotely piloted aircraft system (RPAS) surveys, and permafrost cryostratigraphy confirmed that the gullies did not form from ice-wedge degradation, but rather from lateral groundwater flow causing piping. Piping was confined to the top sand layer of the terrace, where the thaw front and underlying layer of silt loam acted as impermeable barriers (aquitards). Piping likely peaked during snowmelt when the sand layer became saturated. Gullies predominantly formed within the last 4–5 m of the terrace where the steep bluff and collocated seepage face, deeper thaw front, and terrace subsidence likely increased the lateral hydraulic gradient. Some longer gullies reached the ice-rich silt loam, where they deepened further through thermal erosion. While the formation of pipes and gully evolution are likely also influenced by coastal erosion, which maintains the steep bluff and can accelerate gully head retreat, the gullies can also act as thermal conduits, thereby weakening permafrost stability, and potentially mediating accelerated coastal erosion. This study improves understanding of piping in periglacial environments and highlights its interactions with surface, thermal, and coastal erosion in shaping Arctic coastal landscapes.

Rapid Channel Adjustments in Mediterranean Rivers: The Role of Human Disturbance and Flow Variability

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03A: Learned lessons about anthropogenic drivers in the river evolution, Auditorium, February 2, 2026, 4:00 PM - 5:30 PM

The interactions among channel morphodynamics, flow variability, and large wood (LW) dynamics remain poorly understood, particularly in rivers subject to strong anthropogenic and climatic pressures—such as intermittent systems in the Mediterranean region. This study investigates the rapid (≤ decade) upstream propagation of channel degradation—specifically incision followed by widening—in the Evrotas River (southern Greece), triggered by short-term but intensive gravel extraction and riparian vegetation removal between 2013 and 2016. We applied a multidisciplinary approach, combining time-series analysis of Google Earth imagery, detailed field surveys, and hydrological modeling, to evaluate how these disturbances influenced subsequent morphodynamic responses. Our results show that the combination of anthropogenic interventions and high-magnitude flows caused rapid upstream migration of incision (~2 km), accompanied by a twofold increase in channel width over just two years (2017–2019). This transformation accelerated bank erosion and facilitated significant LW recruitment. Between 2019 and 2021, the predominance of low-magnitude, geomorphologically ineffective flows led to a temporary stabilization of channel form. Nonetheless, LW storage continued to increase—likely due to improved retention efficiency in the widened channel. These findings highlight the high sensitivity of intermittent Mediterranean rivers to even short-lived human disturbances and the critical role of flow variability in shaping channel evolution. The observed feedbacks between channel morphology and LW dynamics further suggest that LW may play an important role in sediment retention and post-disturbance stabilization processes. As a follow-up, we are extending this analysis to additional Greek catchments undergoing major morphological transitions linked to extreme floods and riparian corridor management, using remote sensing and numerical simulations of hydraulics, morphodynamics, and vegetation establishment. A better understanding of these coupled processes is essential for the sustainable management of dynamic, human-impacted river systems.

Imprints of mantle dynamics on the rivers of the Western Betics (Spain)

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Earth's mantle dynamic mechanisms drive surface deformation processes that ultimately shape regional geomorphology. Slab rollback produces a migrating regional dynamic topography coupled to a crustal deformation pattern, producing topographic perturbations and drainage reorganization that result in a distinctive landscape in the Western Betics. From a geomorphological perspective, the most striking expressions of the effects of mantle dynamics on the Earth surface are the river responses to the associated crustal deformation. River captures leaving wind gaps, knickpoints and river abrupt diversions occur where transverse drainage, driven by regional uplift of the mountain chain, intersects with orogen-parallel (i.e., longitudinal) drainage systems. These longitudinal drainages are controlled by active structures of the Betic fold-and-thrust belt at the deformation front, as well as by the footwalls of orogen-parallel normal faults in the retro-wedge extensional domain. Prominent examples of the fluvial landforms mentioned above include a 180° bend in the de la Peña River and the diversion in the Guadalete and Majaceite Rivers. Footwall uplift along orogen-parallel normal faults has also generated beheaded valleys east and southeast of the Ronda Basin, indicating a former eastward-directed drainage. Additionally, oblique-reverse faulting has produced aligned wind gaps, such as those north of the Torcal Fault. The most significant drainage reorganization example in the region is the Guadalhorce River capture. Its basin is split by the 200 m high Desfiladero de los Gaitanes knickpoint, separating an aggradational upstream domain in the Llanos de Antequera plateau from an incised downstream sector. This major capture, dated to the middle Pleistocene (~600 ± 300 ka), rerouted drainage from the Guadalquivir basin to the Málaga basin and is supported by both fluvial terrace chronology and biogeographic evidence, freshwater Squalius pyrenaicus fish cladogenesis. Drainage reorganization landforms make the Western Betics a very good example of the influence of transitory mantle dynamics on landscape evolution.

Beyond climate: the role of volcanic, tectonic, zoogenic, and anthropogenic processes in megafan formation and evolution

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01B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 11:40 AM - 1:10 PM

While most documented megafans (approximately 75%) have formed under monsoonal or subtropical climatic regimes—with high discharge variability, substantial sediment supply, frequent avulsions (>1 per century), and active channel margin-to-margin migration at secular scales—a growing body of evidence highlights the existence of megafans that are not primarily climatically driven. The Santa Clara Megafan in Costa Rica exemplifies this alternative model. Situated in a tropical rainforest climate with low seasonal discharge variability, its development cannot be attributed solely to climate. Instead, episodic volcanic eruptions and earthquakes have played a key role, resulting in major avulsions at a rate of ~1 per century and active channel migration across the fan over millennial timescales (~2 ka). A similar pattern is observed in the Pastaza Megafan (Ecuador–Peru), where volcanism appears to influence both its formation and its avulsion rate (~0.5 avulsion/century). The Okavango Megafan (Botswana), located in a semi-arid setting with moderate discharge variability, shows a more complex history, with a slightly higher avulsion rate (~1.5 avulsion/century), attributed to tectonic, zoogenic, and anthropogenic influences. At the other extreme, the Yellow River Megafan (China) exemplifies strong human impact: large-scale deforestation during the Middle Ages led to increased sediment loads and an artificially elevated avulsion frequency (up to 5 avulsion/century), with channel migration velocities rising dramatically—although, under natural conditions, active channel margin-to-margin migration occurred at millennial scales (~5 ka). These cases demonstrate that megafan formation and evolution can occur even in the absence of extreme seasonal climatic forcing. High-magnitude sediment supply events—regardless of origin—are the main drivers of fan development. We propose that systems like Santa Clara, Pastaza, Okavango, and Yellow River represent a distinct class of megafans, where climate alone does not account for their genesis and evolution.

Holocene extreme flood distribution patterns in the upper and middle Yellow River: A review based on slackwater deposits

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10J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 2:30 PM - 4:00 PM

Understanding past Yellow River floods is crucial for assessing natural variability and future risks, but is limited by short instrumental records. Fortunately, flood slackwater deposits (SWDs) within the fluvial stratigraphy provide excellent records for reconstructing extreme floods beyond historical documents and modern observations. Here we scrutinize and synthesize the reported SWD records from the upper and middle Yellow River, and conduct a meta-analysis of these floods, in order to reconstruct the distribution patterns of extreme floods throughout the Holocene. 30 SWD sequences from 57 sites passed our rigorous data quality scrutiny, and subsequently total of 72 flood units were utilized to reconstruct the spatiotemporal distribution of Holocene extreme floods. Our results identified five extreme flood-rich periods, centered at 8500 yr BP, 6300-6100 yr BP, 4300-4000 yr BP, 3400-3000 yr BP, and 1800-1600 yr BP. The floods in these periods exhibit a significant increase in frequency and a shift in their spatial scale after ~5000 yr BP, which are probably modulated by millennial-scale summer insolation, resulting in increased El Niño-Southern Oscillation activity and intensified latitudinal temperature gradient. Our comparison analysis between flood-rich periods and various climatic proxies suggests a centennial-scale 'dry-cold' climatic configuration during these periods. An anomalous low-latitude western North Pacific anticyclone, coupled with an anomalous mid-latitude cyclone-anticyclone pair, contribute to the convergence of water vapor from the western Pacific and Arctic region into northern China. This convergence led to extraordinary rainstorms and extreme floods in the upper and middle Yellow River, which significantly impact the human activity in the lower Yellow River. In addition, identifying Holocene extreme flood-rich periods and their climatic configurations offers new insights for predicting long-term extreme hydrological events in the region. Nonetheless, the uncertainty of our synthesis results owing to the limitation of currently available data should be considered and warrants verification in future studies.

Transformation of kettle holes in paleoglaciated areas of Central European Russia according to geological and electrical resistivity tomography data

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Late Pleistocene transformation of European glacial landscapes is often attributed to the impact of linear erosion. Yet in the marginal zone of MIS6 glaciation, extensive watersheds were protractedly affected by the postglacial flattening in periglacial and interglacial settings. Local sediment sinks such as kettle holes and dry valleys infilled throughout the postglacial stage serve not only as records of paleoenvironmental changes but also for assessing the scales of watershed denudation and landscape transformation since the last glacial cover degradation. We attempted to use electrical resistivity tomography (ERT) for a paleogeomorphological survey of local flat-bottomed depressions studied by conventional lithological and stratigraphic approaches in a series of cores at the Borisoglebsk Upland in the center of the East European Plain. ERT profiles showed a contrasting picture of the relatively higher-resistive glacial base embedded with low-resistive lenses up to 20–60 m thick. The latters were correlated with the postglacial loamy deposits of lacustrine and colluvial origin that infilled the lows of initial glacial topography. Complex inner structure of paleodepressions was revealed, embodying several buried kettle holes that functioned as separate basins during much of the Late Pleistocene and probably merged only at its final stages due to considerable sedimentary infill. ERT cross-sections showed an amplitude bottom relief of each kettle with slopes much steeper than its modern sides. 8 geological and 4 electrotomography facies were distinguished, with their correspondence to each other discussed and compared to the geophysical findings of similar geomorphic objects in analogue regions of Central and Eastern Europe. Thus, ERT prospecting proved to be useful for detecting the postglacial loamy infills of initial lows of the glacial topography and can be further employed to better understand the actual scales of the postglacial redeposition and landscape modeling during the last 130 ka. The study was supported by RSF (project 23-77-10063).

Glacial, debris flow, and slushflow agents in shaping valley landscapes of the Kola Peninsula mountains, NW Russia

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11G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 5:00 PM - 6:30 PM

Landscapes of the Kola Peninsula mountains are regarded as products of extensive Pleistocene glaciations, followed by intensive erosion resulting in a network of deep troughs and valleys. At present, slushflows appear as an essential agent of valley sediment transport alongside fluvial erosion. Despite large and widespread geomorphological manifestations (debris fans and terraces), only the latter is considered when reconstructing the Holocene evolution of initial Late Glacial valley topography. However, a detailed study of a series of mountain basins revealed a significant impact of debris flows and slushflows on their transformation. To reliably distinguish landforms and deposits of different origin, we applied a combination of remote sensing data interpretation, mapping, and field investigation of geomorphic patterns and stratigraphic sequences. Facies analyses and radiocarbon dating of buried organic-rich lenses allowed revealing the age, succession, and magnitude of paleogeographical events and drivers of valley lithodynamics since the Late Glacial-Holocene transition. During the Late Glacial and Early Holocene, debris flows played a leading part in sediment transport, leaving large geomorphic footprints inconsistent with modern runoff conditions. Asynchronous degradation of continental and mountain glaciers caused moraine-dammed lakes those breaches led to the largest of debris flow events. Later, their transportation capacity and frequency distinctly decreased due to depletion of both water and sediment sources. Since the Late Holocene, they broadly succumbed to slushflows with much lower clastic content against the higher erosional potential, causing a pronounced incision of older glacial and debris flow landforms. Integration of 50 14C dates for peats and primitive soils in debris fans and taluses indicates several stages of increased slushflow and slope activity over the second part of Holocene. Even low-magnitude yet high-frequency slushflows almost paralyze the normal fluvial process. Disregarding such intensive landscape transformation agents throughout the Holocene causes difficulties in regional correlations of the postglacial mountain basins’ development.

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Geomorphology and kinematics of rock glaciers in the Subtropical Semiarid Andes: The El Encierro Valley record (28ºS, Chile)

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The Subtropical Semiarid Andes (27-35ºS) are particularly rich in rock glaciers, but their age, Pleistocene to Holocene long-term evolution and climate control are mostly unknown. Despite their potential as valuable paleoclimate archives, owing to elevation-dependent distributions tied to climate-controlled permafrost conditions, such as mean annual air temperature, key data on their geomorphic attributes, chronology, and paleoclimatic significance are still lacking for this region. For instance, recent work has proposed that a glacial to periglacial transition took place on the Subtropical Andes at the end of the last ice age when a trend to drier conditions affected the area, but this hypothesis has not been yet tested thoroughly. In this work, we aim to reconstruct the rock glacier geomorphology and kinematics in order to provide a baseline for a 10Be chronological program and paleoclimate reconstruction in the El Encierro Valley, Río Huasco Basin (28ºS, 4200 m a.s.m.). We use high-resolution remote sensing optical satellite imagery (Pléiades and Neo Pléiades) and field-based mapping to produce detailed geomorphic maps of three rock glacier complexes. We combine this information with land surface motion maps derived from satellite SAR interferometry (InSAR) data in order to detect rock glacier activity. Preliminary results, adding to previous work in the area (Aguilar et al., 2022), show the existence of multiple generations of talus and forefield connected rock glaciers in response to recurrent phases of ice-rich permafrost creep development (i.e., rock glaciers). These rock glacier generations expose significant geomorphic and kinematic differences among them, possibly denoting active, transitional and relict states of these landforms. We further discuss our results in terms of geomorphic processes, the role of Pleistocene glaciation in conditioning the terrain for subsequent rock glacier formation, and the implications of climate change in the landscape evolution.

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The role of glaciation in the formation of eolian coastal paleodunes in the Pacific semiarid Chile: a landscape processes perspective

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06H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 2:30 PM - 4:00 PM

The Quaternary eolian paleodune fields along the Pacific coast of semiarid Chile (35-30ºS) offers a unique possibility to link wind and other key landscape processes. A main question is the causal link between Andean glaciers and Pacific dune formation, as the former acts as sand suppliers through fluvial networks. Coastal paleodunes occur on elevated marine terraces and to the north of fluvial outlets. Rhythmic development of paleosols punctuate the dune stratigraphy and denote conspicuous humidity changes linked to the migration of the Southern Westerly Winds (SWW). In order to test the hypothesis that glaciers (and glaciation) drove paleodune formation in semiarid Chile, we selected a glacier (Andean) and a glacier-free (Coastal) catchment, both geographically linked to respective paleodune fields at the Pacific. We applied several techniques: (1) post-IR infrared stimulated luminescence 225 ºC (pIRIR225) to date the time of eolian dune deposition and paleosol formation; (2) detrital provenance Zr dating to track the source of sands; (3) combined in situ 14C/10Be burial dating analysis to unravel the transport rate and path of sand into the dunes. Our data show that paleodunes were deposited within the last glacial period at multiple multimillennial time frames separated by stable pedogenesis periods. Paleodunes sand can be tracked to rock formations outcropping in contiguous basins, revealing a “local” origin. Within the Andean catchment, sand-dune provenance varied through time between Coastal to Andean sources, probably linked to glacier extent. Preliminary data indicate a multimillennial mean time for the sediments to be transported from eroded rock sources to the coastal dunes. We conclude that climate change (SWW variability) and Andean glacier fluctuations under low relative (glacial) sea level controlled paleodune morphogenesis in the semiarid Pacific coast, but the presence of glaciers is not a requisite for paleodunes as denoted by our record in glacier-free (Coastal) catchments.

Long-term effects of wildfire on soil colour and their relevance for sediment tracing in burned catchments

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09A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 11:35 AM - 1:05 PM

Wildfires can trigger a range of transformations in the physical, biological, and chemical properties of soils. These alterations may serve as indicators of both the origin and quantity of sediment derived from fire-affected areas. Consequently, they can be used in catchment management to assess landscape disturbances and monitor post-fire recovery. This study investigates the long-term persistence of fire-induced changes in soil and sediment colour and their impact on the reliability of colour as a sediment tracer. Soil colour parameters were assessed in a Mediterranean burned catchment 11 years after a severe wildfire through a resampling approach using soil samples collected from identical locations in 2013 and 2024. The discriminative capacity of both sets of source samples was evaluated by testing artificial mixtures created with 2013 and 2024 data. Finally, 25 suspended sediment samples collected over the 2013–2024 period were unmixed with the MixSIAR Bayesian model using sediment source datasets from 2013 and 2024 separately to compare results. Calculating the Delta-E to quantify the difference between colours, significant colour changes were observed in burned surface soils ($\Delta E = 11.83$), with moderate variation in channel banks ($\Delta E = 4.91$) and minimal change in unburned soils ($\Delta E = 1.74$). These shifts were positively correlated with total carbon concentration. Source discrimination tests demonstrated higher accuracy when using the 2013 dataset. Unmixing results for the 25 suspended sediment samples revealed that the 2024 source data did not meet accuracy criteria at the upstream sub-catchment site, although it showed comparable performance to the 2013 dataset at the downstream site. Soil colour within the catchment exhibited significant variation over time, primarily due to ash depletion. These changes diminished the capacity to distinguish effectively between burned and unburned sources. Consequently, a re-evaluation of potential sediment source categories is required.

The role of source-to-sink connectivity in sediment routing in the Alpine Rhine basin (Switzerland) from cosmogenic nuclides and chemical composition

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Mountain landscapes show strong spatial variability in sediment production, with erosion often concentrated in specific areas due to factors such as slope, lithology, glacial melt, and tectonic uplift. However, not all generated sediment is efficiently transferred to the fluvial system over millennial timescales. This transfer depends largely on the degree of connectivity within the sediment cascade. We investigate these dynamics in the 4,300 km² Alpine Rhine basin (Switzerland). In-situ cosmogenic ^{10}Be concentrations from riverine quartz at 75 sites—and paired ^{10}Be–^{26}Al data from 34 of them—are used to quantify millennial-scale erosion rates. These data, combined with bulk geochemical composition from the same samples, allow tracing the materials' origins. Identifying these sources and their connectivity facilitates process-specific attribution of sediment partitioning to geomorphic drivers such as fluvial incision, mass wasting, and overland-flow erosion.

Catchment-averaged erosion rates are very variable, ranging from 0.4 to 2.2 mm/yr. In basins with very high denudation rates (>1.6 mm/yr), sediment production is accomplished by localized sediment sources driven by glacial erosion or mass wasting, often under dip-slope conditions that promote frequent slope failures. In these catchments, the source-connectivity is high, and the downstream signal mainly reflects the source composition.

In contrast, basins with very low erosion rates (<0.6 mm/yr) typically feature poorly connected channel networks. However, sediment here is diffusively delivered to the streams through overland-flow erosion, with little active fluvial incision. Basins with intermediate erosion rates (0.6 – 1.6 mm/yr) exhibit a correlation between sediment supply and mean hillslope gradient, suggesting landscape form as a control on erosion.

These results show that, beyond lithological and tectonic controls, downstream connectivity plays a key role in determining whether upstream erosional signals are preserved and detectable tens of kilometers downstream. Understanding such connectivity is essential for interpreting sediment provenance and reconstructing catchment-scale erosion histories over millennial timescales.

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Effect of thermal cycles on rock slopes: observations, concepts and laboratory analyses

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08D: Engineering Geomorphology, Dobson 3, February 5, 2026, 9:35 AM - 11:05 AM

Rock instabilities hazards can lead to major risks. Even if different external factors such as precipitation, seismic activity or melting, are known to trigger rockfalls, it is more and more assumed that cycling phenomenon has a role in rock mass deformation, displacement and, moreover cracking initiation or propagation. Even more than the extreme temperatures that can be reached, cyclical temperature variations increase the risk of instability, particularly on rock faces subject to significant daily variations in sunlight. The role of freeze/thaw cycles has been the subject of numerous studies, but much less attention has been paid to aspects related to the repetition of positive natural thermal cycles and thermomechanical phenomena occurring near the surface of a rock mass (air-rock interface) due to natural climatic conditions. Nevertheless, interest in the subject has been growing in recent years. In situ observations from different parts of the world are now recorded but still very few laboratory experiments were performed until now to better understand this phenomenon. After an overview of the concept of thermal fatigue we will focus on the results obtained on two French sites: 10 years of recording of fracture opening and closing at the Pas de l'Escalette and 4 years of recording and laboratory experiments on LaRoque-Gageac limestone.

1202

Investigating Boulder Mobility on Rocky Coasts: A Multi-Site Study from the Central Mediterranean

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Coastal boulder deposits (CBD) are widely recognised as geomorphic features resulting from erosion and deposition processes driven by extreme wave activity along rocky shorelines. Over the past decade, scientific interest in the influence of storm-induced wave action on CBD formation has grown considerably. Nonetheless, the complex interactions between boulders and hydrodynamic forces that govern boulder mobilisation remain insufficiently understood.
This ongoing study aims to document instances of boulder displacement and quantify their frequency over a two-year observation period. Monitoring is being conducted at three coastal sites across the Maltese Islands (Central Mediterranean): one in Qawra (northern coast) and two in Marsascala (southern coast). Data acquisition is carried out periodically using unmanned aerial vehicles (UAVs), with subsequent 3D model reconstruction performed using Agisoft Metashape. Each newly generated model is compared to its predecessor to detect changes in boulder positions.
To complement the UAV-based survey, 15 boulders per site have been tagged with RFID (radio-frequency identification) markers to enable post-transport relocation and analysis. Observed boulder movement is evaluated based on key parameters including size, morphology, initial location, displacement distance, and direction of transport. These transport events are then correlated with wave conditions recorded during the interval between successive UAV surveys.
Preliminary findings from the initial six-month monitoring phase indicate that the most frequently mobilized boulders were disc-shaped and weighed less than 0.2 tonnes. However, variability in the frequency, magnitude, and direction of boulder transport was evident across all three study sites. These results suggest that boulder mobility is influenced by a combination of factors, notably wave energy, coastal topography, and shoreline orientation.

The Role of mega-dams in disruption of natural sediment regime of rivers.

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11B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 5:00 PM - 6:30 PM

Large dams have the capacity to retain high volumes of sediment and regulate seasonal discharge, posing significant threats to the ecological integrity and overall health of river systems. This study focuses on the three heavily dammed river basins of Indian; the Narmada, Mahanadi, and Cauvery—to examine variations in the discharge–suspended sediment concentration (SSC) relationship across three distinct phases: pre-dam, during dam construction, and post-dam periods. This research aims to assess how these large dams have influenced the discharge–SSC relation and to quantify the observed variations. To do so we have applied the sediment rating curves and hysteresis loop analysis. Our findings show that during the dam construction phase, hysteresis loops appeared wide and irregular, indicating high variability in the discharge–SSC relationship. In contrast, post-dam loops were thin and linear, suggesting high flow regulation and sediment retention in the reservoir. The areas of the curve which indicated the fatness of the loop helped us to quantify the variation. Additionally, significant shifts were observed in the coefficients of the sediment rating curve parameters across different time periods. These results reveal that large dams cause substantial disruption to the natural sediment transport regime, a high disruption in the relation of discharge-SSC which causes a great threat to ecology and the geomorphology of the basin. The study also discusses the various changes that might or have been occurring on geomorphic landforms due to these mega dams in such a short time.

Tracking Climate-Induced Rock Slope Instabilities Using Portable Ground-Based Radar Interferometry (GB-InRAR)

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

In Canada, rockfalls are among the most significant geohazards in mountainous regions and along critical transportation corridors. Landslides are estimated to cost the Canadian economy approximately $1 billion annually—costs that can be mitigated through proactive, preventive management. Preventing rock slope failures begins with the early detection and continuous monitoring of unstable rock masses. Such failures are often preceded by subtle deformations ranging from millimetres to centimetres. Remote sensing methods such as photogrammetry and LiDAR can detect surface changes on the order of several centimetres when deployed in proximity to the rock face. In contrast, portable ground-based radar interferometry systems (GB-InSAR) allow for the detection of millimetre-scale prefailure deformations from several kilometres away. Our research aims to assess and quantify the impacts of (1) hydro-meteorological processes and (2) permafrost thaw on the development of rock slope instabilities. Fieldwork is conducted at three study sites located in Quebec, British Columbia, and Nunavut. By monitoring micro-meteorological conditions directly on rock faces and quantifying associated instabilities, we have identified specific weather conditions that are conducive to rockfall occurrence. This foundational knowledge has supported the development of forecasting models for rockfall hazards along transportation routes in Eastern Canada (notably in Quebec). While correlations between certain weather events and rockfall occurrences have been established, the underlying failure mechanisms remain poorly understood. The deployment of GAMMA's GPRI (a portable GB-InSAR system) at instrumented sites equipped with hydro-meteorological sensors will enhance our ability to detect previously unrecognized instabilities, quantify prefailure deformation rates, and improve failure anticipation and hazard mitigation.

Quantifying Rockwall Erosion and Rockfall Hazard in Flysch Formations: Insights from a 6-Year Monitoring Campaign

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Flysch formations (stratified sedimentary rock slopes) are prone to differential erosion due to the alternation of weak and strong rock strata. The retreat and settlement of weak layers lead to the gradual cantilevering of stronger beds. As a result, blocks may detach from these stronger strata and eventually slide or topple. These mechanisms commonly generate decimetric to metric-scale rockfalls. In some cases, the propagation of rock bridges along discontinuity sets orthogonal to bedding can lead to the development of larger rock mass instabilities (on the decametric scale). In northern Gaspésie (Québec, Canada), critical infrastructure is threatened by rockfalls and cliff erosion. To assess rockfall hazard—particularly the probability of occurrence—it is essential to quantify erosion rates and establish frequency–magnitude (FM) relationships. Over the past six years, we have combined terrestrial laser scanning (TLS) and UAV-based photogrammetry to quantify rockwall erosion and monitor potential instabilities across four study sites covering a total of 94 622 m^2. These 3D datasets enabled the calculation of erosion rates and the construction of FM curves. 24 large rock instabilities were identified and characterized in terms of volume and geometry. Kinematic analyses were performed to determine the likely failure mechanisms. Erosion rates across the four sites range from 2.8 to 11.9 mm/year. Annual FM distributions of rockfalls follow power-law relationships, ranging from $6.15x^{-1.06}$ ($R^2 = 0.99$) to $315.39x^{-0.94}$ ($R^2 = 0.99$), for monitored areas of 12 056 m^2 and 82 566 m^2, respectively. Based on these results, we attempted to estimate the probability of occurrence of the 24 large rock instabilities. As expected, their volumes lie near the upper bounds of the FM curves, requiring extrapolation of recurrence intervals. Ultimately, several questions remain regarding the spatial and temporal resolution of the monitoring datasets and their ability to reliably assess the hazard posed by large-scale rock instabilities.

Transient simulations of alpine permafrost in the South Coast Mountains of Canada, with retrospective analysis of the 2019 Joffre landslide.

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02G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 2:00 PM - 3:30 PM

Permafrost degradation driven by climate warming is a key control on the magnitude and frequency of landslides in alpine environments. In-depth knowledge of the permafrost distribution and state is essential to advise risk management in deglaciating areas. Multiple large-scale and recent events in the South Coast Mountains of British Columbia can very likely be linked to permafrost degradation. However, permafrost data in the region are sparse. Furthermore, permafrost probability maps are often limited to low-resolution and steady-state global products and are insufficient for site-specific or temporal analyses. To address this gap, we apply the distributed energy and water balance model Geotop to simulate the transient ground-thermal regime and force the model with climate reanalysis data.

Five high-elevation sites with in situ measurements of air and ground temperatures (up to 133 cm depth) were used to validate and calibrate the model. The data spans a range of slopes and aspects, with a focus on steep, debris-free terrain. Mean annual ground temperature, surface offset, and insulating snow cover presence were extracted to inform site classification.

Simulations were conducted using different reanalysis datasets, snow correction factors, and ground parameterizations to evaluate model performance and uncertainty and to find the most robust configuration. The optimized model was then applied retrospectively to the 2019 Joffre Peak landslide, offering insight into the role of permafrost degradation in the slope failure.

Interaction Between Permafrost and Fluvial Dynamics in the Beaver Creek Floodplain (Yukon Territory)

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13G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 11:35 AM - 1:05 PM

The Arctic amplification expresses a rise in air temperatures which is more than double the global average. The climate change has led to a cascade of reactions, the central element being permafrost degradation. While many publications have focussed on the hydrological and geomorphological consequences of permafrost degradation, it is only recently that attention has turned to the morphodynamic and sedimentary evolution of rivers draining permafrost regions. It is essential to determine to what extent permafrost degradation leads to changes in river morphodynamics. Conversely, the mechanical and thermal degradation of the permafrost by rivers has yet to be quantified. In this paper we will seek to gain a better understanding of the role of the river in the formation or degradation of permafrost. Through a case study of the middle Beaver Creek River (a tributary of the White River, Yukon) we analyse the way fluvial dynamics control permafrost distribution at the floodplain scale and we try to determine the time needed for permafrost aggradation in undisturbed fluvial deposits. We also aim to determine a potential fluvial landform change.

We combined different approaches at different spatial and temporal scales. First, we aim to determine the spatial distribution of the permafrost in the floodplain. To do so, we associated, along cross-sections perpendicular to the river, i) topographic surveys using a DGPS and ii) Electrical resistivity tomography (ERT) surveys together with iii) permafrost coring using a portable core-drill. The chronology of the various floodplain levels was obtained by radiocarbon dating and the presence of White River Ash in the soil. Second, we determined the spatial distribution of the permafrost in the plain using the results obtained on the basis of i) the field surveys; ii) the reconstruction of the fluvial landform mobility since 1964 by remote sensing analysis and iii) a detrended DEM.

Intertidal reef flat coral rubble dynamics on Huvadhu Atoll, Maldives

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Coral-derived rubble (gravel, cobble, boulders) is an important mobile sediment component across reef system, often forming tract deposits, nourishing and maintaining low-lying coral reef islands. Climate change related sea-level rise, predicted increase in storminess, and ecological degradation, strengthens the need to better understand the morphodynamics of these deposits on different spatial-temporal scales. First, we examine local-scale morphological changes of a representative intertidal rubble tract derived from six consecutive high-resolution DEMs (RTK UAV photogrammetry) over a ten-month period paired with bed current measurements (ADVs) and offshore wave conditions (ADCP). Second, a month-long coral rubble tracer experiment was conducted on the rubble tract including different sizes (small, medium, large) and shapes (tabular, branching, massive) at two distinct injection points (oceanward - lagoonward). Biweekly to intra-annual analysis revealed that 15 – 43% of the rubble tract experienced changes in elevation (± 0.03 m) under modal forcing conditions (Hs 0.48 – 3.91 m, mean 1.42 m). Although no significant net change in the total sediment budget was observed, active transport patterns and sediment redistribution from the algal rim towards the lagoon could be identified. Between 60 – 100% of 98% recovered rubble tracer were mobilized during the monthly experiment reaching total displacement of 8.07 - 23.95 m (± 0.10 m). Small and medium rubble displayed higher displacement and mobility than large clasts with a significant difference oceanward, where higher bed currents were measured. Positive correlations between mobility and maximum currents were identified following a similar size pattern. Branching and massive rubble presented higher mobilisation rates than tabular with significant differences especially for small and medium clasts. Positive correlations with maximum velocities could be determined. Our findings highlight that rubble tract are morphodynamically active landforms and important pathways under modal conditions governed not only by hydrodynamic forcing, but as well by inherent rubble clast attributes.

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Sediment provenance and transport pathways within a low-lying coral reef island system

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06F: Tropical coral reefs and reef-lined coasts, Conway 1, February 3, 2026, 2:30 PM - 4:00 PM

Low-lying coral reef island systems are especially vulnerable to the impacts from anthropogenic climate change, influencing ecological and physical processes governing sediment production and distribution across reef zones. Frequently located in remote areas of the Indian and Pacific Ocean, the surrounding reef and lagoon are the only source of sediment nourishing reef-associated landforms such as island, beaches, sand aprons, and reef flat deposits. To understand how low-lying coral reef islands will evolve facing major climate change impacts, it is important to resolve the dynamic relationship between reef-derived carbonate sediment production and transport pathways across reef zones. Here we characterise and quantify current sediment production areas and associated pathways through remote sensing techniques and comprehensive sediment analysis. Our study site, located at the southernmost part of the Huvadhu Atoll in the Maldives, consists of an elongated island and associated landforms facing the open ocean on the southwest and enclosed by a shallow to deep lagoon on northeast side. Sediment pathways and provenance are examined through a zonal eco-morphological classification of the sedimentary system using satellite imagery (validated through field surveys and UAV-derived imagery), throughout which surface sediment samples (n = 130) were collected and examined under the microscope to quantify the proportion of each major constituent to the overall composition and to assess qualitatively sphericity and angularity of single grains. Knowing that sediment entrainment and transport is ruled by its hydrodynamic properties (size, shape, density) and the hydrodynamic conditions acting upon it, settling velocities of sand-sized subsamples (10 g) are determined using a 2.1 m long settling tube. Results are applied to generate a high-resolution spatial analysis of sedimentary characteristics which is used to reconstruct sediment production zones and associated transport pathways across the reef with a focus on island formation and maintenance under present-day condition.

Soil erosion and muddy flooding in a small agricultural catchment

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Soil erosion by water in agricultural areas not only leading to a reduction in soil fertility, but also leads to permanent changes in landforms. The intensity of erosion processes is particularly strong during local downpour. Inundation of properties by water and soil runoff from agricultural fields is an increasingly serious problem in Europe. Muddy floods, defined as muddy runoff from agricultural fields, cause damage to property and roads often off-site, and damage control is expensive.
The purpose of this study is to understand the geomorphic effects of a heavy downpour that occurred on April 18, 2025. The affected area is located in a small agricultural catchment area in the village of Pawłosiów in the Kańczucka Plateau (SE Poland). The plateau is formed by leveled loess humps 240−300 m a. s. l., cut by a network of valleys to a depth of 20−80 m. The slopes ranges from 2 to 10°. The Kanczucka Plateau is a traditional agricultural region. The origins of agriculture date back to about 5,000 BC, but the greatest human impact on the environment due to farming began in the Middle Ages and continues to the present day.
The downpour resulted in rapid surface water runoff, which caused linear erosion and soil wash on slopes. The greatest erosion was found in cultivated fields prepared for sowing and lacking protective vegetative cover. The eroded soil was partially deposited on the flattened areas within and at the foot of the slopes and transported as muddy flood which inundated the center of the village of Pawłosiów. The flood magnitude in headwater part of the catchments (1.6 km2) was estimated c.a. 30 m3 s-1. About 150 residential houses and public facilities were flooded to a height of about 0.8−1.0 metres above the valley floor, as a result of the mudflow.

The contribution of subterranean rodent excavation to soil erosion in the Loess Plateau, China

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04K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 3, 2026, 9:35 AM - 11:05 AM

The small-scale biogeomorphological feedback might lead to large-scale landscape evolution. However, linking ecological and geomorphic processes across different spatio-temporal scales emerges as the main research challenge. Subterranean rodent excavation activities constitute one of the factors influencing soil redistribution and erosion on hillslopes. Chinese Loess Plateau (CLP) experiences some of the most serious soil erosion in the world, the impact of biotic disturbance remains to be quantified. To explore the spatial distribution characteristics of subterranean rodent excavation activities and their impact on soil erosion in the Loess Plateau, this study conducted six months of fixed-point repeated monitoring on a typical hillslope (665 m2) in Pingdingshan, located in the central part of the Loess Plateau. Utilizing unmanned aerial vehicle (UAV) surveying combined with field investigations, we tracked the spatial distribution of subterranean rodent excavation activities, analyzed their effects on soil properties, and quantified the soil erosion generated by excavation activities on the study hillslope. The results indicate that: (1) Subterranean rodents exhibit a preference for feeding and burrowing activities in areas with gentle slopes, dispersed flow, and convex slope regions. (2) Excavation activities decrease the bulk density of fresh soil mounds by 14% ($P < 0.05$) compared to undisturbed soil, while porosity and saturated hydraulic conductivity increase by 11% ($P < 0.05$). (3) Over the observation period, subterranean rodent excavation activities overturned 0.13 t of soil onto the surface, with an associated sediment transport flux of approximately 2.18 cm3/(cm·a). If all these fluxes were converted into soil erosion, the erosion modulus would be approximately 397 t/(km2·a). These results highlight the significant role of excavation activities in soil redistribution on hillslopes of the Loess Plateau, contributing to approximately 10% of the total soil erosion, which warrants attention in future assessments and modeling of soil erosion and loss.

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Postglacial incision into ice-cored hillslopes: river canyons and thaw slumps in the ice sheet-marginal Canadian Arctic

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11G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 5:00 PM - 6:30 PM

Climate change is reshaping Arctic landscapes, with hotspots of thaw-induced erosion emerging along past margins of the Laurentide Ice Sheet. In the Richardson Mountains of the western Canadian Arctic, reworking of ice-cored tills by retrogressive thaw slumps indicates a resurgence of paraglacial processes. However, previous work suggests that the concentration of thaw slumps in this region may also reflect the incision of postglacial river canyons. We assess this hypothesis in the Aklavik Range, Northwest Territories, where we mapped 217 thaw slumps and reconstructed over 3 m/ky of bedrock canyon incision since the Last Glacial Maximum. We show that thaw slumps occur preferentially near canyon rims, between fluvially incised bedrock and relict till hillslopes, and that slump size scales with normalized steepness. These results support our interpretation that thaw slumps are forming as incision propagates into ice-cored hillslopes. We trace the origin of canyon incision to ice-marginal drainage entrenchment and the postglacial reorganization of drainage in the Mackenzie River Valley. The geomorphic response to deglaciation involves two broad categories of processes: (1) the transport and redeposition of metastable glacial sediments, and (2) the erosion of underlying slopes as the landscape adjusts to postglacial boundary conditions. Our findings explain how extreme permafrost disturbances emerge from coupling of these processes, as postglacial river incision primes hillslopes for paraglacial reworking by thaw slumps.

Soil Salinization Through Coastal flooding: A study in the coastal region of the Indian Sundarban

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04E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 3, 2026, 9:35 AM - 11:05 AM

The low-lying coastal areas of the Indian Sundarban are constantly exposed to numerous hazards. The saline water intrusion through embankment breaching during storm surges is one of the major challenges faced by the local communities. The present study focused on the assessment of coastal inundation during storm surges and its impact on soil salinity. The study was conducted in the Namkhana Community Development Block in Sundarban, India. The inundation map was prepared using Sentinel 1A data. The different topographic zones (i.e., proximal to coast/estuary, proximal to creeks, and central) in both flooded and non-flooded areas are considered to assess the salinity. A total of 154 soil samples were collected from 77 sampling sites at different depths of 0-10 and 30-40 cm and analysed to measure salinity intensity, considering electrical conductivity (EC), pH, and sodium content. Cyclone Aila (2009) caused embankment breaching and created a huge loss by transforming agricultural land into a wasteland, making 600 ponds saline and waterlogged for 4 to 5 months. The results show that the areas facing proximal to creeks tend to have very high EC values (>04 ms/cm), and the flooded areas had high EC values (03-04 ms/cm). The maximum salinity in the flooded areas appears to be highly saline at a depth of 40 cm.

The study revealed a significant change in agricultural land due to the cyclone-induced flood. The study can help identify salt-affected areas and designs for future land use and cropping practices.

Keywords: Storm surge, Coastal flood, Embankment, Salinity

A dynamic modelling framework to link glacier retreat and soil evolution

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The retreating of glaciers in the Alps has been documented since the 19th century and as new moraine is left behind, it develops into soil under the current geomorphic, climatic and biological conditions. As a result, soils located in areas that have been vacated by the glacier for longer have had more time to develop, giving us the chance to observe first-hand how new soils develop in an alpine environment as a function of age and other variables.
The aim of this work is to develop a dynamic modelling framework to simulate soil development in a proglacial area, to test soil formation theories and to assess sensitivity to drivers. The model is an adaptation of the soil-landscape evolution model LORICA, which adopts a mechanistic framework to simulate both geomorphic (e.g. water erosion, creep, landsliding) and soil forming processes (e.g. physical and chemical weathering of soil, bedrock weathering, organic matter formation.).
The framework makes use of the known glacial extent in each year to dynamically expose new soil as the glacier retreats. The area which remains occupied by the glacier at each time-step contributes to the overall water balance, simulating meltwater, but does not contribute any sediments.
This model has been tested and trained with field data collected during 2023 and 2025 sampling campaigns at the Bachfallenferner glacier (Tyrol, Austria). The 2023 dataset was used for model training, while the 2025 dataset was used for model testing . Lithology, organic matter content and soil thickness were measured in the field and then compared to their modelled counterparts. The processes which were simulated are water erosion and deposition, physical and chemical weathering, organic matter development and clay eluviation and illuviation dynamics.
This open-source modelling framework, validated using field data, proved promising in simulating how soils evolve in a fast-changing proglacial environment.

Modelling surface and sub-surface connectivity with a mechanistic soil-landscape evolution model

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09B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 11:35 AM - 1:05 PM

Sediment connectivity, defined as the degree of linkage between sediment sources and downstream sink areas, governs how the sediments could potentially be redistributed in the landscape. This definition usually refers to the static connectivity of the surface, neglecting both vertical interactions in the soil and the time component.

The goal of this work is to compare the Index of Connectivity (IC, Borselli et al. 2008) with the redistribution of sediments simulated with the mechanistic soil-landscape evolution model LORICA, both in the top layer of soil and in a buried soil layer, as the landscape evolves in time.
Creep and bioturbation were modelled for 500 years in an artificial catchment with a single drainage point. At time zero, sand was absent in the landscape, except for a single cell layer. The redistribution of sand was then tracked in time and space. This process was repeated for every cell, obtaining a quantitative estimation of the total quantity of sand summed both for every single time-step and overall, at the surface and beneath.

The preliminary results show that in the channel, higher values of modelled deposition overlap with higher IC values, however the redistribution of the sand around the channel was more gradual in the former. Differences are explainable by considering that the IC refers to potential redistribution, while LORICA calculates how much sediment should be redistributed on the basis of physics. Additionally, sand deposition affects topography, influencing further transport dynamics which are simulated but not captured in the IC.

In the subsurface, the sand was redistributed with a delay compared to the surface.
Overall this approach allowed to further investigate how connectivity affects the both the surface and subsurface and to observe the rate of sediment redistribution, providing further insight into how the system is connected in the spatial and temporal scales.

National Bed Level Rise in New Zealand's Bedload Dominated Coastal Hydro Systems

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11A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 5:00 PM - 6:30 PM

The inundation of lowland rivers due to rising sea levels promotes low-shear stress conditions that tend to favour sediment aggradation and the elevation of riverbeds. This progressive transition away from a long-term geomorphic steady state may lead to sudden and hazardous fluvial adjustments in floods, including avulsion and the inundation of previously unaffected land. For highly dynamic bedload-dominated systems, the potential for aggradation and morphological adjustment is even greater. Despite well-established future sea level rise projections, the extent of bed level responses in the diverse collection of coastal lowland river mouths remains largely unexplored. Here, we have developed a practical approach for assessing bed level change using readily available data on key influencing parameters. This approach was applied to the lowermost reaches of twelve of New Zealand’s bedload-dominated rivers, termed “coastal hydro systems” (CHS), under various climate change scenarios up to 2150. After categorising sites based on their geomorphic class, data was collected on local factors (morphological features, infrastructure, future flow changes), sediment mass balance, and accommodation space from a range of sources and digital modelling tools. Results showed distinct relationships between the available accommodation space and potential rates of sediment accumulation in each geomorphic class. High sediment loading and an abrupt threshold for overbank inundation suggested that hapua-type lagoons such as the Rakaia and Ashley Rivers were the most likely to exhibit high dynamism under sea level rise. Our ability to evaluate response characteristics is limited, firstly by the complexity of morphodynamic processes and feedbacks at the coast and secondly through our highly approximative models of bedload yield and grain-size composition in these rivers. Nevertheless, this first-order ranking of susceptibility among river outlets is a first step in an important task of assessing evolving risk in fluvial and estuarine environments and prioritising adaptation works in a changing climate.

Pingo distribution and morphology across the Arctic Coastal Plain of Alaska

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12G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 9:35 AM - 11:05 AM

Despite the widespread distribution of hydrostatic pingos across Alaska's 60,000 km² Arctic Coastal Plain, no comprehensive database or map of these dynamic ice-cored mounds exists. Previous studies have had limited spatial extents and used differing techniques and criteria. We used 5-m resolution IfSAR-based Digital Elevation Models (DEMs) to detect pingos, measure their morphometry (height, slope, diameter, etc.) and analyze important associations (climate, substrate/geology) that control pingo inception, growth, and collapse across the entire Alaska Arctic Coastal Plain. We identified 3,117 mounds > 2 m high and 786 additional mounds lower than 2 m (possibly degraded pingos). Of the pingos > 2 m high, sizes range 2-64 m in height (5 m mean), 1-18° in slope (4° mean), and 30-800 m in diameter (130 m mean). We used a subset of 1,034 pingos (940 input, 94 withheld for validation) to train an AI-based Machine Learning model using ArcGIS Deep Learning tools to replicate and improve the manual mapping results. The model results show that this approach can help identify additional pingos: overall, the model found 89% of the pingos included in the final >2 m dataset, including 10% that had not been previously identified manually. The model was also trained to distinguish between two suspected morphologies of pingos: so-called "broad-based mounds" and "steep-sided" pingos (the origin of these bimodal morphologies remains to be explained). Within our > 2 m height dataset, 9% of mounds were classified as "broad-based", and we found that these were concentrated in the eastern Coastal Plain. Future repeat analyses of this pingo database (e.g., testing whether the mapped pingos are growing, stagnant, or collapsing) could be used as a tool to detect landscape change and predict areas vulnerable to accelerated subsidence – a pressing issue as infrastructure development of the Arctic accelerates.

Secondary Alluvial Fans: Concept, Setting, and Characteristics

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Observations of satellite images has led to the identification of landscape features that appear to have received almost no attention in the literature to date, here termed “secondary” alluvial fans. The term secondary refers to a hierarchical pattern of fans, where the primary level consists of two adjacent fans along a mountain front. Found between the upper parts of the these primary level fans is a roughly triangular inter-fan depression that funnels water flow towards a point where the boundaries of the fans converge. It is downstream from that point, sometimes at the lower end of a feeder channel that runs in a trough between the two primary fans, where the apex of a secondary fan may be found to exist. Its sources include water and sediment that occasionally flows along the edges of the primary fans, as well as the inter-fan depression and its adjacent highland area. The secondary fan typically has a narrow, elongated form, and is morphologically separate from the neighbouring primary fans, with its own dispersal pattern and distributary channel network on the surface radiating downslope from the apex. Although it is common for adjacent mountain-front fans to merge and have inter-fan channels in a trough between them, distinct secondary fans do not always form between adjacent primary fans. Where they do exist, secondary fans have potential implications for interpreting sources of sediment. Unlike a primary fan that radiates from an apex and is fed by an upland catchment area that can be delimited, sediments on secondary fans would be a mixture derived from the two primary drainage basins, the inter-fan depression, and some highland terrain. This presentation will illustrate the concept, and setting, and morphological characteristics of a selection of secondary alluvial fans.

Application of Luminescence to Characterise Catchment Sediment Routing: Developing a High-Resolution Dataset from the Walnut Gulch Experimental Watershed, Southern Arizona

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Catchment sediment routing from source to sink has implications for landscape evolution, sedimentary archive formation, and water quality management. Tracing the pathways of sediment through periods of transport and storage is therefore critical for understanding these issues. However, methodological limitations often hinder characterisation of sediment routing, particularly over spatial and temporal scales beyond direct observation. Optically stimulated luminescence (OSL) is sensitive to a mineral grain's light exposure (transport) and burial (storage) history, and recent applications suggest potential for characterising sediment transfer mechanisms within catchments. However, the limited number and spatial resolution of existing field datasets have restricted methodological applications. More high-resolution luminescence datasets are therefore needed, particularly for catchments where shorter-term sediment flux data are available and luminescence data can be assessed against hypothesised sediment routing dynamics.

Here, we consider a high-resolution luminescence dataset obtained from the Walnut Gulch Experimental Watershed (WGEW), southern Arizona. The WGEW covers 149 km^2 of semi-arid rangeland and has been intensively monitored since the 1950s, providing a detailed hydrological and sedimentological context. Sub-catchments with contrasting vegetation cover and channel morphologies provide opportunities to assess the extent to which geomorphic controls on sediment routing are captured within luminescence signals. Specifically, we hypothesised there would be differences in sediment routing dynamics between tributaries draining grassland and those draining shrubland-dominated areas. Grassland tributaries are characterised by limited incision, larger floodplain deposits and low sediment yields. Conversely, shrubland tributaries are deeply incised with minimal off-channel stores, implying rapid sediment evacuation into higher order channels. Using several luminescence signals, we sought to evaluate whether channel sediment luminescence captures these differences in sediment routing and storage timescales. We consider the wider implications for using luminescence as a tool to characterise sediment routing, particularly in ephemeral systems, where highly turbid flows may limit bleaching of the luminescence signal during transport.

Variability of the coastal marine morphology using UAV-LiDAR and bathymetric measurements

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Understanding the processes occurring in the coastal zone is of fundamental importance for effective coastal area management, environmental protection, and forecasting the impacts of extreme weather events in the Baltic Sea region.

The aim of the conducted research was to identify benthic habitat areas and analyze seasonal changes in beach and nearshore morphology using modern measurement tools – laser scanning (LiDAR) from an unmanned aerial vehicle (UAV) and bathymetric surveys conducted in the shallow coastal zone.

As part of the pilot studies, 16 measurement campaigns were carried out using a DJI Matrice 300 drone equipped with an L1 LiDAR scanner, which enabled the acquisition of high-precision digital terrain models and orthophotos. To complement the coastal zone model, additional surveys were conducted using a Trimble R12i RTK GPS receiver and an echo sounder. Four bathymetric campaigns were carried out in different seasons along a 600-meter section of the shoreline, covering depths from 1 to 7 meters below mean sea level.

The research provided valuable information on the seasonal variability of the topographic-bathymetric profile and the potential for identifying benthic habitats in the study area. The results indicate significant dynamics within the coastal zone, particularly in response to storm events, which lead to erosion, sediment displacement, and temporary destabilization of the area.
The integration of UAV-LiDAR and bathymetric data allows not only for precise tracking of environmental changes but also forms the basis for further development of automated monitoring systems for the land–sea transition zone. The results obtained are highly relevant for future strategies aimed at protecting coastal ecosystems in the context of the growing impact of global climate change.

Understanding the subsurface architecture of slow-moving landslides: a geological-geomorphological perspective from the Brandstatt Landslide Observatory in Austria

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01C: State-of-the-art and new perspectives in long-term monitoring and analysis of landslide dynamics, Dobson 2, February 2, 2026, 11:40 AM - 1:10 PM

Slow-moving landslides represent a long-term geological and geomorpholgical hazard, particularly in low-relief mountain ranges where they threaten infrastructure and socio-economic aspects. However, their slow and progressive movement often prevents accurate monitoring of the displacement evolution and leads to underestimation in hazard and risk assessments. These processes typically exhibit non-linear responses to hydrological triggers (e.g., intense or prolonged rainfall) and anthropogenic modifications, resulting in slope deformations that may persist for years or decades.

A detailed geomorphological understanding of such slope instabilities requires insights into both surface and subsurface parameters, including lateral variations in landslide geometry and material heterogeneities influencing slope behavior. In this context, the present study focuses on the Brandstatt landslide in Lower Austria (NE Austria), presenting an integrated, multi-method investigation aimed at advancing the spatial and temporal characterization of landslide dynamics and evolution.

This work underlines the value of combining geophysical methods to delineate the internal architecture of the landslide, particularly in identifying the spatial variability in lithological interfaces and preferential shear surfaces that are often beyond the resolution of conventional geotechnical investigations. By integrating geomorphological mapping, long-term in situ monitoring, and geophysical imaging, we establish a framework to (i) map the geometry and spatial extent of shear surfaces and (ii) interpret the complex interactions driving variations in displacement rates during episodic acceleration phases.

This approach broadens the connection between surface and subsurface structure, enhancing the robustness of conceptual models and numerical simulations. Our findings highlight that the integration of geophysical data into geomorphological investigations not only refines the delineation of landslide boundaries and shear surfaces but also supports local authorities in the implementation of effective mitigation strategies. Ultimately, this study contributes to a deeper understanding of how subsurface variability controls the evolution of slow-moving landslides and offers a transferable methodology for hazard assessment in similarly complex geological settings.

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The Hofermühle socio-natural landslide: Unravelling complex dynamics through interdisciplinary monitoring and numerical modeling

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01J: Denudational Dynamics and Hazards in a Changing Environment, Conway 5, February 2, 2026, 11:40 AM - 1:10 PM

Landslides are increasingly recognized as "socio-natural hazards" as many of them result from interactions between physical processes and human interventions on slopes. The region of Lower Austria exemplifies this dynamic, where anthropogenic interventions interact with denudational processes. The Hofermühle landslide, a reactivated mudflow system in the Redtenbach catchment (Waidhofen a.d. Ybbs), illustrates this feedback. It is characterized by the convergence of lithological susceptibility (Flysch and Klippen Zone), hydrometeorological triggers (rainfall and snowmelt), and human interventions, notably subsurface drainages whose poorly mapped locations and characterization are still an ongoing challenge for hazard assessments. Despite the growing recognition of human-landscape interactions, their role in altering preconditioning and triggering mechanisms remains a critical gap in current hazard assessments. This study sets out to investigate how anthropogenic interventions modify the hydro-mechanical response of a complex slope system. This study addresses this gap by integrating long-term monitoring (NoeSLIDE), citizen science, time-series analysis, and numerical modeling to investigate and simulate the impact of human interventions on hydrometeorological processes and thus slope stability. Preliminary results from in-situ sensors (piezometers and inclinometers) reveal episodic seasonal accelerations linked to seasonal rainfall and snow-melting periods. Time-series analysis highlights the role of antecedent groundwater conditions and dynamic preferential flow paths in reactivation, while numerical models (transient seepage analysis and slope stability models), and citizen records demonstrate persistent feedback between land-use changes, drainage systems, and slope stability. Citizen science initiatives have also bridged historical data gaps and fostered community engagement in hazard monitoring. The Hofermühle landslide demonstrates the need to integrate social dimensions into our current methodological approaches to better understand anthropogenic processes and natural hazard interactions. By integrating geomorphological, hydrological, geotechnical, and social information, this work advances in the quantification of human-induced feedbacks on landslide reactivation, an approach not yet applied in the region of Lower Austria.

Insights into Shallow Coseismic Submarine Landslides at the Kaikōura Canyon Headwall Following the 2016 Kaikōura Earthquake, New Zealand.

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06E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 2:30 PM - 4:00 PM

Submarine canyons are important conduits transferring sediment to deep ocean basins, yet the processes driving sediment mobilisation from canyon headwalls during earthquakes remain poorly constrained. This study investigates the geomorphic response of the Kaikōura Canyon head to the 2016 Mw 7.8 Kaikōura earthquake using high-resolution (0.5–2 m) bathymetry acquired pre- and post-earthquake. We quantify sediment volumes, and geomorphic change to better understand failure dynamics. Geotechnical analysis of shallow gravity cores evaluates how material properties influence landslide size and distribution.

Approximately 11.2 Mm^3 of sediment was mobilised from the canyon headwall, with an average retreat of 17 m—equivalent to ~25% of the total terrestrial volume. Digital elevation model differencing reveals volumes up to three times greater than estimates based on empirical relationships from post-event imagery. We mapped 850 landslides, 75% of which initiated as shallow (<10 m) debris slides transitioning to debris flows or avalanches. Deep-seated failures (10–40 m), mainly in canyon heads, accounted for 4% of failures but contributed ~22% of the total volume.

Integration of geomorphic mapping, pre-earthquake seismic profiles, cone penetration testing, and analysis of 18 gravity cores shows shallow slides were confined to modern or reworked surficial sediments, while deeper failures were associated with thicker post-glacial deposits. Sediment cores consist of homogenous clayey silt, with moderate plasticity (PI: 11–20), low undrained shear strength (3–20 kPa), and a peak friction angle of ~35°. Failure surface geometries, slope gradients, and sediment thickness suggest material property changes at depth control landslide initiation.

This study provides new insight into the initiation of coseismic submarine landslides, demonstrating that small shallow failures are dominant but often underrepresented, underscoring the value of repeat high-resolution, multidisciplinary approaches for understanding marine slope hazards on active margins.

Implementation of Nature-based Solutions for Sustainable River Management in Korea and Their Effects

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

River management reliant on gray infrastructure has demonstrated efficacy in the short term; however, it has also revealed limitations in preserving the ecological and geomorphological functions inherent to rivers. In an age increasingly defined by the climate crisis, where ecosystem resilience and connectivity are prioritized, Nature-Based Solutions (NbS) emerge as promising alternatives for sustainable river management. This study investigates the potential of NbS within the context of Korean river management by analyzing domestic case studies and assessing their effectiveness.
We identified river improvement projects as exemplary instances of NbS and evaluated their impacts through a quantitative analysis of hydrological changes occurring before and after the implementation. We selected a total of 21 sites where the NbS technique was implemented. Specifically, we focused on areas where a reservoir was established using former river channels and where river-crossing structures had been removed.

The establishment of the retention basin led to a decrease in peak water levels and a reduction in the rate of water level rise, with more pronounced effects observed downstream as opposed to upstream of the basin. In areas where crossing structures were removed, the riverbed morphology returned to its natural state, and significant improvements were noted in water quality indicators, including BOD, COD, T-N, and T-P. The direct impacts of these interventions extended approximately 0.8 km upstream and 0.2 km downstream from the site of removal.

These findings illustrate that Nature-Based Solutions can be highly effective in practical river management. Furthermore, they suggest that NbS has the potential to enhance river resilience and facilitate the transition to sustainable management systems, transcending the mere replacement of existing infrastructure.

Sediment dynamics in urban gravel bed rivers

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11I: Urban Streams: From Long Trajectories to Restoration Issues and Hazard Management, Conway 4, February 5, 2026, 5:00 PM - 6:30 PM

The hydrological and morphological consequences of urbanization in river catchments are well documented. Numerous studies have shown that soil sealing associated with urban expansion increases the frequency and magnitude of floods, leading to dramatic transformations in riverbed geometry and, ultimately, the alteration of the river's ecological quality. In gravel bed rivers, the flashiness pattern typical of floods in urban areas, along with increased runoff, promotes sediment mobility and favors erosion. Consequently, urban streams are often deeply incised and characterized by a lack of alluvial particles. This new condition of the riverbed results in habitat loss and reduces the river's restorability. While the loss of gravel load is often linked to river incision, very few studies have focused on the dynamics of gravel bedload in European urban rivers. In this study, we examine how the rapid urbanization of a small catchment in the Paris metropolis has caused significant changes in the composition of bed sediments and their transport conditions. Although some reaches of the river still feature small mobile bars, up to 25% of the particles have a human origin (e.g. bricks, concrete, glass). The riverbed on which these particles travel is either armored or consists of long sectors of bedrock outcrops. These new compositions of the riverbed have modified its rugosity and, combined with the incised geometry of the channel, amplify the consequences of urban-induced floods. Finally, we discuss whether alternative solutions to heavy restoration techniques (e.g. gravel augmentation) could be considered to address these issues and improve the ecological functioning of these heavily impacted urban environments.

Determining fault-slip histories in challenging regions of extensive tephra accumulation in the Taupō Volcanic Zone

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Accurate fault-slip histories are pivotal for constraining the earthquake hazards presented by the extensive array of normal faults in the tectonically active Taupō Volcanic Zone. Paleoseismic studies in tephra-filled valleys that bracket the Ōkataina Volcanic Centre have produced high resolution fault-slip histories. These valleys provide ideal sites for trenching due to the relatively thin and well-dated tephra stratigraphy originating from Ōkataina. However, the fault network north of Taupō Volcano (the North Taupō Fault Zone) is comparatively understudied, likely due to the areally extensive products of the 232 CE Taupō eruption, which fill valleys with up to 30 m of ignimbrite, burying fault scarps and obscuring fault-slip histories. To address this issue and better constrain earthquake hazards in the North Taupō Fault Zone, we have utilized ground penetrating radar (GPR) and paleoseismic trenching to investigate the fault-slip history of the Kaiapo Fault.

Trenching localities were selected on the northern portion of the Kaiapo Fault, where it bifurcates into numerous smaller strands that generate landforms in the Taupō ignimbrite, exhibiting <5 m-high scarps. Because the 232 CE Taupō ignimbrite pools and overthickens into paleo-lows, sites on ridgelines and on paleo-highs were preferentially targeted for investigation. Additionally, GPR surveys were used to identify along-strike segments where the Taupō ignimbrite would be thin enough for paleoseismic trenching to be effective. Deep (~5 m) trenches best captured the tephra stratigraphy on either side of the Kaiapo Fault.

Our approach to date was applied to three strands of the Kaiapo Fault and revealed at least seven seismic events over the last 25.5 ka. Adoption of our approach for paleoseismic trenching will facilitate the collection of an extensive paleoseismic database in the North Taupō Fault Zone equivalent to that of the region surrounding Ōkataina Volcanic Centre.

ENVIRONMENT, GEOHAZARDS AND SOCIETY: THE ORIGINALITY OF MONTANHAS GEOPARK PROJECT (BRAZIL)

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07I: Geomorphology for geoconservation, Conway 4, February 3, 2026, 5:00 PM - 6:30 PM

The Montanhas Geopark project, located in the northern part of the largest passive margin escarpment in South America, has as its mission, in addition to safeguarding a remarkable geoheritage and promoting local development, that both goals are linked to the valorization of mountains and mass movements as heritage and the reduction of risks in the territory. The objective of this work is to present the strategies related to geoheritage, geotourism and geoeducation articulated with the originality of the project and the identity of the territory proposed for the Montanhas Geopark (Rio de Janeiro, Brazil). Marked by recurrent environmental disasters, the territory encompasses the municipalities of Petrópolis, Teresópolis, Nova Friburgo, Magé, Guapimirim and Cachoeiras de Macacu, whose population of approximately 1 million people is highly exposed to mass movements and flash floods. As geoheritage, geosites will be designated as representative features of the dominant processes in this landscape (landslides and debris flows), associated with the genesis of this mountainous relief that, conserved by different protected areas (e.g. Serra dos Órgãos National Park and Três Picos State Park), demonstrate a historical-cultural connection between people and this landscape; in geoeducation activities, it is expected that heritage sites linked to geomorphological processes and disasters will be the link between the geopark and education for risk and disaster reduction in formal and informal environments; and a geotourism perspective that contemplates the qualification (and resignification) of visitation associated with mountaineering based on the environmental interpretation of geodiversity. This project is in line with the Geoparks: resilient territories program and is in accordance with the urgent global demands for adaptation to climate changes for an environmentally appropriate and fair model, according to the specificities of the location.

A National Inventory of New Zealand's Riverscapes

Dr Rodrigo Gomez Fell[1], Dr Philip Bailey[2], Mr Lorin Gaertner[2], Dr Jordan Gilbert[4], Prof. Joe Wheaton[3], Prof. James Brasington[1]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Contemporary river management in Aotearoa | New Zealand demands tools that are scalable, geomorphologically informed and capable of supporting nature-based, process-led interventions. In this paper, we present the use of the Valley Bottom Extraction Tool (VBET) and the broader Riverscapes Waterfall Model in New Zealand's diverse and dynamic fluvial environments. Originally developed in the United States for national-scale applications, Riverscapes has now been successfully adapted for use in New Zealand, making it the second country to implement the framework comprehensively.

The VBET algorithm was calibrated using data from 17 representative catchments across diverse landscape settings. Ground truth points were collected interactively from national orthoimagery to classify the active channel, active valley, inactive valley, and hillslope. By incorporating empirical evidence of channel changes and valley morphology, the calibrated model enables accurate and scalable delineation of valley bottoms. This captures the full spatial extent of dynamic riverscapes, which are defined as the active channel and floodplain within the broader valley margins.

A key outcome of this work is the ability to analyse lateral mobility and frequency of occupation of the dynamic, mobile rivers in New Zealand at multiple scales. The results are summarised using a longitudinal network of Discrete Geomorphic Objects (DGOs), which serve as modular units of analysis. Custom attributes assigned to each DGO facilitate quick assessments of river conditions, restoration potential, and exposure to hazards. By utilising terrain indicators such as Height Above Nearest Drainage (HAND) and valley slope, we can systematically and automatically delineate valley bottoms across various geomorphic settings in a reproducible manner.

This approach transitions river understanding from traditional one-dimensional models to two-dimensional, process-based representations of river corridors. The New Zealand Riverscapes initiative offers a comprehensive, open-source platform to prioritise restoration, identify resilience hotspots, and enable national-scale planning capabilities previously constrained by resource-intensive methods.

Reconstructing Dynamic River Trajectories using Archival Remote Sensing

Dr Rodrigo Gomez Fell[1], Prof James Brasington[1], Dr Justin Stout[1]
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03H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 4:00 PM - 5:30 PM

Understanding the trajectory of dynamic fluvial landforms requires long-term, spatially explicit observations of channel change. In this study, we quantify the lateral mobility of braided rivers across Aotearoa New Zealand using over three decades of Landsat satellite imagery processed within the Google Earth Engine (GEE) platform. Our workflow combines pixel-based classification with statistical frequency modelling to detect and characterise patterns of river mobility through time. Specifically, we delineate active channels, wetted channels, and riparian vegetation using spectral indices and rule-based masks, and structure time series into 1-year, 5-year, and 30-year epochs.

We compute per-pixel transition matrices, change frequency metrics, and trajectory analyses to evaluate river behaviour across multiple timescales. These allow us to identify highly mobile areas and spatial patterns of confinement. By quantifying the probability of class occupancy and transition, we generate metrics of geomorphic stability and dynamism, identifying stable zones and areas undergoing frequent morphological adjustments.

Our analysis is spatially constrained and geomorphologically informed, utilising valley bottoms delineated through the VBET (Valley Bottom Extraction Tool) from the Riverscapes framework. This approach enables us to contextualise channel activity within the broader fluvial corridor and compute confinement ratios and mobility gradients across valley floors.

The results reveal hotspots of channel activity and sediment reworking, and distinguish river reaches constrained by anthropogenic modification from those with greater spatial freedom. This work demonstrates how multi-decadal Earth observation archives can support a process-based understanding of braided river evolution, highlighting the relationships between lateral mobility, valley confinement, and anthropogenic influences.

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Impact of Land Use and Geomorphological Dynamics on Water Provision in Mediterranean Mountain Catchments (Jerte and Ibor, Spain)

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Water provision is a key ecosystem service largely supplied by mountainous regions. In the Mediterranean region, the increasing pressure on water resources makes it essential to understand the complex consequences of human-induced landscape modifications. This study analyses the relationships between water provision, geomorphological dynamics, and land use in two mountain catchments with a Mediterranean climate and in the last decades: the Jerte and Ibor river basins in western Spain. We used Corine Land Cover data and historical imagery to create land use maps spanning from 1980 to 2022. For the geomorphological dynamics, we utilized DEMs generated from LIDAR data for the period 2010-2018. Finally, for water provision, we used data from gauging stations located at the outlet of both catchments from 1980-2022.

Our results show different dynamics in the two study areas. In the Jerte basin, we found significant changes in land use (increase in forested areas and woody crops, mainly fruit trees and decrease in natural grasslands) and a decline in annual average flow (8.9 m^3/s for 1980-1999 vs. 7.5 m^3/s for 2000-2021) and discharge (21.4 hm^3/y for 1980-1999 vs. 19.5 hm^3/y for 2000-2021). From a geomorphological perspective, the main changes in Jerte were anthropogenic, including terracing and the construction of ponds, being both terrain modifications built for cherry cultivation. In the Ibor basin, no relevant changes in land use or cover were recorded and flows and discharge showed no trend for the 1980-2021 period. The primary geomorphological changes in Ibor from 2012 to 2018 were related to fluvial dynamics and the erosion of cultivated slopes. The differentiated response of these two catchments highlights the significant impact that land use and human-induced surface modifications (i.e. anthropogenic geomorphological changes) can have on key ecosystem services like water provision.

Multiscale automatic geomorphological mapping using 3D point clouds

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04H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 3, 2026, 9:35 AM - 11:05 AM

The production of detailed geomorphological maps typically requires expert supervision and relies on 2D (orthophotographs, geological maps) and 2.5D (digital elevation models, hillshades, etc.) information. This study leverages fully three-dimensional (3D) point cloud data, acquired from the same hillslope at two different dates (2018 and 2023) to automatically classify active geomorphological processes. Initially, active geomorphological processes were mapped using the point clouds and the 3D distances between the two clouds (M3C2 distances or DM3C2). This mapping served as the dependent variable, comprising five distinct classes: multiple erosion processes (without incision), channel cutting, channel filling, debris flow and stable. As predictor variables, the DM3C2 and 97 geometric parameters describing the morphology of the 2023-point cloud were used, calculated at various spatial scales (varying analysis radius of 1, 2, 5, 10 and 20 m). Machine learning techniques were employed to select the most relevant predictors and automatically classify the processes on the 2023 cloud. Among the developed models, the treenet gradient boosting technique demonstrated superior performance. Subsequently, an optimization of its involved parameters was conducted (number of terminal nodes and trees to build, proportion of training and test datasets, trimming, etc.). The optimal model, featuring 27 independent variables, classified the points in the cloud with an accuracy exceeding 95%. The generalization capability of the model was assessed by applying it to a neighbouring study area where similar processes have been observed. While the results indicated a lower performance compared to the pilot hillslope, validation statistics showed classification accuracies of over 85% for all processes. The most important independent variables were the DM3C2 itself, verticality, the third eigenvalue, the normal change rate, and anisotropy. These types of approaches hold the potential to enable rapid and efficient detailed geomorphological mapping.

High-resolution monitoring of rocky coast erosion: insights from UAV surveys and TMEM measurements

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Understanding erosion dynamics in rocky coastal environments is essential to assess geomorphological evolution and coastal hazard risks under current and future climatic conditions. In this study, we present an integrated approach combining high-resolution UAV data with TMEM measurements to monitor and quantify erosion processes.

The use of these datasets has allowed us to compare how erosion happens on a coastal platform and a boulder beach, showing which areas are most at risk and connecting small-scale erosion details with larger changes in beach shape. This analysis demonstrates spatial variability in erosion rates based on wave exposure or micro- and mesotopographic features.

This study was carried out in a region that had previously been examined using different methods, like RFID sensors, on the southern coast of Galicia (NW Iberian Peninsula). This database provided comprehensive comparisons of coastal dynamics for at least the previous ten years. The southern part, which is most susceptible to storms from the northwest, and the center sector, where boulder redistribution could increase rock erosion, have shown especially erosive behavior.

High-resolution data show how coastal erosion changes over time in the study area. This approach improves the capacity to monitor boulder beaches and helps in the creation of better models for predicting future changes, especially in the context of rising sea levels and more frequent storms, by combining remote sensing with on-site measurements.

RFID-based monitoring of clast transport in Antarctic streams: a preliminary study from Byers Peninsula (maritime Antarctica)

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

This research provides a preliminary exploration of using (Radio Frequency IDentification) RFID sensors to study sediment mobility in polar streams, with a focus on Byers Peninsula (Livingston Island, maritime Antarctica). A total of 240 sensors were implanted across three catchments (Streams 1, 5, and 18) and monitored from January 2023 to February 2024. Displacement data were gathered using a Differential Global Positioning System (DGPS), resulting in a recovery rate of 61.3%. Overall, 44.6% of the tagged clasts exhibited detectable movement, with an average displacement of 56.3 m and a standard deviation of 89.6 m. The maximum observed transport distance reached 683 m. Results show considerable spatial variability in clast mobility, influenced by stream morphology, slope, and the presence of snow. Notably, sector 1 of stream 1 recorded the highest average displacement (95.6 m) and the longest individual transport event. In contrast, other sectors, such as sector 3 of stream 5 and sector 2 of stream 1, exhibited lower mobility, with average displacements of 19.5 m and 24.4 m, respectively.

RFID-based monitoring has proven to be an effective technique for evaluating sediment dynamics in remote and logistically challenging environments. Although some limitations were encountered, particularly in sector 2 of stream 5, where snow cover hindered detection. These findings demonstrate the potential of RFID technology for long-term, high-resolution studies of fluvial dynamics in polar regions.

Storm deposits in a gravel and boulder pocket beach at the mouth of a karstic canyon (Torrent de Pareis, Mallorca).

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Pocket beaches within coarse karstic canyons represent a rarely studied geomorphological setting, yet they offer valuable insights into coastal morphodynamics under constrained geological and hydrodynamic conditions. This study focuses on the Torrent de Pareis, a major karstic canyon in the Serra de Tramuntana (NW Mallorca, Balearic Islands), which drains a 46.5 km² catchment and descends 627 meters before reaching the coast. At its terminus, the canyon hosts a small pocket beach (c. 20 m long), enclosed by vertical limestone walls and fronted by a gravel and cobble spit that isolates a series of shallow lagoons from the Sa Calobra inlet. Despite its sheltered appearance, the beach remains exposed to episodic yet intense storm events driven by Tramontana and Mistral winds.

Post-storm observations reveal a complex array of sedimentary features distributed across the spit, including ridge-like accumulations of coarse sands and gravels, and digitated overwash lobes on the landward side. Sedimentological analysis indicates that the spit is dominated by well-sorted medium gravels (-3 to -4 phi), primarily composed of calcareous clasts derived from Jurassic limestones. Most clasts are isometric and spherical, suggesting a fluvial origin, although a minority of flattened forms indicate coastal reworking.

The foreshore exhibits moderately well-sorted fine gravels (-2.94 phi), while the breaker zone contains poorly sorted very fine sandy gravels (-0.94 phi) enriched with bioclasts such as bivalve and gastropod fragments. Superimposed on the spit are six poorly sorted gravel ridges (-0.91 to -1.86 phi), compositionally similar to breaker zone sediments and characterized by ochre-hued sands and bioclasts. These features are interpreted as storm deposits, corroborated by the presence of digitated overwash lobes on the inner slope of the spit.

Overall, this work contributes to the understanding of coarse pocket beach dynamics in karstic canyon environments, with implications for sediment transport processes and coastal hazard assessments.

Biologically Mediated Rock Decay in Coastal Limestone Pools: Experimental Development of Nanomorphologies in an Environmental Cabinet

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02F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 2:00 PM - 3:30 PM

Carbonate rocky coasts dominate many temperate and low-latitude shorelines, where coastal morphology is shaped by a complex interplay of physical, chemical, and biological processes. Among the characteristic features of these environments are coastal karren—microrelief forms resulting from the surface dissolution of carbonate rocks. These forms often develop across the intertidal and supratidal zones and are strongly influenced by bio-induced weathering. Within these karren systems, basin pools (or rock pools) represent key microhabitats, exhibiting elliptical to irregular morphologies with flat bases and steep or undercut walls shaped by basal corrosion. Their development and internal dynamics are modulated by coastal position, water depth, microclimate, and the presence of biological communities.

Despite substantial research into terrestrial karren and stone weathering, the nanomorphologies associated with weathering processes in coastal basin pools remain underexplored. This study addresses this knowledge gap by investigating the micro- to nano-scale weathering features across various surfaces within limestone basin pools. Simulated conditions representative of Mediterranean coastal karren environments were recreated in a controlled environmental chamber. Experimental rock tablets—both colonised and non-colonised—were placed in conditions mimicking different basin pool microenvironments (e.g., flat, dry, humid, and vertical surfaces).

Scanning Electron Microscopy (SEM) was used as a semi-quantitative tool to analyse the surface nanomorphologies and associated biofilms. The results reveal notable differences in the abundance, type, and spatial distribution of weathering microfeatures between colonised and non-colonised tablets. Colonised surfaces exhibited greater surface complexity, suggesting an amplifying role of biological activity in carbonate rock decay at the nanoscale.

The findings contribute to broader interpretations of carbonate coastal evolution and the ecological significance of microhabitats within rocky shore environments.

From Site to Regional Scales – Applications of Geophysics to Understanding the Cultural and Environmental Context in Coastal Peru

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10F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 2:30 PM - 4:00 PM

Geophysics have been applied to archaeology research for decades. Historically, geophysical techniques have been used to identify aspects of a site and to locate areas of cultural heritage. More recently, geophysics, coupled with geological methods, have resulted in a more holistic approach to understand a site and its evolution, and to link how cultures and environments have interplayed. With the advances of techniques and tools like LiDAR, 3D GPR, rapid electromagnetics, magnetics and electrical resistivity tomography, the linkage between geophysics, geology, and archaeology has moved into understanding the regional scale by asking questions that include how did/do landscape processes create a landscape that supports the activities of society and how did/does the landscape process impact the society.

Over several field seasons, a team of geologists, geophysicists, and archaeologists investigated a site in south coastal Peru. Initially, the research activities were confined to the site to understand site context. However, after discovering evidence of a fault underlying the site, the focus shifted to understanding the settlement patterns throughout the southern portion of the valley. The team moved northward, using ERT to trace the fault at areas in close proximity to other archaeology sites that were on trend. The electrical data was supplemented with GPR to identify palaeochannels at the site scale. These data were coupled with regional topography and drainage mapping to identify possible linkages between sites and former river channels. At present, we have identified a trend that places early settlements along palaeochannels and astride the fault complex. While we have identified a spatial component, we have not yet established a chronological linkage between the sites and landscape processes that would have resulted from channel avulsion and earthquakes.

Geomorphological effects of the 2024 catastrophic rainfall and flood in Spain – lessons for geohazard management in the changing climate

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Catastrophic floods and mass movements occurred between 29.10 and 16.11. 2024 in eastern and southern Spain, particularly in the Valencian Community, Castilla–La Mancha and Andalusia. The most severe event of 29 October 2024 resulted in over 230 fatalities, over 36,000 evacuated and substantial infrastructure damage, as torrential rains related to the so-called “gota fría” (cold drop, or DANA) brought precipitation exceeding in some areas the annual total. These abrupt phenomena provided a unique opportunity to study the geomorphological effects of extreme hydro-meteorological events. In this study, we aimed to record these effects as they are fresh, still unvegetated and not disturbed by reconstruction works. The record of the flood in relief and deposits of river valleys brings insight into the course and conditions of inundation, alluviation, the role of mass movements and erosion on slopes in delivering material to channels, etc., all vital for improved management of hazards in the future, in the study area particularly vulnerable to climate change. Thus, in our study, we selected two sections of the valley floors located in the Magro River catchment (east of Valencia), mapped their post-event topography and compared it against pre-event satellite imagery of the area. We also aimed to determine the distribution of potential sediment source areas upstream of our study sites. We used pre- and post-event satellite imagery, field measurements and dendrochronology to estimate erosion rates and the volume of material released from slopes to valley floors during the 2024 DANA event.

The study was funded by the Polish National Agency of Academic Exchange NAWA, Urgency Grants Programme, grant number: BPN/GIN/2024/1/00033.

The role of subsurface erosion in the evolution of rectangular valley systems along Kasei Valles, Mars

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rectangular drainage patterns, characterized by straight valley segments and right-angle bends and junctions, are observed across planetary surfaces. Rectangular patterns are commonly considered structurally controlled landscapes since, in terrestrial settings, their geometry typically aligns with pre-existing orthogonal fracture networks. While rectangular valleys have been identified on Mars, their formation mechanisms and paleoenvironmental implications remain underexplored.
We investigate a set of rectangular valley systems on elevated terrain near the northern sector of Kasei Valles, the largest outflow channel on Mars. In addition to their rectilinear geometry, these valleys exhibit elongated sinkholes and topographic 'bridges', which are elevated valley segments that locally preserve the pre-incision surface.

To interpret their origin, we draw on a terrestrial analog: the Wadi Pratzim system in the hyper-arid Dead Sea Basin, Israel. This system displays similar features of a rectangular pattern, straight banks, aligned sinkholes, and surface bridges. Recent work has suggested that these features result from subsurface erosion along pre-existing fractures, forming pipe caves that collapse into sinkholes. As sinkholes coalesce, they evolve into open-air tributaries, preserving the original subterranean drainage path. Bridges in this context are remnants of uncollapsed cave roofs.

Morphometric analysis of the Martian rectangular valleys using CTX imagery and MOLA PEDR reveals a consistent base level, likely corresponding to a former erosional surface of Kasei Valles. Valley floors gradually slope toward this base-level and are punctuated by collapsed material and preserved bridges, consistent with progressive roof collapse.

The similarity between the rectangular systems in Kasei Valles and Wadi Pratzim supports fracture-guided groundwater flow and subsurface erosion as a dominant mechanism for forming the rectangular Martian valleys. These findings reinforce previous suggestions that groundwater erosion played a key role in shaping Mars' surface and highlight subsurface voids as potential natural shelters for future crewed missions to Mars.

Inferring Martian Paleoclimate from the Planform Complexity of Valley Networks

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02D: Planetary Geomorphology, Dobson 3, February 2, 2026, 2:00 PM - 3:30 PM

Branched valley networks on Mars, mostly dated to the late Noachian, are among the strongest geomorphic indicators of an ancient hydrologic cycle. While their existence suggests surface runoff, the climatic conditions that supported their formation remain elusive. To constrain these conditions, we apply and analyze a recently developed planform morphometric metric, referred to as drainage complexity, which has been shown to correlate with both the channel concavity index and the aridity index for terrestrial, bedrock-incising, branching channel networks.

Drainage complexity quantifies the degree of flow path tortuosity at the spatial scale of a basin. It is evaluated based on the distribution of normalized lengthwise asymmetry between paired flow paths that diverge from common divides and rejoin at a channel junction. Similar (symmetric) lengths across a pair indicate simplicity, whereas differing lengths (asymmetry) indicate a complex network. A recent analysis of terrestrial fluvial bedrock basins revealed that drainage complexity correlates positively with (i) channel network concavity index, the exponent of the power law relation between channel slope and its drainage area, and (ii) the aridity index, the ratio between precipitation and potential evapotranspiration. Low complexity networks are characterized by low concavity index channels, and they develop in arid conditions. The relation between drainage complexity and the concavity index is further supported by an analytic model and energy-based simulations. Translating this method to Mars required adapting the approach, as drainage divides are often unresolvable. We treat Martian valley networks as binary trees and identify channel head pairs based on topological constraints and relative geographic proximity.

Our analysis reveals that Martian valley networks exhibit drainage complexity values equivalent to terrestrial systems with a relatively low concavity index and formation under arid-like climate conditions. This result independently supports recent studies that inferred similar conditions based on branching junction angle statistics.

An improved method for constraining postfire debris-flow volume in the western United States

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12D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 9:35 AM - 11:05 AM

Debris flows that initiate following wildfire, commonly referred to as postfire debris flows, are a growing hazard around the world, driven by changes in wildfire activity and increasing urbanization. These hazards pose a serious threat to downstream communities and can result in the loss of human life, damage to downstream infrastructure, and degradation of water quality, necessitating the development of tools that can be used to mitigate the impact of future flows. Methods for accurately estimating debris-flow volume are especially important for reducing downstream impacts, as volume is a first-order control on the area inundated by postfire debris flows. Here we introduce a new empirical model for predicting postfire debris-flow volume in the western United States as a function of rainfall, watershed terrain, and fire characteristics. This model improves on previous volume models by accounting for regional differences in the characteristics of debris-flow-generating rainfall through a rainfall anomaly metric that normalizes the peak 30-minute rainfall intensity of a debris-flow-producing storm by the intensity of a 1-year recurrence interval storm. The model was also developed using a larger, more geographically diverse dataset of postfire debris-flow volumes compared to previous models. Results show that the new model outperforms three previously published volume models when applied in scenarios across the western United States and that it may improve postfire hazard assessments, especially outside of southern California. We also explore several variables related to regional differences in sediment supply that may influence volume to assess whether they may further improve predictions of postfire debris-flow volume.

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Quantifying seasonal ecohydrological roughness along river corridors using environmental sensing techniques

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Despite the importance of floodplain vegetation in fluvial geomorphology, current research is dominated by an ecological perspective which misses the bi-directional feedbacks between ecological and fluvial geomorphological processes. Prior studies have focused attention on the roles of climate and fluvial disturbance in controlling river corridor vegetation dynamics but mostly focus on trees and specific attributes. In contrast, less attention has been paid to the role of understorey vegetation within fluvial systems, despite its potential role in modulating overbank flow (roughness), stabilising banks, and sequestering carbon. Here we define 'understorey' vegetation to mean all biomass up to a metre above the ground, irrespective of it being under a canopy or not.
Within this context, this research aims to quantify how hydraulic roughness and understorey vegetation co-vary seasonally along river corridors representing different disturbance regimes and river types, by quantifying understorey vegetation structure and its interactions with flow. Here we present work that is focused on Highland Water, a small flashy stream in the New Forest, as well as seasonal surveys of the River Teme, UK. The sites have riparian vegetation dominated by a grazed deciduous canopy in addition to log jams promoting overbank flow. The structural complexity of riparian and floodplain understorey vegetation is captured from complementary methods to ensure comprehensive coverage of all relevant above ground biomass. These include terrestrial and mobile laser scanning as well as UAV LiDAR, RGB and multispectral imagery. Monthly surveying along with hydrological monitoring is conducted at Highland Water to capture leaf-off and leaf-on conditions, enabling links between phenological cycles, light availability, and understorey growth patterns to be explored in the context of variable fluvial disturbance. The interactions between understorey vegetation, fluvial disturbance, and subsequent morphology are being examined to identify the processes occurring and how they vary in both space and time.

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Geomorphological and geological properties of tunnel ground and measurements of muon counts by compact cosmic ray muon detectors

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05H: Providing 2D & 3D Subsurface Imagery of Geomorphic Environments: Ground Penetrating Radar and Near-Surface Geophysics, Conway 3, February 3, 2026, 11:35 AM - 1:20 PM

Muon detectors used in previous studies are often large and inconvenient to carry, making it difficult to measure at multiple measuring locations. There are several methods for measuring muons, but they are generally performed using a large measuring device with scintillators arranged in parallel. The device is complex and expensive, which is a barrier to its application in increasing the number of observation objects.

The main purpose of this study is to investigate the usefulness of a density estimation method using a compact muon detector and measuring natural and artificial ground as close to the objects as possible. Since it is easy to carry, it is possible to get as close as possible to the objects, and it can be installed on close outcrops, especially in order to understand the internal structure of the ground surface layer. If a method for understanding the internal structure of an object using a compact muon detector is established, it will be possible to easily maintain and manage infra-structures.

In this study, a detector was manufactured based on a compact muon detector (Cosmic Watch) opened by MIT. By connecting two detectors with an audio cable, it is possible to detect only muons that pass through both detectors simultaneously. The number of muon counts measured was converted to the number of muons arriving per unit area, unit time, and unit 3D angle (muon flux) for comparison.
By installing this compact muon detector inside a tunnel, it is possible to measure muons passing through the ground above the tunnel. Furthermore, by carrying and moving this small muon detector in the longitudinal direction of the tunnel, it is possible to continuously grasp the geomorphological and geological structure above the tunnel in the longitudinal direction.

Scaling Up Riverbank Erosion Monitoring: A Lidar-Based Framework for the Entirety of Australia's Longest River

Mr Thom Gower[1], Dr Geoff Vietz[1], Kira Woods[1], Nicole Wheeler[1], Dr Christine Lauchlan Arrowsmith[1]
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02H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring AND Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 2:00 PM - 3:30 PM

Emerging tools in remote sensing and geospatial analysis offer powerful opportunities for geomorphic monitoring—but translating these into scalable, management-ready approaches remains a challenge. We designed a monitoring framework for detecting riverbank erosion along the entire River Murray, Australia's longest river, spanning more than 2,500 km of channel across multiple jurisdictions. The framework integrates lidar-derived terrain models, Python-based spatial analysis, and supervised machine learning for automated feature extraction.

Developed with support from the Murray–Darling Water and Environment Research Program (MD-WERP), the method uses airborne lidar-derived terrain models to extract consistent, geomorphically meaningful measures. These include top- and toe-of-bank positions, bank slope, and cross-sectional form. The measures are paired with change metrics such as retreat distance and slope change, selected for their relevance to dominant erosion processes and their suitability for consistent extraction from lidar. The workflow supports repeat analysis, programmatic processing, and quality control at scale.

A dashboard provides the user interface, supporting interpretation and prioritisation of outputs in a structured and accessible way across multiple spatial scales. By linking detailed geomorphic change metrics with interactive visualisation, the dashboard enables both broad-scale pattern recognition and site-specific investigation. This makes complex spatial data more accessible and actionable for diverse users—from technical specialists evaluating erosion hotspots and actions to managers comparing and reporting on condition across reaches.

While the tools used—lidar, Python, and GIS platforms—are well established, their integration at this scale is a first for Australia. This project demonstrates how geospatial and analytic tools, coupled with sound geomorphic theory, can enhance the accessibility, consistency, and relevance of spatial data to support large-scale geomorphic monitoring and improved river management. The methods and interface could be readily extrapolated to other systems.

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The influence of landslide movement on soil carbon recovery: integrating monitoring and modelling of post-event successional dynamics.

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Soils store a considerable amount of carbon, serving as reservoirs in global biogeochemical cycles and climate regulation. Rapidly changing climate alters precipitation regimes, and precipitation extremes trigger more frequent and larger landslide events in many regions of the world. These events not only cause severe damage and risks to life, but also disrupt soil structure, root networks, and vegetation communities, hindering the affected areas' participation in biogeochemical processes. Understanding post-event ecosystem recovery trajectories supplements our approaches to hazard mitigation with the restoration of carbon and nitrogen stocks in landslide-prone areas. The primary aim of this research is to reveal which landslide-related factors impact the recovery process of post-event soils.

We conduct monthly, long-term field monitoring of soil carbon and nitrogen stocks at the Hofermühle landslide site in Lower Austria, integrating terrestrial laser scanning, cosmic-ray neutron sensing, and inclinometers on the slow-moving landslide. Static carbon- and nitrogen-flux chambers equipped with an optical spectroscopy gas analyzer recorded CO_2, CH_4, and N_2O fluxes, while laboratory soil analyses provided complementary data on physicochemical soil parameters. Vegetation observations, combined with the above-listed geoecological and geomorphological methods, allow us to unravel mechanisms behind soil carbon recovery on the landslide site and to assess these processes more accurately in the future.

Preliminary observations indicate the establishment of pioneer vegetation communities typical for the study region on the slow-moving landslide. Over the 12 years since the landslide occurred, soil horizons have developed extremely slowly, which might be explained by the specificities of the mineral substrate with high clay content and low water and gas permeability. We expect that properties of the exposed substrate—such as porosity and organic matter content—influence the successional trajectory of the recovery area. We plan to introduce additional methods and expand our research to develop a universal approach that facilitates carbon sequestration on landslides.

Post-glacial rivers: How continental glaciation continues to impact rivers and river management today

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11A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 5:00 PM - 6:30 PM

Rivers draining landscapes recently covered by continental glaciers are young and still evolving. Events occurring during deglaciation and glacial deposits left behind impact base level, sediment supply, and relief in otherwise low-gradient, hummocky, disconnected landscapes. This research draws on data from post-glacial rivers, primarily from the Upper Midwest region, USA, to describe commonalities experienced and how they affect river management today.

Deglaciation had numerous impacts on base level. The Great Lakes in North America, to which many rivers across the Upper Midwest and central Canada drain, experienced lake level changes up to hundreds of meters as ice lobes blocked drainage pathways then retreated, opening a series of lake outlets. During this time, river systems beyond the ice margin experienced megafloods, incision, or aggradation. On-going differential isostatic rebound may continue to impact base level and river gradients today. In places where base level is rising (e.g. the western arm of Lake Superior), river mouths flood, aggradation occurs, and floodplains widen. In places where base level fell (e.g. rivers draining into glacial lake outlet channels), rivers are incising, creating relief in otherwise low-gradient landscapes, and leaving behind remnants of former floodplains as terraces.

As incision propagates upstream on tributary networks, high bluffs and steep ravines form in thick glacial sediments, leading to high turbidity and fine sediment inputs. Incision through glacial till is often the primary source of coarse sediment to the river. Thus, as rivers incise, they coarsen, leading to pronounced downstream coarsening, with boulder lags common in downstream reaches.

Restoration and management of these systems must recognize the incisional or aggradational nature of the rivers, unique source of gravel and roughness elements, abundant fine sediment sources from glacial sediments, and any on-going impacts of differential isostatic uplift on river slopes which can affect river flooding and coastal management.

Valley-scale hydrogeomorphic conditions drive channel avulsion, floodout formation, and (dis)connectivity of arroyos feeding the Little Colorado River, USA

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Dryland rivers face ever-increasing pressures from anthropogenic activities and climate change that threaten water availability and ecosystem health. Understanding the complex interactions between external controls and internal processes is essential for management of these systems, especially those with a propensity for avulsion and with zones of channel breakdown. Polacca and Oraibi Wash are two discontinuous tributaries of the Little Colorado River in semiarid, Arizona. Valley-scale river morphometrics and downstream trends were derived from remote sensing and geospatial analyses, historical aerial photograph mapping and interpretation, hydraulic modelling, and field measurements, to assess the key controls, patterns, and processes driving channel diminution and discontinuity. Both rivers are entrenched along most of their valleys and experience downstream declines in modelled bankfull discharge (from ∼82 to <4 m3/s) and stream power (from ∼334 to <5 W/m2) as valley confinement eases in their low-gradient alluvial reaches. A concomitant downstream reduction in channel cross-sectional area occurs (from ∼82 to <3 m2), until the rivers exhibit a non-equilibrium geomorphic response where their channels terminate in broad floodouts. A series of avulsions leading to small distributary channels are evident in the reaches where channel discontinuity occurs, with a dominance of headward migrating knickpoints (retreat rates from ∼2 to 53 m/a) in distal floodout areas where channel reconnection may be achieved. Channel breakdown patterns and processes in the Polacca and Oraibi Washes are similar to other dryland rivers around the world, revealing common underlying factors central to understanding cycles of hydrological and sediment (dis)connectivity in these systems. In particular, the role of valley-scale hydrogeomorphic controls on intrinsic erosion and sedimentation processes, and avulsion threshold responses, that trigger channel adjustment resulting from downstream fluvial decline. Recognition and ongoing assessment and monitoring of these geomorphic changes can inform river, land, and water management strategies.

Sea-level rise and bedrock morphology control the evolution of a wave dominated delta: Richards Bay shelf, South Africa

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

This investigation presents a high-resolution seismic and geomorphological assessment of the Richards Bay continental shelf, situated along the wave-dominated, high-energy eastern coastline of South Africa.

Sub-bottom seismic reflection data from the wave-dominated east coast of South Africa identifies two prominent deltaic sequences located seaward of a modern low sediment supply river system. The delta lobes extend across the inner shelf and overlie an incised valley and lagoonal/back barrier complex, the positions of which are structurally controlled by regional faulting developed in the Cenozoic bedrock. The deltas represent two phases of progradation, interspersed by deltaic backstepping, a pattern consistent with punctuated rises in sea level. Their positions are controlled by topographic steps in the bedrock surface providing preferential accommodation.

In the nearshore, the deltaic sequences are absent, having been eroded by wave ravinement processes. Above the ravinement surface rest a series of relict shelf sand ridges that indicate a later period of shoreline progradation but in the absence of river influence. Their relict nature relates to a further rapid rise in sea level.

The shelf sequence offshore Richards Bay reflects the interplay between fluvial sources, bedrock control and marine erosion, mediated over the postglacial transgression by changes in rate of sea-level rise and the onset of an increasingly arid hydroclimate.

Stratigraphy and sediments of the south Kenyan continental shelf: Coral reef evolution and sea-level rise

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06E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 2:30 PM - 4:00 PM

The south Kenyan shelf is amongst the narrowest in the world. Multibeam bathymetric and very high resolution seismic surveys show an irregular seafloor topography with alternating areas of topographically high hardground and with mobile sediments confined to the topographic lows. The shelf edge is characterised by multiple slumps. Seismic surveys reveal the stratigraphy to comprise a basal erosional surface overlain by a 20m-thick coral reef unit that spans the entire shelf width. The sequence is topped by a highly irregular surface that reflects an inherited reef morphology of vertical aggradation. Three reef complexes are mapped at -100 m, -65 m and -20 m, each of which reflects initial aggradation, followed by backstepping. Backstepping is attributed to variable rates of sea-level rise. The modern surface sediment on the shelf comprises reworked siliciclastic material deposited by lowstand river deltas. The comparative scarcity of carbonate sediment is the result of in situ drowning of the reef complexes, coupled to low energy wave conditions that limited reef top reworking.

Hydrology, sediment transport and channel morphology during an extreme flood in Nahal Meshushim stream, Golan Heights northeastern Israel

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

During January 2020, an unusual rainstorm in northern Israel generated large floods with causalities and damage to infrastructure. Rainfall amounts at the Golan Heights exceeded 100 mm for 24 hours and generated an extreme flood in the basaltic, boulder-bedded Nahal Meshushim stream (160 km2) with 30-35 years recurrence interval. The peak discharge was 203 m3/sec, the third largest flood on record since 1969, shear stress - 405 N/m2 and maximum velocity - 6 m/s.

Using three acoustic Japanese impact plates located at the official Israel Hydrological Service hydrometric station, recorded intense sediment transport of all grain size fractions available in the bed, including mass entrainment of boulders >1 m in size. The movement of the boulders, which control the channel structure and morphology testifies on breakup of the armor layer and existence of equal mobility transport (EMT) conditions that are rarely measured and described in the field. The results of the acoustic bedload system indicate that the spatial EMT conditions occurred while the momentary hydrologic conditions did not overlap with the concurrent sedimentologic conditions. This unusual sedimentary pattern is explained: 1. Boulders are not as abundant in the channel bed as smaller grain fractions and cannot satisfy the “demand”. 2. The bed transport responds relatively slowly to the quick changes in discharge and thus, coarse fraction motion is discontinuous. EMT conditions occurred at 2.3-4.5τ_c. Comparison of pre- and post- flood measurements demonstrated the extremity of the flood indicating significant changes in channel morphology. These include substantial decrease of the armor ratio by almost half from 19.1 to 10.5, disappearance of pools, riffles and bars, removal and stripping of bank and floodplain riparian vegetation, exposure of bedrock along the banks as well as sediment transport of gravel up to cobble size over the floodplain - 2.0-2.5 m above the channel bed.

Spatial and temporal variability in Phosphorous assimilation: a comparison of geomorphologically contrasting floodplain types

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06A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 2:30 PM - 4:00 PM

Given their position along drainage lines, floodplain wetlands in South Africa have the greatest potential to reduce or buffer the downstream dispersal of sediment-attached nutrients, protecting downstream ecosystems from eutrophication. Variations in stream power relative to resistance in bank and bed substrate results in a range of floodplain types, characterized by differences in geomorphic process and form, and thus varied potential to deliver key ecosystem services.

In order to assess the potential of different floodplain types to assimilate sediment-attached Phosphorous (P), we selected three floodplains across South Africa's climatic gradient, including a meandering river floodplain in the humid east, a discontinuous, previously meandering system near the continent's southern tip, and a multiple-thread wandering river in the semi-arid west. The aim of the study was establish how geomorphic diversity influenced the spatial distribution of P, the total amount of P retained, and the long-term potential for P storage within each floodplain.
In conjunction with aerial photography and field observations, a high-resolution digital elevation model was derived from a LiDAR survey to identify and map geomorphic unit assemblages in the three different systems. Sediment was sampled along three or more transects in each floodplain, taking care to ensure that all geomorphic units identified were represented. In the laboratory, acid extracts from dried sediment were analyzed for total P, as well as Mg, Ca, Fe, Al and Mn using ICPAES. Particle size metrics were determined using a Malvern Mastersizer following hydrogen peroxide pre-treatment to remove organics, and organic content was determined using the loss-on-ignition method.

The analysis of P storage in different geomorphic units was subsequently considered in terms of process rates in each floodplain, allowing us to investigate the importance of geomorphic unit diversity in storing P, as well as to evaluate the long-term sustainability of using floodplain wetlands to attenuate P.

Tectonic geomorphology of the Snowy Monaro, southeastern highlands of Australia

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04D: Advances, challenges and future directions in Tectonic Geomorphology, Dobson 3, February 3, 2026, 9:35 AM - 11:05 AM

The Snowy Monaro region of southeastern Australia has the highest elevation and greatest relief of the continent. While much of this relief has been considered relict, the contribution of intraplate neotectonic activity to uplift of the highlands has remained poorly constrained. Through a combination of lidar-based digital elevation model interpretation, field investigations, and optically stimulated luminescence and cosmogenic radionuclide dating of faulted features, we aim to quantify the contribution of late Quaternary faulting to landscape evolution. We find neotectonic fault uplift rates exceed 0.1 mm/yr on some major faults, implying an ongoing contribution to relief generation. However, the clearest expressions of neotectonic activity do not correlate strongly with the areas of greatest relief. While perhaps partially explained by higher erosion rates in the most mountainous regions, which may have removed evidence of neotectonic activity, this finding is consistent with previous studies suggesting that fault activity in Australia (and other intraplate regions) is episodic. These results have implications for understanding landscape evolution of Australia's highest ranges, and for characterising seismic hazard in intraplate regions.

Century of Change: A Rephotographic Survey of Petra's Dynamic Heritage Landscape

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09I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 11:35 AM - 1:05 PM

Culturally significant landscapes often carry symbolic, economic, and geopolitical value. This designation can lead to major physical changes, particularly in places that draw large numbers of visitors. Petra, Jordan, perfectly exemplifies how a protected cultural landscape is shaped by both natural geomorphic processes and intense anthropogenic pressures. This study uses historic rephotography to analyze long-term visual and physical change in Petra's terrain over nearly a century. The project revisits and rephotographs several original viewpoints published in Sir Alexander Kennedy's 1925 "Petra: Its History and Monuments". By capturing new images from the exact same locations, paired visual records reveal subtle and overt transformations in the landscape. Five indicators guided this assessment: (1) structural erosion and decay, (2) vegetation shifts, (3) wear patterns from foot traffic, (4) restoration and reconstruction activities, and (5) utilitarian or unofficial uses of space. Findings show that while restoration efforts and infrastructure development have preserved many iconic features, they have also introduced new patterns of degradation and altered surface dynamics. Tourist movement has intensified tread wear in vulnerable zones, and vegetation changes hint at microclimatic shifts possibly linked to altered drainage and land use. This research demonstrates the value of rephotography not only as a visual tool but as a method for understanding landscape change at multiple scales. The ability to track geomorphic responses to human activity over time is essential for effective site management and conservation planning. As climate variability and visitor pressure increase, integrating geomorphology with heritage studies becomes increasingly urgent. Petra's evolving landscape offers an invaluable case study in how time, terrain, and tourism intersect—and why monitoring these interactions is critical to sustaining heritage landscapes into the future.

Using historic aerial imagery to develop a coseismic landslide inventory from the 1942 Wairarapa, New Zealand, earthquake sequence

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Coseismic landslide inventories are critical for understanding geomorphic impacts of earthquakes and improving predictive hazard models. This study will develop a high-confidence inventory of landslides triggered by the 1942 Wairarapa earthquake sequence. Two main events on June 24 and August 1, which were MW 7.2 and MW 6.8 respectively, caused widespread slope failures across an area of approximately 6,500 km2 in the lower North Island. MM8 shaking intensities from June and August caused moderate to severe damages in the Wairarapa, Manawatu and Wellington districts. Due to the absence of surface rupture, landslide distribution is one of the few options to determine subsurface faulting.

This project applies remote-sensing to overcome limitations presented by inaccessible terrain and a lack of ground-based measurements typical of historic earthquakes. Historic aerial imagery from 1942 (pre-earthquake), 1943, and 1969 (post-earthquake) was used to generate orthomosaics and DEMs to create a high-confidence dataset of landslides triggered by the 1942 Wairarapa earthquake sequence. We derive various attributes of mapped landslides including lithology, landslide area, and failure style in order to further investigate and understand controls on the spatial distribution and characteristics of coseismic landslides in this region.

This coseismic landslide inventory will help validate and refine a regional coseismic landslide susceptibility model by comparing mapped landslide distributions with areas of high modelled susceptibility. These spatial patterns of landsliding will also be used to infer ground motion characteristics associated with subsurface faulting. The resulting landslide inventory will contribute to national datasets and serve as a valuable source for future landslide susceptibility modelling and seismic hazard assessment, improving resilience in tectonically active regions.

Banded vegetation dynamics annealed by desert pavements

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04K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 3, 2026, 9:35 AM - 11:05 AM

On arid hillslopes, vegetation can organise into bands which follow topographic contours. Terraces emerge with these bands due to vegetation’s drag on sediment-laden runoff, creating a vegetated topographic signature diagnostic of precipitation rate. Another widespread feature of arid environments is desert pavement—finer-grained sediments armoured by surficial pebbles—considered a hallmark of landscape stability. Banding and pavement often co-occur, however their interaction has not been studied. Here we show that pavement development stabilises vegetation-induced terracing. In proximal field sites with varying pavement coverage, we find that pavements supress seed germination and sediment erosion between vegetation bands, halting terrace evolution. Despite sites having consistent contemporary precipitation, they show relationships between terrace morphology and topographic slope indicative of reducing precipitation with pavement coverage, implying aridity has reduced as pavements emerged. This suggests that pavements preserve terracing diagnostic of paleoclimate precipitation. Because pavement age, band wavelength, and topographic slopes are readily observable, we believe our study identifies a new widespread paleoclimate precipitation proxy in arid environments where conventional alternatives are often unattainable.

Complex response of source-bordering dune-field evolution to aridity variability

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02A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 2:00 PM - 3:30 PM

Source-bordering dune fields transgress away from regions replenished with sediment through either supply- or transport-limited aeolian transport. They are key paleoenvironmental archives in Australia's interior for how aridity has varied throughout the Quaternary, since traditional proxies in more temperate environments are not readily available, however intuitions for how aridity may modulate the pace of dune-field development can be contradictory. For example, one might expect that increased precipitation allows for greater supply of fresh sediment to rivers or lakes feeding the dune field, however increased precipitation increases vegetation which reduces the transport capacity of winds. On Mithaka Country, in the northeast Kati Thanda (Lake Eyre) basin, a source-bordering linear dune field elongates downwind from Ngawarri (Lake Machattie) which is delivered sediment from the monsoon-influenced Georgina River catchment. Chronostratigraphy along a dune crest transect reveals younger ages downwind, demonstrating dune growth by extension. The earliest aeolian deposition in our record occurred at 76±7 ka, and periods of deposition suggest increased sediment availability associated with fluvial activity and subsequent lake drying. Coeval fluvial and aeolian activity is further evidenced by stepped swale topography produced by dune-bounded flood drapes. This first investigation of the Ngawarri dunefield enhances our understanding of the complex geomorphic response to, and interpretability of, wet-dry oscillations in Australia's interior.

Karren evolution and solutional erosion in salt outcrops measured by erosion pins, close-range photogrammetry and terrestrial laser scanner.

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Rock salt outcrops in the Cardona salt diapir, Spain (ca. 500 mm/yr precipitation) offer an excellent natural laboratory for investigating the evolution of salt karren and measure solutional erosion over short timescales, thanks to the high solubility of halite (356 g/L). Three techniques with variable resolution and accuracy have been employed: erosion pins, Structure from Motion Photogrammetry (SfM), and Terrestrial Laser Scanner (TLS).

Multi-temporal photogrammetric point clouds reveal that the evolution of solution flutes and solution bevels deviates from the classical model of parallel retreat with form morphological persistence. Instead, flutes undergo dynamic reshaping, with cycles of flute coalescence and splitting. The sharp junction between the fluted slope and the solution bevel typically migrates downward and backward, though localized forward propagation can occur via intra-bevel flute development. Pedestals grow vertically at rates as high as 5 cm/yr.

A mean slope-normal erosion rate of around 1 cm per 100 mm of precipitation has been measured with the different methods, although significant variability was observed across the area with a broad diversity of karren types. The erosion values, normalized to 100 mm, decrease as the slope gradient increases, showing are fairly good linear correlation. Regressions indicating an average increase of around 2.7 mm (normalized to 100 m precipitation) per 20° decrease in the slope angle. No significant relationship was found between erosion rate and other climatic variables (e.g., temperature, relative humidity) or intrinsic factors (e.g., distance to the divide).

From a methodological standpoint, photogrammetric high-resolution point clouds are well-suited for the detailed morphometric characterization of karren and for tracking their short-term evolution. Although erosion pins offer much lower spatial resolution, they provide reliable erosion measurements and effectively validate remote sensing techniques with a high benefit/effort ratio. TLS and SfM photogrammetry provided closely matching results with sub-millimetric discrepancies.

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The geomorphology and kinematics of salt extrusions in the Zagros Mountains, Iran

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07B: Karst geomorphology, Dobson 1, February 3, 2026, 5:00 PM - 6:30 PM

The Fars Arc of the Zagros Mountains in Iran is the best natural laboratory for the investigation of active salt extrusions worldwide. In fact, the salt domes and glaciers (namakiers) of the Zagros Fold-and-Thrust Belt have been selected as a IUGS Geological Heritage Site, and have also been identified as a potential UNESCO World Heritage Site because of their remarkable salt karst developed on a mobile salt bedrock under arid conditions. Some salt extrusions occur associated with major active strike-slip faults, while the majority of them do not show any relationship with surface faults. The salt extrusions show variable evolutionary stages: growing domes, salt fountains comprising a summit dome and laterally spreading salt glaciers, salt droplets, and wasting salt extrusions of various types. As part of the DIAPERNO project, funded by the Spanish Government, a multidisciplinary investigation including DInSAR data has been conducted in a number of salt fountains: Jahani, Mesijune, and Ku-e-Namak. Kuh-e-Namak shows retreating salt glaciers, while those at Mesijune and Jahani are advancing, and the northern glacier of the latter interacts with a major drainage. In this presentation we will share the main findings of our multidisciplinary investigations: (1) recurrent damming of the Firuzabad River in the past by a salt glacier and the development of an upstream lake; (2) development of salt karst poljes; (3) characteristics and evolution of sinkholes developed on continuously spelling and flowing salt; (4) largest salt escarpment on Earth; (5) deformed Quaternary sediments associated with namakiers; (6) morpho-stratigraphic evidence of salt glacier retreat; (7) current displacement patterns revealed by DInSAR, revealing that some previously published displacement rates were greatly overestimated.

Short- and Long-Term Forecasting of Rainfall-Induced Landslides: An Italian Experience

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02C: Addressing Uncertainties in Landslide Prediction Across Spatial and Temporal Scales, Dobson 2, February 2, 2026, 2:00 PM - 3:30 PM

Rainfall is the primary trigger of shallow landslides, and their frequency is expected to increase due to climate change. Anticipating their occurrence is essential for risk mitigation. In a series of studies focused on Italy, we developed and evaluated innovative approaches to forecast rain-induced landslides using deep learning and probabilistic modeling. We proposed a framework for synoptic-scale, short- to long-term forecasting based on a Poisson binomial model, leveraging predictions from 35 deep networks trained on hourly rainfall data and historical landslide records. This framework removes the need for conventional rainfall thresholds or event-based metrics and provides high-resolution space-time forecasts, demonstrated over 180,000 hours from 2002 to 2022. Additionally, we compared four methods to define empirical rainfall thresholds—frequentist, Bayesian, and machine learning-based—and introduced a voting strategy to merge multiple threshold estimates into a single forecast. Independent validation using unseen data from early 2021 confirmed the predictive accuracy and generalizability of the deep-learning system, with improved performance for multiple simultaneous landslides and misclassifications largely due to rockfalls or spatial-temporal uncertainty. Our findings support the operational use of deep learning for national-scale landslide early warning and reveal that rainfall alone carries sufficient information to anticipate landslide timing and location. These contributions collectively advance the paradigm of landslide hazard assessment, offering scalable, data-driven solutions for early warning systems and long-term landslide risk mitigation strategies.

Impacts of large multi-thread tributaries on mainstem channel morphodynamics

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04A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 9:35 AM - 11:05 AM

Tributary-mainstem interactions play important roles in river networks influencing flow dynamics, sediment flux, bed material properties, channel width, and slope downstream of confluences. Tributary junctions promote the formation of fans and induce distinct geomorphic features, with their influence controlled by factors such as river size, junction angle, and discharge ratio. While prior work has explored confluence hydraulics and morphology, it has mostly relied on single-thread channels or flume experiments. Consequently, little is known about how large, multi-thread tributaries influence the geomorphic structure, dynamics, and processes of mainstem rivers. To address this gap, we investigated the confluence of the Yarlung Tsangpo River (YTR) and the Niyang River (NYR, the second largest tributary of the YTR) on the southern Tibetan Plateau to assess the impacts of a large multi-channel tributary on mainstem geomorphic structure, dynamics and processes. Using field surveys and Landsat imagery from 1986 to 2024, we analyzed confluence geomorphology, grain size distributions, and geomorphic dynamics of the mainstem channel both upstream and downstream of the junction. We also introduced a new metric, the River Mobility Index (RMI), to quantify river geomorphic activity. Our results reveal that pronounced high geomorphic activity downstream of the confluence, and significant changes in both channel-related and depositional geomorphic unit-related characteristics. However, the influence of the large tributary is spatially limited. The multi-threaded channel pattern mitigates the direct morphological influence of the tributary at the junction. While the discharge ratio shows little effects on these changes, sediment flux from the tributary is identified as a significant controlling factor in mainstem morphodynamics.

Across the water: an innovative application of ERT surveying

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05H: Providing 2D & 3D Subsurface Imagery of Geomorphic Environments: Ground Penetrating Radar and Near-Surface Geophysics, Conway 3, February 3, 2026, 11:35 AM - 1:20 PM

Electrical resistivity tomography (ERT) is a versatile geophysical method for imaging shallow subsurface structures, materials, and discontinuities. It can be applied in a range of environments, from soil and sediment to bedrock, provided electrode contact can be established. However, challenges arise when survey profiles must cross bodies of water. While specialized equipment exists for aquatic ERT surveys, such tools are often costly and impractical.

We present two low-cost, effective setups that use standard ERT equipment to conduct surveys across both still and flowing water bodies. The first setup ("waterborne") targets stagnant water, such as landslide-dammed lakes. Here, the ERT profile is extended across the water surface using flotation pads connected by a tensioned cord, allowing electrodes to remain fixed and evenly spaced. This configuration enables full-lake coverage and sediment thickness interpolation. The second setup ("airborne") addresses fast-flowing rivers. A steel cable is suspended above the water using a pulley block system. Electrodes are attached to thin wires weighted with metal nuts, which are then lowered into the water, ensuring secure grounding without risk of drowning the electrodes. All surveys are supplemented with bathymetric data collected via boat-mounted sonar or ADCP, and processed using Res2DInv software.

Three case studies that demonstrate practical adaptability of the innovative setups for conducting ERT across aquatic environments without specialized gear are presented:
- Landslide-dammed lake sedimentation – ERT was used to estimate sediment volume in a 150-year-old lake.
- River crossing for gas pipeline – A complex profile over a large, swift river helped assess bedrock structure and tectonic features.
- Březno landslide – A profile spanned both a river and rock face to investigate a landslide in clay, triggered by riverbank erosion.

National scale patterns of landslide persistence and dynamic hazard in a mountain landscape

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Landslide hazard characterises the likelihood that a landslide will be triggered at a point in the landscape within a certain period of time. However, our ability to constrain landslide hazard is limited by a few good-quality datasets often collected across small geographical areas; in turn, this complicates any assessment of the dynamic nature of landslide hazard through time and the influence of triggering events, such as earthquakes or intense monsoon periods. To better capture landslide hazard through space and time, long-term, large-scale datasets are needed.

Here, we analyse a 22-year dataset of landslide occurrence generated from Landsat data to decipher the dynamic nature of the hazard posed by landslides in Nepal. We calculate metrics, such as landslide recurrence and persistence, to explore how hazard compares across the country and in recent years. Using these metrics, we can identify individual triggering events on a national scale. Temporally, we find that only ~10% of landslide locations are new each year. Of these, only ~45% were triggered in locations >30 m away from other landslides. We demonstrate how spatio-temporal landslide hazard metrics, such as recurrence and persistence, add significant value to (multi-temporal) landslide inventories and represent a critical step in the widespread availability of hazard data.

Longitudinal Response of a Mine Waste Impacted Tropical River System, Bougainville Island, Papua New Guinea

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09A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 11:35 AM - 1:05 PM

Construction and operation of the Panguna mine between 1968 and 1989 supplied approximately 812 million tonnes (MT) of mine waste into the Kawerong River, a tributary to the Jaba River that flows into the Solomon Sea. In 1989, when mining ceased, approximately 242 MT of primarily sand-sized tailings were longitudinally distributed down 32 km of river and stored in an area of about 2,000 ha between the mine and the 970 ha mine-generated delta containing approximately 500 MT of unvegetated tailings that extended 3 km seawards. Repeated surveys from the mine to head of the delta between 1971 and 1989 showed aggradation rates in the Upper River ranged from 1.6 m/yr, resulting in excess of 30 m of aggradation, where the channel slope reduced from 0.029 to 0.008 and the valley bottom width increased by a factor of 5, to 0.25 m/yr in the Lower River with aggradation of 4 to 7m where the slope reduced to 0.002 and the valley bottom width exceeded 2 km. Cessation of mining initiated downstream-progressing degradation that by 2023 resulted in erosion of 65 MT from the Upper River and deposition of 60 MT in the Middle River that caused the Jaba River to avulse into the 500 ha Konaviru Wetland in 2017, thereby abandoning 3.7 km of channel and 20 MT of tailings and interrupting sediment delivery to the Lower River. This resulted in about 2 m of degradation of the Lower River and through the revegetated delta and about 100m retreat of the subaerial delta margin. In general, aggradation rates exceeded degradation rates through the river system by a factor of 5 suggesting that long term recovery will greatly exceed 100 yrs, which is a similar response time to other similarly mine waste impacted rivers (e.g. James, Monahan and Ertis, 2019).

Connectivity between hillslope and channel sediment stores in the Indian Himalaya

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03J: Landscape conditioning for cascading sediment hazards in Pacific steepland catchments, Conway 5, February 2, 2026, 4:00 PM - 5:30 PM

Over the next century, flood frequency and magnitude in the Himalaya are projected to increase due to accelerating glacier melt and monsoon intensification. Most work has focused on the upstream triggers of floods, such as glacial lake outbursts, avalanches, or intense rainfall. Entrainment of sediment stored within mountain valleys as they travel downstream can transform these floods into debris or hyperconcentrated flows, however, increasing both their travel distances and downstream impacts. This hazard cascade means the risk to downstream communities is conditioned not just by the trigger events but also the distribution of sediment fill along the flow path. However, the conditions that control the spatial and temporal dynamics of sediment accumulation in mountain valleys are poorly constrained. This is primarily due to a lack of systematic, large-scale datasets that capture both channel sediment and landsliding in steep mountain catchments. Slow moving landslides can also supply sediment to channels, however inventories of these are even more scarce. Therefore, our understanding of how shallow and slow landslides contribute to stores of channel sediment in these catchments is limited.

Here, we apply (semi-) automated approaches to generate inventories of channel and hillslope sediment stores for the Alaknanda Basin systematically through time, using a combination of deep learning and remote sensing data. We use these inventories to develop a framework that explores connectivity between hillslope and channel sediment. We also use these data to identify stable stores of sediment within channels, and hotspots of channel erosion and deposition. We explore whether certain topographic and/or channel characteristics control the spatial and temporal dynamics of sediment supply and fill. These findings allow us to explore landslide-channel connectivity in steep, active catchments, and gain a better understanding of the role sediment stores in steepland landscapes highly susceptible to sediment-rich flood events.

Towards an Austrian Glacier Foreland Inventory: A Platform for Cross-Site Biogeomorphic Analysis

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Glacier forelands are prime examples of accelerated environmental change in high mountain environments. As these regions transition from glacial to non-glacial conditions, they exhibit geomorphic and ecological disequilibrium, characterized by paraglacial adjustment and vegetation succession. While the geomorphic dynamism drives cascading hazards, glacier forelands also offer valuable ecosystem services, underscoring their scientific and societal importance. Detailed monitoring of glacier retreat and foreland growth enables a space-for-time approach, offering unique insights into landscape development under accelerating climate change.

In Austria, the Alpine Convention's glacier monitoring program provides such detailed data on the retreat and mass balance of 90 glaciers, with up to 134 years of records. This consistent monitoring has created a temporal gradient of terrain ages across a range of environmental settings. However, while retreat rates are well documented and while individual glacier forelands have been studied intensively at the local scale, there is a lack of integrated, comparative data across glacier forelands. This limits our ability to understand large-scale biogeomorphic patterns and to manage associated hazards and ecosystem changes.

To address this gap, we propose the development of a nationwide glacier foreland inventory for Austria. We use continuous satellite time series combined with a field-based framework of UAV surveys, vegetation surveys and geomorphic mapping for time-efficient, catchment-wide mapping of structural components. The platform will (I) enable cross-site comparison of biogeomorphic development—capturing geomorphic activity and terrain stabilization via vegetation succession—and (II) provide a robust basis for hazard analysis and environmental management focused on ecosystem services linked to glacier forelands.

This concept aims to establish a research infrastructure for long-term monitoring, cross-site synthesis, and methodological transfer to glacier forelands in other regions. As the initiative is still in its early stages, we warmly invite collaboration from researchers and practitioners interested in shaping and advancing its development.

Topographic control on debris-supply rates from steep slopes: Estimation based on UAV–LiDAR DEMs of an abandoned road surface

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06C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 2:30 PM - 4:00 PM

Amount of debris deposits on an abandoned road at a steep, forested mountainous area in central Japan were investigated using an uncrewed aerial vehicle (UAV) with a light detection and ranging (LiDAR) sensor, which produces high-definition digital elevation models (DEMs) of grounds under canopies. The road was abandoned 31 years ago, leading to the accumulation of rockfall and debris-flow deposits on its surface. The 5-km long road was separated into 96 segments with the length of 50 ± 25 m, and the debris-supply rate from the upslopes was calculated from the volume of the deposits on the road segments divided by the size of contributing area, and the time since the abandonment. Large volume of debris accumulation was observed, likely by active rockfall and dry ravel from the contributing slopes having an area of > 2,000 m^2 and mean slopes of > 44°. Debris transport by water flow or debris flow were common at segments with a larger contributing area of > 20,000 m^2. The debris-supply rate ranged from 0.4 to 98 mm/a. The debris-supply rates were found to be lower with larger contributing areas, probably because of the trapping of rocks during their transport between the sources and the road segments. For segments with contributing of 2,000–20,000 m^2, the debris-supply rates were higher for higher mean slopes, attributed to the higher activity of rockfall and dry ravels in steeper slopes. The estimated debris-supply rates from slopes to a given source area of debris-flow prone valley (contributing area of 10,000–20,000 m^2) is 3–5 mm/a, which is equivalent to the uplift rates of this area (~ 4 mm/a). The estimated annual volume of debris supply is about 50 m^3/a, which reveals that debris flows with magnitude of about 1,000 m^3 may occur in debris-flow prone valley every few decades.

Post-seismic vegetation recovery and geomorphic connectivity in landslide-affected watersheds: a case study following the 2018 Hokkaido Eastern Ibri Earthquake, Japan

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Following the widespread coseismic landslides triggered by the 2018 Hokkaido Eastern Iburi Earthquake in northern Japan, gradual and long-term geoenvironmental changes have been observed in mountainous watersheds. These changes include geomorphic processes, sediment connectivity, and vegetation recovery on landslide-affected slopes. Understanding such dynamics is critical for evaluating sediment-related hazards and ecosystem resilience, as well as informing regional environmental management. This study investigates the post-seismic evolution of geomorphological and ecological conditions using optical, multispectral, and light detection and ranging (lidar) sensors mounted on uncrewed aerial systems over multi-year timescales. High-definition topographic data acquired through structure-from-motion multi-view stereo photogrammetry and lidar were used to characterize the morphological developments in the watersheds, and vegetation recovery therein was monitored using visible and near-infrared imagery. Although spatial correlations between morphological change, sediment connectivity, and vegetation regrowth were not always evident, temporal trends suggest interlinked processes. Slope dynamics appear to be driven or accelerated by freeze-thaw processes under cold climate conditions and medium- to high-intensity rainfall events, also influencing vegetation establishment and regrowth. These interactions highlight the complex feedbacks between geomorphic processes and ecological recovery.

Modelling Soil Erosion–Driven Landscape Evolution in the Yellow River Basin: Integrating Geological Evidence and River System Theory

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The Yellow River, originated from the Qinghai-Tibet Plateau, running acrosss the Loess Plateau, is well-known for its historical floods and sediment crises, presents a unique case study in landscape evolution driven by severe soil erosion. The Yellow River transports some of the world's highest sediment loads. This sediment, derived from widespread gully erosion and slope wash processes, plays a dominant role in shaping the fluvial morphology across its middle and lower reaches. Over the Holocene epoch, the river's course has experienced dramatic avulsions, aggradation, and deltaic progradation, all intimately linked to episodic and sustained sediment influx from upstream.

This study synthesizes geological evidence from terrace sequences, paleochannel deposits, and deltaic stratigraphy to reconstruct the Yellow River's landscape evolution under the influence of soil erosion. Radiocarbon-dated sediment profiles reveal that major avulsion events correlate with periods of intensified erosion driven by climatic oscillations and anthropogenic land clearance. In the North China Plain, floodplain aggradation and levee breaches repeatedly reset human settlement patterns, embedding a deep legacy of socio-environmental vulnerability.

Numerical model simulations, calibrated using Holocene sedimentary data and modern hydrological records, illustrate how feedback loops between sediment supply, riverbed aggradation, and overbank flooding amplify the impacts of upstream erosion on downstream morphology. The Yellow River Delta, in particular, demonstrates rapid progradation cycles followed by abandonment and reoccupation, tied closely to sediment flux variations.

By integrating geological archives with simulation outputs, this study highlights the pivotal role of soil erosion in sculpting the Yellow River's landscape. The findings underscore the necessity of erosion control in the Loess Plateau not only for ecological restoration but also for mitigating flood risks and stabilizing the evolving riverine and deltaic landscapes of northern China.

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Soil Erosion Impact on River Landscape Evolution in the Yellow River, China

Professor Hongming He[1]
[1]East China Normal University's, Shanghai, China

09A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 11:35 AM - 1:05 PM

The Yellow River, one of the most sediment-laden rivers in the world, offers a compelling case study of landscape evolution driven by intensive soil erosion. Originating in the Loess Plateau—one of the most erosion-prone regions globally—the Yellow River transports some of the world's highest sediment loads. This sediment, derived from widespread gully erosion and slope wash processes, plays a dominant role in shaping the fluvial morphology across its middle and lower reaches. Over the Holocene epoch, the river's course has experienced dramatic avulsions, aggradation, and deltaic progradation, all intimately linked to episodic and sustained sediment influx from upstream.

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The Distribution of sand dunes on Earth

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Dunes are known to be widespread landforms on Earth as well as other terrestrial bodies. Most commonly they are associated with the world's deserts and coastlines yet they have been documented in studies from a great diversity of climates and geomorphic settings. However, the absence of detailed accurate maps inhibits our understanding of the environmental factors affecting their formation and distribution. We have completed a new map of sand dunes from original observer interpretation, re-mapping based on published studies and incorporation of previous (high-quality) maps. The map includes all known inland dunes on Earth as well as coastal dunefields.

There is, as expected, a clear association between inland sand dunes and climatic aridity – particularly in the Southern Hemisphere and subtropical Northern Hemisphere. In North America and extra-tropical Eurasia there are both desert dunefields as well as large areas in currently humid climates marginal to former ice-sheets. They include very large areas, previously not well documented in northern Europe and Siberia. In these mid- and high- latitudes, sand dunes are linked to fluvial systems draining former ice-sheet margins with fluvial sorting being an important step in supplying sand for aeolian reworking. In all areas, including arid areas, topography is an important secondary control on the distribution of sand dunes. Low-lying areas store sand which can be blown over the basin floors and onto their margins. This topographic control is much more important than the tectonic setting: high rates of sediment production from tectonically active areas do not clearly lead to high rates of sand dune formation.

Compared to automated mapping studies this observer-interpreted map includes much larger areas of sand dunes where they are small or vegetated. The map should provide a sound basis for investigation of present and past dune dynamics on Earth.

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Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices.

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08I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 9:35 AM - 11:05 AM

Geoheritage plays a key role in the understanding of the history of Earth and has a strict relationship with both the biological and the cultural heritage. The research on geoheritage has garnered significant interest and recognition within the scientific community over the past few decades. Geomorphological heritage is part of geoheritage, having specificities such as the aesthetics, the dynamics, and the imbrication of scales. These unique and distinctive characteristics have sustained significant interest over time from a conservation, tourism and educational perspective. Thus far, geomorphological heritage has been studied mainly within the field of cultural and social geomorphology. However, given the interdisciplinary character of geomorphological heritage, there is a need for the development of specific methods and approaches. A new branch of geomorphological studies, heritage geomorphology, can address this challenge. It can draw upon a range of techniques, including the complex characterization of geomorphological heritage, as well as methods of assessment of dynamics and risks to geomorphological heritage, its protection and management.

The concepts, methods and practices of heritage geomorphology will be presented through a panel of examples and case studies related to the author's experiences in protected areas and Geoparks worldwide, with an emphasis on new trends and approaches, for example by bringing together geoscientists and artists to address the social stakes of geomorphological issues such as the management of geohazards or the geomorphological effects of climate change.

Using Regression and Analysis of Variance to Model Hurricane Storm Surge Sedimentation on East Texas Gulf Coast Marshes

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Throughout the past 50 years, a growing body of research has expanded our understanding of how hurricanes impact coastal marshes along the northern Gulf of Mexico coastline. Despite advances in understanding hurricanes as geomorphic agents, few studies utilize regression and analysis of variance to model hurricane storm surge sediment deposition on coastal marshes. This study utilizes regression to model the thickness of hurricane storm surge sediment deposits based on pit site distance inland, pit site elevation, and distance from the landfall of Hurricane Ike. Additionally, analysis of variance revealed whether distance inland, distance from landfall location, and/or the interaction between distance inland and distance from landfall location had a significant effect on storm surge deposit thickness. Results show that the power law curve from the regression analyses was the strongest predictor of pit site sediment thickness based on distance inland, with an R^2 value of 0.538. The findings of this study add to the body of knowledge on how quantitative methods can be utilized to model hurricane storm surge sediment deposition and provide useful guidance to public policy aimed at combating the effects of sea-level rise on coastal marshes of the northern Gulf of Mexico and around the world.

Asynchronous landslide-lake drainage behaviour in the Dart River/Te Awa Whakatipu, New Zealand

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06C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 2:30 PM - 4:00 PM

High relief mountain systems undergo rapid rates of sediment production and evacuation, and are susceptible to frequent slope failure, which may (partially) block valley floors and alter river flow and morphology. The persistence of landslide blockages is largely a function of impoundment stability and the transport capacity of fluvial networks. Blockages of alpine rivers are potentially hazardous to downstream regions from catastrophic dam failure. Nonetheless, classifications remain a function of stability/risk failing to account for dam longevity (non-failure scenarios) or the internal morphologies within 'stability'. Re-activation of a Holocene-aged slip (Te Horo) in the Dart/Te Awa Whakatipu catchment (New Zealand) in 2013 resulted in partial blockage and back-filling of the braid plain leading to lake formation. This study reports the impacts of the 2013 slip and its decadal-scale behaviour using remote imagery surveying of lake extent alongside rainfall and flow data of the Dart River/Te Awa Whakatipu. Valley floor morphology at the Te Horo landslide reflected three distinct phases: pre-lake formation (before 2013), stable lake presence (2013 – 2019), and lake pulsing (2019 – 2024). Imagery analysis established a presence/absence record of lake impoundment (i.e., filling) and pseudo-failure (i.e., drainage). Hydrogeomorphic conditions over the 41 events between 2019–2024 were synthesised into classifications of drivers for filling or drainage (i.e., Scenario I: rapid lake filling following high antecedent rainfall). Lake filling mostly responded to high antecedent and event-specific rainfall; whereas drainage events ranged from slow to rapid drainage that likely reflected subtle changes in impoundment morphology not easily discerned from satellite imagery. Decadal scale responses in the lake impoundment of the Te Horo landslide suggests that current models of landslide damming have overlooked an intermediate class of impoundment; that is one of transitional behaviour, less vulnerable to collapse due to high river competence relative to the rate of slope failure.

Evaluating the spatial signal of sedaDNA in alluvial floodplain deposits – A case study from Belgium

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

During the Early and Middle Holocene, most lowland river floodplains in temperate Europe were stable environments, characterized by low-energy, multichannel rivers in densely vegetated peatlands. During the Late Holocene, forest clearance for agriculture resulted in increased water and sediment supply to these floodplains, burying the peat deposits under thick sediment layers. This led to the transformation of many of these floodplains into single-channel, meandering systems with overbank deposits and more open vegetation. Although these sedimentary units from agriculture-induced erosion remain visible today due to relative incision, the past effects of increased water fluxes due to upland deforestation are less apparent. As a result, it is unclear whether floodplains that retained their (semi-)natural marshy state experienced ecological change without undergoing a drastic, irreversible transformation.

The spatial and taxonomic resolutions of the currently available reconstructions – based on pollen and macrofossils – are often too low to assess the response of local floodplain ecology to regional upland land cover changes. While sedaDNA can provide the necessary detail, its application in alluvial settings still raises fundamental questions. Though studies show that sediments from low-energy river floodplains can provide suitable samples for successful sedaDNA applications, the spatial representation of this DNA remains poorly understood. By comparing pollen, macrofossil and sedaDNA from samples obtained from different types of floodplain deposits in Belgium – including in situ produced peat deposits and sediment layers deposited as a result of upland erosion – we aim to determine to what extent these palaeoenvironmental proxies represent different spatial scales. Moreover, this integration will allow more detailed reconstructions of Belgian lowland river system biodiversity and ecology in the past and the extent to which they have been transformed in the Late Holocene and Anthropocene.

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Holocene floodplain transformations in NE Belgium: catchment-scale human-environment interactions as drivers of local change

Dr Renske Hoevers[1], Bob Simons[1], Dr Ward Swinnen[1,3], Marleen van Zon[1,2], Professor Bart Vanmontfort[2], Professor Gert Verstraeten[1]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

During the Late Holocene, many lowland river systems in temperate Europe transformed from multichannel rivers in densely vegetated peatlands to single-channel, meandering rivers with overbank deposits in more open floodplains. While this geoecohydrological shift is well recognized, its timing varies significantly both within and between different river catchments. To unravel to what extent these differences in floodplain response can be explained by differences in the timing and nature of the driving forces we adopt an interdisciplinary approach. Human impact is widely recognized as an important driver, yet its underlying activities, their intensities, and their spatiotemporal patterns received little attention. Therefore, we integrate long-term and large-scale reconstructions of floodplain geoecohydrology and upland land cover change, with reconstructions of human demography and land use. We focus on the central Belgian loess belt and compare its evolution with that of the adjacent sandy Campine region.

In both regions, the key trends in geoecohydrological floodplain evolution appear largely determined by changes in floodplain wetness, linked to fluctuations in upland forest cover in the vicinity of the floodplain sites. Forest clearances, driven by population growth and associated agrarian production, resulted in hydrological changes and localized colluviation. Catchment-scale improvement of hillslope-floodplain connectivity initiated alluviation in the valleys and completed in many cases the transformation from forested marshes to open floodplains with overbank deposits. Moreover, we observe a trend towards faster floodplain responses to upland land cover changes over time, likely related to this growing hillslope-floodplain connectivity. While floodplains with active peat growth are still found in the sandy Campine region at present, they have become rare in the central Belgian loess belt due to the combination of higher human pressure and higher soil erodibility. This eventually allowed people to settle in the floodplains, laying the foundations for today's landscape.

Integrating InSAR and Geomorphological Mapping in Deglaciated Alpine Terrain: A Case Study from Taschachferner, Austria

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Over the last few decades, the decline of glaciers and the associated landscape changes within glacier forefields have occurred at unprecedented rates due to climate change. As a result, these areas are undergoing rapid transformation, with consequences such as shifting ecosystem boundaries, changes in sedimentary processes, and an increased risk of natural hazards that threaten human lives and alpine infrastructure, including mountain huts and hiking trails. Therefore, it is essential to comprehensively map and characterise geomorphological and landscape changes.
Earth observation (EO) data from different optical and synthetic aperture radar (SAR) sensors offer great opportunities to systematically map and monitor these often hardly accessible areas and their evolution. We present a case study from the area around the Taschachferner glacier in the Ötztal Alps in Austria, where we integrate geomorphological mapping with results from interferometric SAR (InSAR) analysis to better understand the complex geomorphology and the landscape changes. In particular, we derive surface deformation rates from time series of Sentinel-1 data and assess how the detected surface deformation patterns relate to the geomorphological interpretation of various features, such as debris cones, moraines, and debris-covered glaciers. This approach can help improve the delineation of specific features, for example, debris-covered dead-ice areas, and identify zones with unusual deformation rates that may require closer hazard monitoring.
Our findings can enhance our understanding of landscape dynamics in recently deglaciated areas. Moreover, they can offer practical insights for alpine associations, alpine infrastructure managers, and mountaineers to adapt to evolving terrain and improve safety in high-altitude environments.

Defining Spatial Boundaries in Northern Sweden: Mapping Arctic Aeolian Sand Dunes with CNNs

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Arctic aeolian sand dunes are dynamic geomorphic features that serve as valuable archives of past climatic conditions. Formed primarily from glacial and fluvial deposits, these dunes are shaped by wind activity and stabilized by vegetation cover. Their sensitivity to environmental change makes them important indicators of landscape responses to ongoing Arctic warming. Mapping the distribution and morphology of cold-climate aeolian sand dunes is essential for reconstructing paleo-wind regimes and understanding geomorphological processes. However, the manual delineation of dune boundaries is time-consuming and resource-intensive, resulting in limited polygonal dune datasets across the European Arctic.

To address this challenge, we present a novel convolutional neural network (CNN) model based on an enhanced U-Net architecture, specifically designed for the automated identification and mapping of cold-climate aeolian sand dunes. The model integrates multi-modal input data, combining optical remote sensing imagery with topographic features derived from digital elevation models (DEMs), including curvature, slope, and elevation. A dual-input structure allows the model to process imagery and topographic data in parallel, with feature fusion occurring during the encoding phase. Additionally, an attention mechanism is incorporated to prioritize relevant spatial features, improving dune detection accuracy in heterogeneous and complex terrains.

Our method is trained and evaluated on cold-climate aeolian sand dunes in northern Sweden. It demonstrates its effectiveness in generating accurate polygonal representations of dune features and offers a scalable and efficient approach to geomorphological mapping, reducing reliance on manual methods while supporting mapping of the shape and orientation of dunes at a large(r) spatial scale. This advancement contributes to a more detailed knowledge on sand dunes in a region characterized by fast-paced change and is versatile for adaption. It enhances our potential of mapping geomorphic features and fosters our understanding of aeolian processes under changing climatic conditions.

Expert-based and Data-driven Dune Mapping in Northern Finland

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10H: Shaping Arid Landscapes: Unraveling the Complex Interactions Between Wind, Sediment, and Vegetation in a Changing Climate, Conway 3, February 5, 2026, 2:30 PM - 4:00 PM

Aeolian dunes are formed through the accumulation and movement of wind-blown sand over time. While their shape can reflect wind directions during the period of formation, the stratigraphic layers in aeolian dunes preserve records of past climate and environments. In northern Fennoscandia, extensive dune fields serve as detailed records of Holocene Arctic climate change. Buried soil and charcoal layers observed in parabolic dunes preserve a rich history of past climate variations, environmental changes, and fire events. Understanding the evolution of the dunes is essential to project how Arctic environments may respond to future climate change. Such research depends on knowledge on the location, size, and shape of the aeolian sand dunes, which requires mapping them as polygon features. However, polygon-based dune mapping remains scarce in Fennoscandia.
In this study, we present three different approaches to map aeolian sand dunes in selected focus areas in northern Finland. The dunes vary in size, shape, degree of degradation, and vegetation cover. We explore expert-based and data-driven object detection approaches, utilizing a 2 m digital elevation model (DEM) and terrain derivatives such as slope, hillshade, curvature, and topographic position. The approaches involve varying levels of expert knowledge integration and include: 1) manual mapping, 2) a semi-automatic method based on machine learning models in an object-based image analysis framework, and 3) an automated deep-learning approach. The mapping results are validated during field campaigns. We compare the outcomes of these approaches and discuss their advantages and disadvantages for dune mapping in Arctic regions, including aspects such as achieved accuracy, analysis and processing effort, and the influence of training samples. This analysis will help identify open research challenges in the development of reliable, automated methods for regional-scale mapping of aeolian sand dunes in Arctic Fennoscandia.

The sedimentary record of a single extreme storm; before-and-after the Category 5 Cyclone Zelia, De Grey dryland channel, Western Australia

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11J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 5:00 PM - 6:30 PM

On Valentines Day, February 14, 2025 the De Grey River and its delta took a direct hit by the Category 5 Cyclone Zelia, resulting in extreme flooding from this single storm event. The De Grey is a dryland ephemeral river draining the arid to semi-arid interior of northwestern Australia, exiting to the sea between the Precambrian Pilbara and Kimberly massifs. The De Grey River bed is dry over most of the year, and only flows during extreme flood events. This preserves the post-flood channel bed and floodplain with little modification, and exposes the bed surface and sediments to direct examination. We employed satellite data, LiDAR, drone photogrammetry, auguring/trenching, laser particle size analysis, and age-dating to produce depositional element complex maps for the channel and delta. Repeated centimeter-scale topographic studies of the channel before the flood define multiple side-attached bar forms dominated by lower-flow-regime sedimentary structures upstream of the backwater and tidal reach. Flooding of the channel by Zelia caused discharge exceeding bankfull conditions, which modified the channel and inundated the floodplain. Recession of the waters has revealed the channel bottom and floodplain, which are now being resurveyed and retrenched for comparison with pre-flood conditions. Preliminary examination reveals expanded cutbank and bar modification related to flooding. Additionally, gravel antidune structures not present in prior studies of preserved sediments are now visible within the channels. Complete resurvey and retrenching of prior channel and floodplain sediment after flood modification at centimeter scales during the coming July field campaign will define and quantify the impact by Zelia more precisely. This detailed before-and-after repeat study of a system modified from a single cyclone event without intervening flow will quantify large storm effects at a level of detail not previously attainable, and provide a unique event-based data set across a large river and delta system.

Mapping Debris-Covered Glaciers in the Greater Caucasus Using Integrated SAR–Optical Techniques: Insights from Local Validation and Regional Trends

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07G: Cryosphere Processes and Mountain Hydrology, Conway 2, February 3, 2026, 5:00 PM - 6:30 PM

Observing debris-covered glaciers remains a significant challenge, as traditional optical remote sensing is only limited in its ability to detect ice beneath supraglacial debris. In the Greater Caucasus, where debris cover is increasingly widespread and the terrain is highly variable, we have developed and applied a new semi-automated toolbox - DebCovG-carto - which integrates dual-track Sentinel-1 C-band SAR coherence with Landsat-8 and Sentinel-2 optical indices (NDVI, NDSI), as well as slope and vegetation masks, to improve the delineation of both clean and debris-covered glacier ice. The method was tested and validated on the Ushba and Chalaati glaciers in Georgia, where field GPS measurements and manual delineations from high-resolution SPOT images confirmed a front position within 30 m. The use of both ascending and descending SAR tracks improved the detection of stop and shadow zones, thereby addressing the main limitations of coherence analyses conducted on a single track. This integrated approach significantly reduces subjectivity, accelerates processing time, and enables consistent mapping of large-scale and topographically complex regions.The method applied to the entire Greater Caucasus (~1060 km² glacier-covered area) showed that debris-covered areas constituted approximately 10.3 ± 5.6% of the total glacier area in 2020. A comparative analysis with the 2014 data indicates a clear increase in the extent of debris, particularly in the central and eastern sectors, with debris boundaries migrating upwards by as much as 180 m. These patterns are likely related to increased supraglacial debris input from rock glacier avalanches, which is accelerated by warming trends and reduced accumulation. Our results demonstrate the robustness and scalability of the DebCovG-carto toolkit for updating glacier inventories, hazard monitoring, and climate impact assessments. It offers a reliable, transferable method for tracking the dynamic changes of debris-covered glaciers in various mountainous environments.

Biogeomorphic links between channel degradation, soil quality and aquatic function in semiarid floodplain wetlands

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02K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 2:00 PM - 3:30 PM

Channel degradation can cause negative ecological and geomorphic impacts in rivers and wetlands, particularly in dryland environments with irregular flow regimes. Erosion is a key process threatening the physical and ecological integrity of channels in Australian floodplain wetlands. Soil type and quality – related to carbon, nutrients, pH, electrical conductivity, aggregate stability – plays a vital role in maintaining healthy channel and aquatic ecosystems. However, the relationship between channel degradation and soil quality in wetlands is yet to be fully explored. This study examined biogeomorphic factors in degraded and intact low-flow channels of Gum Cowal, Macquarie Marshes, NSW. A range of techniques were used to assess soil quality and aquatic health indicators, including a laboratory inundation experiment to determine gross primary productivity of phytoplankton (GPP) and planktonic respiration (PR). Channels ranged from 8 to 20 m wide, and from 0.2 to 3 m deep. Degraded channels were deeper, had less vegetation ground cover, and showed evidence of channel incision. Degraded channels had sandier, less cohesive soils and had lower carbon content than soils from intact channels. Across all channels, Emerson aggregate tests indicated dispersive sub-soils (class 2) with less dispersive topsoils (class 3b). Degraded channels had lower mean GPP (18.5±9.0 µgC/L/h) and PR (28.3±2.9 µgC/L/h) compared with intact channels (GPP 24.4±9.1 µgC/L/h and PR 37.5±5.6 µgC/L/h). Both channel types were heterotrophic with similar GPP/PR (degraded 0.653 and intact 0.655). Biogeomorphic links between channel degradation, soil quality and aquatic function occur in this system. A positive feedback of channel erosion, loss of vegetative cover, exposure of dispersive sub-soils, and reworking of sand from upstream to downstream affects aquatic function and health, indicated by reduced GPP and PR. These findings are relevant to water, wetland, and agricultural management in semiarid landscapes, and for conservation and restoration of biogeomorphic integrity of inland wetlands.

Natural connectivity dynamics and the effects of human modification, exemplified in semi-arid catchments

Professor Janet Hooke[1]
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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Natural and expected connectivity patterns and disconnectors occur at a variety of spatial and temporal scales, as illustrated in a range of dryland catchments. Natural features and landscape configuration can produce disconnectors such as rock steps in the long-term, and alluvial fans of varying size on long to short timescales, involving sequences of evolution and spatial propagation; similarly, increases in longitudinal connectivity can occur by gullying and incision arising from natural conditions, complex responses and autogenesis. Full functional connectivity only tends to take place in rare large flow events. The recent connectivity state of main channels has been mapped in detail in two catchments in SE Spain, but various anthropogenic activities are shown to have disrupted or increased the natural connectivity over various timescales. These include: historic agricultural terracing then later abandonment and some landscaping; construction of large dams, smaller check-dams and weirs for water and sediment control; implementation of irrigation works, water transfers and water abstraction from historical to recent times; construction of roads and tracks; and gravel mining within active channels and alluvial terraces, which have radically altered topography. These human modifications change the location, timing and magnitude of responses to natural events. In some cases of large events, the flows have returned to natural connectivity flow paths, sometimes with disastrous consequences. Vegetation associated with natural characteristics or anthropogenic structures can also modify the connectivity, attenuating flood peaks and decreasing sediment flux. Identification of locations and types of plants adapted to various connectivity pathways was used as the basis for practical recommendations for sustainable management of runoff, soil erosion and sediment flux in SE Spain. Thus, applying a connectivity framework can provide a vital basis for understanding natural landscape evolution, changes and dynamics over time and their interrelations, and the extent and effects of human modification.

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Dynamics and interactions of water flow in managed dryland catchments

Professor Janet Hooke[1]
[1]University of Liverpool, Liverpool, United Kingdom

01A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 11:40 AM - 1:10 PM

Semi-arid catchments of southern Europe comprise mainly ephemeral streams set in a highly managed landscape. Modelling and field measurements were initiated in the 1990s when the possibility of future severe desertification in the region was posed. The water flows, morphology, vegetation and sediment characteristics in channel reaches in three catchments of differing lithology in SE Spain have been measured since 1996. This paper examines the accumulated evidence to address questions of the effects of different conditions, events and sequence of flows, the major controls on these and their spatial variations, and the extent to which a signal of climate change and desertification can be identified. Within that period, major phases of drought and of higher rainfall have occurred. Intense, but highly localised, rainfalls produce high spatial and temporal variability of channel flow, with mostly 1- 3 events a year at each site. Even quite low flows can produce erosion and sediment flux, but major floods can have significant morphological impacts. An extreme event was calculated to have produced record-breaking sediment fluxes. Trajectories of morphological change have varied between catchments and between sites. These ephemeral channels tend to have vegetation within the channel zone and, though mostly highly resilient, this can be reset by these flash floods. The variation of both the morphological and vegetation state affects the flood dynamics. Timescales of vegetation recovery from large events and the influence of sequences of conditions are identified. Anthropogenic influences, particularly through water management, have also been significant, especially in effects on connectivity. The infrequency of flows and events, their spatial variability, the sparsity of data, and the various human management actions pose challenges in disentangling these complex interactions and dynamics and their implications.

Geomorphic implications of debris nets in the Tairāwhiti/Gisborne Region – A slash and sediment delivery problem

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08D: Engineering Geomorphology, Dobson 3, February 5, 2026, 9:35 AM - 11:05 AM

Forestry is a dominant industry in Aotearoa/New Zealand, with many forested landcover in river catchments characterised by highly erodible geology, steep slopes and high rainfall. During extreme storm events, forestry slash and substantial volumes of sediment can be delivered to river systems causing damage to downstream reaches, particularly in areas of Multiple Occurrence Regional Landslide Events (MORLEs) and high sediment yields.

Amongst other forestry-led practices, debris nets and racks have been proposed as a solution to mitigate the mobilisation of forestry slash during future extreme events, intended to capture forestry debris mobilised during extreme flood events. The structures are offered as a solution to solve the slash delivery problem, with the removal of wood waste captured by the structures. Current discussions however overlook the sediment delivery problem and to what extent sediment built-up behind the structures will be managed. This presentation explores the broader geomorphic implications of debris nets and racks.

The hydraulic and geomorphic effects of these structures in high sediment yield catchments are explored at a conceptual level. The resulting geomorphic effects are analogous to sediment trapping behind dams and the decommissioning of them. Under extreme flows and partial or full blockage scenarios, velocity is likely to decrease upstream of the structures, resulting in sediment deposition, bed level aggradation and increased inundation upstream of the net. Downstream of the net, velocity is likely to increase, with the degree of downstream incision largely dependent on bedrock controls within the channel. The nets disrupt the sediment cascade for the broader catchment and the cumulative impact of aggradation over successive events is not well understood. This presentation will explore the conceptual understanding of these structures within high sediment yield catchments to instigate discussion around the broader geomorphic implications of debris nets and racks and the sediment delivery problem within Aotearoa/New Zealand.

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Evolution of large wood on bars and it's effects upon sediment storage and transfer

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

This study examined how the break-down of large wood influenced sediment accumulation and grain roughness on the Allier River, France, between Nov 2020 and June 2022. PIT-tagging allowed identification and tracking of 9 trees. Repeat TLS was used to scan the trees positioned on dry bar surfaces, scanning the full tree structure and details of the local topography around the wood. To examine how each tree broke down over time, we derived complexity indices from the tree point clouds including volume, total branch length, branch order and branch reverse order using QSM. Topographic and roughness changes were established through subtracting elevation and local roughness height grids. Trees 074B33 and 074ACC were recruited following a high summer flood event of 600 cumecs, and deposited together on a bar surface. Between Nov 2020 and June 2021, a 560 cumec flood failed to mobilise the two trees, however notable local topographic changes were evident; ~0.5 m of scour around the root, and deposition of ~0.4 m high lobes of sand and fine gravel within and around the branch structure. Zones of scour on the lee of the trees were also seen to have an influence for ~ 50m downstream. Net erosion of 19m^3 was found in the zone of influence the trees. Grain roughness changes were also detected with coarsening coincident with scoured areas, and fining associated with depositional lobes. Data from all 9 trees suggest that local sediment storage was found to decreases as tree complexity reduces over time as the trees broke down, indicating more sediment accumulation when there is more wood volume and when trees have recently been recruited to the channel. Upscaling sediment budget information around trees on bar surfaces to larger reaches of the Allier, should improve understanding of the effects of large wood on sediment transfer dynamics.

Geomorphic drivers of large wood storage and mobility in a meandering reach of the Allier River, France

Borbála Hortobágyi[1], Gabriel Melun[2], Stéphane Petit[3], Hervé Piégay[1]
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02K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 2:00 PM - 3:30 PM

Large wood (LW), supplied to rivers from the fluvial corridor and adjacent hillslopes, plays an important role in fluvial biogeomorphology by influencing channel morphology, flow hydraulics and habitat heterogeneity. At the same time, it may represent a risk when accumulating into logjams, increasing flood hazard and threatening infrastructures, particularly bridges. However, wood storage dynamics in meandering rivers remain less understood, particularly in terms of how geomorphic features influence retention and mobility over time, which has implications for habitat complexity and resilience. This study investigates the spatial and temporal variability of LW storage within a 12-km meandering reach of the Allier River (France), focusing on geomorphic controls influencing deposition and transport. Using a multi-temporal dataset combining eight sequences of aerial imagery between 2009 and 2023 as well as 296 wood pieces that were tracked using radio-frequency identification (RFID) between 2020 and 2024, we analysed LW deposition across 18 alluvial bars. Results reveal significant spatial and temporal heterogeneity in LW distribution, with alluvial bars consistently acting as primary retention zones, capturing over 60% of wood detected during each survey period. However, bar-specific differences in storage capacity, remobilisation frequency and spatial distribution patterns were pronounced. Statistical analysis indicates that bar sinuosity, in particular, plays a key role in promoting wood retention, stability and lateral dispersal. Our findings underscore the geomorphic specificity of LW dynamics in meandering systems and highlight the role of bar-scale morphology in modulating wood dynamics. These insights are essential for anticipating downstream wood-related hazards and informing river restoration strategies that take advantage of naturally effective retention zones.

Field Monitoring of Hāpua Dynamics: Linking entrance morphology, physical processes, and salinity exchange

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Hāpua are coastal lagoons that form at the mouth of gravel-bedded rivers along mixed sand-and-gravel coasts. Globally, hāpua are rare systems, but they are ubiquitous in the South Island of New Zealand and are of high cultural and ecological significance. hāpua are very dynamic systems, with mouths that intermittently close as a result of transient gravel bar construction along the coast, or open by fluvial discharge breach associated with high flow events. The opening/closing of the hāpua results in substantial variability in lagoon water level, water salinity, and channel morphology, which also respond to tidal fluctuations over daily to tidal cycle time scales. Existing models of hāpua formation are drawn from discrete case studies, but do not capture the breadth of different catchment characteristics (e.g., flow regimes, sediment yields, or catchment ruggedness). Additionally, little is known about the periodicity of the turnover in salinity or physicochemical composition of hāpua and whether these are broadly concordant across hāpua between differently scaled catchments. We report on preliminary data observing high-temporal resolution of water level and salinity from several smaller hāpua in Canterbury, New Zealand, providing the first dataset that compares between different systems. The salinity varies from a classic tidal salt wedge to an intermittent, wave-overtopping salinisation flushed at widely varying rates either through permanent (or intermittent openings) or seepage through the bar. The changing nature of the salinity regimes have direct implications for hāpua water quality and habitat and may also act to attenuate nutrient-rich runoff before it is discharged to the marine environment. These field-based data will be useful for refining conceptual models of hāpua development and their vulnerability to changing fluvial and/or marine conditions. Such data will be essential for providing baseline information on hāpua dynamism, by which future environmental change can be evaluated.

Post-seismic transformation and erosion of uplifted shore platforms

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03F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 4:00 PM - 5:30 PM

Co-seismic uplift produces a near instantaneous landform transformation and triggers a cascade of perturbations to geomorphological processes, and in the coastal domain can lead to the formation of marine terraces that act as a surrogate record of past seismicity. Sequences of Holocene marine terraces are, however, unlikely to be complete records of uplift events because during the inter-seismic period there are suites of geomorphological processes that may collectively enhance weathering processes that lead to lithic breakdown and removal of the most-recent terrace formation. Such a sequence of events has occurred on the north-eastern coast of South Island, New Zealand, where the 2016 Kaikōura earthquake (Mw 7.8) uplifted the shore platforms that encircle Kaikōura Peninsula by ~1 m. Immediately following co-seismic uplift there were significant changes in the dominant processes of platform downwearing, especially as portions of intertidal shore platforms were upwardly displaced above the tidal range leading to significant reduction in water depth and wave energy. Cover deposits formed quickly at the back of the platforms from a combination of tsunami deposits, colluvium displacement and subsequent rapid rock material desiccation and slaking from reduced wetting and drying cycles. The effect was a tripling of downwearing rates from the pre-earthquake rates in some locations, although these were spatially variable due to subtle differences in monitoring station material properties and post-uplift frequency of water inundation from tides and storms. The rates of surface lowering have been sustained in the decade following the earthquake, relative to pre-earthquake rates suggesting that the post-seismic period on incipient marine terraces undergo accelerated decay. Here, we interrogate rock breakdown processes that best explain the temporal and spatial differences in platform lowering by examining environmental conditions between quarterly monitoring measurements. Such data are essential for refining empirical models of marine terrace destruction during inter-seismic periods.

An evaluation of shore platform erosion using long-term micro erosion meter data, and InSAR analysis from Australia and New Zealand

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03F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 4:00 PM - 5:30 PM

Micro-erosion meters (MEMs) have been deployed to quantify shore platform erosion at two rock coast sites: Kaikōura Peninsula, New Zealand, and the Otway coast, southeastern Australia. Both sites now represent the longest-running MEM monitoring programs globally, spanning multiple decades (>45 years). These long-term datasets enable the assessment of erosion dynamics across intra-annual to decadal timescales, revealing temporal variability in platform downwearing rates and the episodic nature of erosional processes. The findings underscore the significance of sustained, high-resolution monitoring in refining models of shore platform development and evaluating the evolution of shore platforms. The MEM technique is being challenged by newer methods, but it continues to demonstrate the value of using field-based micro-scale observation. Higher precision rates, long-term datasets, and micro-scale measurements of platform surface changes from less than 0.1 mm to 5 mm/yr are all possible with MEM. The Otway shore platforms eroded at a rate of 0.24 mm/yr between 1979 and 2024, unaffected by any significant tectonic events or earthquakes. The Kaikōura Peninsula platform, on the other hand, shows a rate of approximately 1.22 mm/yr between 1977 and 2016, prior to the 2016 Kaikoura earthquake, and 2.55 mm/yr following the earthquake, up to 2024. The advent of new technologies like Artificial Intelligence, deep learning, machine learning, and various statistical modelling enables a re-examination of platform erosion rates. We can also address scale problems inherent in the MEM method with another technique, Interferometric Synthetic Aperture Radar (InSAR). Here we report the development of an InSAR work stream for investigating platform erosion at the scale of the whole platform. We then compare InSAR-derived erosion rates with MEM-derived rates to evaluate platform erosion. We discuss future potential and challenges in applying InSAR to rock coasts.

Bedload transport alterations due to hydropeaking events: a hydromorphological study of the Warche River (Belgium)

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10A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 2:30 PM - 4:00 PM

This study focuses on a reach of the Warche River (76 km² catchment area) in the northern Ardennes (Belgium), located downstream of the Bütgenbach hydroelectric power plant, commissioned in 1932. Each year, the plant operates for approximately 2,000 hours (about 250 events averaging 8 hours each), releasing a discharge of ~10 m^3/s—equivalent to the river's bankfull discharge. These frequent hydropeaking events significantly increase the occurrence of morphogenic discharges. At the same time, the dam plays an important role in flood regulation, substantially reducing the frequency of large flood events exceeding bankfull discharge.

Research conducted in the 1990s revealed that, following the construction of the dam, the 7 km downstream reach likely first underwent general channel incision over a period of approximately 30 years, followed by a doubling of the channel width over the subsequent 30 years. Additional morphological changes included a decrease in sinuosity and in the number of riffles and pools, as well as an increase in exposed bedrock outcrops. Frequent flow releases have led to the formation of numerous vegetated islets by intensifying lateral erosion and triggering incision of the floodplain.

The objective of the present study is to quantify the impact of hydropeaking on bedload transport velocity, in order to better understand riverbed armouring and the downstream propagation of morphological degradation caused by sediment deficit. To achieve this, approximately 200 pebbles were equipped with RFID tags (PIT tags) and monitored over time. Given the high frequency of morphogenic flows, initial surveys were carried out in the days immediately following tag deployment, followed by additional surveys at longer intervals.

A key finding of the study is the decline in the velocity of tagged particles with increasing duration of flow releases. These results provide valuable insights to guide restoration strategies, particularly gravel augmentation, aimed at rehabilitating the riverbed.

Using geomorphic observations of Holocene and Pleistocene tectonic deformation to constrain a probabilistic forecast of coastal deformation in future earthquakes

Dr Andrew Howell[1,2], Dr Kate Clark[2], Dr Nicola Litchfield[2], Dr Jack McGrath[1]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Incorporating the likelihood of sudden earthquake-driven coastal uplift or subsidence into sea level change forecasts is important in tectonically active countries such as Aotearoa New Zealand (A-NZ). Historical earthquakes in A-NZ have demonstrated the impacts that sudden coastal displacement can have on society, the environment and infrastructure such as increasing flood risk and degrading coastal ecology. A proof-of-concept probabilistic model that forecasts coseismic vertical displacement over 100 years in the Wellington Region of A-NZ has been developed, and we are expanding this model nationwide.

The probabilistic coastal deformation results require validation through comparisons with historical and prehistoric coastal deformation data. The A-NZ historical record is short (~185 years) but there have been 6 earthquakes that have caused coastal deformation within this period. The prehistoric coastal deformation record is much longer, but direct comparisons of geologic and geomorphic evidence of past coastal uplift and subsidence with modeling results are challenging. For example, it is hard to quantify possible long-term uplift from coseismic deformation in subduction earthquakes that is not fully recovered interseismically.

Estimates of (Holocene) single-earthquake displacement and recurrence interval may be the most useful validation dataset, due to ease of comparison with the seismic hazard model that our coastal deformation hazard model is based on. Preliminary results suggest that our Wellington proof-of-concept hazard model underpredicts single-earthquake displacements at some sites, and may consequently need adjustment to model coastal deformation realistically. The elevations of Pleistocene marine terraces also show promise as a dataset to constrain fault dips, a major source of model uncertainty in our proof-of-concept hazard model.

Our validation efforts are at an early stage, but establishing a robust methodology is essential for development of reliable probabilistic estimates of coastal deformation in future earthquakes. We therefore welcome feedback or suggestions on how to use geomorphic datasets.

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Assessing the utility of Ground Penetrating Radar for characterising Holocene marine terraces

Dr Andrew Howell[1,2], Dr Brook Keats[2], Dr Genevieve Coffey[2], Dr Pilar Villamor[2], Dr Nicola Litchfield[2], Dr Kate Clark[2], Mr Matt Cockcroft[1], Dr Jack McGrath[1], Dr Giles Ostermeijer[1]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The ages and elevations of tectonically uplifted Holocene marine terraces provide important constraints on the timing, location and magnitude of past coastal or offshore earthquakes in Aotearoa New Zealand — especially close to the Hikurangi subduction zone. However, post-uplift cover sediments often obscure the terrace morphology, blocking access to uplifted shore platforms and hindering precise estimation of the magnitude of past uplift. It is possible to excavate trenches through the cover sediments to reach the uplifted platforms beneath, but trenches are expensive and long, and risk disrupting archaeological sites in the subsurface.

Here, we assess the utility of ground penetrating radar (GPR) as a tool for investigating marine terraces. We surveyed seven different marine terrace sites where cover sediments had previously been excavated, using several different antennae, to compare GPR results against documented stratigraphy. The GPR performed best at sites where platforms were cut into mudstone bedrock and covered by <2 m of sandy sediments (Aramoana, Mahia and Kaikōura); in those sites, it was possible to determine depth to the bedrock platform using GPR but also to image the stratigraphy of cover sediments. Performance was less good (but still adequate) at sites with thicker sandy cover sediments (Waimarama) or where gravels overlie an undulating greywacke bedrock platform (Te Humenga Point). Sites where GPR did not perform well included Puakimuri Stream (<0.5 m of cover sediments over rocky uplifted platforms) and Cape Campbell (>2 m of gravel over a mudstone platform). Overall, our comparisons show good agreement between true (measured) depths to uplifted shore platforms and depths estimated using GPR. We conclude that GPR is a useful tool for investigation of Holocene marine terraces in Aotearoa New Zealand, either instead of trenching or as a tool to help choose the location of a trench or targeted smaller excavations.

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Geodiversity, Geoheritage & Wildfire Hazards - Tools for Assessment and Management

Dr Melinda McHenry[1], Ruby Hoyland[1]
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13J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 11:35 AM - 1:05 PM

Effects of wildfire on geodiversity elements such as soils, geology and landforms are highly variable, and poorly understood. In protected and conserved areas, misunderstandings and information deficits regarding wildfire and geodiversity have previously resulted in poor geoconservation outcomes. Wilfire can modify and/or diminish intrinsic and cultural values of geodiversity (as geoheritage). Wildfire-induced degradation of geosystem services can also result in other adverse nature conservation outcomes.

Over the past three years, we have sought to systematically address geoconservation issues arising from wildfire hazards. In this presentation, we will review the outcomes of this research, and discuss early and emerging findings from our current and developing wildfire projects.

We will first document our recent qualification and quantification of the immediate post-fire modifications to geodiversity elements and values. We will then show the development of quantitative relative geodiversity sensitivity indices, to be used in hazard planning and conservation mapping. We then discuss our emerging research that developed wildfire exposure parameters relevant to geodiversity and geosites - and show how these parameters can be incorporated into multi-criteria decision analyses and wildfire hazard planning.

We now know from speaking with protected area fire managers and scientists from 30 wildfire prone countries that financial, data paucity and awareness constraints impede meaningful 'wildfire aware' geoconservation. Upon acknowledgement of these constraints, we show how the indices and decision-support tools discussed earlier can be recalibrated and repurposed for fire managers and practitioners unfamiliar with geodiversity or geoheritage significance.

Our research is first to incorporate quantitative and qualitative dimensions to examine wildfire and geoheritage. The aim of this presentation is to describe the results arising from our novel integration of geographic and geomorphic methods and to contextualise these via user-informed and technical tools that aide in future wildfire protections and management.

Understanding drivers of geomorphic change in the braided Lower Waitaki River: Implications for management

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05A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 11:35 AM - 1:20 PM

The Waitaki River is New Zealand’s largest braided river by discharge (mean discharge ~360 m^3/s). The Waitaki catchment is also home to the Waitaki Power Scheme (WPS), New Zealand’s largest hydro-electricity generation scheme, which produces enough renewable electricity for half of New Zealand’s residential households.

We explore the relationship between the operation of the WPS and Lower Waitaki River geomorphology. This work uses field data and GIS analysis to assess morphological changes in the Lower Waitaki River over the past 30 years and uses morphodynamic modelling to help assess the relative role of the WPS on those changes.

Morphological changes in the Lower Waitaki are partly driven by the WPS, which has reduced bed-material supply by ~50% and dampens flood flows. However, the impacts of the WPS also need to be placed in the context of other drivers over the period of WPS operations, including the arrival of invasive exotic woody vegetation, flood management interventions, and agricultural encroachment. Our analysis concludes that truncated bed-material supply has caused some bed incision below Waitaki Dam, but there is no evidence of increased bed armouring. Braiding intensity has reduced along the river, associated with an increase in riparian vegetation cover and narrowing of the active braidplain width. The WPS is partly responsible for the braiding and vegetation changes, but the Lower Waitaki River would still have been incapable of keeping the riverbed clear of woody weeds under its naturally dampened flow regime. Reduced braiding intensity means fewer, more powerful braids and these can cause substantial localised erosion at the river margins during floods. Erosion risk at the margins has been increased by agricultural encroachment. However, dampening of the flood regime has reduced the overall potential for bank erosion. Ongoing vegetation management will play an important role in maintaining braiding and controlling bank erosion.

Why is interdisciplinary cooperation important in the search for optimal river management and restoration? Case study Elbe River (Czechia)

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03A: Learned lessons about anthropogenic drivers in the river evolution, Auditorium, February 2, 2026, 4:00 PM - 5:30 PM

The Lower Elbe Valley in the Czech Republic is a very valuable natural area closely linked to the adjacent area of the Czech Switzerland National Park. Centuries-long use of the environment by humans has led, especially in the last 150 years, to a significant transformation of the river course and its connection to the surrounding floodplain. The Elbe valley represents a significant traffic route, and at the same time the river section is threatened by other navigation structures in the Decin profile. The aim of our project was to determine the hydromorphological status (Usti nad Labem – the CZ/D state border), to create the concept of an interdisciplinary study to understand the development of valuable biotopes within Natura 2000 and to determine the main threat to their sustainable presence on the basis of climatological, hydrological, fluvial geomorphological and botanical analyses. The most valuable biotopes are created on fluvial accumulations (classified ba Natura 2000 as 3270 Rivers with muddy banks with Chenopodion rubri p. p. and Bidention p. p. vegetation). Their threat is determined by the modification of the riverbed and the management of the waterway. The critically endangered species Corrigiola litoralis represents the southernmost population in the given area, which is threatened by limited channel dynamics and inappropriate waterway management. As part of the solution, we proposed a suitable set of restoration proposals that also strengthen people's relationship with the important river of Central Europe. The research was supported by the Technology Agency of the Czech Republic Reg. No. SS03010279: Optimisation of the management of the Lower Elbe River with regard to the presence of 3270 biotopes and improvement of the hydromorphological state based on an interdisciplinary study.

Soil Erosion Processes of Single-Size Particles on Sloping Bare Land

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Soil erosion on hillslopes has long been a significant concern, especially in agriculture and ecosystem management in Taiwan. With increasing human activities, changes in land use, and natural factors, the short-term and long-term impacts of soil erosion on land resources have become more severe. To effectively manage soil erosion issues, realizing the physical processes and mechanism of soil erosion involved is crucial. This study employs an integral transform method to analytically solve the governing equation for soil erosion concentration under the impact of rainfall and uniform flow on sloping bare land. Based on the Hairsine-Rose (H-R) model, a soil erosion model, we incorporate longitudinal diffusivity and slope effects, which were not considered in the original H-R model, into the governing equation. Appropriate assumptions and boundary conditions are associated with the current issue. This study only focuses on single particle size erosion under raindrop impact, assuming uniform flow, constant water depth, and uniform slope erosion, so the slope remains unchanged during the erosion processes. According to the analytical results, the diffusion coefficient changes with increasing slope length, and without considering the runoff scouring effect, soil erosion concentration decreases with steeper slopes due to dilution from increased runoff. The detachment rate significantly influences soil erosion, increasing with higher rainfall intensity and lower water depth. Fine soil particles contribute more to soil erosion concentration, but the concentration decays faster over time. The results suggest that 20 μm may serve as a lower threshold for the influence of soil particle size on erosion, implying that particles smaller than this threshold exhibit minimal variation in erosion intensity.

The application of multiple methods for monitoring the evolution of a landslide near an indigenous community

Assoc. Prof. Huai-Houh Hsu[1], Assistant Professor Huan-Chin Kao[1], graduate student Chia-Chi Chang[1], graduate student Tsung-Yi He[1]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Tengjhih National Forest Recreation Area is located in southwest Taiwan. The strata of this area are the Changshan Formation. Its lithology is mainly slate, occasionally intercalated with thin sandstone layers. Headward erosion and weathering effects triggered landslides while heavy rainfall and typhoons hit Taiwan. Baoshan Village, a community of Bunun indigenous people, is near the Tengjhih National Forest Recreation Area. According to in situ investigation results, floor bulges, broken walls, and cracks were found everywhere in this community. Multiple monitoring methods were used to evaluate and reduce the landslide risk of Baoshan Village. This study set up IoT cloud-based tiltmeters and two inclinometer casings with 40 and 50m depths. The groundwater table and rainfall are also collected. In order to monitor surface displacement, the Global Navigation Satellite System (GNSS) technology has recently been adopted as a high-precision geodetic tool for quantifying surface movements. Employing both continuous and campaign-based GNSS observations enables real-time and long-term monitoring of ground deformation with sub-centimeter to millimeter-level accuracy. Integrating GNSS with the other monitoring methods further enhances spatial and temporal resolution. The long-term monitoring data show that landslides are slowly moving toward the northwest direction in this area. While analyzing the monitoring data, it is speculated that short-duration intense rainfall raises the groundwater table and triggers the movement of landslides. This paper introduces multiple monitoring methods, demonstrates the evolution of a landslide, and discusses the correlation of their output readings.

China’s Largest Freshwater Lake Dynamics Since the Little Ice Age

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Recent studies increasingly emphasize the role of human processes in lake water volume changes, which is undoubtedly important. However, a 700-year record from China’s largest freshwater lake shows that natural processes have remained the dominant driver (~80% contribution to storage variability), despite growing impacts from human processes (rising from 6% during 1300-1986 to 18% during 1986-2022). Notably, natural processes in this context also encompass the effects of climate change induced by human activities. This suggests that in studying modern freshwater lake storage dynamics, it remains essential to consider precipitation trends under global warming at the lake’s specific location.

Geoscience Australia’s Semi-automated Tools for Mapping Seabed Morphology from Bathymetry Data

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05E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 11:35 AM - 1:20 PM

With growing demand for consistent seabed geomorphology maps to support ocean science, management and policy, the International Seabed Geomorphology Mapping Working Group (ISGM) has developed a seabed morphology and geomorphology classification system that is based on standardised terminology and vocabularies (Dove et al., 2020: https://zenodo.org/record/4071940; Nanson et al., 2023: https://zenodo.org/record/7804019). To enable objective and repeatable mapping using this classification system, Geoscience Australia has developed semi-automated, rule-based GIS tools (Geoscience Australia’s Semi-automated Morphological Mapping Tools - GA-SaMMT) that operationalise the mapping of a common set of bathymetric high and bathymetric low seabed features.

GA-SaMMT implements a three-step solution – Map, Characterise and Classify (Huang et al., 2023: https://doi.org/10.3389/fmars.2023.1236788). The Map step delineates polygons that outline High and Low features; the Characterise step extracts attributes (metrics) to describe the geometry of the mapped polygons; and finally, the Classify step uses the attributes generated to assign a Morphology Feature type to each mapped polygon. For each of these steps a number of Esri ArcGIS Pro Python tools with graphical user interfaces have been developed. Importantly, to improve efficiency at the Characterise step, GA-SaMMT v2.0 includes tools that significantly reduce the time required to complete the step by utilising multiprocessing capabilities. GA-SaMMT also contains accessory tools to streamline post-mapping processes.

The GA-SaMMT tools have been tested and applied to case studies that represent a diverse range of spatial scales with complex bathymetric and physiographic settings. Here we present results demonstrating GA-SaMMT’s objectivity, repeatability, consistency, flexibility, and efficiency. We also demonstrate the application of these results to supporting the interpretation of marine geomorphic processes.

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A method for determining the critical conditions leading to meander cutoffs

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12B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 9:35 AM - 11:05 AM

To determine the critical conditions leading to meander cutoffs, a new approach has recently been proposed within the context of the self-organized criticality theory, using a non-dimensional channel mobility number M with channel sinuosity S. To evaluate the applicability of this approach in determining cutoff conditions in the wandering Lower Yellow River (LYR), we investigated the evolution of six actively migrating meanders using remote sensing images and river cross-sectional profile measurements. These meanders progressively developed cutoffs under conditions where $M \approx 1$ and $S \approx 1.6$. The cutoffs occurred more frequently after 2000 due to a drastic hydrological regime shift in the LYR. Before 2000, the river was dominated by hyper-concentrated flows and frequent overbank flooding. However, after the reservoir's operation, sediment concentration declined sharply and no overbank floods ever occurred. As a result, the river has excess energy to expend on both vertical and lateral directions, resulting in highly sinuous meanders that eventually underwent cutoffs. Hence, the critical sinuosities are modulated by allogenic factors, such as hydrological regime shift.

Origins and Characteristics of The Laminated Monoman Formation Muds of the Lower Murray River's "Floodplain" - Geomorphologic Implications

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Geochemical and sedimentological data are presented for samples taken from a ten-metre long core section of finely-laminated, “varved” muds. The core site is located 100 km upstream from mouth of the Murray River at Monteith in South Australia and it was recovered from beneath the present-day riverine floodplain at a site located 800 metres to the east of the present-day river channel. The Monteith core's mud sequence presents delicately interlayered, alternating, 1 mm to 10 mm thick laminae consisting of light-greenish-grey, finer-grained, clay to very fine silt; and coarser-grained, dark-grey, fine to medium silt. The two similar but contrasting materials were apparently deposited as a continuous sequence between ~8,500 ka and ~6,500 ka ago. A valley-wide transect of regularly-spaced, cone-pentrometer soundings indicates that the Monteith core's mud sequence is representative of a laterally continuous, 20-metre thick layer of mud, known as the Monoman Formation, that spans the entire width of the bedrock valley in which the mud layer was deposited. This data is interpreted to indicate that the entire width of the lower Murray River's bedrock valley at Monteith was occupied by large body of relatively still water which enabled the deposition of this very fine-grained, essentially varved material. This interpretation is supported by the location of a relatively large number of documented sites occupied by Meru and Ngarrindjeri communities during and subsequent to the period of time when the Monoman Formation Muds were deposited. The Meru and Ngarrindjeri are the traditional owners of the Lower Murray River and the location of their Holocene occupation sites are floodplain adjacent; they also commonly present shells of the South Australian ‘billabong’ mussel, Velesunio ambiguous. This also suggests that the lower Murray's bedrock valley was then occupied by a much-wider body of very-slowly moving water in the mid-to-late Holocene.

Morphologic Characteristics of Australia's K'gari Continental Margin: an example of slope deconstruction by mass wasting, canyon incision and current action

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06E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 2:30 PM - 4:00 PM

Multichannel seismic reflection and sub-bottom profiles acquired in 2022 aboard the RV Investigator (IN2022-V05) enable the morphologic features of the continental slope and abyssal plain offshore east Australia's K'Gari (Fraser Island) to be characterized. The K'gari continental margin is particularly steep (5–10°), deeply dissected by straight and anastomosing canyons; and presents numerous mass wasting features, including several impressive 'whole-of-slope' mass wasting features. These are the Wide Bay Canyon Slide, the Inskip Slide, and the Noosa Staircase which is a multi-scarp stack of nested rotational slide blocks. The adjacent abyssal plain of the northern Tasman Sea Basin also presents a number of intriguing and distinctive morphologic features. These include: a) a crescentic scour hole at the mouth of the Wide Bay Canyon, b) sets of en-echelon, chevron-shaped and/or arcuate depressions, several kilometres long and tens of metres deep, that have been eroded into the abyssal plain sediments and c) a steep-sided (30°), half-kilometre wide, forty kilometer long, 100 metres deep, sinuous channel that has been incised into apparently stiff, rather than soft abyssal plain sediments located seaward of the Noosa Canyon. While canyon incision and submarine slides are normally expected to present as deconstructional features on continental slopes, the erosional features identified to be present on the adjacent Tasman Sea abyssal plain were unexpected, and it is suspected that strong bottom current erosion during glacial maxima is responsible for the formation of these abyssal plain features.

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Modeling the environmental controls of uplifted beach ridge geomorphology

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Beach ridges are common coastal landforms along prograding and uplifting shorelines. The formation of individual ridges is commonly attributed to storms, co-seismic uplift, and sea-level oscillations. However, the influence of environmental controls and autogenic processes on their formation and character remains poorly understood. In this study, we develop a numerical model to investigate the impacts of both environmental controls and autogenic forcings on beach ridge morphology in regions undergoing glacial isostatic adjustment. Our results not only demonstrate that autogenic processes alone can generate beach ridges, but also that ridge morphology is predictably influenced by changes in environmental parameters such as bedrock slope, the rate of relative sea-level (RSL) fall, and sediment availability, making beach ridges valuable proxies for past environmental conditions. Model–data comparisons reveal strong correlations between ridge characteristics and environmental forcing parameters specifically, slower RSL fall and limited sediment supply produce fewer ridges that form over larger time periods, whereas smaller values of beach platform slope result in more numerous ridges forming more rapidly. These findings highlight the potential of beach ridge systems as archives of environmental change and underscore the need for refined modeling approaches that integrate the complex interplay between autogenic and allogenic processes.

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Indigenous landscapes: past, present and future

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09F: Engaging the relational work of geomorphology, Conway 1, February 5, 2026, 11:35 AM - 1:05 PM

Indigenous peoples have deep ties to their ancestral territories and natural resources. Many Indigenous peoples adhere to the epistemological approach of animism, in which human–nonhuman relationships are reciprocal and contextual rather than unidirectional and abstract, and these relationships shape each entity in meaningful ways. These holistic conceptions often assume a metaphysical realm that imbues landscape features with a spiritual life essence, and the animist worldview acknowledges geological and other landscape features as ancestors because of the generative and supporting roles they play in human survival. These beliefs have informed, and continue to inform, a deep guardianship and sustainability ethic that sees human beings as integral and dependent components of the environment. While modern Indigenous peoples have historical continuity with pre-colonial and/or pre-settler societies, colonial settlement in many places alienated Indigenous peoples from their traditional lands. Despite this, the United Nations Declaration on the Rights of Indigenous Peoples states they have the right to maintain and strengthen their distinctive spiritual relationships with traditional lands, and to uphold their responsibilities to future generations in this regard; they are also entitled to freely pursue their economic, social and cultural development. In this contribution I explore the concept of Indigenous landscapes through the lens of specific Māori communities in Aotearoa New Zealand. I adapt established frameworks addressing landscape physical, associative and perceptual dimensions to include anthropogenic influences on landscape evolution. I then address how in modern states Indigenous landscapes are influenced by the legacy of colonialism and introduction of infrastructure landscapes. This is followed by an exploration of how future trajectories of these Indigenous and infrastructure landscape palimpsests may transpire, and how they may influence and in turn be influenced by landscape evolution processes. I will conclude with how these concepts can be operationalised to conduct community-led landscape and infrastructure planning for climate adaption.

Concept of Anthropogenic Coastline and Proposed Applications

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Coastal erosion issues are primarily driven by rising sea levels resulting from climate change, coupled with human activities related to the development and expansion of coastal cities. Consequently, many coastal urban areas and residential zones are experiencing land loss, infrastructure damage, and ecological degradation. To address these challenges, various artificial structures—such as seawalls, submerged breakwaters, and groins—have been constructed along coastlines. However, these interventions can lead to unintended consequences, including increased erosion in adjacent areas and disruptions to the natural geomorphological balance.
In Gangneung, a coastal city in South Korea, the coastline is undergoing significant artificial alteration. As of 2024, about 56% of the city's 48 km coastline is classified as artificial. The term “artificial shoreline” typically refers to coastal segments that are directly adjacent to visible human-made structures. However, this definition has limitations, as it overlooks shorelines affected by non-visible structures, such as submerged breakwaters or underwater barriers, which may be inaccurately classified as natural. This binary classification of coastlines into “natural” and “artificial” can impede effective and scientifically informed decision-making in coastal management.
This study aims to propose a new concept for classifying coastlines, using Gangneung City as a case study. We define “anthropogenic coastlines” as coastal segments that are functionally and geomorphologically influenced by artificial structures, regardless of their visibility. Furthermore, we present criteria and methodologies for identifying and implementing this new classification in practice. This research can serve as a foundational resource for developing sustainable coastal management strategies. Additionally, it aims to steer coastal management towards a new direction, moving beyond structure-centered policies to approaches that prioritize ecological and social sustainability.

Quantifying the role of proglacial lake development of glacier dynamics in the Himalayas at a high spatiotemporal resolution

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Quantifying the response of lake terminating glaciers in High Mountain Asia to climate change is critical for projecting glacial hazards and freshwater availability downstream. Here, we utilise PlanetScope CubeSat imagery (3 m spatial resolution) to map monthly ice velocity using feature tracking for all major “Level 1” lake terminating glaciers in the Himalaya from 2017 to 2024.
We compare ice velocity against a range of variables; including ice area, slope, climate, elevation, retreat rate, and examine the spatial distribution of velocity trends across the region. Our analysis reveals considerable spatial and temporal heterogeneity: while some glaciers maintained nearly steady flow rates at their termini, others exhibited sustained acceleration and increased retreat velocities.

Seasonal patterns in ice velocity also varied significantly across the region, including differences in both the amplitude and timing of peak and minimum velocities. We find that trends of year on year acceleration toward the terminus can be a precursor to rapid retreat. One striking case is Bhutan’s Thorthormi Glacier, which accelerated to 448 m yr^{-1} by 2021 representing a seasonal variability of over 144.6 m yr^{-1} coinciding with rapid terminus retreat, ice-tongue disintegration, and calving of large tabular icebergs. This behaviour is likely driven by reduced basal drag as the glacier approached flotation.

These findings underscore the urgency of continuous, high resolution monitoring of lake terminating glaciers to anticipate glacial hazards and manage future water resources both in the Himalaya, and globally.

Investigating Snow–Ground Coupling at Rock Glacier Sites in the Retezat Mountains (Romanian Carpathians) Using Climate-Driven Physically-Based Simulations

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12G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 9:35 AM - 11:05 AM

In periglacial zones, snowpack characteristics strongly influences ground surface energy fluxes, regulating subsurface thermal behavior. This interaction is particularly significant in rock glacier settings, where snow accumulation and persistence control the onset, intensity, and duration of ground freezing. However, in marginal periglacial environments such as the Romanian Carpathians, the role of snow in controlling ground freezing conditions remains poorly understood. This study presents a process-oriented investigation of snow–ground thermal interactions at rock glacier sites in the Retezat Mountains, using in-situ measurements from the past decade to calibrate climate-driven simulations of snowpack properties and subsurface temperature dynamics under marginal permafrost conditions. To capture these dynamics in permafrost-susceptible mountain areas, we employ the physically-based SURFEX-Crocus land surface model, driven by ERA5 reanalysis climate forcings topographically downscaled with the TopoPyScale framework. This approach enhances terrain representation, which is critical for simulating cryospheric processes in complex alpine settings. Model calibration and validation are supported by a multi-source observational dataset comprising over ten years of ground surface temperature (GST) and bottom temperature of snow (BTS) measurements, UAV-derived snow depth reconstructions from the past three years, and time-lapse imagery documenting snow onset and melting phases during the 2024–2025 winter season. These data, collected across heterogeneous microtopographic conditions, provide robust constraints for assessing model performance in alpine terrain. By integrating physically-based modeling with high-resolution field observations, this study aims to improve the representation of snow–ground coupling in marginal periglacial sites of the Romanian Carpathians. The calibrated simulations will provide new insight into the spatial and temporal variability of snowpack and near-surface ground temperatures in rock glacier terrain, providing a framework for understanding cryospheric dynamics in climatically sensitive and understudied mountain regions.

Changes of buried river channels and archaeological sites in tectonic subsidence area: the case of the Echigo Plain, Niigata, Japan

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Alluvial lowlands have undergone continuous transformation because of the interplay between human activities and natural processes. In land subsidence areas, historical transitions of river channels and settlements are particularly complex. This study focuses on the Echigo Plain in Niigata Prefecture, central Japan, and aims to reconstruct buried paleochannels through a detailed analysis of surface geology using borehole data and archaeological site distribution. It also examined the relationship between ancient river courses and changes in human settlement patterns. Geological analysis identified multiple lenses of sand and gravel layers within clay deposits formed in flood plains and paleo-lake environments. These coarse-grained deposits correspond to buried paleochannels, including several previously unconfirmed or inaccurately located channels. Some of these paleochannels show upward-coarsening sedimentary structures in their downstream portions, suggesting the formation of deltas at the mouths of paleolakes. A comparison with archaeological data indicates that settlements dating from approximately 3500 to 2000 years ago were concentrated near these buried channels, suggesting that river proximity influenced habitation choices. Since these channels are overlain by widespread clay and humic layers deposited approximately 2000 years ago, it is inferred that they existed prior to this period. Stratigraphic evidence suggests that environmental changes, such as ground subsidence and flooding, have led to the expansion of lagoonal areas, upstream retreat of river mouths, and eventual burial of river courses. Subsequently, new channels are thought to have developed due to stagnation or the lowering of water levels.

Many long-term settlements established approximately 3500 years ago experienced temporary inland retreat between the late 9th and 11th centuries. This shift in settlement patterns appears to differ between the western and eastern parts of the Plain. In the west, changes were likely influenced by the expansion of paleolakes and alterations of paleochannels, while in the east, tectonic subsidence is considered a major factor.

Relationship Between Knickpoints in Mountain Rivers and Earthquake Hazards: A Study on Exploration Methods for Blind Active Faults

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

This study explores the relationship between the distribution of waterfalls and seismic hazards in a tectonically active mountainous region of Japan, aiming to assess the potential of using fluvial geomorphological features to identify active blind faults. By analyzing the spatial distribution of waterfalls in relation to topographic and seismic factors across multiple watersheds, the research reveals that waterfall occurrence is strongly influenced by watershed slope, elevation differences, and proximity to fault zones. Advanced statistical analysis identified key geomorphic indicators associated with waterfall formation, suggesting that these features are not randomly distributed but reflect underlying geological controls. Notably, clusters of waterfalls were found in areas lacking previously mapped faults but exhibiting evidence of past seismic activity, pointing to the possible existence of undiscovered blind faults. These findings highlight the significance of knickpoints—abrupt changes in riverbed profiles—as geomorphic markers of both past and potential future tectonic events. The integration of fluvial geomorphology and seismic data offers a novel approach to understanding landscape evolution and presents a valuable tool for improving earthquake hazard assessments. This study underscores the potential of river-based indicators to complement traditional geophysical methods in identifying fault activity, contributing to more effective disaster risk reduction in mountainous terrains.

Holocene River Evolution in Drylands: Setting the Story Straight with Crooked Creek

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[1]Macquarie University, Sydney, Australia

04B: Distributary landforms: past, present and future, Dobson 1, February 3, 2026, 9:35 AM - 11:05 AM

Palaeochannels preserved on alluvial plains are valuable indicators of long-term hydrological change. Across the Murray-Darling Basin (MDB) in southeast Australia, previous analyses of palaeochannels suggest a link between declining channel size and temperature change over the last 100,000 years. Specifically, catchment-wide shifts from larger, through-going channels to anabranching and discontinuous channels occurred as the climate warmed into the Holocene. In the northern MDB, the Macquarie River distributive fluvial system (DFS) preserves several larger palaeochannels, which contrasts with the smaller modern river that declines in capacity until it breaks down and loses continuity in the Macquarie Marshes. Currently there is a gap over the Pleistocene-Holocene transition between large LGM channels and the smaller 5 ka channel, which this study aims to address. Crooked Creek is a Holocene-aged palaeochannel that is larger than the modern river and preserves evidence of recent avulsions, perhaps indicative of a transitional state between single-thread and multi-channelled systems on the DFS. Using sediment analysis, mapping of channel morphology, and Optically Stimulated Luminescence (OSL) dating, we contextualise the Holocene channel evolution in response to climate-driven hydrological change. Results show that Crooked Creek had bankfull width 1.2-3.7 times greater and bankfull discharge 1.5-12.9 times greater than the modern Macquarie River. The relative difference in channel size increases downstream, reflecting the more rapid decline in capacity of the present-day Macquarie. Meander wavelength, amplitude and sinuosity are also larger for Crooked Creek, reflecting its greater discharge. Core samples reveal coarser and deeper bedload compared to the modern system and exhibit upward-fining sequences, indicating a gradual reduction in discharge followed by channel abandonment and infilling. Understanding river response to past warming climates can help to refine our knowledge of thresholds to river change, particularly in dryland catchments and DFSs like the northern MDB.

Ground Penetrating Radar and Stopbanks

Mr Kent Jacobsen[1]
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08D: Engineering Geomorphology, Dobson 3, February 5, 2026, 9:35 AM - 11:05 AM

Stopbanks are constructed to prevent flood water from encroaching onto land deemed worthy of protecting against inundation. Maybe its farm land, culturally significant land, urban development or critical infrastructure. Most stopbanks forms part of a flood protection that can include all sorts on non-uniform components. Some examples include buried services, paleo channels, uncontrolled tipping, transitions to floodwalls, closure structures, crest overflow structures, geotechnical treatments and seepage filtration.

Prior to construction, or for updated data to feed into condition assessments, or proposed upgrades, there is a need to understand ground conditions, as-built details or simply 'ground truthing' a feature. Ground Penetrating Radar can benefit these tasks.

Long linear infrastructure such as stopbanks often align over geological boundaries, pinching or thickening layers, and other heterogenous formations. What to expect before opening up the ground requires intrusive investigation, and it is recommended that geophysical inputs accompany this testing. Ground Penetrating Radar can give interpretation of geotechnical conditions, this then will help plan drill/CPT test sites; both for service avoidance and to interpolate conditions between point source tests.

Recent developments have substantially improved radar technology and this presentation will give exciting visual outputs that relate to various stopbank aspects, while discussion the benefits provided to the associated projects.

It is expected this field will grow and this presentation will help support adoption of this technology. Expect to gain an understanding of GPR for:

- subsurface scanning
- tomography outputs that can be inputted to GIS
- surface identification supported by GPS
- screening for obstruction to development
- repeat surveys over time for integrity assessment
- geotechnical gap analysis

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Advanced Remote Sensing Techniques for Soil Erosion and Land Degradation Assessment in North Queensland: Insights from the 2019 Flood Event

Ms Laleh Jafari[1], Dr Ben Jarihani[1], Dr Jack Koci[2], Dr Stephanie Duce[1], Dr Ioan Sanislave[1]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

North Queensland is highly susceptible to natural disasters such as cyclones, storms, bushfires, and particularly floods, which result in significant economic, environmental, and social costs across the region. Among the long-term consequences of these extreme events is accelerated soil erosion, especially gully erosion. Such erosion poses a serious threat to land productivity and water quality in catchments draining to sensitive downstream ecosystems, such as the Great Barrier Reef World Heritage area, and the Gulf of Carpentaria.

This study employs advanced remote sensing (RS) techniques to assess land degradation and erosion processes, focusing on the aftermath of the January 2019 flood event—one of the most significant in recent decades. We integrated Sentinel-1A Synthetic Aperture Radar (SAR) datasets with InSAR and SBAS (Satellite-Based Augmentation System) processing chains using SARscape software to detect and quantify land surface deformation, subsidence, and uplift.

Our analysis produced high-resolution displacement maps that reveal the spatial extent and magnitude of land surface changes across the study area. By comparing pre- and post-flood imagery, we were able to assess erosion dynamics and sediment transport processes triggered by the event. The results indicated significant surface deformation, with substantial sediment redistribution and gully development in affected catchments.

This RS-based methodology provided scalable, millimetre-to-metre level insights into land surface processes, offering a cost-effective and repeatable framework for monitoring landscape evolution in flood-prone and environmentally sensitive regions. The study highlights the value of remote sensing technologies for understanding geomorphological change, informing catchment management, and guiding post-disaster recovery planning.

Sediment budgeting in a large Himalayan river system to quantify (dis)connectivity and its implications on river management

Professor Vikrant Jain[1], Dr. Abhishek Dixit[1], Dr. Ajit Singh[2], Prof. S. K. Tandon[1,3]
[1]IIT Gandhinagar, Gandhinagar, India, [2]Earth Sciences, Prayoga, Bengaluru, India, [3]Department of Geology, Delhi, India

09B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 11:35 AM - 1:05 PM

Quantification of sediment (dis)connectivity leads to a fundamental understanding of landscape-channel interaction and basin-scale sediment dynamics. We applied a sediment budgeting approach to quantify sediment (dis)connectivity from source to sink in the large Ganga River system. The Ganga River basin with ~100,000 sq km area is characterised by two hinterlands namely the tectonically active-high relief Himalaya in the north and relatively tectonically-passive lower-relief terrain of cratonic region in the south. Sediment budgeting of the large alluvial reaches provided new insight into river-landscape coupling, nature of sediment dynamics and its drivers.

We compiled suspended sediment load data from various published sources to construct a comprehensive sediment budget for the large but data-scarce Ganga River system. The connectivity structure highlights the important role of (a) alluvial plains in modulating sediment fluxes and (b) strong regional contrasts in sediment dynamics with significant role of lower relief terrain of the cratonic region. The Western Himalayan Hinterland (6%) and Western Gangetic Plains (3%) contribute only 9% of the total 385 Mt/a sediment load, resulting in a supply-limited system with entrenched rivers. Interestingly, the lower-relief cratonic region contributes higher (11%) sediment, which was considered to be an insignificant sediment source to the Himalayan Ganga River. The Eastern Himalayan Hinterland is the dominant sediment source with 51% of the total load, but ~45% of this sediment is trapped in the subsiding alluvial plains, forming aggradational channels. The Transitional Himalayan Hinterland contributes 23% of the sediment load, which further increases to 29% through sediment reworking in the alluvial plains. Regional variability of river-landscape coupling and sediment dynamics in the Ganga River basin is driven by differences in uplift rates and precipitation in the hinterland area, while subsidence rates, stream power distribution pattern and urban growth in the alluvial plains govern sediment mobilisation and reworking in alluvial reaches.

Reconstructing past extreme weather events from alluvial fan sediments in the Upper Sava Valley, European Southern Alps

Dr Petra Jamšek Rupnik[1], Dr Andrej Novak[1], Dr Eva Mencin Gale[1], Dr Manja Žebre[1], Dr Jernej Jež[1], Dr Edmundo Placencia-Gómez[1], Lovro Rupar[1], Anže Markelj[1], Dr Martin Gaberšek[1], Dr Mateja Gosar[1]
[1]Geological Survey of Slovenia, Ljubljana, Slovenia

Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Alluvial fans in alpine regions are dynamic depositional systems that preserve sedimentary evidence of past geomorphic processes, frequently triggered by extreme weather events. Understanding the frequency and drivers of such events during the Holocene is essential for anticipating future landscape responses to climate variability, particularly in inhabited areas where these fans host infrastructure and settlements.

This contribution introduces an ongoing study of Holocene alluvial fan development in the Upper Sava Valley (European Southern Alps), where abundant post-glacial fans offer an excellent archive for reconstructing sedimentation dynamics. Although the impacts of recent (decades to centuries old) extreme weather events are well documented in this region, the long-term (centuries to millenniums) frequency and magnitude of such events remain poorly understood.

This research aims to reconstruct past sedimentary events and provide a detailed imaging of the internal architecture of alluvial fans in the investigated area. The main objectives are to identify and classify past sedimentary events linked to intense precipitation and runoff, to interpret the geomorphic evolution of the fans, and to establish a chronology of extreme-weather-related sedimentation using an integrated geomorphological, sedimentological, geophysical, geochemical, mineralogical, and chronological approach. The first step involves high-resolution geomorphological mapping of alluvial fans along a 35 km stretch of the Sava Valley, based on lidar-derived topography. These results will underpin targeted field investigations, including electrical resistivity tomography, exploratory trenching, and sediment sampling for age dating and geochemical analyses. The analyses will facilitate the differentiation of depositional units and the interpretation of their spatial and temporal relationships, laying the foundation for reconstructing sedimentary event frequencies, depositional processes and overall contribute to understanding of Holocene landscape dynamics in the Alpine foreland realm.

Paleoseismic evidence for surface rupturing earthquakes along the Raša Fault in the northwestern Dinarides (southeastern Europe)

Dr Petra Jamšek Rupnik[1], Dr Eva Mencin Gale[1], Aleša Uršič Arko[1], Lovro Rupar[1], Dr Jernej Jež[1], Dr Ana Novak[1], Josipa Maslač Soldo[2], Andrej Anžel[1], Dr Jure Atanackov[1]
[1]Geological Survey of Slovenia, Ljubljana, Slovenia, [2]Croatian Geological Survey, Zagreb, Croatia

05D: Advances, challenges and future directions in Tectonic Geomorphology AND Seismic Related Cascading Hazards: How Can They Contribute to Improve Paleoseismic Studies?, Dobson 3, February 3, 2026, 11:35 AM - 1:20 PM

The Raša Fault is a major right-lateral strike-slip fault in the northwestern Dinarides and represents a key active structure within the regional seismotectonic framework. Despite its prominent geomorphic expression, the seismic history of this fault remains poorly constrained. As part of a broader investigation integrating tectonic geomorphology, structural and geological mapping, and high-resolution geophysics, we carried out paleoseismological trenching to characterize past surface-rupturing earthquakes and improve the understanding of the role of the fault in regional seismic hazard.

We present the results from two trench sites, Petrovci and Dolenja Raša located near Senožeče in southwestern Slovenia. At Petrovci, trenching across a fault-bounded sediment trap exposed a deformed stratigraphy of fine-grained pedosedimentary units, revealing evidence for at least six paleoseismic events over the past ~25,000 years. The apparent displacements along the steeply dipping fault strands range from 13 to 180 cm, indicating significant coseismic surface ruptures. At Dolenja Raša, the trench was located in an alluvial setting and revealed folded and faulted layers of gravel, sand, and silt within a ~2 m wide fault zone. At least two paleoearthquakes were identified, dated to between ~30,000 and 6,000 years BP. However, we suspect that the records are incomplete as they have been truncated by erosion and more recent records have probably been removed.

These findings indicate that during the Late Pleistocene and Holocene the Raša Fault has generated multiple strong earthquakes with magnitudes likely ≥6.5. The fault is therefore capable of producing surface ruptures and triggering secondary hazards such as slope failures and drainage reorganization. The transpressive kinematics of the fault also drive long-term geomorphic changes. By documenting the recurrence of large surface-rupturing events, this study contributes to improved seismic hazard assessments in the Dinaric region and illustrates how earthquakes are recorded in and shape the geomorphic landscape.

Asynchronous lake level histories of the Willandra Lakes in semi-arid, southeastern Australia: evidence from Lake Outer Arumpo and Lake Mungo.

Dr Nathan Jankowski[1], Associate Professor Nicola Stern[2], Ms Molly Turnbull[1], Dr Haidee Cadd[1], Willandra Lakes Region Aboriginal Advisory Group[3]
[1]University Of Wollongong, Wollongong, Australia, [2]La Trobe University, Bundoora, Australia, [3]New South Wales Department of Planning and Environment, Buronga, Australia

02A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 2:00 PM - 3:30 PM

The Willandra Lakes Region World Heritage area has been a focal point for geomorphological research since the late 1960s. Its lunettes—crescent-shaped dunes framing ancient lake margins—record the complex interplay between hydrological and aeolian processes with their formation, sedimentology, internal stratigraphy, and morphology linked directly to fluctuations in past lake levels.

Although the overflow system comprises 13 major lake basins, research efforts have focused predominantly on Lake Mungo largely because extensive erosion has exposed its internal structure and a wealth of archaeological material. As a result, our understanding of the Willandra's palaeoenvironmental record has been shaped by this one terminal lake and the assumption that its individual lake level history can be applied across the system. This has led to the suggestion of a synchronous lake level history across the system for the past ~54,000 years.

This study explores the palaeoenvironmental record preserved within the lunette and near-shore facies of Lake Outer Arumpo. Detailed analyses were undertaken at three locations in the basin's northeast, two focusing on lunette facies (sites TH1 and OA-15) and one on near-shore facies (site TH3). By integrating micromorphological thin-section analyses with 108 single-grain optically stimulated luminescence (OSL) ages, a high-resolution chronostratigraphic framework for lunette development has been established. This is compared with the record from Lake Mungo, based on the Mungo Archaeology Project's 168 single-grain OSL ages collected along four transects and selected residuals at the southern end of the lunette.

Our results show that rather than system-wide synchronous filling and drying, each lake basin exhibits its own hydrological history linked to its position within the overflow system. These results have significant implications for reconstructing past environmental changes in Australia's semi-arid southeast and are critical for accurately interpreting the region's cultural heritage and the history of Aboriginal land use and occupancy.

From Beach to Cliff: Adapting CoastSnap Citizen Science Methodology for Coastal Cliff Change Detection Using Basic Image Processing

Mr Alfredo Jaramillo[1,2], Dilhani Dodangoda[1], Dr Marion L. Tan[1], Dr Raj Prasanna[1], Dr Sam McColl[2], Dr Saskia de Vilder[2], Dr Carol Stewart[1], Meenambika Chandirakumar[3], Supun Gamlath[3]
[1]Massey University, Lower Hutt, New Zealand, [2]GNS Science, Avalon/Lower Hutt, New Zealand, [3]Department of Computer Science & Engineering, University of Moratuwa, , Sri Lanka

Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Although traditional CoastSnap citizen science initiatives primarily focus on beach monitoring, coastal cliff environments present equally dynamic geomorphological systems that benefit from regular observation. This study explores the feasibility of adapting the CoastSnap methodology for monitoring coastal cliffs using basic image processing techniques applied to smartphone images of varying quality and specifications.
Three study sites were selected across New Zealand: (1) Ōnaero and Urenui in Taranaki, (2) Cape Kidnappers in Hawke's Bay, and (3) Mairangi Bay in Auckland. Citizen scientists contributed smartphone images of coastal cliffs captured from fixed stations. The images collected comprise photos with diverse characteristics depending on the types of devices used by the participating citizens.
MATLAB-based image processing workflows were developed to identify characteristics of morphological change that could indicate potential locations of future rockfall events or be used to determine the nature and frequency of cliff failures. The methodology aims to identify areas of significant changes between photographs, such as new cracks, rockfall scars or new debris at the base of the cliff, that indicate cliff failure events have occurred or could potentially occur. In order to do so, the photos must be aligned via a geometric transformation, noise reduced via conversion to greyscale and Gaussian filtering, and thresholds applied to highlight significant changes
Preliminary results show that, despite variable image quality and camera perspectives, basic processing techniques can help to successfully identify morphological changes. The study findings confirm that the citizen science approach can be used to improve the temporal resolution of morphological change information, compared to conventional topographical survey methods, improving cliff monitoring programmes and contributing to the understanding of cliff behaviour. This research highlights the potential for expanding citizen science applications beyond traditional beach environments to encompass a broader range of coastal geomorphological monitoring.

An assessment of landslide hazard perceptions in coastal cliff environments: An international multi-method approach.

Mr Alfredo Jaramillo[1,2], Dr Marion L. Tan[1], Dr Raj Prasanna[1], Dr Sam McColl[2], Dr Saskia de Vilder[2], Dr Carol Stewart[1]
[1]Massey University, , New Zealand, [2]GNS Science, Avalon/Lower Hutt, New Zealand

04C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 9:35 AM - 11:05 AM

Coastal cliffs are popular recreational areas but expose visitors to landslide hazards. Limited information exists on how people recognise or perceive these hazards. This study evaluates public perceptions of landslide hazards in coastal cliff environments through innovative methodological approaches combining digital and participatory techniques.

An online questionnaire utilised real photographs and AI-generated imagery to assess how individuals identify potential landslide hazard indicators in coastal cliff environments. Participants from over 10 countries, with diverse backgrounds and coastal usage levels, identified environmental signals they perceive as dangerous, providing cross-cultural insights into hazard perception patterns.

Focus group workshops were conducted with government officials from councils corresponding to New Zealand study sites. These sessions provided qualitative data on professional perspectives regarding risk assessment and local governance approaches to coastal hazard management.

Preliminary findings reveal that hazard recognition capabilities vary across groups, with differences influenced by coastal usage patterns, recreational habits, and community engagement. Country of origin does not significantly influence hazard perception. Instead, users' previous experience—through coastal usage or residence in coastal environments—appears more significant. The study demonstrates how varied coastal experiences and participation in citizen science projects shape hazard perceptions. Such factors affect individuals' ability to identify and assess geological hazards.

These findings can inform targeted hazard communication and educational programmes for groups with lower risk perceptions. This research contributes to applied geomorphology by bridging the gap between scientific hazard assessment and public understanding. The multi-national scope and citizen science methodology provide a foundation for improved risk communication strategies, supporting better-informed decision-making in coastal cliff environments and enhancing the application of geomorphological knowledge in risk management contexts.

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Overcoming Vegetation Challenges in Drone-Based Digital Terrain Modelling for Hydrodynamic Applications

Dr Ben Jarihani[1], Mr Lachlan John[2], Associate Professor Nathan Waltham[1], Dr Lynise Wearne[2]
[1]James Cook University, Townsville, Australia, [2]Greening Australia, Brisbane, Australia

04H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 3, 2026, 9:35 AM - 11:05 AM

Accurate digital terrain models (DTMs) are essential for hydrodynamic modelling, particularly in low-relief floodplains, wetlands, and coastal zones where subtle topographic variations influence flow patterns. However, generating reliable DTMs using drone-based photogrammetry or LiDAR remains challenging in vegetated environments. This study explores methods for overcoming vegetation interference in drone-derived DTMs, with a focus on improving terrain representation for hydrodynamic applications.

We present a comparative analysis of DTM generation using both structure-from-motion (SfM) photogrammetry and drone-mounted LiDAR across sites with varying vegetation cover, including grasslands, riparian zones, and mangrove wetlands. Key challenges addressed include vegetation filtering, ground point classification, and integration with ground-based RTK GNSS surveys. The study also evaluates post-processing techniques such as morphological filters and canopy height models to isolate ground elevation.

Results demonstrate that while dense vegetation significantly compromises photogrammetric DTMs, drone LiDAR—when supported by appropriate filtering algorithms—can capture ground surfaces with higher accuracy. However, even LiDAR is subject to errors under dense canopy or complex understory. A hybrid approach combining drone LiDAR with selective ground truthing and terrain correction is recommended to enhance model reliability.

This work contributes practical insights for researchers and practitioners aiming to apply high-resolution topographic models in hydrological and hydraulic modelling. Addressing vegetation-related limitations is critical for advancing the use of drone-based DTMs in flood modelling, habitat assessment, and nature-based infrastructure design.

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Surficial structures and landscape development in dryland paleolake environments: The case of the Ntwetwe Pan Islands

Miss Leloba Jefferis[1], Kebonye Dintwe[2], Andrew Gunn[1]
[1]Monash University, Melbourne, Australia, [2]University of Botswana, Gaborone, Botswana

10H: Shaping Arid Landscapes: Unraveling the Complex Interactions Between Wind, Sediment, and Vegetation in a Changing Climate, Conway 3, February 5, 2026, 2:30 PM - 4:00 PM

The Ntwetwe Pan islands have become increasingly studied as part of a larger effort of untangling the final millennia of the now desiccated Paleolake Makgadikgadi, a large contemporary dust source and critical archaeological site. The islands are clustered along the western shoreline of the salt pan with varied morphology, in some cases resembling barchan dunes or spit-like features. Various formation theories have been proposed, such as relict shoreline erosion and aeolian deposition, however conflicting results has made a definitive formation hypothesis elusive. We present co-registered ground penetrating radar (GPR), aerial imagery, and LiDAR elevation data to determine if vegetated banding apparent on the islands' surfaces reflects internal stratigraphy. These data link banding to shallow terracing structures on the windward face of the islands while gullying incise through terraces predominantly on the leeward faces. GPR of internal stratigraphy in the upper 2 metres of the landforms reflects beds dipping into the wind extending from the terrace faces– particularly on more developed islands – in line with the theory proposed by Richards et al. (2021) of windward accumulation by deposition of deflated pan material. Whether the 'sticky-mound' hypothesis, where island-building is initiated by reduced sand flux over moist patches on the highly heterogeneous surface of the pans, proposed by Richards et al. is also accurate is not immediately clear from the GPR imagery. We focus on both the surface and internal nature of the terracing structures which develop well after 'sticky-mound' initiation, coupled with known ages at depth for selected islands, to link their development with intermittent drying hydroclimate experienced by the pans since ~8.5ka. If possible, these islands may serve as a proxy for aridity trends in a region where conventional paleoclimate proxies are limited.

Multitemporal landslide susceptibility modelling to assess the effects of road upgrading on slope stability

Paula Sofía Jerez-Longres[1], Jorge Pedro Galve[1], Massimiliano Bordoni[2], José Miguel Azañón[1], José Luis Pérez-García[3], José Miguel Gómez-López[3], Davide Notti[4], Francisco Lamas[5]
[1]Department of Geodynamics, University of Granada, Granada, Spain, [2]Department of Earth and Environmental Sciences, University of Pavia, Pavia, Italy, [3]Department of Cartographic Engineering, Geodesy and Photogrammetry, University of Jaen, Jaen, Spain, [4]Geohazard Monitoring Group, IRPI-CNR, Turin, Italy, [5]Department of Civil Engineering, University of Granada, Granada, Spain

13C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 11:35 AM - 1:05 PM

Landslide susceptibility models serve not only to estimate the probability of slope failures, but also to evaluate the potential impact of surface changes over time on slope stability. This study presents a multitemporal analysis of landslide susceptibility along a 15-kilometer stretch of road A-348 in Granada (southeast Spain), where a road upgrade altered the slope geometry and land use. These modifications contributed to the occurrence of multiple landslides following a period of intense rainfall between 2009 and 2010.

Susceptibility models were produced for three time points: before road upgrading, after upgrading but prior to the period of intense rainfall, and following this latter period. To explain the spatial distribution of the inventoried landslides we analysed a set of conditioning factors, including the slope angle, land use, Normalized Difference Vegetation Index (NDVI), and terrain ruggedness.

Modelling was conducted using several techniques. An initial assessment employed the likelihood ratio method to identify the factors influencing landslide occurrence. Subsequently, more advanced approaches were applied, incorporating Multivariate Adaptive Regression Splines (MARS) and machine learning algorithms (random forest classification and support vector machine) to improve the robustness of the modelling approach. The forecast capacity of the susceptibility models was assessed using ROC curves, and the area under the ROC curve (AUROC) was used to compare model performance.

This approach allowed us to estimate a 24-41% increase in landslide susceptibility after the reconfiguration of the road layout. Conversely, we observed a 14-20% decrease in susceptibility after the landslides triggered by the rainfall event, suggesting a natural decrease in slope instability due to the natural adjustment of the slopes.

These results provided insight into the impact of anthropogenic changes on slope stability, as well as the application of landslide susceptibility models to assess the effects of land use changes and variations in slope geometry on slope stability.

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Holocene evolution of the Qiongzhou Strait between Hainan Island and mainland China

Ms Liyun Jia[1]
[1]Institute of Geomechanics, Chinese Academy of Geological Sciences, Beijing, China

02E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 2:00 PM - 3:30 PM

The Qiongzhou Strait, situated between Hainan Island and mainland China, has experienced a complex late Cenozoic evolution involving successive phases of marine flooding and land bridge exposure. Its last Holocene phase of evolution is important for understanding regional tectonics, climate dynamics, and ancient human migration patterns. In this paper, we integrate drilling data, microfossil analysis, and AMS 14C dating, to show that coastal sedimentation established on both sides of the strait at ~11.2 ka BP, and full east-to-west seawater flooding occurred at ~9.0 ka BP. The strait's evolution comprised six phases: (1) A land bridge existed before ~12.0 ka BP; (2) Seawater inundation of low-lying areas occurred at ~12.0–11.2 ka BP; (3) Rapid sea-level rise and complete strait opening occurred during ~11.2–9.0 ka BP; (4) Fluctuating sea-level rise, peaking 2-3 m above current levels and resulting in maximum strait width, occurred at ~9.0–6.0 ka BP; (5) Sea-level regression and marine plain exposure occurred ~6.0–1.0 ka BP; (6) Stabilized coastlines developed after ~1.0 ka BP. These stages highlight the interplay between postglacial sea-level changes and regional tectonic subsidence, providing a framework for reconstructing paleoenvironmental shifts in the northern margin of the South China Sea. The development of full marine connection at ~9.0 ka BP underscores the long-term importance of the strait's role as a hydrographic corridor through the Holocene.

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A semi-automated GIS approach to understanding morphologic pattern and changes over the last five decades at Mallee dunefield, SE Australia

Dr Hong Jiang[1,2], Dr Jan-Hendrik May[2]
[1]TNC Australia, North Melbourne, Australia, [2]The University of Melbourne, Parkville, Australia

10H: Shaping Arid Landscapes: Unraveling the Complex Interactions Between Wind, Sediment, and Vegetation in a Changing Climate, Conway 3, February 5, 2026, 2:30 PM - 4:00 PM

Future climate projections indicate an expansion of the world's dryland systems and thus an increasing mobilization of unconsolidated desert sediments such as sand and dust. The dust, which can be deflated and transported far, is not only a fertilizer for land and oceans, but also a key factor of climate feedbacks such as changing albedo effects and radiative forcing. It is therefore increasingly important to better understand the evolutionary processes and mobilization thresholds. One essential part of this effort is to investigate dryland landscapes, such as dune fields, on a large scale. This study investigates the morphological pattern of the Mallee dune field and its changes over the last five decades, based on remote sensing data. Specifically, we propose an object-based, semi-automated GIS approach to extract dune geometries and parameters from declassified images and Sentinel-2 multispectral images. The declassified images, surveyed by the Keyhole (KH) satellite system KH-9 (Hexagon) in 1973, have a high spatial resolution of 0.6 to 1.2 m. By comparing the remote-sensing-derived generalized dune pattern in 1973 and the present, we obtain the geomorphic changes over time and analyse them with ERA-5 climate reanalysis model data. Our study provides a workflow for investigating dune changes, as well as the first semi-automated dune extraction approach for declassified images.

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Assessing the role of wind-related sedimentary processes in Australia's lakes

Dr Hong Jiang[1,2], Dr Jan-Hendrik May[2], Dr Mathieu Schuster[3,4], Thomas Faraon[2]
[1]TNC Australia, Carlton, Australia, [2]The University of Melbourne, Parkville, Australia, [3]Centre national de la recherche scientifique (CNRS), Parkville, Australia, [4]Institut Terre & Environnement de Strasbourg, Strasbourg, France

09H: The signature of climate change in arid landscapes, Conway 3, February 5, 2026, 11:35 AM - 1:05 PM

Recently, the concept of wind-driven waterbodies was introduced to emphasize lakes for which wind-induced hydrodynamics are the dominant agent for the mobilization, reworking, transport and deposition of sediments. Australia hosts a surprisingly large number of lakes, distributed all over the continent, that show remarkable diversity with regard to their size, shape, geological setting and hydrology. Despite this diversity, most attention has so far focused on non-perennial salt lakes and their hydrological and mineralogical properties and evolutionary pathways. Limited attention, however, was given to other physical properties of these lakes, resulting in a lack of understanding of the primary geological processes relevant to the lake's sedimentary budget during both wet and dry phases – and consequently their longer-term geomorphic evolution. This study proposes a new classification of 116 Australia's large lakes based on their dominant sedimentary processes. To identify and categorize them, we developed a remote-sensing-based multivariate dataset, comprising 162 variables that cover aspects such as geometry, climate, vegetation, water coverage, wind fetch, hydrological connectivity, and bathymetry. We derived wind-driven waterbody indices for Australia's large lakes and compare them with existing global datasets. Combined with expert assessment of individual lakes, we present a classification system for assessing wind-related sedimentary processes designed for Australian lakes and, more broadly, for lakes in drylands.

Marine geomorphology of Solitary Canyon; the utility of deep-camera tow imagery to support seabed mapping and stability analyses

Dr Alysha Johnson[1,2], Dr Bernadette Sloyan[3], Dr Chris Chapman[3], Dr Rachel Nanson[4], Dr Zhi Huang[4]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The Solitary Canyon is situated 32 km offshore from Coff's Harbour on the east coast of Australia and extends 36 km from the Australian continental shelf break (175 m deep) to the Tasman Seafloor (~4700 m deep). The close proximity of this large shelf-incising canyon to the populated coastline makes its geomorphic stability a matter of significant interest. In June 2024, the R/V Investigator (IN2024 V04) conducted high-resolution bathymetric mapping (1394 km2) thirteen deep-towed camera transects to characterise the canyon. A two-part seafloor classification approach (Part 1 - Dove et al., 2020; Part 2 – Nanson et al., 2023) were used to map the geomorphology of the canyon. Deep-tow images revealed diverse substrate throughout the canyon, including unconsolidated sediment (graded from silty to cobble), and consolidated outcrops of blocky or stratified rock. At the shelf break, at least five submarine gullies and three submarine tributary canyons feed into the submarine canyon. Within the canyon, 50% of the seafloor is escarpment (>10° slope), 38% is slope (5°-10°) and 12% plane (<5°). Evidence of mass movements are common throughout the canyon, but are concentrated over escarpment areas. Deep-tow imagery also reveals ongoing erosion within these features and supports the sub-classification of mass movement into debris falls, flows, creep along the canyon walls, and talus and debris aprons and fans at the base of slopes. Creep erosion is frequently visible in the high-resolution imagery, at scales finer than can be captured in the bathymetric grid (50 m). These results highlight the utility of deep-tow camera imagery and mixed tool approaches to submarine geomorphology mapping.

3D Coastal Mapping project: Mapping New Zealand's coastline

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09E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 11:35 AM - 1:05 PM

Accurate topographic and bathymetric data is crucial for effective coastal management, risk mitigation and adaptation. However, studying nearshore regions can be challenging as they are often too shallow to be mapped by traditional hydrographic methods, leading to disjointed datasets. Toitū Te Whenua Land Information New Zealand (LINZ) is leading an effort to map 40% of New Zealand coastline, equating to over 10,000 km2. From January 2025, high resolution Airborne LiDAR Bathymetry (ALB) has been collected along the coastal zone from 200 m inland of the Mean High Water Spring coastline, across the nearshore region, and seaward to 25 m water depth. The use of ALB at a national scale has uncovered high-resolution bathymetry along coastlines that were previously unfeasible to be mapped. Seamless topographic and bathymetric DEM surfaces are produced, supported by a plethora of auxiliary information including aerial photographs, intensity and classified point clouds. All surfaces created throughout the project are made freely available through the LINZ Data Service. The data generated in this unprecedented effort to map New Zealand's coastline has applications in a wide range of disciplines, including geomorphology, habitat mapping, tsunami modelling, flood and sea level rise modelling. LINZ wish to use this opportunity to not only showcase the data already collected, but to invite the coastal scientific community to utilise the data to support their own research.

How much room do rivers need? Deriving River Management Lines for three rivers in the lower North Island, New Zealand

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02I: Living with geomorphic change, Conway 4, February 2, 2026, 2:00 PM - 3:30 PM

The question of how much room does a river need is one that has been gaining traction in NZ over the past few years, particularly following a series of major floods in different parts of the country in the last ~5 years. These events have exposed the vulnerability of communities along river corridors to water inundation, sediment deposition and the physical expansion and adjustment of river channels during and after these storm events. River management predicated on 'command and control' approaches is now being questioned, with an appropriate shift towards working with river processes, which includes understanding the space these rivers need and revising river management lines accordingly.
Work has recently been completed in New Zealand to standardise a technical approach to derive river management lines that are intended to provide an envelope accommodating river movement (Christensen, 2023). However, there is little in the public domain providing New Zealand case studies giving exemplars of these lines and the extent of river management envelopes to which River Managers can refer. This paper addresses that need by focusing on extended reaches in three river systems within the Manawatu region (Pohangina, Ōroua and Lower Manawatu), where the approaches outlined by Christensen (2023) have been applied to derive a set of river management envelopes. Key technical challenges are discussed and recommendations provided for practitioners in the derivation of river management lines that aspire to improving community resilience in our river corridors, particularly given the prospect of more floods and larger floods in an era of rapid global change.

Subsurface imaging of a cobble – boulder fluvial bar within Kawatiri | Lower Buller Gorge, Aotearoa | New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The Buller River, known to Māori as Kawatiri, is the largest river on the West Coast of the South Island, and in flood carries one of the largest discharges of New Zealand's rivers. The river has a catchment area of 6350 km2, annual mean flow of 454 m3/s, and during large storm events up to 12,700 m3/s. These storms allow for a significant amount and size of sediment to be transported and deposited into large depositional bars within the lower Buller Gorge. The fluvial bars consist of rounded, cobble to boulder size clasts. The objective of the project is to image the internal stratigraphy of a coarse-grained fluvial bar. A Sensors and Software pulseEKKO™ Pro ground penetrating radar (GPR) system was used with 50, 100, 200, 500 MHz antennae. Initially 100 MHz antennae surveys were collected along both the downstream axis of the bar and two cross bar profiles. Results show dipping reflections facing downstream at angles averaging 17° and down lapping onto a lower horizontal to sub-horizontal reflection approximately 4-5 m below surface or onto a convex-down reflection. The cross-bar profiles show horizontal to sub-horizontal reflections and shallow dipping reflections both to the southern river edge and the river. The reflection patterns are interpreted as a bar migrating downstream onto an erosional surface and at times onlapping and burying bedrock knob(s). From cross-bar profiles, the bar is aggrading with horizons dipping both to the southern edge of the gorge as well as to the present river. The 50 MHz antennae show a deeper penetration (~24 m) into the sediment/bedrock. The higher resolution lines (200 and 500 MHz) provide more detail of the horizons. The study demonstrates that coarse-grained fluvial bars can be imaged as well as provides a framework to better understand and manage these high energy environments.

Locating Holocaust mass burial sites: Using geomorphic models, subsurface imaging, and testimony at Šķēde, Latvia

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05H: Providing 2D & 3D Subsurface Imagery of Geomorphic Environments: Ground Penetrating Radar and Near-Surface Geophysics, Conway 3, February 3, 2026, 11:35 AM - 1:20 PM

Along the Baltic Sea coast near Šķēde, Latvia, thousands of Jews were executed over three days and buried in long trench(es) which had been prepared in the foredunes under orders from the Nazi Einsatzgruppen. The Soviet Commission's investigations into Nazi and collaborator activities at the Šķēde dunes site resulted in producing sketches depicting mass graves' locations. To date, the burial trench(es) have not been located, and the Latvian Jewish community would now like to properly memorialize the 2700+ victims. The project is using multiple geomorphic approaches including aerial photos, ground models, coring, OSL, UAV, and ground penetrating radar (GPR). The GPR acquisition system used was a Sensors and Software pulseEKKO Pro with 500 MHz antennae that had a separation of 0.5 meter. The field data was downloaded and processed within EKKO_Project v6 software. The application of radar stratigraphic analysis on the collected data provides the framework to interpret the grids. Multiple grids were collected on site. Grid 3 was 30 m x 15 m and oriented northeast to southwest direction. The grid is located entirely amongst scrub coniferous tree growth. The reflection patterns were dominated by steeply dipping reflections which are interpreted aeolian dunes or coastal overwash deposits. In addition, horizontal to sub-horizontal semicontinuous reflections are apparent indicating possible soil horizons and/or water table. Slice data and cross-sectional data from a depth of 0.55 to 0.6 meters beneath the surface showed several anomalous feature(s) such as erosionally truncated dipping reflections (e.g. 19-22 m) and “disturbed” reflections (horizons) of the horizontal-sub-horizontal reflections. This anomalous reflection pattern and its geomorphic context lead to interpretation that the site was disturbed by humans which may possibly be associated with the major Holocaust execution site at Šķēde.

From Geology to Governance: Integrating Landscape Evolution Modelling into Coastal Erosion Management

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Coastal landscape evolution models are tools for informing and supporting decisions around sustainable coastal management, hazard mitigation, and climate adaptation in the face of accelerating environmental change. These models integrate the fundamental principles of geomorphology and geology to simulate and forecast coastal change across a range of spatial and temporal scales. When combined with insights from planning and social sciences, they can also inform risk-communication strategies and enhance understanding of how communities perceive and respond to coastal hazards. This is particularly important for New Zealand; approximately 75% of the population resides within 5 km of the coastline, and major urban centres including Auckland, Tauranga, Wellington, Christchurch, and Dunedin are situated near the sea. The close proximity of communities to dynamic coastal environments has implications for urban planning, infrastructure resilience, and long-term adaptation to sea-level rise and increasing extreme weather events.
This project presents a multidisciplinary approach to modelling the evolution of the north Taranaki coastline, on North Island's west coast. By integrating coastal geomorphology mapping, coastal cliff stratigraphy, and available remote sensing data, we developed conceptual models of past and present landscape dynamics. Concurrently, we engaged with local stakeholders and kaitiaki (guardians) to better understand their science needs for the development of locally relevant coastal management strategies. Finally, we explored the potential of physically based modelling approaches to forecast measurable landscape changes over both human and geological timescales.

What controls the frequency-area distributions of co-seismic landslide inventories - can the differences between earthquakes be explained by local geology?

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06D: Dynamic Landscapes: Tectonic Geomorphology of Aotearoa New Zealand, Dobson 3, February 3, 2026, 2:30 PM - 4:00 PM

Co-seismic landslide inventories are critical for understanding the spatial distribution and triggering mechanisms of landslides induced by earthquakes. However, these inventories often differ significantly between seismic events due to a complex interplay of seismological, geological, environmental, and methodological factors. Variations in earthquake characteristics—such as magnitude, depth, rupture mechanism, and shaking duration—directly influence the extent and intensity of ground motion, thereby affecting landslide occurrence. Regional topography, geological conditions, and hydrological states at the time of shaking also play pivotal roles in determining slope stability. Human factors, including land use and vegetation cover, further modulate landslide susceptibility. In addition, methodological differences in data acquisition, resolution, and mapping criteria contribute to discrepancies among the inventories. This study investigates these multifaceted influences by comparing landslide inventories from the 2008 Mw 8.0 Wenchuan (China), 2015 Mw 7.3 Gorkha (Nepal), and 2011 Mw 9.0 Tōhoku (Japan) earthquakes, alongside five significant New Zealand events: the 1929 Mw 7.3 Murchison, 1968 Mw 7.1 Inangahua, 2003 Mw 7.2 Fiordland, 2009 Mw 7.8 Dusky Sound, and 2016 Mw 7.8 Kaikōura earthquakes. For the New Zealand cases, we further examine how local geology - and the geophysical properties of these rock units - influence regional variations in landslide frequency, highlighting why certain areas are inherently more susceptible to co-seismic landsliding.

Down-drifting elongate sand bars on fetch-limited, macrotidal mud flats, Hampyeong Bay, Southwestern Korea

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Numerous sandy beaches and spit bars are distributed along the macrotidal shores of Hampyeong Bay, a semi-enclosed embayment on the western coast of Korea. Unlike typical tidal flats, this area exhibits a shoreward coarsening pattern in grain size, due to a variety of sand bodies and their migration present in the upper intertidal zone. Previously known as "fetch-limited beaches and bars in estuaries," their morphodynamics and maintenance mechanisms remain poorly understood. Particular feature is elongate sand bars migrating downdrift, despite the extremely short fetch for wind-generated waves. In this context, this study examines the migration of a sand bar and its morphodynamic response to waves and tidal currents. For the purposes, drone-based 3D mapping and VRS-GPS profiling have been repeatedly conducted. An ADV(Acoustic Doppler Velocimeter) was deployed during the storm and calm condition on the crest of the bar.

The sand bar is approximately 1,500 m in length and 5–15 m in width. Its elevation reaches above the mean high water level and gradually decreases down to the mean sea level. The sand bar is strongly asymmetrical, while the northern region shows relatively symmetrical in profile. Ebb-oriented bedforms such as 2D- and 3D-dunes are observed on the bar surface. The mean grain sizes of the sand bar is -0.48 phi, corresponding to coarse-grained sand. Measured tidal currents show no large differences between flood and ebb even during calm and stormy condition. However, maximum current velocities reaching up to 47 cm/s are much stronger under calm weather, highlighting the limited wave influence in down-drift migration of a bar. Tidal currents and bedforms' orientation are not aligned perpendicular to the crest of the sand bar. The results suggest that tidal currents are a primary driver for bar migration, with minor wave activity.

Hydrological Events and Sediment Processes in Historical Documents

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10J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 2:30 PM - 4:00 PM

Historical documents contain a vast amount of information on hydrological events likewise episodes of wet and dry conditions and floods and droughts. They describe damages on water bound infrastructure likewise bridges, dams and mills.

These information can also include detailed description of sedimentation processes as erosion, transportation and deposition of silt, sand or cobbles.

These information can be extracted from the corpus of the Collaborative Research Environment tambora.org by using methods of natural language processing and machine learning to classify them. How dense is the information and can this data confirm or enhance the understanding on historical floods? What additional information do they offer beside the direct descriptions of the flood events?

Beyond Traditional Riparian Buffers: The Need for Adaptive Guidelines

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Riparian areas are playing focal role for water quality, erosion control, biodiversity, river stability and flood mitigation. Through our review, we found that riparian buffer guidelines generally fall into three main approaches: fixed-width buffers, function-based approaches, and conceptual approaches. Policies such as the Resource Management Act (1991, NZ) and the Danish Buffer Zone Act prescribe fixed widths but often lack scientific justification. In contrast, function-based approaches offer greater flexibility by tailoring buffer widths to environmental conditions.

Function-based guidelines identify buffer widths based on site-specific environmental conditions. For example, Alberta's "Stepping Back from the Water" Guide provides formulas that adjust buffer widths depending on erosion susceptibility, groundwater recharge potential, and floodplain connectivity. Instead of focusing on exact buffer measurements, conceptual approaches prioritize natural processes like floodplain connectivity and river migration.

Primary riparian management studies (1990s–2000s) focused mostly on water quality improvement, providing narrow buffer zones (≤30 meters) for sediment retention and pollutant filtration. By the 2010s, research began expanding to include broader ecological functions leading to advice for wider buffers (≥30 meters). Recent advancements incorporate GIS analysis and hydrological modelling, pave the way for adaptive, site-specific guidelines.

Modern case studies highlight the benefits of wider, flexible buffer zones that integrate floodplain connectivity and channel migration (e.g.70m to 500m). These findings challenge outdated, rigid policies and emphasize the importance of multifunctional riparian zones.

Additionally, recent reviews have questioned the reliability of early fixed-width recommendations, highlights inconsistencies in data and methodology. As environmental challenges like urbanization and climate change intensify, riparian guidelines must move toward adaptive, science-driven policies that can better protect waterways and support long-term ecosystem resilience.

Geomorphic Response of Topsoil Moisture to Differential Moss Treatments

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02K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 2:00 PM - 3:30 PM

Riparian vegetation plays an important role in affecting the topsoil moisture. Despite a considerable fluvial research on the role of vegetation in affecting soil moisture levels to stabilize stream banks, the role of mosses is not clearly understood. The two most common types of riparian vegetation options to stabilize stream banks include woody plants (trees and shrubs) and herbaceous plants (grasses and sedges). Both options have their limitations in low order alluvial streams with relatively high soil moisture. We tested a new alternative in such locations i.e. mosses (division Bryophyta) to regulate the top soil moisture of stream banks which may help reduce erosion and stabilize stream banks. A total of 56 sites along the banks of two different streams were selected. Each site included 4 different types of experimental plots which were surveyed for three years at an interval of six months. The surveys included scanning of each plot with a terrestrial LiDAR, recording the top soil moisture at an interval of 2cm from the surface, and general geomorphic data collection at each site. The preliminary results reveal that the presence of moss affects the top soil moisture on stream banks. While moss indicates a tendency to colonize, many other environmental factors can counter the growth of moss on stream banks.

Keyword: Stream bank, riparian, vegetation, moss, moisture, soil

Channel bed degradation and meandering processes following sediment control in the mixed soft bedrock–alluvial Tottabetsu River, Hokkaido, Japan

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

This study investigates channel bed degradation and meandering processes following sediment control in the mixed soft bedrock–alluvial Tottabetsu River, eastern Hokkaido, Japan. The 20 km study reach includes a lower 11 km segment underlain by soft lacustrine siltstones. Historically, sediment from headwater landslides created a meandering and braided river with frequent flooding. Since the 1960s, sediment control structures (weirs and dams) have been applied in the headwaters and upper 9 km, significantly reducing downstream sediment delivery and flood risk, as shown during the 2016 hundred-year flood.

ALS and ALB surveys (Airborne Laser Scanning and Airborne LiDAR Bathymetry) after 2016 reveal that, rather than immediate bed lowering, the flood triggered rapid channel incision (up to 1 m/year), entrenched meander migration, and dynamic point bar development. This process involves: (1) coarse sediment trapped in point bars; (2) channel narrowing and steepening at bar margins, promoting bed incision at outer banks, pool formation, and bank retreat, thereby enhancing meandering; and (3) bar-edge sediments readily moving over steep beds into pools, driving further bar migration and repeating the cycle downstream. Consequently, the lower 11 km channel bed continues to degrade. Hard rocks stored atop banks from past sediment influxes are now supplied laterally as erosion progresses, serving as effective tools to carve the banks and beds composed of soft bedrock.

These incision and bar migration cycles occur with regular floods, while larger events, such as the summer 2022 flood (~10-year recurrence), intensified the process and deepened the channel. The ongoing reduction of coarse sediment supply due to river engineering sustains bed degradation; without such intervention, bed elevation might have been more stable, though at higher flood risk. This case highlights the importance of understanding sediment flux, channel dynamics, and catchment lithology for predicting and managing river responses to engineering and extreme events.

Timeslice Analysis of Slope Failures Using UAV Imagery and LiDAR Data in Hokkaido Prefecture, Japan

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The geographical setting of Japan is characterized by mountainous terrain covering approximately three-quarters of the country, with limited flatlands. This topography often necessitates the construction of road infrastructure in steep and geologically unstable areas. Consequently, appropriate slope management is crucial for ensuring safe and reliable road transportation. In particular, Hokkaido Prefecture, located in the northernmost part of Japan, has experienced several large-scale rockfall disasters. Such events pose significant threats to both human life and transportation networks, making the early detection and prevention of large-scale slope failures a critical challenge in disaster risk reduction.

To address these issues, we have been developing a method for the early detection of hazardous slope conditions using cameras and Light Detection and Ranging (LiDAR) sensors mounted on an Unmanned Aerial Vehicle (UAV). This approach efficiently identifies rockfall events involving displacements of more than several tens of centimeters, even on steep, inaccessible slopes.
We report findings based on multi-year UAV data collected from several rock slopes in Hokkaido where rockfall or collapse events have occurred. By performing differential analyses of UAV-derived point cloud data, we identified spatial patterns of rockfall and associated volumetric changes. On one slope where a collapse exceeding 100 m^3 had occurred, clear lateral expansion of the collapse area was observed between autumn and spring. These results suggest that in the years following a large-scale rockfall—particularly during the snowmelt season—there is a heightened risk of additional large-scale collapses in adjacent areas, underscoring the importance of continuous slope monitoring. Our findings provide valuable insights into the progression of slope instability and demonstrate the effectiveness of UAV-based monitoring in steep, cold-region environments.

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Decompiling the stratigraphy of White Sands dunes

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07H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 5:00 PM - 6:30 PM

White Sands Dune Field in New Mexico (USA) is field of gypsum barchanoid and parabolic dunes that began forming after the Last Glacial Maximum as sand supply was mobilised through the deflation of drying Lake Otero (NM, USA). In the present day, dune shape is governed by seasonal unidirectional winds and sedimentation via a rising water table. The latter in combination with downwind wind slowing allows for the excellent preservation of aeolian stratigraphy beneath active dunes and exposed in the interdunes. Our work aims to model this stratigraphy by using a parallelised multi-core approach. We calibrated free parameters in a generalised aeolian landscape evolution model forced by observed winds to match the topographical change between observed temporally-sequential input and output topography. Three pairs of topographical measurements have been taken with airborne LiDAR at White Sands alongside concurrent wind observations and showcase the migration and evolution of dunes within the field. The free parameters include sediment transport constants and the rate of upwind sediment supply. Their calibration produces a synthetic stratigraphy which matches contemporary deposition at White Sands. The model can be used to infer past sediment supply and dune migration rates by matching long-term deposition rates to observed Optically Stimulated Luminescence dates. Applying this model in development to a well-chosen case study paves the way for future computational studies of more complex and unconstrained aeolian depositional systems on Earth and other planetary bodies.

Fire impact decreases the resilience of tidal wetlands to sea-level rise

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01K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 11:40 AM - 1:10 PM

The building and maintenance of surface elevation are crucial processes underpinning the resilience of tidal wetlands to the impacts of sea-level rise. Decades of research has demonstrated the important roles of vegetation production (i.e. root growth), geomorphic processes (e.g. mineral sediment delivery), and their interactions, in driving elevation patterns in tidal wetlands. The influence of climate-driven disturbances on these biogeomorphic processes, however, remains a significant knowledge gap.

The 2019/20 ‘Black summer’ fires ravaged the east coast of Australia, including impact to mangrove, saltmarsh and supratidal forest ecosystems. We have been assessing post-fire responses of mangroves using a combination of vegetation and surface elevation monitoring approaches. Fire impacts and subsequent mangrove response have been spatially variable. Vegetation impacts ranged from partial defoliation of landward-fringing individuals, through to dieback of entire forest patches in some embayments of Bhundoo/Clyde River. Recovery via epicormic regrowth has been patchy and slow (12+ months until initiation) relative to adjacent terrestrial forests. Mangrove recruitment via tidally-dispersed propagules has typically concentrated towards upper tidal elevations, leaving some lower elevation zones devoid of live vegetation. We found significant differences in root mass and root volume between fire impacted sites and nearby reference locations within the first two years following fire impact. Measurement of surface elevation change and sediment accretion rates via the rod Surface Elevation Table-Marker Horizon technique have shown that these losses of root volume translate to net subsidence of fire-impacted mangroves, contrasting elevation gain in nearby reference mangroves. Such autocompaction and loss of surface elevation will have implications for ecosystem structure, function and environmental service delivery, particularly under increasing rates of sea-level rise. Our findings demonstrate the importance of interactions between biotic and abiotic processes when assessing coastal wetland response to the combined stressors of climate-driven disturbances and sea-level rise.

Detection and Accuracy of a Geomorphic Proxy-Based Shoreline Indicator in PlanetScope Imagery

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09E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 11:35 AM - 1:05 PM

Satellite-derived shoreline mapping is a common technique for quantifying geomorphic shoreline change, although shoreline positions derived using moderate resolution data have questionable accuracy, are influenced by metocean conditions, and are typically based on the boundary of a binarized spectral index instead of a visible geomorphic indicator such as the high-water line (HWL). PlanetScope (PS) can visualize the location of the HWL as the spectral reflectance differences between wet and dry sediment along a sandy beach surface, owing to its improved spatial resolution of 3 m/pixel. The accuracy of nine HWL proxy shoreline positions is assessed by comparison to a contemporaneous mean high water (MHW) shoreline delineated across Moro Beach, CA, using a digital elevation model created from RTK GPS-corrected Unmanned Aircraft System imagery. The offset between the PS-derived HWL and UAS-derived MHW positions (Δd) was measured every 10 meters in the alongshore direction using the Digital Shoreline Analysis System for each HWL dataset. A significant exponential relationship was observed between Δd and the tide height at the time of PS image acquisition, whereby the HWL shoreline was located further landward (seaward) during higher (lower) tides. The HWL shoreline, when acquired at or close to low tide, was spatially coincident with the MHW shoreline, the most reliable, yet cost-prohibitive, shoreline proxy. PlanetScope's advancement in spatiotemporal resolution introduces a new approach to satellite-derived shoreline mapping, one that is based on a geomorphic proxy position and a minimized influence of tide heights.

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Changes in the Australian Monsoon recorded in terminal splays and ephemeral deltas of Eyre Creek, Georgina River Basin

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09H: The signature of climate change in arid landscapes, Conway 3, February 5, 2026, 11:35 AM - 1:05 PM

For much of tropical Australia, terrestrial records of environmental change have been slow to emerge, limiting the development of a regional picture of the Indo-Australian Monsoon system and its behaviour through time. The scarcity of continuous, long sedimentary records is owing to continental aridity, tropical weathering and the distance from population centres. Here, we present a fluvial record covering the last glacial cycle from terminal splays and ephemeral deltas of Eyre Creek in the Georgina River Basin. The Georgina is the most northerly of the Lake Eyre Basin catchments with an area of some 203,300 km2 above Glengygle Station. Eyre Creek is the main river channel in the arid, southern half of the basin and tranfers flows derived from tropical headwaters dominated by monsoonal rainfall with a high annual variability. Flows are ephemeral but floods recur every 4-5 years, on average. The floodplain of Eyre Creek is largely confined between longitudinal dunes, but the main channel branches into a number of smaller distributaries that discharge or flood out into the ephemeral Lake Machattie area. Six sediment cores were collected to depths up to 5m from proximal splays, deltaic plains, and interdune embayments along the northern boundary of Lake Machattie. Sediments range from silty clay to fine sand with rare gravel lenses, overprinted with gypseous and and carbonaceous precipitates. The chronology is based on >30 single-grain OSL ages on quartz and records intermittent fluvial and deltaic sedimentation since ~120 ka ago. Linear, lake-marginal deposits are younger features relating to floods within the last 200 years that are likely reworked during higher and lower lake phases.

Geomorphology and Holocene Formation of Manuae Atoll, Cook Islands

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06F: Tropical coral reefs and reef-lined coasts, Conway 1, February 3, 2026, 2:30 PM - 4:00 PM

Located along the eastern chain of the Southern Cook Islands, Manuae atoll is situated approximately 100 km Southeast of Aitutaki, and 95 km northwest of Takutea reef platform. Earliest descriptions of the atoll identify conspicuous elevated deposits, and the presence of makatea suggesting the atoll has experienced uplift as consequence of lithospheric flexure, that has affected islands further to the southeast. However, the role of flexure in the geomorphic development of the atoll is speculative and the precise nature of the elevated deposits, their elevation with respect to sea level and evolutionary context of the atoll and its islands with respect to sea level have not been resolved. Here we combine high-resolution LiDAR data and field-based surveys to resolve the geomorphology and distinctive geomorphic units that comprise the atoll. The atoll supports two large islands on the east and west that impound a shallow lagoon. The seaward margins of islands are found to be up to 9 m above mean sea level. Evidence of elevated past sea level is found on both islands. On Manuae the high seaward ridge impounds an emergent fossil reef in the central basin of the island, while the lagoon shoreline is fringed with an elevated cemented reef deposit. A field of emergent fossil microatolls is also present on the seaward margin of eastern island of Te Au Otu. Uranium-series age determinations from fossil microatolls and elevated fossil corals on each island are used to constrain the timing and elevation of the mid-Holocene highstand in this part of the Cook Islands. In addition, AMS ages on island sediments are used to constrain the age of the atoll islands and provide insights into formation of the atoll in the context of past sea level change.

Timber and Trajectories: Accelerating River Recovery in North-Eastern Melbourne Using Applied Geomorphology

Mr Nicholas Kerr[1]
[1]Melbourne Water, MONTMORENCY, Australia

06A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 2:30 PM - 4:00 PM

This presentation showcases the application of applied fluvial geomorphology in the rehabilitation of two waterway locations in north-eastern Melbourne, where timber has been used as a central design element to accelerate natural recovery processes. These projects exemplify a shift from traditional river engineering towards process-based, nature-aligned interventions that work with geomorphic and ecological dynamics rather than against them.

Drawing on geomorphic principles, timber piles, large woody debris (LWD) and engineered log structures were strategically introduced to re-establish hydraulic diversity, promote sediment sorting, and support channel evolution. These timber features mimic natural river processes, enhancing habitat complexity and fostering conditions conducive to riparian vegetation recruitment and aquatic biodiversity.

The design and implementation process involved detailed geomorphic assessments, hydrological modelling, and stakeholder collaboration to ensure that interventions were both place-based and scalable. Monitoring data from the early stages of recovery indicate improved channel stability, increased in-stream habitat heterogeneity, and signs of geomorphic self-adjustment—key indicators of successful river recovery.

These case studies contribute to the growing body of evidence supporting low-cost, nature-based solutions in urban and peri-urban river management. It highlights how geomorphic science can be translated into practical action, aligning with the broader movement towards sustainable, adaptive, and community-informed river rehabilitation.

By sharing insights from these Melbourne-based case studies, this presentation aims to inspire further uptake of timber-based geomorphic interventions and contribute to the development of communities of practice in applied geomorphology.

From Short-Term Erosion to Long-Term Landforms: Assessing Different Coastal Erosion Models for Marine Terrace Formation

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The geomorphic features of tectonically active coastlines—such as marine terraces, sea cliffs, and intertidal platforms—record the combined effects of sea-level fluctuations and crustal deformation. These landforms result from the interplay of multiple processes, including wave-driven mechanical erosion, wetting–drying–induced weathering, and biochemical alteration. Despite extensive field observations and theoretical research, disentangling the relative contributions of these processes remains challenging due to their complex interactions.

To address this, we develop a modular numerical modeling framework that enables flexible combinations of geomorphic processes under consistent boundary conditions. This structure supports both direct model intercomparison and the construction of integrated models combining multiple processes. It allows us to explore a key question: can a universal erosion model be established, or should models be tailored to specific coastal settings?

In this study, we implement simplified models, each emphasizing a distinct erosional mechanism, and compare them with a combined-process model built within the same framework. By selectively activating each process module, we simulate coastal morphology over tens to hundreds of thousands of years, including responses to sea-level fluctuations. The results demonstrate that subtle differences in morphodynamic assumptions—such as feedbacks or debris removal efficiency—can produce significantly divergent landform trajectories. These variations directly influence the formation and preservation of marine terraces, highlighting the importance of model selection and calibration strategy.

Our findings suggest that the choice and combination of dominant processes within a model framework fundamentally shape predicted coastal evolution. This work underscores how modern platform morphologies can inform morphology-based model selection, ultimately improving our understanding of long-term coastal responses to climatic and tectonic forcing.

Geomorphic impacts of dams across Northern Australia

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Dams regulate river water and trap upstream sediment that disrupts the functioning of a rivers' 'sediment conveyor belt'. This alters stream power and sediment dynamics. Depending upon 'reach' to catchment scale hydro-geomorphic and vegetation controls, this disruption can lead to changes in river channel morphology.

In Northern Australia (NA), sustainable water resource development is a priority for the Australian government. However, we have limited understanding of the geomorphic impacts of dams in NA, and often, scientists and practitioners draw analogies from elsewhere in the world. Considering that NA is globally unique, in terms of the antiquity of its landscape, its high intra- and inter-annual variability in rainfall, unique and largely intact vegetation, and its largely unregulated rivers, drawing such comparisons may be inappropriate.

Drawing upon the case study of four distinct river catchments across NA, here we use a suite of historical imagery and hydrological records to assess geomorphic impacts of dams. Depending upon geomorphic river type and degree of water regulation, we find drastic to minimal changes along the river corridor for each study catchment.

Where geomorphic changes occurred, they included:

- Upstream of dam- Incision of vulnerable chain of ponds geomorphic river type into continuous channels
- Within reservoir- Sediment trapping cutting-off sediment supply to downstream reaches
- Downstream of dam- (1) Vegetation encroachment within the channel resulting in up to 80% reduction in active channel width leading to reduced flow capacity/conveyance and (2) Changes in midstream and downstream reaches to a predominantly depositional geomorphic regime.

Fluvial geomorphology and biogeomophology provide a basis for maintaining healthy environmental flows needed for sustaining natural riverine processes and ecosystems. For water resource planning in NA, geomorphic assessment can be used to inform the degree of water regulation and instream flow requirements to maintain geomorphic integrity and ecological function.

An approach for assessing geomorphic risk following catastrophic flood event(s): Integrating LiDAR with historical imagery

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04A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 9:35 AM - 11:05 AM

Often there is a misconception that erosion and deposition is ‘bad’ and needs to be ‘fixed’. However, rivers are inherently dynamic systems that undergo erosion and deposition within an expected behavioural regime. Depending on the type of river various forms of river adjustment are expected to occur. For example, meander bends are expected to erode and deposition creates bars and islands. However, extreme events or changes in boundary conditions can trigger unexpected geomorphic adjustments in certain rivers making them more/less geomorphologically sensitive to future disturbances. This can initiate geomorphic risk and make such reaches critical hotspots of geomorphic change that urgently need river management action.

Using the case study of the February-March 2022 floods in the Wilsons catchment in northern NSW, Australia, this presentation showcases when geomorphic adjustment becomes geomorphic risk. For this, we use (1) long term historical imagery and (2) multi-temporal LiDAR to assess change in river sensitivity and provide a hierarchical traffic light gradation of geomorphic risk.

The long-term historical records provide baseline evidence of geomorphic adjustments that indicate the expected behavioural regime of the rivers and their inherent behavioural sensitivity to adjustment- Active Sensitive, Passive Sensitive, Insensitive or Resistant (Khan and Fryirs, 2020). This sets the benchmark against further events. For the Wilsons catchment, pre- and post-flood LiDAR is used to detect geomorphic change along the fluvial corridor to (1) map the forms of adjustments that occurred during the 2022 floods and (2) measure the volume of erosion and deposition. This is used to reassess reach scale post-flood behavioural sensitivity across the catchment. The extent to which geomorphic sensitivity has been altered (switched class) provides basis for assessing geomorphic risk, grading river reaches into various risk categories. For river management, the degree and type of intervention (soft or hard engineering) will be guided by these categories.

Paleoceanographic information from the turbidite-containing sediments in the South Shetland Trench of the Antarctic Ocean

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

About 11 m-long piston core (PC02) was collected from the South Shetland Trench (61°59.02'S, 62°19.41'W, 4731 m deep) during KH-19-6 expedition using R/V Hakuho-maru in 2019. Based on visual observation of core sediments and examination of core photos and CT images, 29 turbidite layers were distinctly recognized, overlying the liquefied mud and sand/gravels at the lower part of core, which are consistently repeated, despite the different thickness. Each set of turbidite layer consists of the upper turbidite mud and lower muddy sand, both of which were capped by the hemipelagic mud layer, although the boundary between the hemipelagic mud and turbidite mud seems unclear. Grain size analysis confirms the upward fining trend within a set of hemipelagic mud, turbidite mud, and muddy sand. Each muddy sand coincides exactly with the maximum magnetic susceptibility (MS) whereas the minimum MS corresponds to the hemipelagic mud. The AMS 14C dating of bulk sediments in the hemipelagic mud layer marks old core-top age (~8.6 ka) and about 15.7 ka for the lowest hemipelagic mud. Geochemical properties (TC, TN, and biogenic opal), representing the surface water productivity, were different between the turbidite muds and hemipelagic muds, and the turbidite muds are higher than hemipelagic muds. Such difference implies that the turbidite muds might be transported from the shallower areas where the open ocean favors high productivity. In addition, the hemipelagic muds, after excluding turbidite mud and muddy sand, show the upward increasing TN contents. Based on the linear sedimentation rate and assumed age model, the climate shift from the middle Holocene climate optimum to the late Holocene Neoglacial condition seems to be recorded even in the South Shetland Trench of the Antarctic Ocean.

Intermittent Estuaries in a Changing Climate: Bridging Knowledge Gaps through Collaboration

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05F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 11:35 AM - 1:20 PM

Intermittent estuaries, defined by their dynamic entrances and periodic disconnection from the ocean, are globally significant yet persistently underrepresented within coastal and catchment research and management agendas. Despite their widespread distribution and ecological importance, these estuaries constitute less than 1% of all estuarine scholarly research. This global assessment identifies and maps over 2,200 intermittent estuaries, predominantly along temperate and semi-arid wave-dominated coasts, currently supporting approximately 55 million people. By 2100, the populations near these estuaries are projected to exceed 100 million, particularly in regions already confronting socio-economic and environmental challenges.

Critical knowledge gaps persist, notably across Asia, South America, and Africa, where substantial populations depend directly on intermittent estuarine resources. These areas face escalating risks from climate-driven threats such as sea-level rise, altered hydrological patterns, intensified storms, and direct anthropogenic pressures. Scholarly research to date primarily focuses on local-scale physical and ecological processes, resulting in uncertainties regarding broader climate-driven responses, ecosystem service valuation, and integrative management strategies.

Addressing these gaps necessitates enhanced interdisciplinary and international collaboration, combining expertise in geomorphology, socio-ecological systems, advanced numerical modelling, and integrated catchment-to-coast management. Establishing international partnerships, promoting cross-regional knowledge exchange through active research networks, and creating accessible data-sharing platforms will be crucial. Such collaborative efforts will significantly enhance global capacity to sustainably manage intermittent estuaries, thereby supporting resilience among coastal communities and ecosystems in the face of increasing climatic and anthropogenic pressures.

Determining fine sediment sources and loads through a collaborative approach to post-wildfire restoration and monitoring

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08J: Responses of geomorphic processes and earth surface systems to extreme weather and climate events, Conway 5, February 5, 2026, 9:35 AM - 11:05 AM

The 2021 Sparks Lake wildfire burned nearly 90,000 ha (51%) of the Deadman River watershed, located in Skeetchestn Indian Band (SIB) territory, near Savona, BC. This fire consumed nearly all vegetation and drastically altered the landscape that was previously impacted by the 2017 Elephant Hill wildfire. The Deadman River is a major source of water for the Skeetchestn community and is important habitat for multiple species of Pacific Salmon, including stocks of Coho and Chinook, and Steelhead trout, all of which have been assessed as ‘at risk’ by the Committee on the Status of Endangered Wildlife in Canada. Immediately following the fire and continuing today, SIB has undertaken a range of actions to attempt to mitigate the impact of the fire and restore the watershed through a multi-disciplinary project: Tsecmenúl̓ecwem-kt - Deadman Recovery & Resiliency Initiative. A range of culturally relevant restoration practices have been undertaken by SIB, and a team of researchers – involving university, government, consultant and First Nations scientists – aims to understand if these treatments are working from a geomorphic, hydrologic, and biotic perspective. One objective of the project is to gain knowledge into the fine-sediment dynamics of the watershed and thus, six stations were established to collect turbidity data, and ISCO samplers were used to determine suspended particulate material (SPM) concentrations. Preliminary results show that during base flows, the Deadman River had higher concentrations of SPM, but during high flows, Criss Creek contributes more sediment, likely due to the steeper gradient in the Criss Creek basin and because it was more heavily burned. On-going work will also investigate the sources of fine- and coarse-grained sediment using sediment fingerprinting, LiDAR, helicopter surveys, and satellite imagery. Finally, researchers are engaged in a consistent exchange of information with SIB to ensure the work remains relevant to their goals.

Unusual spit building on a tidal beach under prevailing wind in the southwestern coast of Korea

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

A spit bar is an accumulation feature formed by longshore currents along the shoreline. Along the western coast of Korea, some spits have developed in a northward direction opposite to the prevailing north-northwesterly winds deviating from the typical pattern. The parabolic dunes in the area has developed southeastward, under the influence of strengthened northwesterly winds during the winter, while the spits have grown toward the north opposite to the wind direction. To understand the formation of these unusual features, beach profiling using a VRS-GPS system was conducted at two-month intervals. Additionally, two ADVs (Acoustic Doppler Velocimeter) were deployed to collect tidal and wave characteristics on the southern and northern ends of the beach during both calm and stormy conditions.

Macrotidal Ujeon Beach, southwest coast of Korea is approximately 100 to 240 m wide and 3 km long, gradually widening toward the north. Over the past 30 years, wind patterns have shown dominant northerly winds from autumn to spring and southerly winds during summer. Time-series analysis of aerial photographs revealed that the spit first began to form in 1972 and has steadily extended about 750 m, with rapid growth between 1972 and 1980.

Beach profiling surveys showed that no bars on the southern side, while two shore-parallel bars appear progressively toward the north. ADV measurements show that the currents flow from the north to the south during calm conditions, with the maximum of 0.75 m/s. Under storm conditions, however, the strong northward flows have been recorded with a maximum velocity of 1.02 m/s. This suggests northward sediment transport during high wave conditions coupled with high tides, contributing to spit growth. The study highlights a mismatch between the dominant northwesterly winds and the northward-flowing current in the formation and growth of the spit. The cause of the spit growth remains elusive.

Lens of Evolution: Reconstructing Biogeomorphology through Evolutionary Touch

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03K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 4:00 PM - 5:30 PM

Building on recent syntheses that define biogeomorphology as a discipline centered on feedback processes and functional traits, we propose a conceptual revisiting through the perspective of evolutionary biology. While biogeomorphology has long focused on ecological and geomorphic interactions, evolutionary processes—particularly rapid evolutionary changes—have remained unexplored, despite their growing significance in today’s rapidly changing environments.

In this perspective presentation, we define lifeform–landform feedback as a reciprocal mechanism: changes in biological traits modify geomorphic activity, while landform evolution feeds back to influence selection on those traits. Recent empirical studies suggest that such feedback processes can operate on ecological timescales, offering new insights into contemporary biogeomorphic dynamics. Concurrently, evolutionary biology has shown increasing interest in geo-evo feedback mechanisms, highlighting a timely opportunity for deeper integration between the two fields. This perspective spans both fine-scale organism–habitat interactions and broader frameworks, including mineral evolution and deep-time landscape evolution. The metaphor of the “evolutionary touch” captures the idea that evolutionary processes leave enduring legacies not only on species but also on the landscapes they inhabit—thereby extending the conceptual scope of biogeomorphology into the evolutionary territory.

We present this as a preliminary revisiting to spark a further discussion on how biogeomorphology could engage with evolution as both a process and a theoretical lens. By viewing evolution as a connective and structuring process, this approach seeks to foster integration across biological and geomorphic knowledge at various scales and disciplines. Ultimately, it provides a conceptual foundation for examining how lifeforms and landforms co-evolve in changing environments based on complex Earth surface systems.

Plant community structure and geomorphic stability: A biogeomorphic perspective for tidal creek dynamics in the Danish Wadden Sea

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01K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 11:40 AM - 1:10 PM

Existing literature suggests that plant species composition can significantly influence the stabilization of soil substrates; however, much of this research predominantly relies on experimental approaches, such as transplantation trials and numerical modeling. Consequently, there exists a marked deficiency in long-term, in situ observational investigations that examine the interplay between plant assemblages, soil conditions, and sedimentary and erosional dynamics within natural wetland ecosystems. This study explores the complex interconnections between geomorphological transformations and plant community structure across multiple tidal channels at the Skallingen salt marsh in southwestern Denmark, spanning from 2006 to 2023. Detailed vegetation, soil, and topographic surveys were conducted during the summer of 2006 at eleven cutbank sites and eleven point bar locations. The findings showed that, within cutbanks, the sites experiencing more pronounced erosion—up to 7-8 meters over the seventeen-year period—were characterized by the greater presence of Atriplex portulacoides and higher soil bulk density measured in 2006, compared to less-eroded sites (< 0.3 meters). Conversely, point bars exhibiting more vegetation advancement were also more extensively colonized by the same species in 2006. These results highlight the pivotal role of Atriplex in mediating plant species diversity and driving geomorphological modifications within tidal channels. While this shrub facilitates sediment accumulation and promotes wetland expansion, it concurrently enhances the susceptibility of wetland margins to wave-induced disturbance, owing to increased marsh platform steepness and cantilever formation. This research advances a scale-dependent biogeomorphic framework for understanding self-organization processes in natural systems, indicating that although functional resilience may be augmented in the short term, such ecosystems are potentially vulnerable to critical collapse over extended temporal scales.

Understanding Urban Stream Erosion: A Cross-Disciplinary Approach to Assess Sediment and Stream Health

Mr Boniface Kinnear[1], Mr Shakti Singh[1], Mr Danny Baucke[1], Mr Tony Wang[1]
[1]Wood And Partners, Grafton, New Zealand

11I: Urban Streams: From Long Trajectories to Restoration Issues and Hazard Management, Conway 4, February 5, 2026, 5:00 PM - 6:30 PM

Erosion and sediment transport are fundamental geomorphic processes that shape landscapes across Aotearoa New Zealand. Many communities often live in close proximity to streams, forming a strong connection with these dynamic waterways. Understanding stream erosion is critical, not only to safeguard our natural watercourses, which are vital for biodiversity and ecological health, but also to address the growing pressures of urbanisation and population growth. Urbanisation accelerates hydrological responses, exacerbating channel instability and sediment fluxes. By improving our understanding of erosion processes, we can develop more effective management strategies to protect stream health and resilience in both rural and urban catchments.

Traditionally, geomorphology and stormwater management have often been considered in isolation. While each discipline provides valuable insights, this separation can limit our ability to fully understand the effects of urbanisation on stream systems. A more holistic approach is needed, one that integrates geomorphic processes with hydrologic and hydraulic assessments.

Recent advances in high-resolution topographic data (e.g., UAV-based LiDAR, bathymetric capture) and accessible hydrodynamic models enable more nuanced erosion risk assessments. We utilised a high-level Stream Erosion Risk Tool, which estimates critical shear stress exceedance to model the spatial and temporal variability of erosion potential under various land use and climate scenarios.

By coupling this tool with geomorphic field assessments, the approach allows for improved prediction of sediment mobilisation and delivery to receiving environments. The integration of geomorphology into flood modelling frameworks enhances decision-making processes and supports proactive management of both ecological values and built assets in vulnerable urban catchments.

This paper presents case studies from Tāmaki Makaurau, demonstrating the practical application and benefits of this integrated methodology. These examples highlight the potential for innovative, interdisciplinary approaches to support sustainable stream management and enhance environmental outcomes.

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Shoreface geomorphology and morphodynamics in New South Wales, Australia

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The shoreface extending offshore from sandy beaches is a critical domain for coastal sediment systems with the potential to act as a source or sink in different settings and across different timescales. For many beaches, considerable uncertainty in shoreline response to current and future sea level rise emerges from a limited understanding of the present morphodynamic state of the shoreface environment, and how that might evolve in mode and timescale with changing boundary conditions. Some uncertainty can be addressed through the detailed mapping of shorefaces to quantify dimensions and composition, and by investigating geomorphology in the context of prevailing wave energy and sediment controls.

This research analyses the geomorphology of shorefaces adjacent to sandy beaches along the coastline of New South Wales, Australia. Shoreface profiles were derived for 728 shoreline sectors covering 338 beaches by spatially averaging coastal bathymetry alongshore, thereby developing morphology profiles capturing the three-dimensional complexity of the shoreface seabed. Corresponding seabed character profiles that quantify the proportion of sedimentary and rocky seabed by depth within each sector were also derived to investigate geological controls on shoreface morphology. Profile sets were developed using high-resolution coastal topo-bathy LiDAR and multi-beam echosounder mapping datasets covering the shoreface-inner-continental shelf.

Morphometric analyses were carried out to measure the dimensions, gradient, shape and complexity of profiles across the entire shoreface extent and locally within upper and lower shoreface domains. Local wave climate hindcast data and local to regional sediment grain size data were used to calculate upper and lower shoreface limiting depths and to derive theoretical equilibrium profiles. The database of morphometrics and depth-based geology are explored statistically using cluster analyses to describe variability in shoreface geomorphology and investigate regional- to local-scale spatial patterns, including in the relationship between theoretical and measured shoreface geometry and the implications for response to sea level rise.

Thermal drivers of shallow movements in clay-rich slopes in temperate climates: evidence from field monitoring and remote sensing

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The role of temperature in driving surface and near-subsurface soil movements in temperate climates remains largely overlooked. This is despite the significant changes in annual average temperature and seasonal temperature patterns that are expected. This contribution examines cyclic, reversible deformations in clay-rich soils and shallow landslides, with a focus on the interplay between land surface temperature, precipitation, and soil moisture. Using InSAR data, thermal imagery, and field monitoring (including Shape Accel Array sensors), we examine both gravitationally stable and unstable sites to distinguish thermally induced surface movements from those linked to gravitational deformations. Our findings indicate that reversible movements - often phased with annual temperature cycles - can occur independently of pore-water pressure variations. At the monitored site in Tertiary clay stones, Czechia, for instance, seasonal surface and shallow sub-surface displacements (magnitudes of 2 - 8 mm) followed temperature patterns and diminished with depth. These patterns appear particularly in clay-rich soils, where seasonal desaturation occurs near the surface, and thermal effects alter the soil's water retention and mechanical properties. We conducted a comparative analysis across sites with expansive vs. non-expansive clays, and further, we explored whether the amplitude of seasonal vertical deformations differs between landslide bodies and adjacent stable terrains, potentially indicating softened or remoulded landslide materials. To improve spatial understanding, we integrate regional datasets (e.g., InSAR analysis, satellite-based land surface temperature, precipitation, and soil moisture) with field monitoring data and landslide inventories. This approach allowed us to assess: i) the dominant drivers of cyclic surface and near-surface deformations, ii) contrasts inside and outside landslides, iii) when landslide movement overrides thermal signals, and iv) how surface and shallow subsurface responses correspond.

Geomorphically Effective Management Solutions (GEMS): Promoting Natural Fluvial Systems in an Urban Environment

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05A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 11:35 AM - 1:20 PM

Urban stormwater management has traditionally prioritized efficient flow conveyance, resulting in straightened channels, drained wetlands, and piped systems that disrupt functions of hydrologic connectivity. This hydromodification degrades water quality, diminishes environmental health, and erodes critical ecosystems. In response, cities are adopting WSD and NBS to mimic lost natural processes. However, these measures often fall short of fully restoring dynamic hydrologic and geomorphic processes, leaving stormwater systems fragmented, still reliant on engineered interventions, and ecologically impaired. This highlights the need for holistic, process-based approaches that integrate the full functionality of natural systems into urban water management.

The GEMS program at Healthy Waters, Auckland Council, attempts to address these challenges by developing tools and guidance emphasizing the importance of understanding and working with natural system processes. GEMS identifies risks to and from dynamic fluvial systems, advocating for natural solutions such as appropriate riparian extents and floodplain access. Encouraging approaches that allow channels to naturally adjust to changes in energy dynamics, reducing reliance on costly engineered solutions.

GEMS employs a suite of tools and assessments to inform targeted interventions and long-term planning. Catchment-scale geomorphic investigations, combined with high-resolution LiDAR, inform classification of historical, current, and future trajectories of stream evolution. Erosion models, such as the Erosion Screening Tool and Regional Erosion Risks, quantify the sensitivity of systems to hydraulic pressures and lateral erosion rates, identifying potential hazard areas for landowners. The program engages in policy reviews to advocate for riparian buffer standards, floodplain connectivity, and wood-in-stream management, ensuring hazard mitigation aligns with ecological integrity. Community workshops enhance stakeholder understanding of channel dynamics, fostering informed decision-making.

Through its science-based framework, GEMS promotes living with dynamic systems, reconciling urban-development with the preservation and restoration of natural stream processes. By prioritizing process-based dynamics, GEMS fosters resilient urban environments that work in harmony with constantly changing systems.

Karst Rock Reading

Professor Martin Knez[1,2], Professor Tadej Slabe[1,2]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The rocky sections of surface and subsurface karst phenomena reveal outward signs of their development, shaped by diverse geological factors and processes under varying environmental conditions. Carbonate rocks, differing in composition, stratification, and fracturing, exhibit varying degrees of solubility, which influence the formation of rock structures and often define their distinctive morphological features. Deciphering these traces in rock features and karst relief provides essential insights into karst evolution, with newly gleaned information guiding future research directions. This is also at the forefront of comprehensive studies focusing on karst surfaces and caves, integrating knowledge of regional characteristics and specificities.

Interpreting and understanding karst rock relief, combined with laboratory-based experimental modelling using plaster, enables the identification of formation processes and the development of karst phenomena, while also revealing the regional evolution and distinguishing features of karst landscapes across the globe. Decades of research of the rock relief of surface karst features - from the Classical Karst, the tropical karst of Central America to Brazil's stone forests, the desert karst of North Africa, the UAE, and Iran; from Mediterranean karst to that of Siberia and Tibet; from Pacific coastal karren to Vietnam's cone karst and China's underground stone forests, as well as high-mountain subglacial karst -alongside studies of caves, from flooded and intermittently flooded systems at the water table to shafts and infiltration conduits critical to water resources, have enabled the reading of karst rock records and fostered the development of one of the most fundamental and integrative karstological approaches to the study of karst.

Thus, individual case studies from diverse regions and conditions around the world dovetail and inform one another, converging into an integrated conceptual and comparative model that demonstrates the broad explanatory power of the approach and firmly establishes it as a cornerstone in the understanding of karst phenomena.

Spatial patterns of surface hardness of rock shore platforms

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rock shore platforms are relatively common around the South African coast and, although these are the most studied of rock coast elements, are not well mapped or their morphodynamics understood. This is despite the importance of shore platforms for biodiversity and in buffering the impacts of coastal storms and sea-level rise. Rock surface hardness broadly reflects the interplay of weathering and erosion processes operating on a rock surface, and is also affected by lithological and wave/tide properties of the shoreline. This study systematically examined rock surface hardness values at three shore platform sites around East London, Eastern Cape, South Africa, all of which are developed in the same (sandstone) lithology and under the same wave/tide conditions. At each site, measurements of rock surface hardness were made along three shore-normal transects (20-60 m long), and at three locations along each transect (supratidal, upper intertidal, lower intertidal). At each location, 50 measurements were made using an N-type Schmidt hammer. Observations were also made on bedrock structure, weathering/erosion forms and biogenic features. Results show statistically significant differences in surface hardness values within and between sites and at different positions in the tidal frame based on their Schmidt hammer values. This shows that lithology and regional wave/tide regime are not the major controls on surface hardness. It is likely that subaerial (thermal, wetting/drying, salt and biogenic) weathering and episodic refreshing of the rock surface by wave detachment are the major geomorphic controls.

How do we evaluate Earth system sensitivity?

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13J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 11:35 AM - 1:05 PM

Climate change is a first-order control on land surface processes and thus the geomorphological evolution of regional-scale landscapes. These geomorphic changes also then influence other landscape properties including its soils, river dynamics, slope processes, ecosystems, environmental resources and geohazards. Thus a key research question is to understand the sensitivity of any landscape to present and future climate change, termed its Earth system sensitivity. This research question can be addressed from a range of different perspectives: using theoretical biophysical models, based on examining sediment budgets, through dating of land surface features, mapping spatial patterns of landforms that develop under certain environmental conditions, or looking at contemporary forcing-response relationships based on environmental monitoring. This study examines this issue with respect to the sensitivity of different environments to climate change. This is addressed through examining the morphodynamics and thus the Earth system sensitivity of (1) glaciated mountains undergoing paraglaciation, and (2) geomorphic change taking place in semiarid environments. This is based on field observations and measurements of these geomorphic elements in different localities worldwide. Results show that, even under the same climate regime, different geomorphic elements within these landscapes do not respond in the same ways, or at the same rates, to climate forcing. This leads in different geomorphic expressions in response to different aspects of climate (temperature, rainfall, seasonality), the preservation of relict features in the landscape, and distinctive spatial and temporal patterns of geomorphic change separated by (spatial and temporal) periods of quiescence. In totality, these properties reflect the different Earth system sensitivities to climate change, even within any one landscape setting. This approach to understanding landscape processes and responses to forcing has implications for prediction of future geomorphic change under global warming, changes in environmental resources, and hazard risk.

Confounded landform-soil relationship in a temperate riparian wetland: Implications of vegetation and anthropogenic factors

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03K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 4:00 PM - 5:30 PM

Riparian wetlands are characterized by biogeomorphic interactions among geomorphic, vegetation, and anthropogenic factors. Nevertheless, field-scale investigations that elucidate the combined impacts of these factors on soil properties remain limited. In this study, we explored the spatial variability of soil attributes within a riparian wetland situated near the Godal Bridge on the Seomjingang River in southern Korea. A total of 78 soil samples were systematically collected, with measurements recorded for surface elevation, soil depth, water content (Moist), pH, electrical conductivity (EC), and soil organic matter (SOM) at each sampling point. The landscape was further classified into four distinct units based on vegetation type (herbaceous versus woody) and disturbance history (anthropogenically influenced versus undisturbed). Statistical analyses demonstrated that the spatial distribution of soil properties was significantly driven by vegetation and disturbance factors, with marked differences observed in pH and SOM across the four categories. Conversely, geomorphic variables such as elevation and soil depth exhibited limited explanatory power regarding soil spatial variability. Notably, strong correlations emerged between Moist and SOM, as well as between pH and EC, indicating the operation of substantial geochemical processes across the wetland.

These findings contrast with conventional geomorphological perspectives that assume the significant role of topography in determining soil properties. Such assumption alone may be insufficient to explain soil distribution, particularly in modern river systems experiencing increasing frequency and intensity of anthropogenic disturbance. In complex riparian wetland environments where multiple interacting factors are present, a more holistic (i.e., biogeomorphic) approach as attempted in this study is needed. The present study will enhance the knowledge of the vegetation-anthropogenic-soil triangular relationship, improving our understanding of landscape patterns and processes.

Volcano Meets Reef: Unveiling the Hybrid Geomorphology of Niuatoputapu

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The Tonga archipelago presents a striking geological dichotomy: islands are typically of volcanic composition associated with the western Tofua volcanic arc, or of uplifted limestone, forming part of the eastern Tonga forearc. Niuatoputapu, an island in northern Tonga, stands out as an exception as it comprises a central volcanic core with an extensive uplifted limestone platform. This unusual geomorphic configuration offers a unique opportunity to study the interplay between volcanic and carbonate island evolution in a tectonically active region and in an under-studied part of the Pacific. This study aims to produce the first high-resolution geomorphological map of Niuatoputapu to support research into the island's Holocene development, sedimentary processes, and hazard exposure. Our methodology integrates a newly acquired high-resolution Digital Elevation Model with extensive fieldwork and sedimentological analyses. The resulting map reveals the spatial relationships between the volcanic interior and limestone platform, identifies depositional and erosional landforms, and highlights zones of recent coastal change and sediment build-up. Stratigraphic evidence from sediment cores indicates a complex history of reef accretion, tectonic uplift, and surface reworking influenced by late Holocene environmental dynamics. Moreover, the geomorphological map serves as a valuable tool for hazard assessment and coastal management for remote islands in Tonga and across the Pacific, which are exposed to multiple hazard types such as earthquakes, tsunamis, storms, and gradual coastal changes.

Discovery of the world’s largest cliff-top boulder: Initial insights, temporal framework, and numerical wave modelling

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01F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 11:40 AM - 1:10 PM

Cliff-top boulders emplaced by high-energy wave events serve as powerful indicators of past coastal hazards, yet few are as extraordinary as the newly documented megaclast Maka Lahi on Tongatapu, Tonga. Weighing approximately 1,180 tonnes and located 39 m above sea level and 200 m inland, this deposit represents the largest cliff-top boulder ever reported. Its exceptional size and remarkable location advance the current understanding of wave-driven boulder transport and extend the boundaries of known processes responsible for such emplacement.

This study aimed to reconstruct the boulder's emplacement scenario and determine the wave height and period required for its transport. Comprehensive field investigations were undertaken, encompassing photogrammetric scanning and systematic trenching, alongside the collection of sedimentological and geomorphological datasets to thoroughly characterize the boulder and constrain its depositional age. U-Th dating of flowstone samples established a minimum age of emplacement at 6891 cal yr BP. To evaluate possible wave scenarios, we applied incipient motion formulas numerical and simulations, testing a range of storm and tsunami wave heights and periods. Our results show a scenario with 50 m wave heights and 90 second wave period can reproduce the necessary cliff-top run-up and lateral displacement to explain the boulder’s position. This wave scenario is likely associated with a landslide tsunami rather than storms (typically shorter wave period of <30s) or earthquake tsunamis (commonly wave periods of several minutes to hours).
This discovery redefines the upper bounds of known boulder transport and has important implications for understanding tsunami hazards in steep coastal environments. The Maka Lahi boulder highlights the potential for low-frequency, high-impact wave events to produce extreme coastal geomorphological signatures. Our integrative approach demonstrates the value of combining local indigenous knowledge, modern survey techniques, and numerical models to resolve the origin of boulder deposits and reassess coastal hazard risks.

Shaping Wetlands: 250 Years of Human Impact – A Comparative Analysis of Rhinluch Peatlands and Lower Havel River Floodplain

Dr Anne Köhler[1], Marie Kaniecki[1], Dr. Rita Gudermann[2], Dr. William J. Fletcher[3], Prof. Dr. Anja Linstädter[4], Prof. Dr. Natascha Mehler[5], Dr. Ulrike Werban[6], Prof. Dr. Christoph Zielhofer[1]
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03I: Lowlands a place for humans? Geomorphic functionality and anthropomorphization of alluvial and coastal plains from past to future, Conway 4, February 2, 2026, 4:00 PM - 5:30 PM

Floodplains and peatlands across Central Europe have long been subject to human transformation. From early drainage attempts to large-scale engineering projects in the modern era, anthropogenic interventions have altered their hydrology, morphology, and ecological functions. Yet the nature, intensity, and consequences of these changes vary significantly depending on local geomorphological and hydrological conditions. Understanding these differences is essential for assessing the long-term impacts of land use on wetland ecosystems and their geomorphological development.
This talk presents a comparative study of land use changes over the past 250 years in two distinct wetland regions of northeastern Germany: the peat-rich Rhinluch and the fluvial Lower Havel floodplain. Both areas have experienced extensive human interventions, including peat extraction, river regulation, mill and canal construction, settlement expansion, and deforestation. By analysing old maps from multiple time periods, we trace the spatial and temporal development of land use changes and their varying impacts on landscape form, surface hydrology, and sediment pathways. The comparison highlights how geomorphological settings shape the character and consequences of land use transformation. With regard to palynological studies, both regions have undergone significant human impact. However, the old map analysis shows that the nature and focus of interventions differ, shaped by the contrasting characteristics of fen and fluvial environments. This perspective offers regionally specific insights into wetland change and underlines the value of historical cartographic analysis for reconstructing long-term anthropogenic influences on geomorphic processes.

Littoral woody vegetation modulates sediment deposition and shoreline stability on reef islands

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06F: Tropical coral reefs and reef-lined coasts, Conway 1, February 3, 2026, 2:30 PM - 4:00 PM

Coral reef islands are low-elevation (<3 m), unconsolidated landforms composed of reef-derived sand and gravel, widely considered vulnerable to sea-level rise (SLR). While wave overtopping is often characterised as a flooding hazard, recent work highlights its geomorphic role in delivering sediment to island surfaces, contributing to vertical accretion and longer-term island morphodynamics. However, the role of vegetation in mediating sediment dynamics and contributing to island development under SLR, or as an effective nature-based solution, remains poorly understood.

Here, we examine how littoral woody vegetation influences sediment deposition and shoreline morphology during overwash events. We present observational data from two Maldivian reef islands (one ocean-exposed atoll rim island and one lagoon sand cay) documenting sediment deposits and their interaction with vegetation, supplemented by published literature. Field evidence from overwash deposits and vegetation zones indicates that coastal shrubs and trees affect the distribution, depth, and retention of deposited sediment, with outcomes strongly linked to plant form.

Strong, dense shrubs (e.g. Pemphis acidula), or with persistent prop-roots (Pandanus spp.), trap coral gravel on rim islands, promoting sediment accumulation and ridge development. In contrast, upright, widely spaced trees (e.g. Cordia subcordata) allow sediment bypass and inland penetration. These effects are shaped by geomorphic setting, vegetation structure, and disturbance history. Post-overwash survival and regeneration were species-specific: some individuals resprouted or colonised new substrates quickly, while others died. Dead vegetation also played a geomorphic role by increasing surface roughness. Collapsed Cocos root mats reduced erosion and facilitated sediment retention by forming ramps between the beach and island interior.

These findings highlight that the functional role of vegetation in reef island morphodynamics is trait-dependent and context-specific. Recognising how plant form and legacy effects influence sediment transport is critical for integrating vegetation into future island resilience models and nature-based adaptation strategies under rising sea levels.

Integrating UAS and TLS data for High Resolution Change Detection of the Komolithoi Badlands (Chania, Greece)

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08H: New frontiers in the study of erosion processes and geomorphic dynamics in badlands, Conway 3, February 5, 2026, 9:35 AM - 11:05 AM

The Komolithoi badlands, located in the Kissamos providence of Chania, Crete (Greece), are dunes consisting of soft clay that form conic shapes and represent a visually striking and geomorphologically active landscape, shaped by intense erosional processes characteristic of Mediterranean semi-arid environments. Their study can offer insights into the processes and mechanisms of erosion since due to their unique rock properties, including their high clay content, low organic matter, and low infiltration capacity, they are exceptionally vulnerable to erosion. Capturing the complexity and evolution of such landforms requires high-resolution, georeferenced data and a flexible methodological framework adapted to this challenging terrain.

In this study, we combine Unmanned Aerial Systems (UAS) and Terrestrial Laser Scanning (TLS) data to generate ultra-detailed 3D models of the Komolithoi formations. Two full surveys were conducted in 2023 and 2024, enabling the construction of multitemporal point clouds.

The integration of aerial and terrestrial methods enables dense, accurate surface coverage, overcoming limitations posed by occlusions, steep gradients, and fine-scale roughness. The resulting point clouds achieve high spatial resolution and geolocation precision, offering valuable insights into both surface morphology and potential erosion pathways. In addition to forming a baseline for future monitoring, the datasets allow for preliminary assessment of geomorphic dynamics and sediment redistribution.

This contribution emphasizes the methodological potential of combining UAS and TLS technologies for badland research. It highlights how modern geomatics can advance the study of erosional landscapes where traditional surveying methods may fall short. Ultimately, this work contributes to the development of standardized, high-accuracy protocols for mapping and modeling badlands, aligning with broader efforts to monitor landscape change and aid land management in sensitive geomorphic environments.

1130

15 years of experience with the Puls Doppler Radar in alerting natural hazards

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09D: Engineering Geomorphology AND Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 11:35 AM - 1:05 PM

Automatic monitoring of alpine mass movement is a major challenge in dealing with natural hazards, 15 years of experience with the pulse-dopper radar shows that automatic monitoring of mudslides, avalanches, debris flow, rockfall, etc. is precisely and reliably possible with this radar technology. We managed to develop a system that minimizes false alarms to almost 0 and never misses an event. More than 30 installations have now been carried out worldwide. In addition, this technology is used to obtain valuable scientific data that enables a deeper understanding of of these events. This data also makes it possible to verify and improve models and several papers and theses were written as a result.

Unveiling coastal sabkha environmental history of the United Arab Emirates through multi-proxy analysis

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The United Arab Emirates (UAE), characterized by its diverse coastal and marine environments juxtaposed with arid terrestrial landscapes, holds a rich and complex geomorphological history, which can be effectively reconstructed through the integrated study of a multiple proxy records. The area’s unique environmental gradients and geological settings, such as coastal sabkhas in the western regions, offer and ideal context for employing biomarkers alongside geochemical analysis. Together, they serve as powerful proxies for interpreting past environmental conditions and geomorphological processes. Data were collected from several cores in the western regions coastal sabkha environments of Wadi Mati and western Marawah Island in United Arab Emirates. Benthic foraminifera, elemental and sedimentological analyses, along with radiocarbon dating were employed to reconstruct past environmental conditions. Our results reveal distinct transitions from nearshore/paralic high-energy environments to shallow marine/lagoonal settings, culminating in the establishment of present-day sabkha conditions. Focusing on diverse multi-proxy records preserved within the UAE's varied geomorphic settings since the middle Holocene, this study highlights their critical role in decoding the region's complex coastal evolution, sedimentary dynamics, and environmental history. These insights provide valuable information for informed coastal management and future environmental planning.

Paleoenvironmental and paleogeographic evolution of Christiana-Santorini-Kolumbo volcanic field (South Aegean Volcanic Arc)

Dr Olga Koukousioura[1], Professor Paraskevi Nomikou[2], Professor Dimitrios Papanikolaou[2], Dr Vasiliki Grigoria Dimou[1], Professor Adam Woodhouse[3], Professor Shun Chiyonobu[4], Researcher Paraskevi Polymenakou[5], Professor Tim Druitt[6], Researcher Steffen Kutterolf[7], Dr Thomas Ronge[8], Msc Sarah Beethe[9], Msc Alexis Bernard[10], Dr Carole Berthod[11], Professor Hehe Chen[12], Msc Acacia Clark[13], Professor Susan DeBari[14], Msc Sofia Della Sala[15], Msc Tatiana Fernandez-Perez[16], Dr Ralf Gertisser[17], Professor Christian Hübscher[18], Dr Reymond Johnston[19], Msc Christopher Jones[20], Msc Anna Katsigera[2], Professor Stephanos Kilias[2], Professor Gunther Kletetschka[22], Dr Xu Li[23], Professor Kumar Batuk Joshi[21], Professor Michael Manga[24], Professor Molly McCanta[25], Dr Iona McIntosh[26], Dr Abigail Metcalfe[6], Professor Anthony Morris[27], Dr Katharina Pank[7], Msc Vasiliki Papadimitriou[5], Msc Ally Peccia[28], Dr Jonas Preine[29], Dr Masako Tominaga[29], Professor Yuzuru Yamamoto[30], Msc Takeru Yoshimoto[30]

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12H: Quaternary Geomorphology and Landscape Evolution, Conway 3, February 6, 2026, 9:35 AM - 11:05 AM

IODP Expedition 398, conducted in the Christiana-Santorini-Kolumbo (South Aegean Volcanic Arc) Volcanic Field, drilled twelve sites in and Santorini volcano, penetrating the caldera and rift basin fills hosting a volcano-sedimentary sequence. Situated in a densely populated and highly touristic region, Santorini's volcanic activity was marked by the ~1600 BC Minoan eruption. Many such hazardous volcanic systems are located in extensional back-arc settings, where the interplay between volcanism and tectonics is poorly understood due to limited long-term records. The Christiana-Santorini-Kolumbo volcanic field, located in an active continental rift zone, offers an ideal natural laboratory to investigate these interactions. The expedition successfully recovered nearly 3.5 kilometers of core, providing crucial age-depth constraints and paleodepth estimations, mainly from biomarkers, ground-truthing seismic data, while drilling penetrated the Alpine basement and a thick sequence of Messinian evaporites. The recovered samples enable us to access the significant portion of the CSK field's volcano-tectonic history that is preserved offshore. The detailed stratigraphic and paleoenvironmental data derived from the analysis of the IODP 398 sediment cores offer a crucial long-term perspective on the region's dynamic geological and environmental history. This study defined the paleoenvironmental and paleogeographic evolution of the south Aegean, providing a critical foundation for understanding its present-day characteristics, informing future assessments of seismic and volcanic hazard and marine ecosystem dynamics and serving as a global model for studying volcano-tectonic interactions.

Morphology, stratigraphy and sedimentary record of the Northwest Atlantic Mid-Ocean Channel, Labrador Sea

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07E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 5:00 PM - 6:30 PM

The Northwest Atlantic Mid-Ocean Channel (NAMOC), located between Greenland and Canada, is the longest known deep-sea channel in the world and is comparable in length with the longest rivers in the world. It stretches for ~4000 km offshore Hudson Strait through the Labrador Sea, circumnavigates the Grand Banks of Newfoundland and terminates at the northern limit of the Sohm Abyssal Plain. NAMOC exhibits many morphological features similar to fluvial systems, including tributaries, channel meanders, levees, point bars, and a prominent thalweg. NAMOC is unique in respects other than just its length; it is not associated with a river system, did not form on a delta or deep-water fan, and has no evident source of sediment that would account for its formation.

NAMOC was mapped over a distance of ~2000 km during RV Maria S. Merian Cruise MSM102. This northern portion of the channel is bounded by well-developed levees, whose height decreases significantly with increasing distance to the continental margin. Channel sinuosity is highest where the path is confined by bedrock outcrops and rare tributary confluences. Where the channel path is unaffected by these external factors, the channel maintains a low sinuosity. Most of these low-sinuosity channel segments are also characterized by extensive channel wall failures. This observation suggests that instability of the levee sediments may play an important role in minimizing sinuosity growth through channel wall collapses that reset amplification of meanders.

Mass wasting adjacent to the NAMOC also plays a role in the development of the channel. The acoustic data image a series of stacked debris flows along the western side of the NAMOC. These debris flows, sourced from the Canadian continental shelf, run parallel to the NAMOC for tens or even hundreds of kilometers before locally breaching the channel levee and continuing within the NAMOC itself.

Identifying coastal cliff erosion hotspots and related forcing mechanisms

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01F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 11:40 AM - 1:10 PM

Coastal cliffs represent about 50% of the world's coast, and their erosion impacts public resources and critical infrastructure. Thus, identifying alongshore erosion hotspots, drivers, and precursors provides valuable information to inform risk management strategies. Wave-driven erosion at the cliff base is a primary process; however, quantifying this relationship remains challenging because of variation in the wave field, nearshore morphology, cliff material properties, and lack of high temporal frequency topographic datasets. This study aims to address this issue by analysing seven years of weekly high-resolution LiDAR surveys (320 surveys) and hourly nearshore wave hindcast in southern California. A correlation r^2 of 0.4 (±0.04) was observed between alongshore patterns of lower cliff erosion and wave impact height (defined by the elevation of the total water level above the back beach elevation) during modal wave conditions, increasing to $r^2=0.47$ (±0.04) during energetic wave conditions (top 20 percentiles of wave conditions). A sensitivity analysis based on Stockdon's wave runup equation showed that the dominant drivers of alongshore variability in wave impact height at the cliff toe are beach gradient and back beach elevation. The spatio-temporal patterns of beach gradient and back beach elevation were defined from an Empirical Orthogonal Function analysis. The dominant spatial modes of both beach parameters were characterised by a lower back beach elevation and steeper beach gradient in front of the observed cliff erosion hotspot, compared to other locations. The alongshore patterns were more pronounced in winter and displayed interannual variability, when incident waves increased, indicating a likely dependence on the wave climate. The results highlight the influence of the subaerial beach morphology in the evolution of coastal cliffs.

Landslide Diversity in Northern Vietnam's Monsoon Region: Implications for Process-Based Geomorphological Classification

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05J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 11:35 AM - 1:20 PM

Landslides are among the most dangerous natural hazards, causing severe damage and claiming numerous lives each year worldwide.

Regions affected by monsoons and typhoons are simultaneously global landslide hotspots. One of the areas most prone to landslides is northern Vietnam, where the impact of slope failures on both the environment and society is recorded annually.

Field investigations were carried out after the last three monsoon/typhoon seasons. These included geomorphological mapping, UAV surveys, soil sampling, orthophoto analysis, photographic documentation, and observations of other manifestations of morphogenetic processes.

Several types of landslides were identified: shallow translational slides and debris slides, sometimes as clusters of shallow landslides, deep-seated rotational/translational slides as well as other variants. Cascading geohazards were also documented, in which landslides transformed into debris flows and were associated with flash floods.

The wide range of landslide types and landforms observed, despite a common triggering factor (intense monsoon or typhoon rainfall), demonstrates that a single dominant trigger can provoke varied environmental responses. Other factors such as topography, soil grain-size distribution, and the depth of weathering act as modifiers, influencing the system's sensitivity to triggering events. The identified landslide types are classified according to the widely accepted Varnes classification and the conventional division into shallow and deep-seated landslides. A deeper analysis of landform types highlights that specific climatic conditions are associated with a limited set of landslide types, while others are not observed at all. Long-term slope development under monsoonal climatic conditions increases susceptibility to particular landslide types. However, the diagnostic criteria for these types should be reviewed and adapted to reflect local environmental conditions.

Geosystem services and disservices: possible links to geomorphological processes and landforms

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The ecosystem services concept is, despite certain controversies, widely accepted and reflected in scientific literature with a notable overreach to nature conservation, management, and policies already for several decades. A similar situation is with geosystem services, although their conceptualisation is the matter of a shorter period.

In contrast, the ecosystem disservices approach is relatively new to the field and its conceptualisation is being developed in recent years. Originally, ecosystem disservices were perceived simply as negative impacts of ecosystems on human well-being, but recently, the definitions have shifted towards more complex views. Ecosystem disservices are now defined as the results of ecosystem functions that impact human well-being and are assessed as damaging under a relevant value system. The majority of the approaches to ecosystem disservices are focused on biodiversity and although the negative impacts of geodiversity (especially geomorphological processes and eventually landforms) are well-known, a clear conceptual framework for describing these impacts is still missing. In this contribution, the geosystem disservices concept is discussed. Nevertheless, it is necessary to mention that a holistic approach is needed as the attitudes to geodiversity (including geomorphological processes and landforms) depend on the societal context, time and space; the same entity can be valued as a geosystem service or disservice, depending on the lifestyle, culture, age, experience, or historical period.

Geosystem disservices may thus be considered as results and outcomes of functions, structures, and aspects related to abiotic entities, processes and interactions that may impact human well-being and are assessed as damaging under a relevant value system at a particular moment (a period or a time span). Several classification frameworks for geosystem disservices (impact-oriented, framework-based, cascade or reflecting natural or human-induced processes) are outlined, and examples of geosystem disservices (with a special regard to geomorphological processes and landforms) are presented.

Linking geomorphology and culture: An integrated approach to heritage conservation and management

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08I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 9:35 AM - 11:05 AM

Relationships between geomorphology and culture are very close and frequent and they are reflected in numerous areas, situations, or levels. These links have been already reflected and studied within cultural geomorphology, but they can be described and analysed within the concept of abiotic ecosystem services (or geosystem services) as well. The relationship between geomorphology and culture (or eventually geomorphological and cultural heritage) is best visible and recognisable within the cultural and knowledge services, however, other types of services (provisioning, supporting, regulating) are relevant too.

Anchoring and conceptualising the geomorphology-culture relationships within the geosystem services may provide a framework for future inter- and transdisciplinary studies and may contribute to the better understanding and justification of protection and sustainable use both for geomorphological and cultural heritage. It can also serve as a basis for more effective efforts and activities resulting in the development of integrated approaches to heritage conservation and management.

The contribution provides several examples of how geomorphology (or geomorphological heritage) interact with culture (including history, archaeology, mythology or arts) and discuss the links of geomorphology – culture within geosystem services taking into account the applications in heritage protection, management, and their contribution to a sustainable future.

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Geophysical and hydrologic analysis of of Pituffik peninsula incipient suprapermafrost wetlands

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Northwest Greenland's PItuffik Peninsula (76ºN, 69ºW) is a high Arctic desert underlain by permafrost. Progressive deglaciation beginning 11-9 kya reveals rocky, inhospitable terrain, where isolated wetlands with facultative vegetation are developing despite the conditions of low precipitation (< 2 cm monthly) and short growing season (2-3 months). Wetlands and peat are present in nearby regions; this work targets newly colonized areas. Wetland colonization and peat development are dependent primarily on near-surface water availability. The early summer season (late-June) is marked by brief pulses of meltwater from snow, and later (July-August) from sustained glacial melt off the Greenland Ice Sheet. We identified two wetland sites in the North Mountain vicinity, north of Pituffik Space Base (formerly Thule AFB), which overlay permafrost and appear snowmelt fed. We seek to understand the balance of hydrologic contributions from seasonal snow and permafrost melt, as well as if their characteristics are translatable to other Pituffik permafrost thaw zones. A suite of water analyses indicate wetland bioactivity via diminished pH and slightly elevated DOC/TOC. Comparison to results from an adjacent, larger drainage may clarify the fate of these waters' characteristics – export or retention. Wetland keystone plants such as Sphagnum spp. are present. Early summer geophysical investigations (ground-penetrating radar; EM34) in the region indicate shallow permafrost (<1 m), potentially deeper in wetland areas. We hypothesize a permafrost aquitard keeps meltwater in the active layer, enabling wetland development, but biological activity and consistent snowmelt patterns accelerate deepening of the active layer relative to the vicinity. We plan to radiocarbon date basal materials and collect aerial multispectral imagery to further characterize these sites and investigate the spatial extent of similar on the peninsula. Polar wetlands such as these are the vanguard of encroaching life into the thawing Arctic; results here may reflect on the future of postglacial lands.

Landscape sensitivity and soil development in an area of toxic, naturally-occurring minerals: Gawler Downs, New Zealand

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13J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 11:35 AM - 1:05 PM

Climate is amongst the key factors controlling soil formation. Its influence is primarily driven by moisture and temperature components that affect the rates of de-composition of organic and inorganic material, moisture availability, and patterns and processes of organic activity. Soils, therefore, integrate climate signals in their physical, chemical, and organic properties. Gawler Downs in the eastern foothills of the Southern Alps, New Zealand presents a remarkable geomorphic archive where climate-driven landscape change and environmental hazards converge. This is a landscape of downlands, comprising subdued landscapes of undulating smooth hills or broad ridges, dissected by steep gullies draining to broad floodplains. Gawler Downs is composed of the erosional and block-faulted remnants of a suite of Late Cretaceous volcanic rocks, the Mount Somers Volcanics Group (MSVG). These volcanic flows and domes are preserved discontinuously in the eastern foothills of the Southern Alps, northeastwards from the Rangitata River gorge to the Malvern Hills. This case study explores the region's response to past and current climatic regimes, most notably the evidence of relict glacial landforms and associated deposits, now partially buried beneath thin, post-glacial soil covers. These soils reflect landscape response to climate, and the site studied here provides insights into the history of erosion, sediment transport and soil development. Thin, residual soils are present at the tops of slopes, with soils thickening downslope, where transported soils accumulate at the slope toe. Mineralogical analyses of the soil profiles have also identified the presence of erionite, a fibrous, highly toxic zeolite mineral. The changing morphology of these minerals downslope within the soils is also an indicator of weathering as they are translocated through the soils. Ultimately, this study emphasises how soil development and geomorphology is intimately tied to the slope geology on which soils form.

Reconstructing Cyclone Frequency in the Bay of Bengal: Insights from GPR, OSL and Sedimentology in Odisha

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05H: Providing 2D & 3D Subsurface Imagery of Geomorphic Environments: Ground Penetrating Radar and Near-Surface Geophysics, Conway 3, February 3, 2026, 11:35 AM - 1:20 PM

The Bay of Bengal (BoB) is a well-known hotspot for the frequent and severe occurrence of tropical cyclones. Despite this, comprehensive written records of cyclonic events in the region remain limited, largely due to the historical scarcity of documentation. Odisha, a state located on the eastern coast of India along the periphery of the BoB, is particularly vulnerable to these extreme weather events. We use ground penetrating radar (GPR) to identify signatures of cyclone events buried within the prograded beach systems near Astaranga town in Odisha. Three Shore-normal GPR reflection profiles were collected using 250 MHz antennas of the pulseEKKO PRO GPR system. Processed GPR profiles exhibit several high-angle erosional surfaces, which are likely the result of erosion during severe cyclones. Sediment cores and excavated faces, analysed along the same GPR lines, together with optically stimulated luminescence (OSL) ages, provide a chronological framework for these features spanning the past 400 years. Trench and core data from the swales also highlight distinctive layers rich in heavy minerals, possibly deposited by repetitive cyclonic events. OSL dating provided an estimated cyclone recurrence interval of ~3.2 to 3.6 years, consistent with historical records. By integrating geological archives—such as sedimentary records identified through GPR and OSL analyses—it is possible to extend the written record and gain long-term insights into past cyclone activity. This information will be valuable for coastal management and for developing strategies in the BoB region.

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Geomorphological evolution of the multi-chain cascading disaster of Wayanad (30 July 2024), Kerala, India

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04J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 9:35 AM - 11:05 AM

The Western Ghats are increasingly vulnerable to landslides due to extreme rainfall, complex geological structures, and anthropogenic activities. This study examines the catastrophic multi-chain disaster that occurred in the Vellarimala Hills of the Western Ghats, Wayanad district, Kerala, on July 30, 2024. Triggered by unprecedented rainfall of 572 mm over two days, the event involved a large-scale landslide in the early hours (2 AM), transforming into a debris flow along the Punnapuzha channel. The debris flood in the morning at 4 AM caused widespread devastation, including the destruction of villages and infrastructure, with significant casualties and displacement. This study aims to reconstruct the catastrophic event through detailed field observations, analysis of rainfall and channel topography, and comparisons of pre-and post-event imagery, engaged with local administrative authorities and survivor interviews. Our findings reveal that the landslide was triggered by prolonged and intense rainfall, infiltrating deeply weathered charnockite bedrock. The affected region transversed by the lineaments and fractures acted as conduits for water infiltration, increasing pore-water pressure and reducing slope stability. The landslide transformed into a high-mobility debris flow, depositing significant material in downstream floodplains. Extreme rainfall, steep topography, and high channel stream power caused extensive erosion (~ 30 m) and channel widening. Pre- and post-event analyses indicate substantial channel widening and erosion, reshaping the river morphology. This catastrophic landslide has drastically affected the land use/ land cover features in the Punjirimattom, Mundakkai, and Chooralmala villages, and it is estimated that the channel flow widened from 20.98 ha to 84.43 ha after the landslide event. This study highlights the Western Ghats' increasing landslide susceptibility, linking slope failures to geological structures and extreme rainfall, and emphasizes the need for hazard assessment, early warnings, and sustainable land-use planning.

The Role of Joint Kinematics in Improving Accuracy of Landslide Susceptibility Zonation

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02C: Addressing Uncertainties in Landslide Prediction Across Spatial and Temporal Scales, Dobson 2, February 2, 2026, 2:00 PM - 3:30 PM

Reliable landslide prediction remains a critical challenge, particularly in mountainous regions where complex geo-structural settings and limited data introduce significant predictive uncertainty. This study aims to enhance the predictive accuracy of Landslide Susceptibility Zonation (LSZ) maps in jointed rock terrains. The involved method incorporates kinematic susceptibility as an additional internal causative factor alongside commonly used terrain and geological variables (e.g., slope, aspect, lithology, proximity to faults). Kinematic susceptibility in jointed rocks refers to the geometric compatibility between rock discontinuities and slope morphology, indicating the potential for structurally controlled failure. Applied to a structurally complex segment of the Indian Himalayas, characterized by intersecting discontinuities, the study compares two LSZ models: one using standard causative factors and another incorporating an additional kinematic susceptibility layer. The GIS-based kinematic susceptibility analysis was performed using a modified Markland's test embedded in a custom tool, GISMR, which evaluates the failure potential of jointed rock slopes based on their geometric configurations.

Validation through success rate curves revealed that including kinematic susceptibility improved the Area Under Curve (AUC) from 0.866 to 0.881, an increase of 1.5%, demonstrating that structural orientation and arrangement metrics can measurably improve landslide prediction accuracy. The results underscore the value of integrating geomechanically informed layers into statistical LSZ frameworks to reduce spatial uncertainty and improve hazard assessment in complex mountainous terrains.

Paraglacial Response to Global Warming: Unravelling a Decade of Landscape Change in the Austre Lovénbreen Basin, Svalbard

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11G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 5:00 PM - 6:30 PM

Understanding the interplay between meteorological factors and mass wasting processes is crucial for comprehending paraglacial landscape evolution in rapidly changing Arctic environments. High-Arctic regions like Svalbard are particularly critical for studying slope dynamics in a changing climate, especially due to Arctic amplification effects. Despite their significance, empirical evidence in these regions often lacks the long-term, high-resolution terrain data necessary to assess the impact of meteorological conditions on landscapes severely affected by climate change. Bridging this data gap is vital for comprehending the intricate relationships between meteorological factors and landslide development.

This study presents a decade-long (2011-2021) high-resolution remote sensing dataset from the Austre Lovénbreen glacier basin, Svalbard, to investigate the trigger mechanisms and spatio-temporal evolution of translational debris slides and debris flows. We found that translational debris slides account for approximately 96% of the total sediment flux, and their activity significantly increased between 2011 and 2021.

Heavy rainfall events primarily influence the frequency and magnitude of these slides during the hydrological summer, while the duration and intensity of the thawing period are the principal controls for their initiation, indicating a thermal threshold. The presence of a widespread subsurface ice layer, acting as a rupture surface, further emphasizes the paraglacial conditioning of slope instability.

Our findings highlight how increased temperatures and precipitation in the Arctic are accelerating paraglacial slope modification, demonstrating the substantial contribution of these processes to the net erosion and reshaping of glaciated landscapes in a warming climate. Furthermore, this research demonstrates that long-term observatories, like the Austre Lovénbreen glacier, are irreplaceable for future studies on climate change's impact on landslide dynamics.

Paleoseismology and slip rates from geomorphic features along the northern Alpine Fault, New Zealand

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06D: Dynamic Landscapes: Tectonic Geomorphology of Aotearoa New Zealand, Dobson 3, February 3, 2026, 2:30 PM - 4:00 PM

The northern Alpine Fault exhibits structural complexities that could influence the rupture extents and magnitudes of future earthquakes. We present Late Quaternary slip rates along northern Alpine Fault and consider their implications for rupture segmentation. We combine detailed geomorphic mapping from lidar data at ten locations that reveals 10s to 100s of meters of right lateral offset. We use OSL dating to establish ages of associated geomorphic features and derive geological slip rates. At the boundary of the northern and central Alpine Fault, slip rates are as high as 21 ± 2 mm/yr, with incremental decreases of slip rate towards the northeast down to 6 to 10 mm/yr. We suggest that slip rates on the Northern Alpine Fault have been consistent over the Late Quaternary and do not find evidence for incremental changes in slip rate through time as seen on the Marlborough Faults. Our trench logs show evidence for only three Holocene earthquakes through the Glenroy Valley of the Alpine–Wairau Bend. We identify the Alpine-Wairau Bend as a significant rupture terminator including the possibility for terminations of ruptures at junctions of the Alpine Fault with the Marlborough Faults. This has implications for hazard characterization in how the Alpine Fault is considered in fault source models, the potential rupture extent, and whether slip along the principal rupture is constant or segmented along-strike during the next Alpine Fault rupture.

Beyond the index: mapping connectivity using a mixed method approach

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10B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 2:30 PM - 4:00 PM

Connectivity has become an increasingly prominent concept in geomorphology, particularly in studies of fluvial and alpine landscapes. As it gains traction as a valuable analytical framework, a growing number of methods have emerged to quantify and interpret connectivity. Among these, the Index of Connectivity (IC) first proposed by Borselli et al. (2008) has been widely adopted and adapted. However, the development of IC variants often risks becoming an end in itself, with IC maps treated as final products rather than components of broader interpretative frameworks.
In this study, we argue for integrating quantitative indices such as the IC with geomorphic mapping and conceptual models to capture site-specific nuances of landscape connectivity. We present an approach that combines a modified version of the IC with a morphological mapping strategy to provide a more holistic interpretation of connectivity processes.

The method is applied to two contrasting mountain stream catchments (Strahler orders 1 and 3) in the Chic-Chocs Mountains of Québec, Canada. First, we introduce a revised IC formulation in which impedance is defined using a slope stability model—particularly suited for analyzing sediment transfer from shallow landslides in forested mountain environments. Second, we map landforms that act as buffers, barriers, and blankets (following Fryirs et al., 2007) using field surveys and lidar interpretation. Finally, we apply conceptual frameworks from Hooke (2003) and Brierley et al. (2006) to spatialize and contextualize our findings at the landscape scale.

Our results show that incorporating slope stability into the IC enhances the identification of sediment recruitment zones. Moreover, the analysis underscores the critical role of landscape configuration in connectivity and demonstrates how a combination of tools can inform effective river management strategies.

The only way out is through: geomorphic response of through-going alluvial rivers to temperature change at the Pleistocene-Holocene boundary

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03B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 4:00 PM - 5:30 PM

Within the unconfined, semi-arid sedimentary basins of south-eastern Australia, westerly flowing relict river channels record phases of past fluvial activity. Within these plains a variety of spatial, morphologic, and sedimentologic features are preserved when river courses and planforms change; a response associated with changing hydrology throughout the late Quaternary. Contrasting with the smaller, often discontinuous Holocene channels, late Pleistocene palaeochannels are thought to represent a vastly increased runoff regime that transported sandy bedload sediments. Situated on the southern riverine plain of NSW, the Lachlan River is of particular interest, due to the complex network of mostly unstudied palaeochannels that cross the plain surface. This study aimed to demarcate the morphologic shift in palaeochannels from larger, through-going rivers to the present-day anabranching system that declines with distance downstream, presenting a framework of river evolution from the late Pleistocene into the Holocene. Morphometric mapping at a plain scale indicates contemporary waterways preferentially adopt pathways originally forged by larger palaeochannels, with smaller, sinuous channels occupying the confines of laterally expansive palaeochannel terraces. Palaeochannel capacity ranged from 2 times to 10 times greater than modern (based on bankfull width), whilst meander amplitude was more than 5 times greater in the most laterally unstable channels (Willandra Creek), decreasing as channel adjustment changed from laterally migrating to avulsing channels. Sedimentological analysis suggests declining discharge moving into the Holocene, with most channels exhibiting upwards fining sequences within bedload sands, alongside periods of interchange between bedload material and infill. Optically stimulated luminescence dating of palaeochannels (Merrimajeel, Box Creek, Merrowie Creek) estimates the timing of change before ~8ka and ~10ka.

Interactions between Geomorphological Processes and Human Occupation at Bastos Site - State of São Paulo/ Brazil

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The Bastos Archaeological Site, located in Dourado (SP), is currently the oldest in the state with evidence of hunter-gatherer groups. Located at the bottom of a slope, in an open-air environment, the site presents geomorphological conditions favorable to the preservation of anthropic remains, due to successive depositional events that protected them over time. In order to comprehend the evolution of the site, soil descriptions were carried out in the field, as well as granulometric and micromorphological analyses in the excavation unit UE110/101, located on a terrace. The unit revealed a complex sequence of depositional and pedogenetic processes with materials from two main sources: clayey deposits from the slope, and sandy sediments of fluvial origin. Initially, pedogenetic processes predominated with the formation of profile 3, evidenced by horizons IIP5Cg and IIP5Cg2, characterized by a high proportion of clay, illuviation processes and signs of gleization, indicating hydromorphic conditions. The period of stability was interrupted by an erosive event that truncated the profile. Then, horizon IP4C presents a conglomeratic deposit with large basalt and silcrete clasts in a sandy matrix, indicating an episode of intense erosive activity followed by deposition. Horizon IP3Bt, located above, presents recent colluvial input, with subsequent pedogenetic development. Fluvial deposition returns in profile 2, resulting in a thick sandy level. Evidence of biological activity, such as channels and fillings, occurs during this interval. Finally, the most superficial horizons A and Bt indicate recent colluvial input. The succession of erosion, deposition, and pedogenesis events suggest a dynamic evolution of the landscape, currently in a phase of relative stability. The presence of preserved lithic artifacts indicates low transport energy, sufficient to remove the finest materials.

Granitic weathering profile beneath sedimentary cover: evidence of a paleosurface in Northeastern Brazil

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12H: Quaternary Geomorphology and Landscape Evolution, Conway 3, February 6, 2026, 9:35 AM - 11:05 AM

Paleosurfaces are key elements of the Earth's surface for understanding geomorphological contexts in landscape evolution, from past environments to current landforms. Ancient surfaces developed in granitic areas are of particular interest in this study. In Caldeirão Grande do Piauí (Brazil) occurs a paleosurface associated with weathering profiles overlain by Cretaceous sediments. Similar features have been observed regionally on the Araripe Plateau in Northeastern Brazil, where the studied profile is located. The ancient surface is recognized through several weathering profiles in granites, either buried beneath sedimentary sequences or exhumed in different parts of the plateau. The present study aims to correlate a weathering profile developed on Neoproterozoic basement granitic rocks — currently overlain by Cretaceous sedimentary rocks (dated between 108 and 93 Ma) — with the prominent paleosurface in the region. The fieldwork included morphological descriptions of the profiles following standard Brazilian procedures. Based on the descriptions, horizons were identified and sampled for granulometric and chemical analyses. In the described profile, the granitic saprolite is 14 meters thick, overlain by over 2 meters of Cretaceous sediments, and characterized as a sequence of C horizons. The C horizons present its upper portion truncated with features of weathered rock in the lower section, however, without signs of unweathered granitic basement, which lies at greater depths. Granulometric analysis did not detect fractions >2 mm, and all horizons showed a high clay content (average of 39.3%), and a silt/clay ratio of 0.5. The characteristics may indicate intense clay formation and weathering processes throughout the profile, resulting from ancient weathering associated with the formation of the paleosurface, as the material is buried beneath lithified sediments no longer affected by the current weathering processes.

The role of anthropogenic pressures in the evolution of alluvial fans on sedimentary cliffs, NE-Brazil

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

In the southern coastal region of Bahia, in Northeastern Brazil, sedimentary sea cliffs emerge as part of an extensive Coastal Tableland composed mainly of sandstones and mudstones from the Barreiras Group (Neogene). This area, known as the “Discovery Coast” (Costa do Descobrimento), was the first region of Brazilian territory to be occupied and exploited by the Portuguese colonizers. Consequently, vegetation removal on this Coastal Tableland has been occurring for centuries, more recently giving way to agricultural fields and the construction of roads. In the area known as Lagoa Azul (a lagoon environment in Porto Seguro municipality), a prominent erosional indentation in these sedimentary cliffs, a possible lagoon is also observed, which may reflect sea-level fluctuations that affected the northeastern Brazilian coast during different periods of the Holocene. Additionally, a small sandy alluvial fan is found in this sector. Using orbital and non-orbital imagery and geomorphological interpretations, this study suggests that the genesis and evolution of the alluvial fan are recent and linked to the history of land use and occupation atop the cliffs. These anthropogenic activities may have redirected erosion and overland flow paths across the unconsolidated Barreiras Group deposits. The images reveal cliff gully erosion, the presence of alluvial fan at the base of cliffs, and patterns of land use above the tableland. Therefore, a process initially considered natural, i.e. rainwater surface runoff forming the fan, may be accelerated due to human-induced changes in the landscape.

Anthropogenic pressures and coastal changes in transitional environments on the Mediterranean basin

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05K: Identification, quantitative assessment and mapping of anthropogenic landforms in urban areas, February 3, 2026, 11:35 AM - 1:20 PM

Diverse coastlines, including transitional environments such as estuaries, deltas, and lagoons, characterize the Mediterranean coastal zone. It has historically been vulnerable to natural processes and increasing anthropogenic pressures. In this sense, impacts inherent to human activities — such as urbanization, construction of coastal infrastructure, sediment extraction and modification of river courses — have been causing imbalance in these environmental systems, especially in coastal areas located close to river mouths, as is the case of the coast adjacent to the Pineios (western Greece) and Volturno (southern Italy) rivers. Different types of use and occupation throughout history have progressively altered the hydro-sedimentary dynamics in these environments and consequently generated new morphological responses in the coastal system, such as coastline displacement through erosion and aggradation processes. The intensification of this process has been making the coastline of the Pineios and Volturno rivers increasingly less resilient and generating negative socioeconomic consequences due to environmental changes. Thus, this work aims to perform a multi-temporal analysis of these two areas, identifying the most vulnerable coastal sectors and quantitatively measuring the morphological changes resulting from the horizontal displacement of the coastline. Geospatial data and analysis of the fractal geometry of two coastline sectors were used to present the progression of such changes on the coast, identifying their possible causes and relationships with the main vectors of anthropogenic pressures. The results indicated that in the last 30 years, there has been a more significant change on the Italian coast, while in Greece, the more recent intensification of land use and the reduction of river sediment input have aggravated erosion processes. Finally, the need for integrated management and coastal adaptation strategies is highlighted, focusing on mitigating these negative impacts and preserving essential ecosystem services on the Mediterranean coast.

Channel dynamics in response to compounding disturbances in western USA mountain streams

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08J: Responses of geomorphic processes and earth surface systems to extreme weather and climate events, Conway 5, February 5, 2026, 9:35 AM - 11:05 AM

Infrequent, episodic influxes of sediment by wildfire, floods and landslides are an important control on channel dynamics and morphology in mountain rivers. Given the increasing frequency and magnitude of extreme watershed disturbances including post-fire debris flows, understanding how mountain rivers respond to these perturbations is a pressing challenge. We approach the issue by leveraging high-resolution pre- and post-fire DEMs and imagery, repeat cross-sectional surveys and pebble counts to document channel responses to post-fire debris flows for mountain rivers in distinct geomorphic settings. We further use morphodynamic modeling to explore the effects of sediment input volume and location. These investigations provide a framework for understanding how compounding climate disturbances could alter river morphology and sediment regimes with direct consequences for aquatic habitat and flood risks.

Tracing the Anthropogenic Fingerprint: Sedimentological and Isotopic Insights into Vienna's Floodplain Archives

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Human impact has developed into a major external forcing control on Earth's environmental and geomorphic processes, yet our understanding of the magnitude of the impact and its evolution, particularly in (peri-)urban settings, is still limited. This study investigates the anthropogenic impact of the metropolis Vienna on its peri-urban environment in floodplain archives of the Danube River. By applying sedimentological, geochronological and chemostratigraphic methods, we aim to characterise the interplay between upstream human interventions and local river dynamics, and to identify and evaluate the geological signal of the Great Acceleration since the 1950s downstream of Vienna.

The study area is located in the National Park Donau-Auen, where minimal direct human intervention allows quantifying the human stratigraphic fingerprint and testing event-based dating using (artificial) radionuclides in an alluvial setting. Flood deposit ages were successfully determined combining radiogenic nuclide concentrations (137Cs, 239Pu, 240Pu, 237Np, 233U, 236U), field sedimentological methods, and historical records. Preliminary results reveal three distinct sedimentation periods reflecting upstream human interventions. The first phase (1870 – 1954) aligns with extensive river channelization leading to rapid erosion of mid-channel bars and backwater aggradation. The second phase (1954 – 1991) shows laterally extensive and thick sandy flood deposits from fast and undamped sediment transport through the straightened riverbed during extreme events. The final phase (1991 – 2002) is characterized by the thick, silty, and seemingly structureless flood deposits, interpreted as remobilized sediment from barrier lakes since the construction of the nearby hydro-power station Freudenau in 1997.

Testing the utility of deep-seated slope failures as paleo-seismometers: fault and landslide characterization in the Hikurangi margin, Wairarapa, New Zealand

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05D: Advances, challenges and future directions in Tectonic Geomorphology AND Seismic Related Cascading Hazards: How Can They Contribute to Improve Paleoseismic Studies?, Dobson 3, February 3, 2026, 11:35 AM - 1:20 PM

Large (MW >7) and multi-fault earthquakes can generate significant natural hazard cascades as evidenced from recent earthquakes (2010-2011 CES, 2016 Kaikōura) in Aotearoa New Zealand (A-NZ). Recent updates to the NZ Seismic Hazard Model (SHM) indicate significant increases in hazard across the Wairarapa region, located in the uplifted Hikurangi subduction forearc. We set out to investigate the presence, distribution, timing and process related to very large (>106 m3) landslides across the Wairarapa. Based on the occurrence of very large landslides during large to great historical earthquakes (e.g., January 1855, June and August 1942), they were recognised as being an important proxy for considering paleo-ground motions across this margin.

Across the coastal ranges east of the main Wairarapa valley near Tauweru, extensive landsliding in Neogene marine rocks can be identified as having occurred in both the MW ~7.2 June 1942 Masterton I earthquake, and as large paleo-landslides. These occur to the north and south of the Carterton Fault, an active upper plate dextral-slip fault that accounts for ~3-4 mm/yr of motion through the coastal ranges.

Results are presented here from trenching and geologic studies at three sites straddling the Carterton Fault: 1) across a landslide complex at Te Matai, reactivated in June 1942; 2) a large paleo-landslide at Hapua; and 3) across the Carterton Fault itself in proximity to Te Matai and Hapua. Our results indicate multiple Holocene landslide reactivations at Te Matai and Hapua that may coincide with surface-rupturing earthquakes on the Carterton Fault. If co-seismic in origin, these landslides occur within c. 2500 m of the fault, which is considered a limit for causative wider shear zone to co-seismic landslide generation process. This work highlights the utility of the growing field of landslide paleoseismology in A-NZ in providing real-world data that can test the NZ SHM.

1211

Seepage through the Sand Barrier at the Mouth of the Russian River, an Intermittently Closed Estuary

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05F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 11:35 AM - 1:20 PM

Intermittently closed estuaries (ICEs) – bar-built estuaries that periodically close – are common along mountainous coastlines such as California's. While providing valuable salmonid habitat, periodic estuary closures can exacerbate challenges related to water quality and flood risk. Tools to forecast water levels during closures can support management decisions, such as whether to manually breach an estuary berm. One outstanding knowledge gap in the development of such tools is how much water seeps through the berm during closures.

Here, we use a mass-balance approach to estimate seepage through the sand barrier (berm) of the Russian River estuary, a wave-dominated estuary in northern California that closes 1-15 times per year, with closure durations of 1-30 days. Using Darcy's Law to describe flow through the berm, we estimate an 'Integrated berm hydraulic' conductivity K that reflects the combined influences of berm dimensions and sand conductivity. Seasonally, K decreases over subsequent closures, possibly due to clogging of the sand barrier by fine sediments. This effect can persist over multiple years, although interannual variation in K likely includes variation in the shape of the berm, which can be washed away during winters with heavy rains and reform the following spring.

1207

Patterns in the Closure of Bar-Built Estuary Mouths in California

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04F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 9:35 AM - 11:05 AM

In California as on other wave-exposed mountainous coasts, bar-built estuaries are common and many of them are at times isolated from the ocean by a sand barrier. These intermittently closed estuaries exhibit intriguing seasonal patterns of accretion in the channel that connects the lagoon basin and the ocean. Observations from 20 estuaries across California reveal distinct seasonal behaviors in response to seasonal cycles in waves and runoff, interacting with tidal dynamics. Apart from differences between estuaries, there are differences between years for the same estuary (observations have been collected for multiple decades in some estuaries). A critical concern is how closure patterns will change with sea-level rise. Leveraging observations and a reduced complexity model of closure, we have explored future changes in closure for selected estuaries. Specific estuaries are likely to shift through a regime of increased closure followed by a regime of decreased closure as sea level rises. However, we have not accounted for morphological feedback, which is likely to be important in some systems. More importantly, future estuary states are likely to be determined by policy and management responses and we demonstrate dramatic differences between scenarios where there is no response to flooding versus scenarios where low-lying land is protected from flooding.

1291

Using sedimentary ancient DNA to identify past ecosystem engineering in rivers

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Before humans took on a dominant role in modifying streams and floodplains, native species were the primary agents of ecosystem engineering and surface change within river-floodplain systems. These natural, pre-human condition of European rivers and their floodplains remains poorly understood. In periods when human activity became a major driver of river and floodplain evolution, it is often difficult to distinguish between human and faunal impacts, especially in the absence of clear physical evidence.

In this pilot study, we aim to reconstruct the pre-human environmental conditions of low-order streams and their floodplains in central Europe. We also develop a methodology to identify the dominant ecosystem engineers at specific riparian sites. Three research sites in central Europe were selected, where we reconstruct palaeo-environmental conditions using a combination of sedimentary ancient DNA (sedaDNA), botanical macroremain analysis, and chrono-stratigraphy to detect the presence or absence of key wetland plant species. Additionally, we investigate the presence of key animal ecosystem engineers which are now globally or locally extinct but were once critical to the functioning of sustainable riparian ecosystems. Identifying when and where these species were present will not only enhance our understanding of natural, resilient riparian conditions but also provide a baseline for interpreting subsequent human-environment interactions.

A tale of two mountains: controls on soil production and chemical weathering rates in rapidly uplifting versus post-orogenic alpine landscapes

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Mountains occupy a small fraction of Earth's surface, but high rates of erosion in mountains fracture rock, expose minerals to fluids, and drive chemical weathering, causing mountains to disproportionately influence the flux of solutes to the oceans and long-term climate. Soils are a hotspot for silicate weathering, but our understanding of the controls on chemical weathering are incomplete. For example, erosion influences chemical weathering rates by setting the supply of fresh minerals, but vegetation also influences chemical weathering rates, both by physical processes that expose mineral surfaces and via production of acids that contribute to mineral dissolution. However, the relative influence of erosion versus vegetation on soil production and chemical weathering rates is unclear. Here we use 10Be and geochemical mass balance to quantify soil production and chemical weathering rates in two mountainous landscapes; the western Southern Alps of New Zealand, and the Elk Range of the Rocky Mountains, USA. Both sites are high-relief, formerly glaciated landscapes but the western Southern Alps are rapidly uplifting, whereas the Rocky Mountains lack appreciable rock uplift. We sampled soils across gradients that span forest vegetation at lower elevation and rocky alpine hillslopes at high elevation. Soil production rates increase with decreasing soil thickness and hillslope curvature at both sites. Chemical weathering rates do not vary significantly as a function of vegetation at either site, however, soils become more chemically depleted as soil thickness increases. For a given soil thickness, denudation rates are an order of magnitude greater in New Zealand than in Colorado, and drainage divide migration caused by tectonically-induced base-level fall in New Zealand drives the highest soil production and chemical weathering rates. These findings indicate erosion plays greater role than vegetation in influencing soil chemical weathering rates in mountain landscapes.

Busy beaver capture carbon? The role of beaver-engineered wetlands in enhancing soil carbon sequestration

Dr Annegret Larsen[1], Dr Lukas Hallberg[2], MSc Tom Brouwers[1], MSc Manou van Mierlo[1], MSc Rodin Dukker[1], Dr Michiel in t'Zandt[1], MSc Nick Quist[1], Christof Angst[3], Prof Thierry Adatte[3], Prof Carsten Mueller[5], Dr Joshua R. Larsen[2]
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02K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 2:00 PM - 3:30 PM

Beavers (Castor fiber, Castor canadensis) are among the most influential mammalian ecosystem engineers, significantly altering river corridor hydrology, geomorphology, nutrient dynamics, and ecosystem function. As a key agent of disturbance, their primary mechanism of influence is dam construction, which impounds water, expands the extent of standing water bodies, and initiates a cascade of geomorphic and ecological transformations. Following a period of widespread regional extirpation, beaver populations have been recovering and expanding across Europe, necessitating a deeper understanding of their ecological impacts on river corridor dynamics and the development of management strategies that optimize benefits for both human and ecological systems—such as employing beavers in nature-based solutions or translocating individuals from areas where they present safety concerns.

In this study, we investigate the influence of beaver wetlands on carbon cycling within several riverine and riparian river sections, with a particular focus on soil carbon storage and sequestration at one beaver wetland in Switzerland. Our research quantifies soil carbon stocks and characterizes their composition. Field work and UAV-based remote sensing included sediment and vegetation mapping and measurements of organic and inorganic soil carbon content using Rock-Eval pyrolysis (RE6 and RE7), and density fractionation. Our results indicate that soil carbon sequestration is a major contributor to negative carbon fluxes (see abstract by Hallberg et al.). Furthermore, we demonstrate that a substantial fraction of the stored soil organic carbon is not only highly recalcitrant but also exists as mineral-associated organic matter (MAOM) —a heavier, less complex, and more stable carbon fraction with typically lower turn-over time. Insights from a controlled incubation experiment gave further insights into the microbially mediated processes driving MAOM formation and hence carbon sequestration. Our findings indicate that beaver wetlands effectively store and sequester carbon over millennial timescales, which persists also in the absence of active beaver presence.

A geomorphic perspective on the present, past, and future of soil erosion in the midcontinent of North America

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09C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 11:35 AM - 1:05 PM

Organic carbon-rich soils are the foundation of agriculture. However, conventional farming practices accelerate soil erosion and diminish soil organic carbon, ultimately undermining soil fertility. The need to feed the growing global population and increasing calls for soil-based policies to sequester atmospheric carbon dioxide highlight the societal relevance of soil carbon. Yet despite the importance of soil to humanity, we have a poor understanding of the rates and extent of soil erosion in Earth's most productive agricultural landscapes. Geomorphology provides a unique perspective and toolsets for quantifying rates of soil erosion and redistribution of soil organic carbon. The presentation will highlight insights gained from using high-resolution topographic data, cosmogenic nuclides, and landscape evolution modeling to assess present, past, and future rates of soil erosion in the midcontinent of North America. These tools reveal that the extent of soil erosion is widespread; organic carbon-rich A-horizon soils have been completely eroded from one-third of the landscape in less than two centuries, erosion rates greatly exceed predictions from government agencies, and erosion rates exceed rates of soil production by orders of magnitude. The findings demonstrate how a quantitative understanding of geomorphic processes and rates in agricultural landscapes can better guide practices that promote soil sustainability.

Short-term trends of rockwall temperatures and potential effects on future rockwall weathering in western Norway

Dr Katja Laute[1], Dr Achim A. Beylich[1]
[1]Geomorphological Field Laboratory (GFL), Selbustrand, Norway

Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Contemporary hillslope processes are considered to react sensitively to ongoing and future climatic changes, anthropogenic impacts and other disturbances. It is therefore of both scientific and social interest to advance our knowledge about possible changes in rockwall weathering as a result of ongoing climatic and environmental changes.

Special focus in this study is given to rockwall system as initial source area for bedrock weathering and rockfall supply for the formation of talus cones. In detail, we will explore how different rockwall thermal regimes will react to expected changes in air and rock temperatures in the near future. Our research is conducted on selected hillslope systems within two mountain valleys located on the western side of the Jostedalsbreen ice cap within the fjord landscape of western Norway. The lithology consists primarily of Precambrian granitic orthogneisses. The general climate is cool temperate oceanic. Higher elevations are characterised by a distinct seasonal frost regime with occurring permafrost from approx. 1500 m asl. upwards. Rockwalls having a favourable exposition can also receive relatively high solar radiation.

We present a unique dataset of up to ten years of rockwall temperature measurements from ten temperature sensors installed in the two mountain valleys, covering different elevation ranges, rockwall aspects and slope inclinations. Short-term trends of rockwall temperatures, frost cracking activity and potential solar-induced thermal stresses are statistically analysed based on quantitative monitoring data of rockwall temperatures and simultaneously measured air temperatures and precipitation.

The results of this study will provide important quantitative data on the weathering of rockwalls and will make it possible to anticipate the potential impact of future rockfall activity and associated rockwall retreat and sediment fluxes under ongoing and accelerated climate change in these investigated mountainous regions in western Norway.

Global distribution of landslide events as related to environmental and anthropogenic factors

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07J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 5:00 PM - 6:30 PM

There is no doubt that climate change has obvious effects on slope stability and on the typical patterns of landslide occurrence. In addition, humans have significantly impacted and altered the natural environment during recent decades. To date, there are few studies that provide a global perspective on the occurrence of landslide events in conjunction with current climate classification maps and an outlook on the interaction between slope mass movements and projected changes in climatic drivers.

This study presents an up-to-date and comprehensive compilation of the current global distribution of slope mass movements and landslide events in relation to the identified environmental and anthropogenic drivers, excluding seismic and volcanic triggers. The global occurrence of landslides is analysed based on NASA's Global Landslide Catalogue (GLC) in connection with the latest and high-resolution maps on climate classification and global precipitation pattern, susceptibility to landslides as well as on the human terrestrial footprint. Recent examples of landslides and their possible triggering factors are discussed for each climate zone. Variations between climatically and anthropogenically driven landslides are analysed and projected changes in climatic impact-drivers and their potential effects on landslides are highlighted.

The results of this study show that the majority of slope mass movements occur in temperate and tropical environments associated with mountainous topography. Even if a large number of events can be attributed to natural/climatic factors (especially precipitation), the results show that the impact of anthropogenically triggered events should not be underestimated. There is a high probability that slope mass movements will generally increase in frequency and magnitude worldwide as climate change progresses and human impacts further increase. With respect to urgently needed and effective mitigation strategies, a better understanding of the interactions and feedbacks between natural and anthropogenic factors related to ongoing climate change, increasing urbanization and human pressures is essential.

Karst dolines function as ecological hotspots in an Australian montane grassland

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04K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 3, 2026, 9:35 AM - 11:05 AM

Dolines, or 'sinkholes', are geomorphic depressions that form over karst, providing topographical complexity in landscapes where they occur. They are a prominent component of our study site, the 'Vale of Belvoir', a montane grassland of high conservation value in Tasmania, Australia. Despite their potential to influence ecological distributions, the interactions between dolines, flora and fauna are poorly understood, hampering integration of biogeomorphological considerations into conservation strategies. In particular, the interaction between dolines and native herbivore wildlife remains critically under-researched.

Here, we show that dolines strongly influence wildlife and their ecosystem effects in a grassland with an abundant native fauna, including marsupial herbivores and ecosystem engineers. Using camera traps and field surveys, we compared wildlife occurrences, signs and habitations between dolines and adjacent plateau sites. Our findings reveal a dramatically higher incidence of marsupial herbivores in dolines compared to plateau habitats, indicating that dolines can serve as focal points for wildlife. Additionally, dolines exhibited a substantially higher density of wombat burrows and wildlife shelves, suggesting enhanced habitat value.

We also investigated wildlife effects on habitat and vegetation by comparing evidence of grazing and bioturbation (diggings) between doline and plateau sites. Results showed a marked increase in the percent cover of cropped vegetation ('marsupial lawn'), and higher density and volume of substrate disturbed by wildlife bioturbation in dolines, highlighting significant ecosystem effects. Finally, we tested the role of these influences on doline vegetation through experimental exclosures, revealing strong effects on community structure and composition.

Our research underscores the role of karst depressions as ecological hotspots, concentrating the activities of native fauna, and subsequently influencing the ecosystem through intensified grazing, digging, and structure building. Our findings highlight the necessity of considering landform features and their interactions with biota to understand ecological patterns and processes in grassland landscapes.

Glacial landforms on Mars: evidence for recent ice-rich deposits around Alba mons

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02D: Planetary Geomorphology, Dobson 3, February 2, 2026, 2:00 PM - 3:30 PM

Around 4 billion years ago, Mars may have resembled Earth, with liquid water, active fluvial systems, and a thicker atmosphere. Over time, however, the evolutionary paths of these neighbouring planets diverged: Mars gradually lost most of its atmosphere, leading to a sharp drop in surface temperature and pressure. As a result, much of its water was either lost to space or trapped as ice, marking a transition from an active hydrosphere to a dominantly cryospheric regime.

For the last 3 billion years, Mars has been a cold, dry world shaped mainly by glacial, periglacial, and aeolian processes. While the polar caps are the most visible expression of water ice, recent robotic exploration has also revealed abundant ice in the mid-latitudes, typically buried under a dry regolith layer as it is unstable when exposed under current conditions. Its presence is inferred from landforms and geophysical data (e.g. orbital ground penetrating radar), and it likely formed through repeated cycles of accumulation and degradation, modulated by variations in Mars' obliquity. Understanding the distribution and characteristics of ice-rich landforms is key to reconstructing recent climate history and evaluating ice as a potential resource for human exploration.

Impact craters are ideal locations to search for ice-rich deposits as their pole-facing slopes act as cold-traps, favouring the deposition and preservation of ice. In this study, we investigate the region around Alba Mons (30°–60°N), where pole-facing crater slopes frequently host lobate deposits that could be similar to debris-covered or rock glaciers. These features appear morphologically young and are likely remnants of recent glaciations. We have mapped all these lobate deposits in the region, and aim to determine their age, structure, and nature—whether they are glaciers or not—in order to better understand how they formed and what they reveal about recent Martian climate history.

Landscape sensitivity to rainfall triggering effects: western Auckland, New Zealand

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12J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 9:35 AM - 11:05 AM

Cyclone Gabrielle was an extraordinary storm event of February 2023, causing 100s of 1000s of landslides across New Zealand's North Island. Auckland, where one-third of New Zealand's population live, was severely impacted. The focus here is the Karekare and Muriwai townships of western Auckland, where contrasting styles of landslides occurred between the two areas. At Muriwai, landsliding occurred via rapid flows and debris-avalanching from a 80-high escarpment composed of Pleistocene-age, weak, poorly-cemented Awhitu Group sands. Increased porewater pressure caused failed blocks to disintegrate into downslope-traveling, destructive, rapid debris-flows, often entraining large trees. In contrast, at Karekare, ~18 km to the south, landslides were still destructive, but were much smaller, occurring as shallow (<2 m deep) rotational slumps or translational slides. These occurred within residual soils of Miocene-age Waitakere Group volcanics, and colluvium. The crenulated escarpment at Muriwai reflects the effects of historic and pre-historic landslides. Indeed, fatal landslides previously occurred in Muriwai in 1965, from the same escarpment as in 2023. In contrast, knowledge of prior landsliding at Karekare is uncertain. Contractors undertaking landslide risk mapping on behalf of Auckland Council during the response to the 2023 Cyclone Gabrielle event identified several very large relict landslides. These are at much higher elevations than occurred in 2023, and would each have displaced volumes of material several orders of magnitude greater than landslides during the 2023 event. These proposed landslides would have been deep-seated, in rock, and presumably earthquake-triggered. However, (1) there is no obvious deposit on the flat valley floor, (2) the proposed landslide "headscarps" do not exhibit obvious topographic expression and (3) the area is of low risk of earthquakes, being >400 km from the plate boundary. This underpins the need for careful geomorphic analysis when undertaking landslide risk mapping, coupled with a realistic understanding of the site geological history.

Predicting the full signal (all grain sizes) of landslide-induced sediment cascades preserved in fluvial stratigraphy following an extreme event

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05C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 11:35 AM - 1:20 PM

Catastrophic sediment release in fluvial systems is largely driven by landsliding that occurs naturally in mountain belts during extreme events, such as earthquakes or storms. Sediments are routed through the river system until they are stored either permanently in alluvial fans and lakes or temporarily in floodplains.

The river response to such catastrophic sediment release has already been studied with 2D numerical models using a single effective grain size. Yet, in natural systems, the sediment grain size distribution can span several orders of magnitude and evolves during transport. Sediments play a different role on river morphodynamics depending on their grain size. While fine sediments contribute to floodplain formation and maintenance, coarse sediments armour the channel bed surface thus preventing its degradation and in turn leading to channel widening.

To better understand how various grain sizes affect a river following a catastrophic sediment release, we use a multi-grain size sediment transport and storage model and apply it to river reaches in New Zealand that were impacted by landslides following Kaikōura earthquake in 2016 or Cyclone Gabrielle in 2023.

Assuming a constricted river reach that consists of a straight channel with a floodplain on both sides, numerical simulations reveal: i) how the grain-size specific signals (or fluxes) propagate in a river reach in response to a catastrophic sediment release, and ii) how various grain sizes build the channel and floodplain stratigraphy over time.

Ultimately, the combination of empirical data with numerical simulations will allow us to predict for the first time the full signal (all grain sizes) of sediment cascades preserved in stratigraphy in response to an extreme event at the scale of a catchment. It will also pave the way for inverting the stratigraphic record of landslide induced sediment cascades for quantitative insights into their response amplitudes and relaxation times.

Quantitative assessment of the lateral migration of an alluvial river using a change detection tool

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The landscape of a natural alluvial river is mainly composed of channel morphology and riparian vegetation stand, and reflects flow-vegetation-morphology interactions. At first, a simple change detection tool was developed, and it was applied to analyze channel migration in an active sand-bed river named Naeseongcheon Stream in Korea using a series of annually collected aerial photographs and LiDAR DEMs. The relationship between the hydrological fluctuation and lateral migration was also examined. Bank erosion began at the upstream part at the right bankside of the study reach with relatively sparse riparian trees. Then it was concentrated on the downstream part beyond the bend apex, showing lateral and downstream migration. The average annual migration rate is 5.6 m/yr. The annual change in cross-sections shows that the lateral migration is accompanied by the retreat of the outer bank, the formation of a point-bar at the inner bank, together with the degradation of the low water channel bed that appeared throughout the river. Volumetric sediment relocation brought forth by these processes was also quantitatively evaluated. Bank erosion was driven mainly by floods, and the eroded area is proportional to the duration of inundation. The usefulness of frequently collected data, including aerial images and high-resolution topographic surveys, is discussed.

Possibilities and Limitations of Mountain Wetland Identification in South Korea

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Mountain wetlands have recently attracted attention not only for their role in climate change adaptation but also for their value in reconstructing past climate and geomorphic evolution. Despite their ecological importance, mountain wetlands in South Korea remain underrepresented in national wetland inventories. This is largely due to limited accessibility in mountainous terrain, which hampers field surveys, as well as a general lack of awareness of their significance. Despite the dominance of mountainous terrain in the country, mountain wetlands remain largely undocumented.
To address this gap, this study aimed to identify the potential distribution of mountain wetlands within national parks using a combination of geospatial analysis and field verification. Five spatial variables—slope, curvature, Topographic Position Index (TPI), Normalized Difference Vegetation Index (NDVI), and Normalized Difference Water Index (NDWI)—were extracted from digital elevation models and Sentinel-2 imagery. Based on values derived from 11 representative wetlands, suitable grid cells were classified, and areas adjacent to rivers or covered by artificial surfaces were excluded. As a result, a total of 522 candidate sites were identified based on the minimum area requirement. From these, 65 sites were prioritized for field surveys based on accessibility and visual interpretation. Field investigations conducted in 2023 and 2024 confirmed 29 previously undocumented mountain wetlands. In mountainous terrain, swamps with woody vegetation were more prevalent than herbaceous marshes. However, these swamps are often small and visually like surrounding forests, making them difficult to detect using satellite imagery alone. While GIS-based approach is effective for preliminary identification, limitations remain due to vegetation cover, scale, and seasonal variability.

Coastal Landforms and Their Relationship with Coastal Erosion in North Taranaki

Julie Lee[1], Mr Malcolm Arnot[1], Mr Dougal Townsend[1], Saskia de Vilder[1], Regine Morgenstern[1], Mr Jason Farr[1], Mr Andrew Boyes[1], Katie Jones[1], Mr Paul Oluwunmi[1], Mr Alfredo Jaramillo Velez[2], Mr Kyle Bland[1]
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08E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 9:35 AM - 11:05 AM

The coastline of North Taranaki, New Zealand, is directly exposed to the Tasman Sea and experiences high-energy wave conditions driven by prevailing westerly winds. As a result, coastal communities, nationally significant infrastructure, and cultural sites in the region are vulnerable to rapid erosion. Erosional coastal features such as cliffs, sea stacks, wave-cut platforms, headlands, and bays are prominent along the shoreline. Coastal cliffs expose stratified layers of sediment and rock offering a natural cross-section into the region's depositional history.
This study presents an analysis of the coastal landforms in North Taranaki and their contribution to the erosion and depositional history for the area. Key geomorphic features were mapped using lidar data, supported by field observations and published sources that provided direct evidence of landform composition and structure.
Understanding the nature and evolution of these landforms offers valuable insight into the geomorphic processes shaping the coastline, some of which represent events/features/processes from many millions of years ago. It also provides essential data and constraints for forward modelling of coastal erosion, supporting a deeper understanding of coastal behaviour and enabling more effective management of erosion risks that may affect coastal communities in the future.

Change the Channel: Quantifying lateral river migration rates using manual and automatic mapping

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Aotearoa's large rivers gradually migrate across their floodplains through bank erosion, influencing the location, duration, and magnitude of flood risk. With climate change altering river discharge patterns, understanding how lateral river migration has changed across Aotearoa is crucial for safeguarding local communities and infrastructure.

Using orthorectified mosaics of historical aerial imagery from 1930-2010, we have mapped the active channel, water, and vegetation of the Mataura and Rakahuri rivers on a decadal timescale. Lateral migration rates, calculated from manual mapping, will then be compared with automatic mapping using satellite imagery.

Preliminary results indicate South Island rivers are capable of prominent lateral migration on decadal-centennial timescales, with the Mataura River showing migration of 50-200m over 50 years. Channels have increasingly thinned over time, with reclaimed land used mostly for pasture, indicating anthropogenic impacts are limiting natural river migration. Reclaimed land in the former riverbed may be intruding onto the natural channel, posing a higher risk of flooding. These findings will inform how lateral river migration is monitored in New Zealand, with crucial implications for future flood protection and resource management.

A call for Global River Science

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12B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 9:35 AM - 11:05 AM

Fluvial geomorphology has often relied on case studies to deepen our knowledge of landscape processes. Through detailed terrain mapping, historic air photo analysis, field measurements, sedimentology, and geochronology, our community has investigated how rivers respond to the processes acting on them, and how rivers in turn act on the landscape. This site-specific approach is crucial to the foundation and future of our discipline, but recent work across geomorphology and hydrology has highlighted the insights that can be gained from comparing a wide range of sites spanning an environmental gradient. In this talk, we advocate for this large-sample approach to fluvial geomorphology, which we term "Global River Science". We present a review of Global River Science research spanning a range of time scales in geomorphology, from landscape evolution through to event scale channel change. Finally, we identify challenges to large-sample geomorphology and priorities for its future.

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The role of glacial lake outburst floods in incising Hellmobotn Canyon, Norway

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Hellmobotn Canyon, a unique canyon complex located immediately upstream of Hellmofjord in northern Norway, displays abundant evidence for fluvial erosion by one or more high-discharge floods, including absence of erratics upstream of the canyon head, large rounded boulders near the canyon mouth, extensive gravel deposits, and depositional bars comprised of rounded cobbles. Hellemobotn Canyon is thought to have been formed between 9 -10 ka, likely by catastrophic drainage of 8 - 10 km³ out of glacier-dammed Lake Sitasjaure. However, it is not clear whether Hellmobotn Canyon was carved in a single flood or over multiple floods, and whether the flooding took place subglacially or subaerially. Here we synthesize 2D hydraulic modeling, field mapping, and cosmogenic nuclide exposure dating to propose a sequence of events for the formation of Hellmobotn Canyon. First, erosion of the main lower canyon was accomplished by at least one large subglacial flow. During deglaciation, the lower canyon was filled with ice, and the fjord downstream was inundated by higher sea levels. Following deglaciation, subaerial erosion from outburst flooding from glacier-dammed Lake Sitasjaure incised the upper canyon. The subglacial flow(s) during a period of extensive glaciation substantially changed the topography in and around the canyon in such a way that made it susceptible to modification by other processes, notably outburst flooding, which may explain why canyons are not generally present upstream of other fjords in the region. This newly constrained sequence of events which formed Hellmobotn Canyon yields new insight into the deglaciation history of northern Norway, and adds to the growing understanding of the role of extreme floods in shaping landscapes through geologic time.

Employing ICESat-2 water depth measurements to estimate 2D bathymetry in mountain lakes

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Alpine catchments are incredibly dynamic environments, simultaneously storing essential water resources while posing hazards to downstream communities and infrastructure from processes such as outburst flooding. Modeling both water storage capacity and flood risk depends on accurate characterizations of bathymetry in reservoirs and lakes, yet the availability of bathymetric data required to estimate water storage is limited, and especially so in alpine regions due to the difficulty of conducting fieldwork in mountain landscapes. Most applications therefore employ simple geometry-based methods to estimate 2D lake bathymetry, but because mountain lake geometry is strongly controlled by bedrock geology and prior geomorphology, it often deviates from the simple geometric shapes such as an ellipsoid, box, triangular prism, or cone which are frequently assumed when generating lake bathymetry. Here, we develop an approach to estimating 2D bathymetry using satellite-based remote sensing data from NASA's Ice, Cloud, and Land Elevation Satellite-2 (ICESat-2) for inland alpine lakes. ICESat-2's Advanced Topographic Laser Altimeter System (ATLAS) instrument can penetrate shallow water and has been demonstrated to produce reliable bathymetric measurements for nearshore, supraglacial lake, and non-alpine inland lake environments. The agreement between the newest ICESat-2 water depth product, ATL13 version 7, and in-situ bathymetric measurements for several lakes across different mountain landscapes will be assessed, and a variety of traditional interpolation and machine learning-based interpolation methods will be tested to generate 2D bathymetry from ICESat-2 water depth along-track point measurements. These assessments will be used to evaluate whether 2D bathymetry generated from ICESat-2 data is more accurate than traditional geometry-based methods for estimating lake bathymetry.

Humidity Weakens Rock Elasticity: A Laboratory Study of Competing Effects from Water Adsorption and Mechanical Stress

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Rock elasticity is influenced by both environmental moisture and mechanical loading, but their combined effect has received little experimental attention. We present controlled laboratory tests on porous sandstone under cyclic axial loading (1–30 MPa) while systematically increasing relative humidity from 20% to 95%. The results reveal a pronounced reduction in stiffness—up to 40%—due to water vapor adsorption at low stress levels. However, this softening effect is progressively suppressed as stress increases, resulting in less than 10% reduction in elastic modulus at 30 MPa. To interpret these findings, we develop a micromechanical model based on contact theory, incorporating surface energy loss from adsorption and capillary condensation. This model quantitatively describes how intergranular contact stiffness evolves under concurrent loading and wetting, accurately predicting the transition from humidity-dominated to stress-controlled elasticity. Additional tests on granite confirm the generality of this behavior. The model provides depth-dependent predictions, identifying stress thresholds beyond which moisture effects become negligible—approximately 140–450 m for sandstone and 235–1200 m for granite. These insights enhance our understanding of poroelastic behavior in near-surface bedrock, with implications for geophysical monitoring, slope stability, and fluid-rock interaction in engineered and natural systems.

A process-based regional landslide debris inundation hazard and risk assessment for the West Coast of the South Island of Aotearoa/NZ

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12C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 9:35 AM - 11:05 AM

The West Coast of New Zealand's South Island spans 25,000 km², with around 90% of the region susceptible to landslide debris inundation. It is the country's wettest region, with some locations receiving over 6 m of annual precipitation, and experiencing rainfall on more than 200 days each year. Situated along the active Pacific–Australian plate boundary, the region faces significant seismic hazards, including a 75% probability of a magnitude Mw ≥8.0 Alpine Fault earthquake in the next 50 years. Tectonic uplift, and erosion rates, both exceed 10 mm/yr in places, and data suggests the western Southern Alps are in dynamic equilibrium, with bedrock erosion driven by landslide processes.

In collaboration with West Coast Emergency Management, GNS Science has developed a new process-based regional landslide debris inundation hazard and risk model grounded in geomorphological principles. To our knowledge, this is the first model to explicitly integrate:

- Volumetric landslide sediment production;
- Susceptibility to rainfall and earthquake triggers;
- Runout and sediment distribution; and
- Inundation hazard and risk in a single, physically-constrained workflow.

The model enables us to extrapolate beyond limited historical landslide inventories by leveraging long-term geological and geomorphological datasets. We generate both mean-annual and scenario-based (e.g. 50-year ARI rainfall events or Alpine Fault earthquake) hazard and risk maps at 25 m resolution, for both present-day, and future climate scenarios.

While the greatest source of uncertainties are associated with the accuracy of the national DEM, and resolution of runout models, adopting a lidar DEM, and increasing model resolution to 8 m or better leaves debris production rates in source areas the greatest single source of uncertainty, and therefore most critical single input parameter.

This new approach provides a scalable, transparent framework for regional hazard assessments, providing opportunities to support long-term planning and risk reduction in tectonically and climatically dynamic settings.

Reviving Urban Streams: A New Socio-Environmental Index for Restoration Prioritization

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Numerous studies have highlighted the dramatic hydro-geomorphological and ecological alterations to urban streams resulting from urban sprawl. Furthermore, their extensive artificialisation often causes residents to neglect them as natural infrastructure. It is necessary to make them more visible because they are crucial for the balance of urban ecosystems. They also offer the opportunity to improve the relationship between cities and their inhabitants, nature and the aquatic environment. Research has shown that these watercourses provide opportunities to 'reclaim urban nature'. This is why we propose an innovative approach combining biophysical and social issues, using the Paris urban area as an example. We have developed an Urban River Socio-environmental Index (URBS) to serve as a practical tool for assessing the socio-environmental quality of stream environments and social connectivity. The URBS is a multi-criteria index comprising four indicators calculated at the reach scale: hydro-geomorphology, macroinvertebrates, riparian vegetation, social connectivity. We used the index to analyse the organisation of various sections of the river and to create a detailed functional socio-environmental typology. To illustrate the discussion, we used the URBS to evaluate the Morbras River. Our results highlight the significant longitudinal diversity and emphasise the need for a combination of watershed and territorial approaches to management and/or restoration. Due to the environmental heterogeneity and urbanisation gradients that characterise urban streams, it is essential that we design appropriate solutions to improve or restore ecological status, rather than relying on one-size-fits-all solutions. We must also avoid a form of river landscape standardization that prioritizes scenic appearance or simplifies ecological issues at the expense of the ecological diversity and functionality of the restored environment. In conclusion, URBS enables us to provide managers with recommendations for the ecological restoration and to promote a holistic approach that also restores the relationship between populations and urban streams.

From Natural Shifts to Human Impacts: the Sedimentary Story of desert floodplain in Arabia (AlUla oasis, Saudi Arabia)

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03I: Lowlands a place for humans? Geomorphic functionality and anthropomorphization of alluvial and coastal plains from past to future, Conway 4, February 2, 2026, 4:00 PM - 5:30 PM

Floodplains, with their surface and mainly subsurface water resources, are particularly attractive for human activity in desert environments. This study demonstrates how sedimentary archives can reveal major environmental changes in Arabian Peninsula floodplain oases during the Holocene and assesses the respective roles of climate and human activity in shaping landforms. The Al-Ula oasis, located in a floodplain at the base of a canyon traversed by a major wadi, offers an ideal case study due to its exceptional archaeological record, including Dadan, Hegra, and the ancient city of Al-Ula. Combining fieldwork, geophysical surveys, and sediment analyses, we examined 50 sections, 20 test pits (2–4 m deep), and 5 cores to reconstruct the valley's chronostratigraphy, supported by 85 radiocarbon and 51 OSL dates. Our findings reveal 11 distinct Holocene sedimentary phases, documenting natural (fluvial and aeolian) processes, anthropogenic earthworks, and numerous agricultural structures since the end of the Bronze Age, including cultivated soils, planting pits and various types and sizes of hydraulic structures. The distribution of cumulative probabilities of numerical dates allows us to track short-term hydroclimatic fluctuations and successive waves of agricultural development. These records show that, despite a long-term aridification trend in the latter Holocene, floodplain archives can preserve clear evidence of both climatic impacts and human-induced changes. Crucially, they offer a robust framework for identifying the Anthropocene in alluvial oasis environments.

Constructing Rock Glacier Velocity Time Series in the Urumqi River Source Region (Chinese Tien Shan) using InSAR

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rock Glacier Velocity (RGV), the annualised surface velocity of rock glaciers, has been recognised as an Essential Climatic Variable for its role in indicating permafrost thermal status. The construction of RGV time series has been ongoing in the European Alps, Andes and High Mountain Asia. However, rock glaciers in the Chinese Tien Shan and their relationships with climate remain understudied. These rock glaciers are widespread, diverse but difficult to access due to remote and hostile environments and a scarcity of monitoring stations. To address this gap, we defined the Urumqi River Source Region, a study area that contains a long-running weather station and abundant rock glaciers. Since permafrost thermal status is reflected by the creep of active rock glaciers, 53 active rock glaciers from 886 potential candidates were selected using geomorphic features on satellite imagery and using InSAR fringe patterns from wrapped interferograms. The first round of RGV time series was constructed from 12-day interferograms generated using SAR images (2017-2024) from multiple Sentinel-1 tracks in both ascending and descending orbits. The initial results suggest distinct responses to temperature and precipitation changes driven by varied mechanisms of rock glacier motions. However, unwrapping errors remain a major challenge affecting accuracy. To improve the quality and reliability of the time series, we will correct unwrapping errors, use multi-span interferograms to bridge time gaps, conduct spatial clustering within a rock glacier to find its representative motion area, classify rock glaciers based on velocity trends, integrate time series and use ALOS satellite data to cross-check the results. These enhancements aim to establish clear relationships between rock glacier surface kinematics and temperature changes, providing insights into regional permafrost thermal evolution in a changing climate. Additionally, this study contributes to broader discussions on permafrost stability under global warming.

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Quaternary glaciations in High Mountain Asia: A review of chronologies established by absolute dating

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Quaternary glaciations in western China have been investigated over the last century with the emphasis on the Tibetan Plateau and its adjacent regions. Earlier studies were mainly based on field observation and interpretation of geomorphic landforms and processes to identify and define past glacial sequences. The advent of absolute dating techniques, such as optically stimulated luminescence dating and cosmogenic radionuclide exposure dating, has revolutionized glacial chronological research in recent decades. Glacial chronologies have been established across various mountains, providing evidence to reject the Tibetan ice sheet hypothesis. Glacial advances generally occurred synchronously in this region, but the detailed timing, extent, and form of past glaciers vary at different locations. Major findings include but are not limited to (1) a rejection of the theory of a coalescing ice sheet on the entire plateau during the Quaternary, (2) abundant glacial geomorphic and sedimentological evidence exists in both glaciated and currently ice-free high mountains of western China, (3) the timing of glaciations is not strongly correlated with polar regions and other continents, (4) the maximum glacial extent occurred asynchronously across the region, and 5) the Asian monsoon system and the mid-latitude westerlies are the dominant climatic systems driving glaciations in the TP and surrounding mountains. This review presents recent progress and challenges on reconstructing the timing and extent of Quaternary glaciations, seeking to promote further studies and a broader interest from the geomorphology community in this critical region.

Cirque-like alcoves in the northern mid-latitudes of Mars as evidence of glacial erosion

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02D: Planetary Geomorphology, Dobson 3, February 2, 2026, 2:00 PM - 3:30 PM

Viscous flow features known as glacier-like forms on Mars often emerge from alcoves that resemble glacial cirques on Earth. However, many alcoves on Mars lack associated glacier-like forms, and these features have never been analyzed at a population scale. On Earth, cirques are primarily formed by wet-based glacial erosion, although cold-based glaciers can also contribute to minimal headward and sidewall retreat. Here, we present evidence that cirque-like alcoves on Mars, similar to terrestrial cirques, are shaped by glacial erosion.

We mapped a population of ~2000 alcoves in Deuteronilus Mensae, a region in the mid-latitudes of Mars characterized by mesas surrounded by glacial remnants. Based on visual characteristics and morphometrics, we refined our dataset to 435 “cirque-like alcoves”–nearly six times the number of glacier-like forms in the region. High-resolution imagery reveals icy geomorphic evidence of glacial occupation within these cirque-like alcoves, including flow features, linear terrain, mantling material, moraine-like ridges, mound-and-tail terrain, polygonal terrain, moraine-like ridges, rectilinear-ridge terrain, and washboard terrain.

Most cirque-like alcoves face south to southeast, similar to gullies poleward of 40°. Two possibilities to explain this trend are that southward facing cirque-like alcoves in the northern mid-latitudes were more favorable for ice accumulation during periods of high obliquity, or alternatively, increased insolation and meltwater is necessary for cirque-like alcove erosion. Using wet-based glacial erosion rates, the timescales for martian cirque-like alcoves align with both glacier-like forms (millions to tens of millions of years) and other viscous flow features such as lobate debris aprons (hundreds of millions of years). In contrast, cold-based erosion rates are only consistent with the older ages of lobate debris aprons. By mapping cirque-like alcoves at a large scale for the first time, we expand the catalog of features attributed to glacial erosion on Mars.

Landscape and hydrological connectivity dynamics between thermokarst lakes and river network in the headwater zone of Yellow River

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10B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 2:30 PM - 4:00 PM

A close surface and subsurface hydrological connectivity exists between thermokarst lakes and river networks in the Yellow River Headwater (HZYR), which is crucial for water resources and ecological conservation. Nonetheless, landscape and hydrological connectivity changes in these lakes and river networks driven by climate warming over the past 30 years remain poorly understood. Using Landsat and Sentinel remote sensing imagery (1986–2020), hydrological data, and field investigations, this study analyzes basic characteristics and water surface area of thermokarst lakes, alongside spatiotemporal changes in vegetation cover and hydrological connectivity indices, to identify the drivers of landscape-hydrological connectivity changes. Results indicate that landscape patches of highest importance are concentrated near the inlet of Zhaling Lake. Driven by climate warming, changes in precipitation and evapotranspiration resulted in a generally increasing trend in thermokarst lake water surface area. A significant expansion (increasing by 77.95%) occurred after 2003, followed by a fluctuating decline after 2017. Hydrological connectivity in the HZYR initially increased then decreased, with the overall Integral Index of Connectivity (IIC) and Probability of Connectivity (PCI) peaking in 2014 (IIC = 0.121, PCI = 0.311) and continuously declining from 2015 to 2020. Vegetation cover fluctuated, reaching a maximum of 0.507 in 1995 and a minimum of 0.360 in 2015. Its spatial distribution generally aligned with topography, being higher and more stable in mountainous areas, while thermokarst lakes and riparian zones exhibited greater variability. Rising air temperature is the dominant driver affecting changes in water surface area, landscape connectivity, and vegetation cover, accounting for up to 65.8% of the variation in water surface area. This study provides insights into the dynamics and driving mechanisms of landscape-hydrological connectivity between thermokarst lakes and river networks in the HZYR.

Profile Integral: a robust and unified metric to measure topographic profile concavity

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03H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 4:00 PM - 5:30 PM

Quantifying the concavity of a topographic profile is of importance in geomorphology for analyzing landform characteristics, interpreting erosional and depositional processes, and understanding landscape evolution. To address the limitations of existing metrics, we introduce Profile Integral (PI), a robust and unified concavity index based on the integrated area under a profile. Applicable to cross-valley, slope, and stream-long profiles, PI is standardized to a 0-1 scale, where 0.5 represents a straight-line long profile or a V-shaped cross-profile, >0.5 indicates a convex profile, and <0.5 indicates a concave profile. We develop a GIS toolbox to assist in determining the PI and for comparison with other metrics of profile shape, including the V-index, VWDR, k-curve, power-law, and quadratic polynomial fits. The toolbox provides tools to delineate smoothed streamlines, generate cross-profiles along streamlines, and derive the PI and other available metrics for both cross-valley and long profiles. Applications in two glaciated areas in Tian Shan (China) and Iceland demonstrate PI's effectiveness in measuring the degree of glacial valley modification, with expected down-valley concavity trends. PI shows strong correlations with single-parameter concavity indices but weak correlations with metrics derived from multi-parameter curve-fitting models. The advantages of the PI include (1) its low-skewed distribution and consistent interpretation across long, slope, and cross-valley profiles; and (2) its applicability to asymmetric cross-profiles (e.g., valleys with differing flank heights), which are common yet often excluded from traditional analyses. Given its robustness, low skewness, and broad applicability, we propose PI as a preferred and unified index for measuring topographic profile concavity in geomorphic studies.

Coherent motion of channel threads in the braided Brahmaputra-Jamuna River

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12B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 9:35 AM - 11:05 AM

Braided rivers are formed by multiple channel threads that often shift laterally through either abrupt avulsion or more sustained migration over time. Several approaches have been developed to quantify the planform change of braided rivers, but predicting this change remains challenging due to the intricate structure of the channel network and the strong sensitivity of planform morphology to water stage. We develop an approach to test whether individual channel threads in a braided river move coherently over annual timescales. As a case study, we analyze the migration pattern of the Brahmaputra-Jamuna River, whose discharge is strongly seasonal due to the monsoonal hydroclimate. We characterize planform morphology by selecting low-stage water masks derived from Landsat images. We find that from 2001 to 2021, ~43% of the total length of channel threads migrated coherently, at an average rate equivalent to ~30% of the local width of the channel thread per year. Migration rate is weakly related to channel-thread width. In three examples, migration rate is closely related to the channel-thread curvature, and a curvature-driven model successfully describes their migration. By connecting the motion of channel threads with their planform geometry, the analysis suggests that the seemingly chaotic motion of braided rivers is somewhat organized over decadal timescales, indicating the potential for improved hazard and flood predictions for communities living within and along braided rivers.

Reading landscape as a means for students' environmental literacy of geomorphological heritage

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09I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 11:35 AM - 1:05 PM

Reading landscape ("du jing") is a program for environmental and geomorphological education promulgated and promoted by Taiwan Geoparks Association. As the program aims to raise environmental literacy through sketching landforms, introducing landscape conservation and geo-tourism, and fashioning civic-participatory geoparks, it has attracted high school teachers' attention. Participating teachers have since contributed much to the formation of procedure knowledge for conserving and heritage-geared geomorphology.

This paper will first introduce the five steps of identifying, explaining and interpreting landforms and how they affect together to form an educational program popular for teachers. The five steps include:(1) What is the landform/landscape called? (2) Why does this landform/landscape appear here? (3) How was the landform formed and shaped? (4) How will the landform/landscape change over time? (5) How do we appreciate the landform/landscape? These five questions become a set of guideline for high school teachers to develop their teaching programs.

Secondly, this paper will elaborate how the participating high school teachers see such program in light of Taiwan's national curriculum goals and through our training courses and workshops. For this, a trans-disciplinary framework of geomorphology conservation and heritage will be proposed and evaluated.

Lastly, the paper will focus on the significance of field observation and how it intertwines with identity and motivation to conserve landscape for a resilient future where environmental literacy and competence is fundamental.

Collapsed caves of the Nullarbor Plain: insights into karst evolution from cave passages to surface collapses

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06B: Karst geomorphology, Dobson 1, February 3, 2026, 2:30 PM - 4:00 PM

The Nullarbor Plain in southern Australia, one of the world's largest limestone platforms, has limited surface karst expression. However, recent advances in more detailed digital elevation models have revealed previously unnoticed karst landforms, including enigmatic elongated (north-south) depressions, 6 to 20 km long and 200 to 500 m wide, which occur across the southern part of the Nullarbor Plain. We combined high-resolution topographic mapping with geophysical imaging and stratigraphic analysis to determine that these depressions are collapsed caves formed by progressive ceiling collapse of originally phreatic or epiphreatic passages. Electrical resistivity tomography and seismic imaging demonstrate the unique morphology and deep sedimentary profiles of these features, distinct from other karst landforms such as singular collapse dolines or relict interdune swales, both also occurring on the Nullarbor Plain.

These elongated, continuous depressions with well-defined edges and significant sedimentary infill (up to 50 m thick), are prominent features in the eastern part of the plain. Westward, the trenches become increasingly fragmented and isolated, transitioning from pronounced depressions to clusters of collapse dolines with only subtle surface expression. At the western edge of the plain, only isolated collapse features are present, although these can connect to extensive, still accessible subsurface karst systems. This continuum from enterable collapsed cave passages to surface elongate depressions may reflect a tectonic influence (the plain has been tilted down to the southeast) or lithological differences within seemingly homogenous limestone. This research is intended to establish a predictive framework for identifying analogous features in other karst regions, helping to reconstruct landscape evolution.

Holocene Marine Terraces Provide an Incomplete Record of Paleoearthquakes in the Hikurangi Subduction Margin, New Zealand

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06D: Dynamic Landscapes: Tectonic Geomorphology of Aotearoa New Zealand, Dobson 3, February 3, 2026, 2:30 PM - 4:00 PM

Holocene marine terraces are common along the rocky Hikurangi Subduction Margin coast and have long been studied as records of paleoearthquakes. Features such as staircase shore platform geometry, clustering of individual terrace deposit ages and historical analogues (1855 Wairarapa, 1931 Napier, 2016 Kaikōura earthquakes) supports their interpretation as coseismic landforms. Traditionally the paleoearthquakes that uplifted the terraces were attributed to nearshore faults, but more recently their potential as records of subduction earthquakes, or combined interface-upper plate fault earthquakes, have been examined. Our recent studies have also identified some challenges with marine terraces as paleoearthquake records, such as incompleteness (terraces missing) influencing recurrence intervals and interseismic deformation complicating the use of terrace height differences to estimate single-event uplift.

We provide an overview of the current state of knowledge of Hikurangi Margin marine terraces through a series of examples. In the south, two young (<1000 yr BP) Holocene marine terraces along the Kaikōura-Cape Campbell coast mimic 2016 Kaikōura earthquake uplift, but there are some notable differences. In the southern North Island, the northwest side of Palliser Bay was last uplifted in 1855 by the Wairarapa-Wharekauhau faults, whereas the southeast side may have been uplifted in a subduction earthquake ~830 yr BP. In southern Hawke's Bay up to three terraces span a much longer timeframe (up to 6500 yr BP) but large vertical steps and age gaps between some terraces suggest the record may be incomplete. North of Gisborne young terraces (<1800 yr BP) at two sites only 10 km apart are anti-correlated, suggesting complex nearshore faults may be the predominant source of uplift.

Overall, along the Hikurangi Subduction Margin we see that although Holocene marine terraces are commonly present, their use as paleoearthquake records requires careful consideration of the geomorphic and tectonic environments, which vary along the Margin.

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Holocene Optimum Landscape Change and Human Land Use in the Mu Us Desert, China

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

At the monsoon margin of northern China, arid landscapes are shaped by linked changes in wind regime, sediment supply, and vegetation cover. The Mu Us Desert preserves extensive Holocene aeolian and lacustrine archives that record millennial-scale environmental change. We integrate OSL and AMS 14C dating with sedimentary facies, grain size, geochemical proxies, pollen, charcoal, and organic matter, together with archaeological evidence, to reconstruct desert–lake dynamics and human land use. Results indicate a regional thermal maximum from 8.5–3.0 ka marked by widespread paleosols, lacustrine deposition, strong chemical weathering, and vegetation dominated by Artemisia, Taraxacum, and Stipa—consistent with surface stabilization and reduced dune mobility under intensified East Asian summer monsoon influence. The climatic optimum (6.5–3.0 ka) shows peak paleosol development, maximal lake and marsh extent, and the highest archaeological site density. Subsistence strategies shifted from mainly settled agriculture in the Yangshao period (7.0–4.8 ka BP) to mixed agriculture, husbandry, hunting, and fishing in the Longshan period (4.8–3.9 ka BP). These patterns demonstrate how monsoon-driven interactions among wind, sediment, and vegetation structured landscape stability and framed human land use in a changing climate.
Keywords: Mu Us Desert; Climatic Optimum; Human Activities; Environmental Evolution

Increasing Glacier and Paraglacial Landsystem Instability in Mt. Gongga, Southeastern Tibet

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02G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 2:00 PM - 3:30 PM

Anthropogenic climate change is rapidly altering high mountain environments. Especially in mountain glacier zones, increasing water-mass movement and instability of both glacier itself (surge, crevassing and collapse, etc.) and glacial landsystems (moraine slope movement and failure collapse, lateral rock fall and rock avalanches, proglacial fluvial dynamics, etc.) usually generate cascading cryogenic disaster risks, threatening the ever-expanding mountain communities and downstream infrastructures. With more than 70 modern glaciers, Mt. Gongga, located in center Hengduan Mountains and southeastern Tibet Plateau, is one of the major monsoon-temperate glacier regions in High Mountain Asia. Since the Little Ice Age, temperate glaciers in Mt. Gongga retreat substantially and show an accelerating deglaciation rate during the recent decade. The remarkable thinning and retreat glaciers expose new but most unstable landscapes around the Mt. Gongga, susceptible to rapid glacial geomorphological and biological changes. In this talk, I will review the observed glacier and paraglacial changes in Mt Gongga, evidence will be presented with the aid of archive long-term satellite monitoring since 1970s and the recently developed high temporal-spatial remote sensing technology (including repeat UAVs since 2016), as well as automatic ground inspections such as time-lapse cameras and automatic environment sensor stations. Drivers, processes and impacts of glacier and glacial landsystem instability will be discussed with categorized typical cases/events happened in recent years.

Earthquake, coseismic landslide, and landscape evolution: Insights from the Mw7.9 Wenchuan earthquake, East Tibet

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04J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 9:35 AM - 11:05 AM

The Mw 7.9 Wenchuan earthquake ranked as one of the world's largest continental mega-thrust events in the last 150 yrs and devastated the Longmen Shan and the Sichuan basin, eastern Tibet. The earthquake produced a surface rupture over 220 km-long with oblique thrust/dextral slip and maximum scarp heights of ~10 m. It also triggered nearly 200,000 co-seismic landslides, displacing several cubic kilometers of soil and rocks. Debris flows were frequent during the summer monsoon season in the years after the quake. This event provides a unique opportunity to investigate the role of a large-magnitude earthquake on the sediment flux and topographic evolution of a tectonically active mountain range. We investigated the variations of detrital 10Be concentrations over 15 years after the quake. During 2008–2022, we collected repeatedly (eight times) river sediment samples at 19 locations and measured the concentration of cosmogenic 10Be in quartz. When compared with published pre-earthquake data, we found that a substantial influx of landslide material into the river network resulted in a significant decrease in 10Be concentrations. 10Be concentrations reached a minimum five years after the quake and then rebounded, with vegetation restoration gradually becoming a key factor in regulating the recovery of 10Be concentrations. The consolidation effect of vegetation restoration on loose sediments reduced the input of landslide material and accelerated the recovery of 10Be concentrations. It will take at least decades and possibly up to thousands of years to remove the co-seismic landslide materials from the catchments in the Longmen Shan. Through our long-time observations, we offer new insights into the impact of this earthquake on the long-term topographic evolution of the active orogenic belt and to provide a theoretical basis for postearthquake ecological restoration and secondary disaster prevention.

1123

Quantifying Water Storage in China's Lakes Using Bathymetric Surveys and Geostatistical Modeling

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01H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring, Conway 3, February 2, 2026, 11:40 AM - 1:10 PM

China is home to a vast number of lakes that play a vital role in drinking water supply, agricultural irrigation, and biodiversity conservation. While remote sensing has enabled comprehensive monitoring of lake numbers, surface area changes, and water level fluctuations, large uncertainties remain in estimating total water storage. This is primarily due to the limited availability of in situ bathymetric data, particularly on the Qinghai-Tibet Plateau, where lakes are numerous but logistical challenges hinder data collection. Over the past decade, the China Geological Survey and the Chinese Academy of Sciences have conducted extensive national lake surveys, collecting measured depth data for most of the country's major medium- and large-sized lakes. In this study, we compiled bathymetric data for 576 lakes across China. Through rigorous data quality control, spatial alignment, and bathymetric modeling, we accurately estimated lake water storage volumes. We further developed regional geostatistical models to extrapolate storage volumes for lakes lacking direct measurements. As of 2023, China has 2,972 lakes larger than 1 km^2, covering a total area of 79.2 × 10^3 km^2 and storing approximately 1,151.5 km^3 of water. However, lake water storage is highly uneven across regions: the Qinghai-Tibet Plateau holds about 83.7% of the national total, while the eastern plains—where water demand is highest—contain only 3.9% (45.2 km^3). Using multi-temporal satellite remote sensing, we estimate that China's total lake water storage has increased by 9.9% since 2002, primarily due to lake expansion on the Qinghai-Tibet Plateau driven by climatic warming and increased humidity. Overall, this study provides a robust, spatially explicit assessment of lake water storage in China, offering critical insights for hydrological research and water resource management.

Outburst floods in China: progress and problems

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11J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 5:00 PM - 6:30 PM

Outburst floods can have disastrous impacts on people, and are an important driving force in landscape change and have been studied widely on Earth and other planets. In China, outburst floods have occurred frequently, they have been relatively considerable studied. Here, we review outburst floods in China in terms of the characteristics, distribution, causes of dams and outburst floods. In terms of natural dams, landslides accounted for the majority (300 cases), followed by moraine dams (34 cases), which are mainly found on and around the Tibetan Plateau, and although other types (such as glacier and volcanic dams) were historically rare, many examples may be preserved in the geologic record. In addition, there have been thousands of outburst floods from artificial-constructed dams, the majority of which were from small earth dams, but few have been recorded in detail. The largest reliably recorded peak discharge for an outburst flood was 1.24×105 m3/s, which occurred in Yigong, Tibet. The peak discharge of the 1975 Banqiao artificial dam collapse was 7.9×104 m3/s. Our recent investigations on the Yarlung Tsangpo in Southeast Tibet have identified gravel deposits that probably record megafloods and offer great potential for paleoflood analysis.

Unravelling the reaction and relaxation times of a gravel-bed river disturbed by a volcanic eruption

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01J: Denudational Dynamics and Hazards in a Changing Environment, Conway 5, February 2, 2026, 11:40 AM - 1:10 PM

Volcanic eruptions can significantly alter river dynamics by introducing large volumes of sediment, such as pyroclasts and tephra, which profoundly reshape river morphology through the removal of existing features and the formation of new ones. Following the initial reaction phase, rivers typically undergo a longer relaxation period during which geomorphic stability and ecological function are gradually restored across different spatial and temporal scales. This study aims to analyse the geomorphological evolution of the Blanco-Este (Chile), a gravel-bed river that was impacted by the April 2015 eruption of the Volcano Calbuco. Two study reaches were selected, one in the upper of the catchment and another in the lower river valley. Reaches were surveyed twelve and seventeen times, respectively, between 2017 and 2024 using high-resolution topographic data acquired via UAV-based Structure from Motion (SfM) photogrammetry. In the absence of direct discharge measurements, hydrological forcing was estimated using rainfall data from nearby meteorological stations. Preliminary findings indicate that the river corridor has evolved through three distinct phases: (1) an aggradation phase (2017–2020/2021), marked by the downstream sediment transfer after the eruption; (2) an adjustment phase (2020/2021–2023), dominated by channel incision into unstable deposits; and (3) a continued adjustment phase (from 2023 onwards), influenced by an increased sediment deposition and upcoming anthropogenic impacts, such as hydropower development. A notable finding is that morphological responses in the upper and lower reaches are one-year out-of-phased, highlighting the asynchronous nature of the river's adjustment. Understanding these reaction and relaxation dynamics is crucial for the understanding of sudden changes in river's sediment budgets, and improving risk management, infrastructure planning, and ecological restoration following major natural disturbances. Importantly, this research underscores the need to account for interactions between natural processes and human interventions in such highly dynamic river systems.

Volga Delta: new aspects of multidisciplinary study geomorphology, paleogeography, archaeology

Miss Daria Lobacheva[1], Mr Sergey Kotenkov[2], Mr Radik Makshaev[1], Mr Damir Soloviev[4], Mr Andrei Korotkov[3], Mrs. Tamara Yanina[1]
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03I: Lowlands a place for humans? Geomorphic functionality and anthropomorphization of alluvial and coastal plains from past to future, Conway 4, February 2, 2026, 4:00 PM - 5:30 PM

The dynamics of the natural environment of the Volga River Delta is inextricably linked to the transgressive-regressive cycles of the Caspian Sea. The Baer's knolls are the key to the search for geomorphological landmarks reflecting the oscillations of the Caspian Sea, especially during the existence of settlements of the Volga Khazar kaganate in the study area.
The paper presents the results of a comprehensive study of sediments and landforms of the central part of the Volga River Delta in the area of the Semibugry archaeological complex (Astrakhan region) an ancient settlement of the Khazar Kaganate epoch. Archaeological finds of the Saltovo-Mayak culture, which is identified with the time of the Khazar Kaganate (8th-10th centuries), were found on the knoll. In the southwestern part of the surface there is an abundance of red and gray clay pottery. During the period of settlements' existence (8th - early 10th centuries), the level of the Caspian Sea was presumably low (-30 - -33 m abs.), and more areas in the Volga Delta were occupied. During the periods of the Caspian Sea level rise (6-8th centuries, the second half of the 10th century), most settlements were located on the Baer knolls, which at that time became islands, while others probably occupied areas in the upper reaches of the Volga Delta. Judging by the traces of ancient coastlines on the Baer knolls, as well as the altitudinal position of the Khazar settlements of that time, the level of the Caspian Sea in these time intervals could rise to about -24 m abs.
The research was carried out within the framework of RNF grant 25-27-00357 “Climato-hydrological events during the Early Middle Ages (VI-X cc.) on the territory of the Volga River Delta”.

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Quantifying Volcanic Sediment Deposition in a Changing Climate: SAR-Based Lahar Monitoring in Southern Chile

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Lahars are high-magnitude, episodic mass flows capable of delivering large sediment volumes from steep volcanic terrain into downstream fluvial systems. Monitoring these events in the field is costly, requiring human and equipment resources, and is complicated by their rapid onset and destructive power.

We present a synthetic aperture radar (SAR)-based workflow to estimate lahar deposition volumes and assess sediment cascades in mountainous volcanic regions. Focusing on Volcán Calbuco in southern Chile, where lahars present ongoing risks to river systems and nearby hydropower infrastructure, we use a decade of Sentinel-1 data to detect and quantify sediment delivery following the volcano's 2015 eruption.

Our method integrates coherence loss and amplitude change detection to identify lahar deposits, track their evolution through time, and estimate volumetric change. We reconstruct multiple post-eruption lahar events from 2015 to 2024, offering a retrospective view of sediment mobilisation and redistribution in this highly dynamic system.

Preliminary volume estimates reveal sediment accumulation in river channels draining the volcano's flanks, with implications for sediment routing toward the site of a proposed hydropower station rebuild. In addition to this retrospective analysis, we outline future work modelling sediment delivery and remobilisation under projected climate scenarios. These scenarios anticipate increased rainfall intensity and glacier retreat—factors speculated to enhance the frequency and magnitude of non-eruptive lahars.

By enabling efficient, remote estimation of sediment volumes and delivery pathways, this method provides a transferable framework for understanding evolving sediment cascades in volcanic landscapes undergoing climatic and cryospheric change.

Investigation of Interferometric Synthetic Aperture Radar (InSAR) Coherence with Respect to DEM Resolution and Other Insights in Western Coastal Greenland

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Landslide and landslide-generated tsunamis along coastal fjords are a significant hazard in Greenland. After the devastating 2017 event at Karrat Fjord, Greenland, that resulted in massive property damage, the death of four people in the Southern Avannaata municipality, and the permanent evacuation of two villages, the risk of future slides and their resulting waves is a serious and ongoing concern for Greenlanders (Strzelecki and Jaskólski, 2020). Our research aims to constrain the location of potentially dangerous slopes in the southern region of Avannaata using InSAR (Interferometric Synthetic Aperture Radar) to better inform future hazard mitigation efforts. SAR data are available from the Sentinel-1A/B satellite for the past ten years and processed into InSAR coherence images using ISCE. We compare coherence results on the western coast of Greenland at multiple localities at 2m, 5m, 10m, 15m, 30m and 90m DEM resolutions and demonstrate that DEM resolution can have a statistically significant impact on InSAR coherence results, specifically when working in areas with steep slopes. The change in quality of coherence results is an important finding for our research in Greenland as a whole. Using changes in coherence, we examine locations of potential landslides throughout the region (Jacquemart and Tiampo, 2021; Bekaert and Handwerger, 2020). We estimate how to best optimize the parameters (date range of images, orbit direction, resolution) for visualizing proof of landslides using this method. This research is part of the NSF NNA (Navigating the New Arctic) Greenland Hazards project, which has the overarching goal of studying how the changing arctic climate impacts natural hazards and, as a result, the people who live in Greenland. In future research for this project, we will expand this method to other regions in Greenland, with the eventual goal of obtaining results that provide complete coverage of the ice-free regions.

Crater Rim and Slope Stability at Te Wai ā-moe, Ruapehu Maunga, NZ using Photogrammetry and Interferometric Synthetic Aperture Radar (InSAR)

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Te Wai ā-moe, the crater lake at the summit of the volcano (Mt.) Ruapehu maunga in Aotearoa New Zealand, has historically been the source of many large volume mass movement events, including the volcanic mudflow, or lahar, that caused the 1953 Tangiwai rail disaster, the deadliest volcanic hazard event in New Zealand's history. The lake holds upwards of 9 million cubic meters of water at the highest elevation on the North Island and sits atop the active volcanic vent of Ruapehu. It is surrounded by rapidly shrinking glaciers in an environment with high weather variability and fast climatic change. These factors combine to produce a system with a great potential for slope instability from some combination of volcanic activity, seismicity, severe weather, hydrostatic pressure, glacial debuttressing. In addition, dam-break outburst floods have occurred approximately every 50-60 years on Ruapehu. The stability of the crater lake's rim is directly tied to the potential for these large, far-reaching lahars and outburst floods (up to 30 km). These hazardous events dramatically reshape the landscape at the summit and down valleys and influence the dynamics of future mass movement events as well. This research focuses on using a number of remote sensing techniques, including photogrammetry and Interferometric Synthetic Aperture Radar (InSAR), to investigate and define the extent to which the crater rim of Te Wai ā-moe and the surrounding slopes deform, both now and in the past. InSAR data from ENVISAT, ALOS, and Sentinel-1 is processed from 2003 to today using ISCE software and Agisoft is used to process digital photographs for photogrammetry. This work investigates how the landscape at the summit of Ruapehu maunga is changing, how that development can influence future hazardous events, and in particular, how glacial melt trends are controlling the system's dynamics.

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Tracking the trajectory of agriculture along the eastern coastlines of Eurasia: farmers living with sea level variations

Assoc. Prof. Tengwen Long[1], Dr Christian Leipe[2], Mr Haisu Chen[1], Prof Mayke Wagner[3], Prof Pavel E. Tarasov[2]
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10F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 2:30 PM - 4:00 PM

Agriculture is one of the most sensitive systems to global warming, making it crucial to study the resilience of agricultural practices within changing environmental contexts. To predict future agricultural challenges, understanding the past relationship between agriculture and the environment is essential. This study examines the origins and spread of key domesticates in East Asia—Asian rice (Oryza sativa), millets (Panicum miliaceum and Setaria italica), and wheat (Triticum spp.)—using Bayesian and spatio-temporal modelling of radiocarbon data. Evidence shows rice cultivation began around 7430 BCE along the southwestern margin of Hangzhou Bay and spread to the middle Yangzi and Huai River regions by 6680–6650 BCE. Major dispersal events occurred during the 4th–3rd millennia BCE and again between the 1st millennium BCE and 1st millennium CE. The latter phase saw rice spread northward into the Korean Peninsula and the Japanese Archipelago, where it coincided with pivotal cultural shifts. Millet-based agriculture emerged around 5800 BCE and is linked to the early development of the Sino-Tibetan language family. Wheat, introduced from Southwest Asia via the Eurasian Steppe, reached eastern China by around 2600 BCE, likely as an elite commodity. These developments were closely tied to coastal environments. Following the deceleration of early Holocene sea-level rise, coastal wetlands, such as those around the Bohai coast and Hangzhou Bay, provided fertile, resource-rich settings for early agricultural communities. However, such areas were also vulnerable to sea-level fluctuations. In the lower Yangzi region, marine intrusions disrupted agricultural activity and led to site abandonment. Comparative analysis of the Taihu and Ningshao Plains reveals that the former was better protected by deltaic progradation, while the latter remained more exposed, influencing long-term cultural trajectories. The findings underscore the dual role of coastlines as productive yet fragile zones for early agriculture, offering historical insights relevant to modern societies facing sea-level rise.

How Fast do Rivers ‘Jump’?: Interrogating River Avulsion Duration with Large Sample Remote Sensing Data in Google Earth Engine

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03H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 4:00 PM - 5:30 PM

River avulsions can pose significant flooding hazards (Sah et al., 2022; Valenza et al., 2020) but remain unpredictable (Ganti et al., 2014). Recent studies on avulsion style (Valenza et al., 2020) and avulsion set-up mechanisms (Gearon et al., 2024) on large remote sensing derived datasets highlight the ability for remote sensing to fill this research gap. However, avulsion duration and controls on avulsion duration remain understudied. Here, existing databases are used to investigate river avulsion duration using remote sensing data in Google Earth Engine. This research explores the global spread of avulsion durations and analyses the controls on avulsion duration including sediment supply, climate zones, discharge, topographic position, and avulsion set-up type. Importantly, understanding avulsion duration can help separate river avulsion ‘set-up’ and ‘trigger’ events and may aid work toward predicting avulsions, thereby contributing to better management of avulsion natural hazards.

Smaller Dead Storage for Smarter Dams: Rethinking Reservoir Design for Sustainable Hydropower and Sediment Resilience

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Dead storage — the non-releasable volume of water and sediment in reservoirs — has long been a default feature of large dam design, particularly in sediment-rich river systems like those in China. Yet this legacy design philosophy is increasingly at odds with sustainable hydropower goals. Large dead storage volumes trap valuable sediment, reduce reservoir lifespan, and disrupt downstream geomorphic and ecological processes. In contrast, modern sediment management technologies — including bottom outlets, sediment sluicing, and bypass tunnels — now make it possible to minimize dead storage while maintaining operational performance and flood safety.

We propose a fundamental shift: new reservoirs should be designed with small or even near-zero dead storage, supported by adaptive sediment passage strategies. This “small dead storage” design principle offers triple dividends: it improves sediment connectivity, extends reservoir lifespan, and enhances environmental sustainability. Drawing on lessons from the Yellow River, Yangtze, and international case studies, we argue for integrating sediment-aware design into national hydropower planning and international green energy standards. In the era of climate adaptation and ecological civilization, reducing dead storage is not just feasible — it’s essential.

1301

Co-Evolution of the Yellow River and the Desert-Loess Plateau Coupled System during the Cenozoic in North-Central China

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12B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 9:35 AM - 11:05 AM

The Yellow River, the Chinese Loess Plateau and the adjacent deserts together define a singular land-surface system across North-Central China. Although the Yellow River ranks as China's second longest river, the origin and evolution of its catchment remain notoriously debated. Meanwhile, the thick, uninterrupted eolian-silt sequences blanketing the Loess Plateau constitute one of the world's longest and continuous archives of past environments and landscape change. These silts were ultimately derived from the upwind deserts, yet the Yellow River has itself supplied vast volumes of sediment to those desert sediments, forging a tight genetic triad among river, deserts and plateau. Because the eolian silt deposit (loess and the eolian Red Clay) succession spans virtually most of the Cenozoic—its oldest eolian beds now dated to the Paleogene, along with their generic linkage, it offers an exceptional temporal scaffold for reconstructing the coupled evolution of all three geomorphic entities.

This presentation places the Yellow River, the deserts and the Loess Plateau within a single, integrated framework for the first time. I will outline their shared genealogy, the timing of their initial establishment, the progressive evolution of their interactions, and the ultimate forcing mechanisms that have shaped this late-Cenozoic landscape mosaic across North-Central China. In particular, the timing of the Yellow River formation and its stepwise evolution is presented on the basis of the independent and precise timescale.

Morphologic signature of active splay faulting in Cascadia's submarine channels

Madeleine Lucas[1], Alyssa Iverson[1], Tamara Aránguiz-Rago[1], Alison Duvall[1], Harold Tobin[1]
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07E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 5:00 PM - 6:30 PM

Submarine channels are a common geomorphic feature of sediment-rich subduction margins. At the Cascadia subduction zone, submarine channels cross the wide accretionary wedge complex offshore Washington and Oregon, USA, and incise into numerous splay fault systems, both active and inactive. How subsurface fault processes and wedge deformation influence the formation, evolution, and morphology of submarine channels in Cascadia remains poorly known and underexplored. This study quantifies channel evolution for eight major submarine channels perpendicular to the margin in Cascadia (Astoria, Quinault, Juan de Fuca, Nitinat, Quillayute, Grays, Guide, Willapa). Using a suite of topographic analysis tools, we extract longitudinal channel profiles and cross-channel morphology using a new 30-m resolution bathymetry dataset. We link variations in channel morphology to nearby splay fault structure and activity, and more broadly, to regional-scale observations of structural segmentation of the margin. We propose that together, splay faulting and wedge lithology control the location where submarine channels form within the accretionary wedge, and that submarine channel evolution and morphology is inherently linked to the evolution of splay fault systems. We are also investigating how channel morphology can be used to discriminate active from inactive splay faults. Overall, this study provides new insight into modern splay fault activity at the Cascadia subduction zone and highlights the utility of joint structural-geomorphic interpretation in understanding active subduction zone processes.

Machine Learning For Coastal Landscape Dynamics

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The evolution of coastal areas is influenced by numerous climatic, oceanographic, and anthropogenic factors, which cause significant geomorphological changes over varying temporal scales. The ability to accurately predict these altimetric variations plays a crucial role in environmental management, hazard mitigation, and territorial planning.

In this study, we present the development and application of a convolutional neural network (CNN) model, specifically a variant of the Mini-U-Net architecture enriched with Feature-wise Linear Modulation (FiLM) modules, designed to predict the topographic evolution of coastal environments. The model was trained using altimetric data obtained from Digital Elevation Models (DEM) spanning multiple temporal intervals. These data were integrated with critical climatic and oceanographic parameters, including significant wave height, mean sea level, and precipitation specific to the investigated coastal area. Additionally, meteorological forecasts were incorporated to further improve the predictive capability of the model.

The proposed approach demonstrates considerable potential based on preliminary results obtained, providing realistic predictions of coastal landscape dynamics. It successfully highlights key geomorphological phenomena such as erosion and deposition processes, achieving high spatial and temporal resolutions.

Consequently, this research contributes concretely to the advancement of innovative monitoring and sustainable management tools for coastal zones, underscoring the significant potential of deep learning techniques for the prediction of complex geomorphological dynamics.

Integrated Forecasting Approaches for Optimizing Alluvial-Coastal Drainage Systems

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Alluvial-coastal plains and shallow-marine areas are facing increasing hydrological pressure from rising sea levels, changing precipitation patterns, and more frequent extreme events that alter their water balance. Prolonged droughts and unsustainable freshwater withdrawals further exacerbate the problem, causing saline intrusion into already vulnerable aquifers. In this context, adjusting drainage channel levels has become a key climate adaptation strategy. Our work combines long-term forecasting of aquifer dynamics using hydro-climatic data, including meteorological forecasts, with near-real-time forecasting to optimize the operation of high-capacity pumping stations that safeguard the drainage network of San Rossore Migliarino Massaciuccoli Regional Park (Pisa, Italy).

The study addresses two complementary forecasting approaches:

1. Extended-range forecasting of aquifer levels through the integration of historical groundwater measurements and meteorological forecasts, with particular emphasis on precipitation and temperature projections over a two-week period. This approach provides weekly predictive outputs essential for determining optimal operational thresholds for pump activation, accurately tailored to varying seasonal and meteorological conditions throughout the year.
2. An operational, near-real-time forecasting framework designed to support daily management decisions. This system incorporates real-time data on meteorological conditions, groundwater levels, channel hydrometric levels, and drainage system activity to serve as an early warning mechanism during exceptional events requiring prompt intervention.

Overall, preliminary results unequivocally highlight how integrated long-term and near-real-time operational forecasting systems are now indispensable for sustainable and resilient water resource management. Such systems allow for proactive anticipation of critical conditions, optimized drainage system use, reduced energy consumption, and preservation of the hydro-saline equilibrium in coastal aquifers. This emphasizes the necessity for continuous monitoring and technologically advanced solutions in fragile alluvial-coastal plains facing intensifying climatic and anthropogenic pressures.

Salinity regimes in response to the opening regime of Te Roto o Wairewa: competing processes and human alterations

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Te Roto o Wairewa [Lake Forsyth] is an intermittently brackish and rarely open coastal lake. The lake is an important but threatened tuna (eel) fishery due to decreasing marine connectivity and harmful cyanobacteria blooms. The lake was historically deeper and open more often than today. It is now also largely infilled with nutrient-rich sediment. The opening regime of the lake changed in the 1800s as the gravel barrier at its entrance widened, and again in 2009 when a canal was excavated to attempt a more cost-effective and regular connection. Both lake salinity and the frequency of cyanobacteria blooms decreased after canal construction. The lake water balance is primarily between catchment inflows, seepage through the barrier, evaporation, and marine intrusion after openings; all processes are unconstrained during openings as only lake level data are historically available.

A water quality sonde (temperature, salinity, chl-a, turbidity) and a current meter moored in the canal, supported by flow transects, constrain the salinity balance over multiple months and lake opening and closure sequences. Salinity intrusion events have been observed in the closed lake as wave overtopping flux drives lakeward currents in the canal. The saline intrusions are modulated by lake levels, and accurate flow measurements have permitted an estimation of the seepage rate through the bar.

Implications for these data on the lake water balance and a potential engineered fish passage include a new understanding of the opening event flow rates and the potential for salinity intrusion before, during, and after openings. Combining these data with wave measurements and hydraulic modelling allows for an understanding of the present overtopping flux and predicts the potential for active management of the future salinity regime.

Adapting CASCADE for braided river sediment transport: A one-and-a-half dimensional approach

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13B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 11:35 AM - 1:05 PM

Braided rivers are dynamic systems that support diverse habitats and ecological communities associated with their shifting mosaic of anabranches, backwaters, bars and islands. These units are characterized by multiscale variations in substrate, elevation and hydraulics. Assessing changes in riverbed composition and sediment storage due to changes in flow and sediment supply is notoriously difficult given the inherently dynamic nature of large braided rivers. In this research, we propose a new data-rich modelling framework designed to simulate the effects of flow variability and sediment supply on long-term adjustment of riverbed composition in braided rivers.

The model is parameterized using metre-resolution substrate maps of a 56-km reach of the Rangitata [Rakitata] River, Aotearoa New Zealand, derived by machine learning based on high-fidelity helicopter lidar and orthophotography. These data are used to generate a library of 2D steady-state hydraulic models that reconstruct the distribution of potential sediment transport, for any transient flow scenario, but based on the static map of bed composition.

Here, we extend this approach to simulate dynamic changes in bed composition by adapting the sediment routing model CASCADE to account for the spatial complexity of hydrodynamics in multichannel rivers. We use the library of 2D flow simulations to parameterize a hypsometric solver that predicts flow and sediment transport and updates the bed composition both laterally across the braidplain and longitudinally down the river.

The model is tested and used to simulate the impacts of flow regulation on bed composition for the Rangitata River. Application of the model to two other rivers shows how the updated modules extend the existing CASCADE framework, and can be used to characterise multi-fraction sediment transport and bed adjustment at catchment scales.

Application of Ground Stress Monitoring Technology in the Study of the Evolution of Seismic Subsidence Landforms in Coastal Zones

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04H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 3, 2026, 9:35 AM - 11:05 AM

Ground stress is the internal stress effect generated within the Earth's crust, and the ground stress in rocks is constantly changing. Such changes have important indicative significance for analyzing the mechanism source of landform evolution and its future activity trends. At home and abroad, borehole strain monitoring is mainly used to observe changes in the ground stress field of fault zones and provide data for earthquake prediction through simulation calculations. However, there are relatively few cases of using strain monitoring data for landform evolution analysis.

This study utilized the strain observation data from 3 ground stress monitoring stations installed in different blocks of the 1605 Qiongshan Ms 7½ earthquake area. It analyzed the dynamic changes of ground stress, extracted the stress mutation information recorded, analyzed the ground stress changes and tectonic activity from March 2016 to May 2018, and discussed the evolution trend and subsidence mechanism of the landform in Dongzhai Harbor. The results show that: The study area is generally affected by a northwest - trending compressive stress field. As a result, the Yanfeng and Dazhipo areas located on the hanging walls of the Maniao - Puqian Fault and the Puqian - Qinglan Fault are mainly subject to tensile stress, while the Jinshan area on the footwall of the fault is mainly under a compressive stress field; The Maniao - Puqian Fault and the Puqian - Qinglan Fault continuously undergo non - seismic activities to adjust the local stress field under the action of the regional stress field. Among them, the Maniao - Puqian Fault had multiple activities from March to July 2016, in October 2017, and in April 2018, and the Puqian - Qinglan Fault had two activities in October 2017 and April 2018. The activity energy of the Maniao - Puqian Fault is stronger than that of the Puqian - Qinglan Fault; The change trend of the stress field indicates that, bounded by the Puqian - Qinglan Fault, the eastern part has a gradual uplift trend, and the western Dongzhai Harbor may continue to subside; The fault activity trend indicates that, bounded by the Maniao - Puqian Fault, the subsidence rate in the Yanfeng area in the north of Dongzhai Harbor should be greater than that in the Sanjiang area in the south; In addition, the volumetric strain monitoring data also indicates the traces of magmatic activity below the north - south seismic zone of Hainan Island. Comprehensive research believes that the subsidence of Dongzhai Harbor is mainly controlled by the normal faulting activities of the Maniao - Puqian Fault and the Puqian - Qinglan Fault caused by the upwelling of deep magma, and is also affected by various factors such as Holocene sea - level changes, soft soil landslides, sand liquefaction, and seawater erosion caused by the properties of soft soil sedimentary strata. The research innovatively applies the borehole strain observation technology to the study of exploring the evolution laws and trends of typical seismic subsidence landforms in coastal zones, which has important academic value in the fields of ground stress monitoring and tectonic landform research. At the same time, this achievement also has important application value for the protection of mangroves and the planning and construction of towns in the Dongzhai Harbor area.

Snow in the desert: connecting cryospheric change with communities in the semiarid Chilean Andes

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

In central Chile, the cryosphere is the primary source of water, with snow accounting for 85% of streamflow variability. However, since 2010, the wider region has experienced a persistent mega drought, which has directly impacted livelihoods and ecosystems. In response, new collaborations have emerged among scientists, stakeholders, and local communities to better understand water scarcity and changing precipitation patterns. This presentation highlights Vecinos de las Nieves (Snow Neighbours), a co-created programme developed to answer a central question raised by local communities: How is climate change impacting water availability in arid mountain zones? Since 2018, the programme has integrated local knowledge with scientific methods to study snow dynamics in the semi-arid Andes of the Coquimbo region, Chile. Volunteers living or working above 1,200 m elevation monitor fresh snow and liquid precipitation using simple, standardized protocols. Participants assess snow hardness, crystal type, depth, density, and collect samples for stable isotope analysis, using low-cost kits and observational tools. Over multiple winters, more than 75 volunteers—including residents, teachers, workers, and students—have contributed data from 16 monitoring sites. The resulting observations have improved understanding of snowfall trends and provided baseline datasets for isotope-based hydrological studies. Since 2020, the programme has also collected photographic evidence of shifting precipitation regimes. In parallel, it launched the Red de Escuelas Vecinas de las Nieves (Snow Neighbours School Network) with six rural schools, where teachers, students and practitioners co-create educational resources and engage in reflection on climate change and drought. This community-based initiative not only strengthens environmental monitoring and scientific literacy in the region but also empowers mountain communities to participate in knowledge creation and adaptation strategies. It represents a model for inclusive, climate-resilient research in headwater catchments increasingly vulnerable to global change.

RGIK guidelines for compiling consistent rock glacier inventories

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rock glaciers are characteristic and ubiquitous periglacial landforms. They contain key information for understanding the past and present evolution of the mountain cryosphere, as well as for addressing a range of more applied concerns such as water supply/quality and geohazard assessment, especially in relation to ongoing climate change. Their spatial distribution and characterization, including their state of activity, has been long documented by means of rock glacier inventories (RoGIs). However, owing to the inherent morphological complexity of these landforms, contrasting definitions, and limited international cooperation, most RoGIs compiled around the globe exhibit a high degree of heterogeneity. This is a critical shortcoming that hampers our ability to combine RoGIs across regions towards the compilation of a global inventory. To address this limitation, the International Permafrost Association (IPA) Action Group (2018–2023) on Rock Glacier Inventories and Kinematics (RGIK) has fostered and coordinated international collaborative work to develop widely accepted guidelines for inventorying rock glaciers, including the characterization of kinematic behavior. Accordingly, a technical definition of rock glaciers and a methodological workflow for inventorying these landforms are provided. This RGIK definition relies on three morphological criteria: the mandatory evidence of a rock glacier front and adjoining lateral margins, and optionally, ridge-and-furrow topography. To account for landform complexity, a hierarchical classification scheme of rock glacier units (RGUs) and systems (RGSs) is also introduced. The methodological workflow is composed of four steps: (i) detection, which consists of rock glacier identification according to the relevant morphological criteria; (ii) location, which involves assigning a georeferenced primary marker to each RGU and RGS; (iii) characterization, which among a set of optional attributes, entails assigning a geomorphological type of upslope connection and a degree of activity to each RGU; and (iv) delineation, in which the rock glacier outline is mapped and relevant degree of uncertainty is documented.

A global assessment of the impacts of mine waste on river systems and hydromorphology

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13D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 11:35 AM - 1:05 PM

The extraction and processing of metal ores and the discharge of waste into water courses, which began more than 7000 years ago in Western Asia, constitutes humanities oldest form of river pollution. In the 18th and 19th centuries unregulated and extensive extraction of base and precious metals in Europe, North and South America, and Australia resulted in transformation of river channels and floodplains downstream of mining areas, with legacy pollution still affecting many catchments worldwide. Metal mining significantly expanded in Asia and Africa post 1950 associated with the Great Acceleration. The 21st century “green energy” boom has resulted in an unprecedented increase in metal extraction and waste discharge to rivers from both localised artisanal and large-scale industrial mining, including the failure of tailings dams that have resulted in the destruction of entire river corridors. In this paper the impacts of historical, artisanal, and current industrial mining on hydromorphology are reviewed, and process-based management options outlined that can minimise river pollution as well as protect ecosystem and human health. Climate change related increases in the incidence and severity of floods and droughts globally pose the greatest challenge to mitigating the uncontrolled dispersal and remobilisation of mine waste in rivers.

The use of UAV-based HD-DEM in the geoform mapping of small intermittent rivers

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The classification of geomorphological units is of great relevance for characterising and acquiring data from an area, particularly through the development of geographic cartography. The objective of this study is to carry out a detailed classification of the geomorphic units of a section of the Tigre Stream, located in the city of São João do Tigre - Paraíba, based on an orthophoto map generated from images obtained by Unmanned Aerial Vehicles (UAVs), which were processed using the Agisoft Metashape software. It establishes the need for geomorphological mapping in the semi-arid region and the use of resources, such as UAV images, satellite images, and field visits, to visualise the data obtained in the laboratory for the development of this mapping. This characterisation is important due to the limited availability of data in these environments, which is essential for their planning and management. Based on the image analysis, the identified geomorphological units were two islands, one damming area, one sandbar, and one artesian well. The HD-DEM was essential for identifying variations in the complex morphology of small intermittent rivers.

Point cloud filtering in HR-DEM generation for the mapping of fluvial units

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The use of Unmanned Aerial Vehicles (UAVs) has proven to be of great importance for environmental monitoring due to their lower cost and greater efficiency compared to orbital images or other human-crewed vehicles. Recognising the importance of this, the study aims to generate three Digital Elevation Models (DEMs) of a fluvial section of the Tigre Stream, located in the city of São João do Tigre, Paraíba, using images obtained through UAVs. These models were generated using Agisoft Metashape software with various configurations to determine which setup yields the best results by distinguishing the ground from other elements present in the analysed images. The variations in configuration include the standard settings provided by Agisoft Metashape, a customised setting based on the literature, and a DEM generated without any configuration. The enhancement of Digital Elevation Models (DEM) is important for improving geomorphological analyses, as it allows for the identification of more detailed features. A comparison between the results and the original DEM shows that the average, maximum, minimum, and standard deviation values vary depending on the customised configurations used, helping to understand what changes were applied. The original configuration presents an average value of 556.84, a maximum of 551.6, and a minimum of 541.511. With the customised configuration, the values change to an average of 549.81, a maximum of 556.84, a minimum of 543.24, and a standard deviation of 2.08. These modifications demonstrate how the image becomes more refined, allowing for better visualisation of topographic information. Point filtering was essential for removing artefacts, such as vegetation, including within the beds of intermittent rivers.

Event-Scale Sediment Response in a Mountain Sediment Cascade: Integrating Experimental Rock Attrition and Field Observations

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02J: Mountain sediment cascades and landscape response to changing climate, Conway 5, February 2, 2026, 2:00 PM - 3:30 PM

Mountain catchments are at the forefront of systems that are most vulnerable to the impacts of anthropogenic climate change. One impact of climate change will be perturbations to sediment cascades. Sediment yields are extremely difficult to observe in mountain rivers, and it is usually assumed that the suspended portion of transport is the dominant mode of material conveyance. As such, suspended sediment is used as an indicator for detecting trends in catchment erosion; but are highly variable due to differences in material supply and the intensity of event-scale precipitation. In this study, we consider sediment supply and storm characteristics of the Haast Awarua in New Zealand to discern the underlying drivers of variability in suspended sediment, as observed through turbidity measurements, experimental observations of material abrasion, and catchment-scale mapping. Event scale response showed a dominance of anticlockwise hysteresis independent of seasonal variations in snow and ice coverage. Less common was clockwise or no hysteresis responses, which occurred during the autumn to spring period, suggesting reduced sediment supply from more distal alpine sources. The dominance of anticlockwise hysteresis may also reflect higher sediment yields from the Landsborough tributary due to the propensity of the underlying semi-schist lithology to lithic breakdown via in-channel attrition and abrasion. At present there is no apparent change in the annual suspended sediment yield, despite catchment-wide increases in winter water temperatures and reducing snow cover. Rather, near-term variations in sediment yield are due to local-scale spatial variations in sediment mobilisation and in-channel processes rather than indicating larger changes in the climate system. At present, it the sediment cascade has not yet reached a climate 'tipping' point where the impacts of anthropogenic climate change exceed the envelope of natural environmental variability; and ongoing monitoring is essential for determining the timing and magnitude of such changes.

Active faults and coastal landscapes in Central Japan's back arc after the Mw 7.5 Noto Peninsula earthquake

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04D: Advances, challenges and future directions in Tectonic Geomorphology, Dobson 3, February 3, 2026, 9:35 AM - 11:05 AM

On January 1st, 2024, the Mw 7.5 Noto Peninsula earthquake ruptured on a series of coastal offshore reverse faults in the back arc of central Japan. Closest to the rupture, in the northwest, the coastal rocks uplifted as much as 4.4 m. The coastline accordingly moved seaward by up to 200 m creating new wide bedrock platforms that could become marine terraces if they survive erosion and weathering. The Peninsula itself hosts 4767 unique mapped terraces ranging in age from Holocene to 1.02 Ma. The terraces associated with the last two interglacial high stands (ca. 120 and 234 ka) record a tectonic SE-tilting similar to that of the Mw 7.5 earthquake. Older terraces all record a spatially uniform rate of uplift across the Peninsula. The landscape itself does not appear to be equilibrated to this gradient in uplift, with a seemingly disconnected fluvial geometry. We conclude that the faults that caused the most recent earthquake became the dominant structures on the Peninsula around 250 ka and that the Peninsula is in a state of transient equilibration. Most of the faults that ruptured on January 1st track the coast along a marked ramp at ca. 60 m below sea level. This corresponds to the average elevation of sea level over the last 500 kyr. 80 km to the northeast of the Noto Peninsula lies the Island of Sado where marine terraces record a strong southeast tilting similar to the Noto Peninsula. Earlier work suggested that the tilt is driven by a fault lying just offshore of the Oosado coast. The bathymetry reveals a ramp at around -60 m reflecting a geometry similar to the Noto Peninsula. This calls our attention to the often less-studied near-shore, and highlights a potential seismogenic source capable of >M7 ruptures.

Multi-period ore exploitation in Upper Silesia, Central Europe, and its legacy in relief and soils

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10F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 2:30 PM - 4:00 PM

We studied the abandoned mining field in Bytom-Tarnowskie Góry (UNESCO World Heritage area), southern Poland using high-resolution lidar images to distinguish the number of mining shaft remains and their morphological diversity. We identified 13,864 remains of mining shafts of various sizes (2–30 m in diameter) and diverse levels of denudation. This allowed us to select 13 mining shafts for detailed study. The radiocarbon dating of charcoal and peat from the shafts indicate three phases of exploitation in the study area: the Roman and early migration period (2nd century b.c.–6th century a.d.), the Middle Ages (6th–14th century a.d.), and the modern period (15th–17th century a.d.). The data on metal ore exploitation in the European Barbaricum is scarce and, in the study area itself, historical written sources indicate the onset of mining only in the 12th century a.d. Therefore, ore exploitation in the study area during the Roman period and early migration period, as well as in the early Middle Ages, is an unexpected result, as is the total scale of historical exploitation in the area recorded in large numer of shaft remains.

1201

Factors Triggering Landslides in Urbanized Areas: Insights from Central European Case Studies

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05K: Identification, quantitative assessment and mapping of anthropogenic landforms in urban areas, February 3, 2026, 11:35 AM - 1:20 PM

Landslides in Central Europe are increasingly driven by anthropogenic landscape modification, posing growing societal risks as urban populations reach approximately 60% in Poland and 78% in Germany. This study examines geologically and geographically diverse urban centres in Germany: Kaub (Rhine River), Cochem (Moselle River), Oppenheim (Rhine River), and in Poland: Kraków (Vistula River) and Gdynia (Bay of Gdansk). Harmonised RDB and SOPO landslide inventories, combined with GIS-based analyses, were used to quantify human-environment interactions across contrasting geological settings. Methodologically, high-resolution LiDAR-derived DEM (1 m resolution) were integrated with GIS-based modelling techniques and meteorological datasets. Archival materials were additionally reviewed using AI-assisted data mining approaches. Persistent Scatterer Interferometry (TerraSAR-X) was applied to quantify slow-moving slope deformations, while gravitational process-path models were used to simulate rockfall trajectories. Landslides in Germany reveal cyclical reactivation patterns. In Oppenheim, tableland-type failures have reactivated repeatedly over the past 150 years due to progressive degradation of Miocene limestone caprock overlying Oligocene marls. Despite engineering stabilisation measures, active slope deformation persists. In Cochem, creeping movements of up to 7 mm yr-1, accompanied by minor rockfalls were detected in Devonian slate formations, with similar behaviour observed in Kaub. In Poland, slope stability conditions are significantly modified by anthropogenic earthworks. In Gdynia, the 2017 Kamienna Góra landslide, developed within Pleistocene sediments, is directly linked to embankment construction (up to 2.3 m thick), which locally lowers critical precipitation thresholds. In Kraków, the Nad Baranówką landslide remains active, exhibiting approximately 10 m of horizontal displacement between 2017 and 2023, triggered by embankment loading on Miocene loess deposits. The results indicate that landslides in Germany and Poland are strongly associated with increased precipitation intensity, while anthropogenic triggers remain consistent across contrasting geological settings. These include slope cutting, excavation, surcharge loading, structural failure of retaining systems, ground loosening, embankments construction, leakage, and inadequate drainage.

Numerical simulation of the filtering of subglacial sediment export by proglacial forefields

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02J: Mountain sediment cascades and landscape response to changing climate, Conway 5, February 2, 2026, 2:00 PM - 3:30 PM

Proglacial forefields are geomorphologically active zones with rivers that may buffer sediment connectivity between glaciers and downstream regions. To date, there are few studies of the magnitude of this process and the role of system-internal perturbations, such as meltwater discharge rates, subglacial sediment supply and changing valley topography following glacier retreat. The aim of this study is to determine the magnitude and drivers of the filtering of subglacially-produced sediment by proglacial river morphodynamics under potential deglaciation-driven scenarios. We use a physically-based morphodynamic model (eRiDynaS), calibrated using continuous field-collected data from the Glacier d'Otemma proglacial forefield (Switzerland), to investigate the geomorphic response of these fluvial systems to varying topographical, sedimentological and hydrological boundary conditions. We simulated five scenarios involving higher meltwater discharge, increased subglacial sediment supply for both suspended and bedload particles, exhaustion of bedload export, increased floodplain size and valley bottom slope compared to the actual situation to replicate potential conditions occurring in the proglacial margin following deglaciation. The results confirm the central role of the supply-to-transport capacity ratio in determining both the geomorphic response of proglacial streams and the downstream delivery rates of sediment, particularly for bedload transport. In contrast, suspended sediment transport is less affected by morphodynamic processes. Simulations further revealed that filtering is influenced by lateral accommodation space and valley bottom slope. Greater lateral accommodation allows for increased braiding intensity and enhanced buffering and deposition of subglacially-exported bedload particles. A steeper valley bottom counteracts this effect by confining flow into fewer, more hydrologically efficient channels, thereby promoting sediment transport and riverbed incision. These observations suggest not only that proglacial filtering varies across geomorphological settings, but also that the shape of the valley (width and slope) as revealed following glacier retreat, plays a significant role in influencing this filtering and so the longitudinal sediment connectivity in deglaciating catchments.

Twenty years of research along the north-western coast of Malta: a holistic approach for the investigation of slow-moving landslides

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10E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 2:30 PM - 4:00 PM

This study summarizes two decades of research along the north-western coast of the island of Malta (Mediterranean Sea), a region significantly impacted by slow-moving landslides. The area is particularly prone to rock spreading and block sliding, driven by its distinctive geological setting and commonly favored by rainfall and coastal erosion. Adopting a holistic and multidisciplinary approach, we integrated advanced mapping, monitoring, and modeling techniques. These included contributions from Earth observation, topographic analysis, geomorphology, geophysics, and geotechnical modeling. The research leveraged extensive datasets, including space-borne radar imagery, GNSS positioning, UAV-derived orthomosaics, and data from in situ geotechnical sensors. The integration of innovative sensing technologies with tailored modeling approaches significantly improved data interpretation and the robustness of predictive models, thereby contributing to more effective landslide risk mitigation strategies, in the context of climate change.

Estuarine morphodynamics regime shift caused by reservoirs: Illustration from the Minjiang River Estuary, China

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08F: River Deltas: Dynamic Systems Under Climate and Human Forcings, Conway 1, February 5, 2026, 9:35 AM - 11:05 AM

Human activities, particularly reservoir, have become a focal point in contemporary earth science research due to their profound impacts on flow-sediment-ecology systems of catchment. While some investigations have examined reservoir-induced alterations in fluvial-estuarine sedimentation patterns, the feedback mechanisms between morphological changes and tidal dynamics remain inadequately explored. This research focuses on the Minjiang River estuary, a macrotidal system in southeastern China, characterized as a medium-scale catchment (length: 562 km; drainage area: 60,000 km²). Employing an integrated approach combining field hydrographic measurements, multi-temporal digital elevation models, and Mike21 simulations, this study quantifies the decadal-scale interplay between anthropogenic-driven geomorphic evolution and tidal system adjustments over a 40-year period (1984–2022). The analysis reveals that reservoir operations and river sand mining have transformed the estuarine sedimentary regime from net deposition (0.4 cm/year, 1984–2005) to accelerated erosion (2.6 cm/year, 2005–2022). This geomorphic transition has triggered significant hydrodynamic responses. During the deposition-dominated phase (1984–2005), sediment accumulation resulted in a progressive decline of 1.5 cm in the mean tidal levels and a 6.5 cm/s reduction in flow velocities. Conversely, the subsequent erosional period (2005–2022) saw a 2.2 cm rise in tidal levels accompanied by a 9.3 cm/s acceleration in flow velocities. The ebb diversion ratio of water and sediment in estuarine branches such as North Branch increased by 18% and 17%. Furthermore, the bed dunes in Maiwei and North Branch increased by 0.3m (13%) and 0.1 m (8%), respectively. This research establishes a fundamental principle of sediment dynamics: depositional processes attenuate tidal energy while erosional regimes enhance hydrodynamics. These findings provide critical insights into the cascading effects of human activities at the catchment scale on coastal hydro-morphological systems, offering a scientific framework for sustainable estuarine management under increasing anthropogenic pressures.

The Geoscience of Wine: The influence of surficial geology on viticulture in Atlantic Canada

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13H: Quaternary Geomorphology and Landscape Evolution, Conway 3, February 6, 2026, 11:35 AM - 1:05 PM

This study explores links between geology and wine terroir in the Gaspereau Valley region of Nova Scotia, Canada, an emerging cool-climate wine region. Terroir describes the environmental factors that influence wine characteristics and is significantly influenced by the geomorphological features vineyards are situated on. Vitis vinifera and hybrid grape varieties require specific metals (Ca, K, Mg, Cu, Fe, Mn, Zn, Mo) from the soil for optimal growth, vigor, and to impart distinctive qualities to the wine, defining its sense of place. The Gaspereau Valley's landscape is a complex product of multiple late Wisconsinan glacial ice flow phases. A 1:50,000 scale surficial geology map of the Gaspereau Valley was created using LiDAR classification mapping. Vineyards and associated geomorphic features that were identified included stepped glaciofluvial terraces, colluvium, thick till blankets, river terraces, modern alluvium, and drumlins all within a palimpsestic landscape.

Soil samples were collected from cores in four vineyards to examine the relationship between local geomorphology, soil properties, and grapevine nutrient availability in order to provide a more comprehensive understanding of the environmental factors shaping terroir in this region. Soil samples contained unique elemental concentrations associated with specific landforms which host high variability. Notably, copper (Cu) is most prevalent in glaciofluvial terraces, while potassium (K) is elevated in drumlins. Hierarchical clustering was conducted to determine geochemical correlation and variability among the mapped geomorphic features. This analysis confirmed some expected correlations, such as the association of deep samples with the Chignecto till phase sediment. However, some associations of unique geochemical clusters between geomorphic features were identified the majority are variable, suggesting a complex interplay of colluvial, fluvial, and topographic influences that may overshadow correlations to mapped geomorphic units which in turn, highlights the complex interrelation between glacial landforms and terroir.

Depositional and erosional dynamics at fine spatial and temporal scales: Insights from Monterey Canyon, offshore California

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06E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 2:30 PM - 4:00 PM

In October and December 2024, a geomorphological study was conducted in the upper Monterey Canyon, in Monterey Bay, California, to monitor the geomorphic impacts of turbidity currents. Bathymetric and backscattering data were acquired through boat-based repeated multibeam echosounder (MBES) surveys along the canyon, in 5-236 m water depth. A R2Sonic 2022 MBES was pole mounted and the data were georeferenced thanks to a Trimble positioning system with an RTK connection.

During the reference period, MBES survey campaigns were conducted on October 14th and on December 5th and 19th, generating three overlapping Digital Terrain Models (DTMs) covering the canyon head and upper canyon. These DTMs were subsequently used to generate difference maps, allowing for a detailed assessment of the morphological changes the seafloor underwent over time. Turbidity currents affecting the Monterey Canyon are known to cause both erosion and deposition over short timescales. The difference maps reveal that the northern tributary showed pronounced erosion between October 14th and December 5th, while no significant morphological change—either erosional or depositional—was detected between December 5th and 19th. The southern tributary showed evidence of slight erosion between October and early December, followed by a more pronounced one in the month of December. Moreover, the alternation of erosional and depositional features observed mostly in the upper canyon, downslope from the areas where the aforementioned changes occurred, suggests upcanyon migration of bedforms.

Monthly measurements at fine spatial scales are proving to bear the potential of highlighting the significant morphological changes that can occur in submarine canyons over short timescales. By linking these changes to specific flow events, we can better understand the cause-and-effect relationships governing canyon morphodynamics, and the geomorphic impact of such flows.

A Long-Term Landslide Monitoring Framework Applied at Three Permanent Observatories in Lower Austria

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01C: State-of-the-art and new perspectives in long-term monitoring and analysis of landslide dynamics, Dobson 2, February 2, 2026, 11:40 AM - 1:10 PM

Landslides are among the most frequent natural hazards in Lower Austria, often triggered by intense precipitation events that alter pore-water pressure and cause slope failure. The region's complex geological setting, especially in the Flyschzone with its high clay content and deeply weathered lithology, makes it prone to both shallow and deep-seated landslides as well as debris flows. Human-induced changes such as land-use modifications, drainage, and slope alterations further increase landslide susceptibility. In response to recurrent landslide damage affecting infrastructure, farmland, and settlements. The University of Vienna’s ENGAGE research group, Geomorphological Systems and Risk Research, established three Landslide Monitoring Observatories in Lower Austria, starting in 2014. These include three sites—Hofermühle, Salcher (Gresten), and Brandstatt—each representing distinct landslide types and socio-environmental contexts.

The observatories employ a suite of complementary monitoring techniques—including automatic inclinometers, piezometers, meteorological stations, terrestrial laser scanning (TLS), UAV surveys, and cosmic-ray neutron sensing (CRNS)—to generate long-term, high-resolution datasets on surface and subsurface processes. Real-time data transmission enables immediate quality control and integration into modeling workflows. The collected data reveal diverse landslide behaviors, including temporal variability and complex internal dynamics. DEMs of Difference derived from TLS and ALS data have enabled precise mapping of surface displacements and reactivation zones. Historical records and recent precipitation-linked events have further clarified the role of predisposing, triggering, and controlling factors in landslide development.

Recent activity underscores the importance of continuous, site-specific monitoring. The slow-moving nature of these landslides offers a valuable opportunity for long-term analysis and early warning system development. Ultimately, the observatories contribute to a deeper understanding of landslide mechanics, improved risk assessment, and more effective hazard mitigation—particularly crucial in light of climate change and the projected increase in extreme weather events.

NSF SHIRE: Filling data gaps in marine terrace uplift and paleoseismology studies along the Hikurangi subduction zone, New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

From 2017-20, Cal Poly Pomona (USA) and GNS Science (NZ) engaged in collaborative NSF SHIRE geomorphic research to investigate tectonic uplift along New Zealand's Hikurangi margin. CPP student projects filled data gaps in ongoing GNS studies of coastal deformation and paleo-earthquake history. Marine terraces here record uplift over two time scales: 1) short-term Holocene coseismic events, and 2) long-term late Quaternary net deformation. Six sites were studied along the North Island east coast (south to north): 1) From Te Kaukau to Flat Point (southern Wairarapa), Holocene terraces and beach ridges record multiple prehistoric earthquakes. Paleo-shorelines were mapped using LiDAR, linking prior radiocarbon dated field sites. 2) From Flat Point to Riversdale Beach (central Wairarapa), four Pleistocene marine terraces record long-term uplift and folding. New LiDAR mapping and IRSL ages constrain local deformation rates. 3) From Waimarama to Clifton (southern Hawkes Bay), three Holocene terraces record paleo-earthquakes. LiDAR mapping, field surveying, and radiocarbon dating provide updated spatial and temporal constraints on these events. 4) On adjacent Cape Kidnappers (southern Hawkes Bay), Pleistocene marine and fluvial terraces record long-term uplift and warping. LiDAR mapping, IRSL dating, and tephrochronology yield new constraints on this deformation. 5) While no new data were collected at Mahia Peninsula (northern Hawkes Bay), a continuous sequence of four Holocene and seven Pleistocene marine terraces (Berryman, 1993a,b) provided a model for interpreting terrace flights elsewhere. 6) From Okitu to Pouawa Beach (south-central Gisborne), emergent Holocene platforms record differential uplift and paleo-earthquakes. New radiocarbon dating of fossiliferous carbonate-cemented sand horizons ("treadrocks") constrains uplift event timing. Along the entire Hikurangi margin, coastal uplift results from both deep megathrust slip and shallow upper-plate faulting. Continued research aims to differentiate between broader megathrust ruptures and localized upper-plate events. Both earthquake types pose significant seismic and tsunami hazards for New Zealand residents.

Human activity as a driver of aeolian activity: lessons for understanding long-term changes in dust generation

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07H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 5:00 PM - 6:30 PM

Dust emissions have traditionally largely been linked to aridity, whereby greater aridity results in increased dust output. However, an increasing number of records imply that human activity, namely the onset of intensive agriculture has markedly altered regional dust loads independent of changes in moisture availability within source areas. Here we present a series of examples where the timing of increased dust flux matches the timing and patterns of human activity. First, we present a record of dust accumulation downwind of the deserts of northwestern China over the late Holocene. For most of the record, dust deposition matches the behaviour of climate features known to influence regional dust emissions, including the position of the westerly jet and the strength of the East Asian Monsoon; however, within the past 100 years dust deposition rates increase significantly in apparent opposition to climate factors. This is largely attributable to human expansion into the deserts of northwestern China and associated landscape change. Second, we examine dust emissions from Australia's Murray-Darling Basin where a sharp increase in dust deposition rates to 2-5 times that of the previous 6,500 years occurs coinciding with the onset of European farming in semi-arid Australia; albeit with dust flux modulated by episodic drought events. Third, we show that dust deposition in Puna-Altiplano of northwestern Argentina increased within the past 400 years; attributable to land use change associated with expansion of the Inca Empire and Spanish colonization. Collectively, these examples imply landscape instability is a key driver of dust emissions, and therefore changing dust emissions over Quaternary timescales should not a priori be ascribed to aridity alone.

Geomorphic sensitivity of a (long-term) perturbed, mountain fluvial system to an extreme storm event

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Since the late 1940s, the Marecchia River underwent major disturbance associated with three decades of intense gravel mining. Riverbed excavation caused abrupt base-level fall and exposed highly erodible mudstone and poorly consolidated sands, triggering rapid vertical incision into bedrock and headward knickpoint migration. Cumulatively, this ver¬tical adjustment has carved a canyon that is ∼6 km long and 10-to-20 m deep. To prevent bedrock incision from reach¬ing a bridge and secure a stable site for water diversion to irrigation, a major check dam was built in 1987 at Ponte Verucchio. Between 2009 and 2019, headward knickpoint migration travelled for about 500 m to the base of the check dam, which eventually failed on 13 May 2019 during a flood with peak flow of 590 m3/s. To track ongoing coarse sediment dynamics and evaluate the state of sedimentary (im)balance associated with the canyon, we monitor topographic change within three 1-km-long channel reaches by means of four consecutive, annual (2020-2023) SfM-photogrammetric (i.e., UAV platform) and GNSS-RTK surveys. The study reaches – respectively multi-thread, single thread, and multi-thread – are located upstream, within, and downstream of the canyon. DoD analysis of the sequential SfM-derived DTMs displays: (i) in 2020-21 upstream balance, net canyon degradation, and net downstream aggradation; (ii) in 2021-22 upstream aggradation, and subtle net degradation both in the canyon and the downstream reach. During the last year of monitoring, a severe storm poured about 250 mm of water within 48hrs in mid-May 2023. This forcing brought about a total volumetric change (i.e., aggradation plus degradation) 2-to-3 times larger than what estimated over each prior year of monitoring. Most importantly, while the upstream and downstream reaches displayed substantial balance and net aggradation respectively, the canyon underwent a 9-to-30-fold increase in net degradation, thus pointing to persistent, sky-high geomorphic sensitivity to change.

Geomorphic adjustment of highly confined streams to severe storms, Romagna, Northern Apennines

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

In May 2023, two storms struck within two weeks the entire Romagna sub-region, Italy. Over 48 hrs, each storm dropped respectively ≃200 mm and ≃250 mm of water. In this contribution, we examine the post-storm adjustment of two meandering, highly confined mountain streams – the Savio (47 km) and Senio (39 km) – in the context of their historical evolution. Both streams may be broadly split into an upper, naturally confined segment, characterized by bedrock and mixed bedrock-alluvial reaches, and a lower, artificially confined segment where purely alluvial reaches prevail. Median, post-storm active channel width in the Savio River, which experienced the first event only, increased abruptly by 16% (4.2 m) across the naturally confined reaches (i.e., 1-26) and by 96% (26.2 m) across the artificially confined reaches (i.e., 27-38), owing to generalized meander cuts, as well as breached and/or overtopped levees. Comparatively, the Senio River mainstem, which was struck by both storms, displayed virtually identical rates of median widening (i.e., 15%, 2.3.m) in the naturally confined reaches (i.e., 1-13), but substantially greater ones (i.e., 116%, 20.2 m) in the artificially confined counterparts (14-29). Interestingly, post-storm widths along the artificially confined reaches are comparable with those reconstructed in 1954, when the river displayed a wandering pattern. Preliminary results along the Savio River from repeat cross-sectional surveys respectively show a tendency to mean bed-level incision at reaches 16-26 (median = -0.3 m; mean = -0.8; max = -3.3 m; std dev = 1.5 m) and one to aggradation at reaches 27-38 (median = 0.2 m; mean = 0.5; max = 4.1 m; std dev = 1.1 m). Ongoing DoD analysis (i.e., 2009, 2022, 2023, 2024) on the active channel footprints of both streams aims at constraining the volumetric budget associated with the 2023 storm events and the subsequent degree of recovery.

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Rebalancing River Lateral Connectivity: An Interdisciplinary Focus for Research and Management

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Lateral connectivity between rivers and terrestrial landscapes is critical for both river and landscape health. Alterations to lateral connectivity are one of the most pervasive anthropogenic impacts on rivers, prompted increasing efforts to re-connect rivers to floodplains, riparian zones, and wetlands. However, there is currently no consensus on how to conceptualize and study lateral connectivity in rivers across disciplines. Here we review how river-landscape lateral connectivity is conceptualised, measured and managed bridging geomorphology, hydrology, ecology, biogeochemistry and the social sciences. We present the concept of a lateral connectivity balance which evaluates the bidirectional material fluxes operating both into and out of river channels and the balance between these directions. This focus marks a shift from conceptualising rivers primarily as linear features transporting water, matter, and organisms from source to sea, to a network that is intimately integrated with riparian and terrestrial processes, in which lateral exchanges of matter, energy and organisms are as important as longitudinal transport. Anthropogenic impacts have swung the balance of lateral connectivity, enhancing the transport of materials into and through river networks while suppressing fluxes from rivers to adjacent landscapes. This often leads to a disconnection between channel and former floodplain. We propose a need to “rebalance” lateral connectivity, explicitly recognizing the natural bidirectionality of laterally connecting processes, the significance of the hydrologic, geomorphic, and biologic functions they support, and the value to society of the ecosystem services and climate change resilience they provide.

Up the creek without a channel? Hydromorphological adjustment of rivers after valley reset restoration (Stage 0)

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06A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 2:30 PM - 4:00 PM

Anabranching or wetland riverscapes, characterised by high hydrological connectivity across the valley floor, were once a common river typology but are now rare in anthropogenic landscapes. Restoration to (re)create these “Stage 0” riverscapes is gaining momentum globally but remains relatively untested, resulting in uncertainty in river response in the short- and longer-term. Valley reset involves filling river channels level with floodplain surfaces and aims to provide a blank slate to reset natural processes and initiate the evolution of channel networks. We aimed to understand the geomorphological evolution of riverscape form and process after valley reset and compare the resulting riverscape to pre-restoration.

We conducted a detailed monitoring strategy at two UK sites, the river Aller and river Witham. Monitoring included before-after continuous measurement of in-channel and water table hydrology, annual topographic surveys and analysis of surface sediments and remote sensing. During restoration, rapid increases in groundwater elevation increased both surface and subsurface water storage. River width increased from 4 m up to >100 m and the rivers transitioned from single thread to multi-channel river corridors with a mosaic of wetland habitats. Channel development was controlled by discharge regime, with the Aller river developing a more defined channel network whilst the Witham maintains a pooled morphology upstream but downstream patches of vegetation and large wood are driving slow evolution of channel form. The results indicate that valley-reset is just the start of the restoration process and subsequent evolution diversifies geomorphic units, sorting into areas of faster flow and gravel and slower pooled and wetland habitats. Therefore, valley reset restoration provides a tool to store water and recharge alluvial aquifers, with benefits in particular to wetland habitats, lacking in many agricultural catchments.

A new potential for coastal monitoring using solar powered UAV’s

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

This contribution presents an UAV design that extends coastal surveillance capability well beyond current standards. The XSun® SolarOne UAV is a four-wing aircraft combining solar panels and high-performance batteries. Its advanced design offers very high operational capability: 12hrs flight time, 600km range, 50km BVLOS range and a dual-band GNSS receiver for highly accurate positioning. It has a payload capacity of over 4 kg, enabling it to use various sensors (i.e. VHRS camera, multi/hyperspectral, Lidar sensors...).

The Xsun® coastal survey was tested over a coastal area of cliffs located between Omaha Beach and Pointe du Hoc, two Second World War landing sites (Normandy, France). Coastal data was collected using RGB and Lidar sensors on 29 March 2025 over 4 sq. km and a tidal coefficient of 109. A first 2-hour flight was used to capture the RGB data using a Phase One iXM-RS150F camera (150mio pix.). A second 2-hour flight was used to capture 3D data at low tide using a Riegl VUX120 lidar sensor (2mio pts/sec).

Studying the topography of a beach requires the driest surface conditions to avoid lidar acquisition artefacts. This means that the drone must follow the tide with sufficient time to capture lidar measurements when the beach has been drained by the retreat of coastal waters. This can only be managed on site using coastal scientific expertise. To achieve this objective, the XSun® drone circled over the area of interest waiting for the best opportunity to carry out the topographic survey. This was only possible thanks to the XSun®'s flight autonomy, which surpasses over UAV's ant its long-range BVLOS with on-board video camera for remote, real-time monitoring of water level on the beach. Xsun® is a great advantage for coastal monitoring given coastal stakes which are threatened by natural hazards, human pressures and sea-level rise.

Ballynacourty Point and Knockmore drumlins: two centuries of evolution of two coastal sentinels (Carrowmore, Co. Galway, Ireland)

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03C: Marine and lacustrine geomorphology - mapping and applications, Dobson 2, February 2, 2026, 4:00 PM - 5:30 PM

Our contribution to the paraglacial geomorphology session relies on the landscape analysis of two coastal drumlins of Knockmore and Ballinacourty located at Carrowmore (Co. Galway, Ireland). Inherited from the Midlandian glaciation correlated with marine isotope stage 2 (Knight et al. 2004), these two geomorphic features are part of a drumlin field partially drowned in the head of Galway Bay. Knockmore and Ballinacourty drumlins' landscape is shaped by various geomorphic coastal/land processes but they also provide two complementary cross-sections: the first one in the width axis (i.e. Knockmore) and the second in the length axis (Ballinacourty). Their foot cliff reinforced by boulders resulting from the surface processes against drumlin till and their location in the head of the bay are protecting these geomorphic features from active coastal erosion unless severe storm conditions with extreme western wind provide sufficient wave energy to undermine the cliff base. The landscape analysis evolution over two centuries is twofold. Firstly, four photographic surveys between 1994 and 2024 focused on field validation of ongoing processes and the evolution of this coastal landscape. Secondly, a GIS analysis of historical maps, namely the Ordnance Survey of Ireland 1839 and 1892 (scales 6 inches and 25 inches to a mile), historical aerial photographs (1973, 1996, 2006, 2013) and more recent VHR Worldview-2 satellite imagery (2018) provides geohistorical mapping of the shoreline retreat. Located in a low energy coastal system, these two sentinels provide a perfect monitoring site for the impact of sea level rise combined with high magnitude, low frequency coastal events.

Knight J., Coxon P., McCabe A. M., McCarron S. G., Pleistocene glaciations in Ireland, Editor(s) : J. Ehlers, P.L. Gibbard, Developments in Quaternary Sciences, Elsevier, Volume 2, Part 1, 2004, Pages 183-191. https://doi.org/10.1016/S1571-0866(04)80068-X

Alluvial Fan Genesis: Landslides as Architects of Fan Development

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01B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 11:40 AM - 1:10 PM

Alluvial fans are depositional landforms that typically develop where there is a marked change in topographic relief—linking an eroding upland catchment to a lowland sediment accumulation zone. While commonly associated with tectonically active margins, alluvial fans also occur in other geomorphic settings. A key factor in their initiation is the presence of slope concavities that can focus erosion to develop a catchment to act as a focal point for the fan initiation and development.

This study explores the role of bedrock landsliding in triggering and shaping the evolution of alluvial fans, with particular emphasis on arid environments where excellent preservation potential enables detailed analysis of formative processes. We focus on two contrasting dryland regions: (1) the coast and western margin of the tectonically active central Andes of northern Chile, and (2) the tectonically quiescent Anti-Atlas region of southwest Morocco. Despite differing tectonic regimes, both regions host extensive fanscapes—landscapes dominated by alluvial fans of varying scales.

Initial findings suggest that bedrock landsliding (rockslides and rock avalanches) is a core process that influences fan initiation and morphological evolution in both settings. The associated geomorphic processes not only contribute to the sediment supply but may also determine the spatial distribution and structural development of the fans themselves. Through comparative analysis, we examine how these mechanisms interact across different tectonic contexts, with implications for understanding landscape evolution, sediment transfer, and hazard potential in dryland environments.

From submarine erosion to subaerial weathering: The 2024 Noto Earthquake exposed various miniature cavernous forms on uplifted rocky coasts

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

A Mw7.5 Earthquake on 1st January 2024 uplifted the northern coasts of Noto Peninsula, Japan, by up to 4 m, exposing wave-cut benches and cliffs. This unusual event has provided a great chance to observe submarine, intertidal and subaerial landforms simultaneously and to understand the transition from submarine erosion to subaerial weathering. At 13 uplifted coasts we distinguished six miniature landforms, notches, tafoni, honeycombs, potholes, urchin holes (drilled by rock-boring urchins) and shell holes (drilled by rock-boring shells), in terms of the shape, dimension and location. The shapes and dimensions of these forms were measured on 3D models produced by a LiDAR-equipped tablet PC (for centimeter-scale forms) or from UAV-derived images (for meter-scale forms). We also measured rock strength (Schmidt hammer rebound: R) and rock structure (strike and dip of bedding or joint). The pre-earthquake sea level (PSL), defined by the upper line of bleached Corallina, was used as a reference. The six forms showed different vertical distribution: notches around PSL, tafoni from 0 to 22 m above PSL, honeycombs from 0 to 2 m, shell holes from -1 to 1 m, urchin holes and potholes from -4 to 1 m. Notches are favored by soft rocks ($R<35$), while potholes are calved even in hard rocks ($R>50$) and the other forms mostly in rocks with R~40 or smaller. The diameter of tafoni increases at an average rate of 0.3 m with rising by 1 m. Urchin and shell holes are likely to be deformed into honeycombs or tafoni when exposed subaerially. A notable post-earthquake erosion was observed as formation of a new notch in mudstone (20 cm deep in 9 months) by differential wet-dry weathering.

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Rock controls on sea caves along Japanese rocky coasts

Professor Norikazu Matsuoka[1,2], Dr Takuro Ogura[3], Ms Kanami Shinohara[1], Mr Atsuya Ito[2], Mr Keita Ushigome[2], Professor Yoshinori Kodama[4]
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03F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 4:00 PM - 5:30 PM

Marine cavernous landforms, including notches, caves, arches and tunnels, characterize the rocky coast landscape, but systematic studies on their forms, origins and geological controls are extremely limited. Here we classify these forms using morphological parameters and interpret the morphological variability in terms of bedrock geology (rock strength and structure) of sea cliffs based on field investigations at 185 caves along six coastal areas in Japan (Sanriku, Joban, Boso, Izu, Kii and San-in coasts). Morphological parameters, width (w), depth (d) and height (h), of the cavernous landforms were measured directly on-site or through UAV-based 3D images. On-site data were collected also on geological factors, including rock types, strength (Schmidt hammer rebound values: R) and dips and strikes of weak structures (bedding, joints and faults). Using the shape index, d/w, and the presence of the open/closed end, we classify the cavernous landforms into notches ($d/w<1$, closed), caves ($d/w\geq1$, closed), arches ($d/w<1$, open) and tunnels ($d/w\geq1$, open). The major geological controls differ between notches and the other three forms. Notches are favored by low rock strength ($R<40$) and sub–horizontal bedding. Caves, arches and tunnels tend to develop, irrespective of rock strength, along weak structures with a dip steeper than 30° and a strike trending nearly perpendicular to the cliff face. Cliffs having medium rock strength (R=30–50) favor deepening of caves, providing an optimal balance between the erosion force and resisting force. In general, vertical or steep structures contribute to deepening, whereas horizontal or gentle structures favor widening. The cave opening takes either slit, triangle, square or semicircular forms, depending on the rock strength and the presence, number and dip of weak structures.

Holocene fluvial dynamics and sediment provenance in the Llanos de Moxos, Bolivia - first pieces in a complex riverine puzzle

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The Andean foreland basins are critical components of South America's sediment routing system, transmitting material from the Andes to major rivers like the Rio Madeira and Amazon. These basins act as sites of temporary sediment storage and dynamic redistribution, forming fluvial systems marked by frequent avulsions. This process creates complex landscapes of active and abandoned channels, levees, floodplain lakes, and diverse backswamp settings. Avulsions also trigger geomorphic and hydrological changes that cascade downstream, representing a first-order control on flood regime, topography and ecological condition with implications for human land use across timescales.

The Llanos de Moxos, in the northern Bolivian foreland, exemplify such complexity, featuring a network of active and inactive channels draining sediment-rich tributaries from the eastern Andes. Archaeological evidence from the region points to significant interactions between pre-Columbian populations and this dynamically evolving fluvial landscape. Yet, key aspects remain poorly understood: the local-scale chronology of channel activity, the changing provenance of sediments over time, the spatial and temporal pattern of avulsive channel shifting and abandonment, and the regional-scale hydrological consequences for human societies.

To address these gaps, we present a multi-method study of the Llanos de Moxos. This includes a detailed map of active and paleochannel systems, luminescence (OSL) dating of previously undated fluvial features, and analyses of trace elements from upstream Andean catchments to distinguish sediment sources. These geochemical fingerprints are then compared to a broader suite of sediment samples from diverse geomorphic and temporal contexts across the region to reconstruct the fluvial system's evolution. For selected archaeologically relevant subregions of the Llanos de Moxos, our combined results allow exploring a range of potential local-scale changes in sedimentary connectivity and hydrological conditions over the Holocene and highlight the value of integrating dynamic fluvial change with the archaeological record across all timescales.

Interpreting $^{26}Al/^{10}Be$ Ratios: Lithological and Geomorphic Controls in Tropical Bedrock Rivers

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12H: Quaternary Geomorphology and Landscape Evolution, Conway 3, February 6, 2026, 9:35 AM - 11:05 AM

Measurement of cosmogenic nuclides in fluvial bedload is a primary tool for quantifying catchment-scale denudation. Paired measurement of ^{26}Al and ^{10}Be has provided critical insights into complex sediment transport pathways. Deviations of $^{26}Al/^{10}Be$ concentration ratios below the nominal surface production ratio of 6.8 are widely interpreted as indicators of prolonged sediment storage and burial in transient depositional settings (floodplains or terraces). In bedrock dominated landscapes, where escarpments experience dissection and active retreat the interpretation of 26Al/10Be concentration ratios may not reflect long sediment burial times or reworking of stored alluvium. Landscape modification in bedrock terrains is by bedrock channel incision, fracturing and block-size plucking often associated with knickpoint propagation, plunge pools, waterfalls and escarpment retreat. In such systems, bedrock $^{26}Al/^{10}Be$ ratios may not only depend on steady state surface weathering but also on the stochastic nature of rapid bedrock fragmentation.

Here, we present ^{26}Al and ^{10}Be data from bedrock channels across four different catchments in northern Australia (the Kimberley and Kakadu ie The Top End), each with distinct jointing patterns, lithologic and geomorphic characteristics. We show that in quartzite-dominated Kakadu catchments, $^{26}Al/^{10}Be$ ratios (5.9–6.9) closely align with simple surface exposure/ erosion conditions with minimal evidence of burial. In contrast, the sandstone-dominated Kimberley sites yield consistently lower ratios (4.3–6.1). These depleted ratios are also mirrored in downstream modern detrital samples. The heavily bedded sandstone bedrock results in stochastic processes such as bedrock plucking, escarpment and headwall retreat at waterfalls process which are contributing episodically to sediment flux. By this process, deep seated bedrock that has experienced lower than surface cosmogenic production appears to mimic low 26Al/10Be ratios that would otherwise be associated with long term burial. We conclude that the use of coupled ^{26}Al and ^{10}Be measurements in bedrock-dominated fluvial systems is essential to identify the dominant mechanism of landscape change.

An Investigation of Water Ice Sublimation Under Simulated Planetary Conditions: Insights Into Pitted Terrain Formation On Mars and Small Bodies

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Pitted terrains are polygonal to quasi-circular depressions that occur in clusters within impact craters across Mars, Ceres and Vesta, and are proposed to be formed by either slow or rapid phase change of subsurface water. Individual pits range from 10 m to 3 km in diameter, increase in size with crater diameter and are hypothesized to reflect buried ice abundance at time of impact. Thus, pitted terrains can potentially be used as sounders for historic subsurface water ice abundance and depth. The two main schools of thought regarding pitted terrain formation are as follows: (1) low temperature and quiescent subsurface sublimation of ice-rich impact slurry [Hartmann et al., 2010] which suggests that pits represent void spaces, and (2) The Boyce Model [Boyce et al., 2012] which was used to account for the formation of Martian pitted terrain [Tornabene et al., 2012] and later applied to Vesta [Denevi et al., 2012] and Ceres [Sizemore et al., 2017], involving the explosive erosive action of gas `pipes' formed by rapid degassing at high temperatures (>750°C). However, since that time, an advent of empirical studies of volatile phase change dynamics in regolith under vacuum resulted in a paradigm shift in our understanding of the agency of sublimation under low pressure and temperature. Volatile sublimation (CO2) out of regolith has shown that vigorous sublimation dynamics can form a variety of pits under lower temperature regimes than those modeled by Boyce [Mc Keown et al., 2017, 2024). We present experiments performed under low temperature vacuum conditions to investigate the parameter space bounded by these end-member models for water ice within regolith simulant and, acknowledging scale differences, we combine these observations with analysis of remote sensing imagery to constrain the conditions where either rapid degassing or slow sublimation of water ice may have formed pitted terrains.

Lake Stars on Earth: a Window into Europa's Manannán Crater Cryovolcanic `Spider' Feature?

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01D: Planetary Geomorphology, Dobson 3, February 2, 2026, 11:40 AM - 1:10 PM

Jupiter's icy moon, Europa is a prime candidate in the search for extraterrestrial life due to its subsurface ocean. Among its intriguing surface features is an asterisk-shaped `spider' formation at the center of Manannán crater, which we informally name Damhán Alla. This feature has been suggested to represent fractures formed by plume activity. We present a new formation hypothesis for Damhán Alla, based on Earth's "lake stars"—dendritic melt patterns that form on frozen lakes in winter due to the spread of lake water through overlying snow or slush. We suggest that after impact, a brine reservoir formed within Europa's icy crust and over-pressurization during freezing caused liquid brine to extrude through granular ice impact slurry on the crater floor. Locally elevated pressures as well as the possible formation of a protective crust allowed brine to remain liquid transiently, melting the granular ice and forming a dendritic pattern similar to those observed for Earth's lake stars, which was eventually preserved as it froze. Through morphological analysis of Galileo imagery and laboratory experiments conducted under cold conditions at NASA's Jet Propulsion Laboratory, we show that similar patterns to Earth's lake stars can form via water flow through ice simulant under predicted post-impact temperatures for Europa, albeit on a much smaller scale. We place limits on eruption timescales and volumes of liquid brine extruded for Damhán Alla, as well as likely depth at time of emplacement through quantitative modelling of post-impact brine pool freezing-induced overpressurization. Subsurface brine pools are expected to be prime targets for future lander missions on Europa and other icy bodies such as Ceres and Enceladus, aimed at detecting life within our Solar System. If similar features are detected by the Europa Clipper mission, this work may help to locate recent or currently-active liquid brine sources within Europa’s icy shell.

Evolution of the Leader River in Response to a Landslide Dam, Triggered by the 2016 Mw 7.8 Kaikoura Earthquake

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06C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 2:30 PM - 4:00 PM

The North Canterbury and Marlborough regions of Aotearoa | New Zealand were severely impacted by almost 30,000 landslides triggered during the 2016 Kaikōura Earthquake. Of these landslides approximately 200 dammed rivers. In the study area near Waiau (Mid-conference Fieldtrip site - Earthquake Faulting and the Leader Landslide Dam), rupture of The Humps and Leader faults (and associated ground motions) initiated at least 42 co-seismic landslides. The Leader Landslide is the largest of these landslides, with an area of approximately 600,000m² and a volume of 6-8 million m³. The landslide buried approximately 980m of active Leader River bed length and dammed the river. The dam produced four lakes (aerial extents ranging from 3,000m² to 140,000m²), with two remaining today and two having been breached by partial landslide collapse and knickpoint migration in the year following the earthquake. The change in topography, and therefore stream bed gradient, across the field area also triggered the generation of two knickpoints in the form of waterfalls. As of 2025, the landslide dam has not been completely breached and Lake Rebekah remains.

A timeline of the evolution of the Leader River, pre- to post-earthquake, triggered by the emplacement of the Leader Landslide into the river was collated utilising aerial imagery, photography and spoken history. Schmidt Hammer pressure resistance testing was conducted on relevant lithologies, to define the role of lithology strength in the rates and styles of erosion which were observed at the two knickpoints. Geospatial data was also utilised to map the position of the Leader River and its associated lakes throughout time and generate elevation difference models across the time of the earthquake. These data were used to forecast future evolutions of the river system, with a focus on the migration of the knickpoint proximal to Lake Rebekah.

Natural flexibility in river systems as a resilience mechanism to live with geomorphic change: Kimberley Reserve, Ohau River, New Zealand

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Natural river corridors that retain their geomorphic dynamism offer unique opportunities to reconcile human pressures with the need to live with environmental change. This study explores the role of erodible river corridors (ERCs) as “environmental sponges”—landscape units that store, regulate, and release water, sediment, and ecological functions in ways that buffer ecosystems against artificialization. We focus on a reach of the Ohau River (New Zealand) within the Kimberley Scenic Reserve (KSR), an area that contrasts sharply with the heavily modified surroundings dominated by agriculture and grazing. Drawing on the environmental sponge concept, we argue that ERCs should be valued not only for their hydrological buffering capacity, but also for their ability to preserve the ecogeomorphological dynamics that underpin biodiversity, connectivity, and resilience.

Our approach integrates field-based geomorphological surveys and aerial imagery (UAV) with historical map and land-use analysis to assess changes in river dynamics and human impact. This combination allowed us to assess spatial and temporal changes in river dynamics and human intervention across the catchment. We document how the KSR acts as a zonal sponge within the catchment, providing space for lateral river migration, sediment balance, and riparian regeneration. These functions are largely absent in adjacent artificialized reaches. The findings suggest that maintaining or restoring ERCs is a viable nature-based strategy for adapting to hydrological variability and mitigating the ecological costs of landscape simplification.

By reframing ERCs as operational environmental sponges, this case study contributes to a broader paradigm shift in geomorphology—from controlling change to coexisting with it. The KSR example illustrates both the feasibility and necessity of embracing natural dynamics at local scales as part of wider catchment resilience strategies. In doing so, it aligns with indigenous perspectives (Māori) on landscape change and provides empirical support for planning policies that prioritize geomorphic flexibility over rigid infrastructure.

Is it a canyon or is it a gorge? An approach to the characterisation of valley morphologies

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08A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 9:35 AM - 11:05 AM

Valley shape and morphology exerts a primary influence upon contemporary river morphodynamics. Various terms have been used to describe different valley morphologies, with little consistency in nomenclature and terminology. Lack of definitive criteria to differentiate a V-shaped valley from a canyon or a gorge, for example, leads to different terms being used to describe similar morphologies. Here we develop a generic framework that differentiates types of bedrock valley morphology based on the relative dimensions of valley floor width, valley top width and valley depth, and the shape of three facets (sidewalls, interfluve and valley floor). Our approach does not quantify absolute dimensions for particular types of valley morphology (e.g., slope length, angle); rather, the ratio between attributes is used. Using rivers that flow to the Rangitāiki Plains in Aotearoa New Zealand as a case study, we characterise six distinct valley morphologies that are products of lithological variations and different stages of landscape development (notch, canyon, gorge, trough, open and stepped-strath). A seventh type of valley morphology, composite valleys, refers to instances where two or more valley morphologies are inset within each other - a valley within a valley. As our approach is open-ended, different types of valley morphology can be added to the framework, which we contend can be applied to any landscape.

The use of a clear and consistent terminology to describe valley morphologies helps to characterise the imposed boundary conditions under which contemporary rivers operate. Clearer nomenclature for different valley morphologies underpins consistent approaches to landscape mapping, thereby supporting approaches to landscape evolution modelling and machine learning applications.

The other fault displacement hazard: Forecasting changes in flood risk due to coseismic surface deformation

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05J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 11:35 AM - 1:20 PM

Large earthquakes can deform river channels and trigger rapid, unanticipated changes in flood risk. Forward modelling of earthquake-related surface deformation and its influence on inundation extent, depth, and frequency offers an opportunity to assess exposure to this compound hazard before an earthquake occurs. Here, we present a forward-modelling framework to quantify Increased Flooding Vulnerability (IFV, defined following New Zealand's 2011–2012 Canterbury Earthquake Sequence) pre-emptively. We apply this framework to assess potential changes in flood hazard following future Titri fault rupture in New Zealand's Taieri Basin (Otago), where the Lower Taieri Flood Protection Scheme and drainage infrastructure currently modulate flood risk. Elastic dislocation models simulating a Titri fault rupture are integrated with 2D hydrodynamic flood models to assess flood behaviour on a fault-deformed terrain. Results identify areas with elevated susceptibility to coseismic and post-seismic flooding due to ground deformation and highlight how fault-induced changes may compromise existing flood defences. Dunedin International Airport is critically exposed during a flood rated between a 2–5% Annual Exceedance Probability, with a 2.6 m single-event displacement on a 45° dipping Titri fault exposing the terminal to flood depths ≥0.5 m, increasing to >1.5 m near the runway. Uplift along the Titri fault may obstruct the basin's sole river outlet and damage key drainage infrastructure. Together with footwall subsidence and altered groundwater levels, these effects may trigger coseismic lake formation in West Taieri Plain. These results align with analysis of 52 global historical case studies of coseismic river response (CRR), which reveal behaviours ranging from in-channel flow diversion and backwater formation to overbank flooding, coseismic lake creation, and avulsion. This approach supports hazard-informed infrastructure design and land-use planning, enabling pre-disaster identification of areas with IFV where cascading seismic and flood hazards threaten long-term resilience.

Sand Dunes and Ventifacts used as Climate Indicators at Mason Bay, Rakiura|Stewart Island: Implications for Martian Paleoclimate

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Dunes and ventifacts are aeolian landforms that can serve as indicators for wind regimes, dunes reflecting modern conditions, and ventifacts preserving paleo-wind directions. The presence of dunes and ventifacts on Mars provides the opportunity to evaluate modern and ancient Martian surficial processes and climatology. This study examines the dune and ventifact field at Mason Bay, Rakiura|Stewart Island, New Zealand, as a terrestrial analogue for Mars. Remote sensing and 3D modelling techniques commonly used in Martian research were applied to assess the relationship between short-term and long-term wind indicators. Aerial imagery (2003 – 2023) was used in ArcGIS Pro to map the orientation and migration of parabolic dunes. Photogrammetric images of 18 ventifacted clasts and 11 (1m x 1m) quadrats across deflation surfaces, created detailed and scaled 3D reconstructions. Ventifact orientation was analysed using these georeferenced models in CloudCompare.

Results show parabolic dunes migrating east (average 95°), with an average displacement of 113.5m over 20 years. Of the 4,447 clasts analysed, 85% were ventifacted. Average feature orientations of 279° were consistent across lithologies and between mobile surface clasts and immobile outcrops. Ventifact development was influenced by: (1) grain size, coarser lithologies showing more pronounced features; (2) local topography affecting wind deflection; and (3) ventifact height and topographic elevation increasing groove depth. The dunes and ventifacts at Mason Bay consistently reflect prevailing westerly winds, aligning with recorded wind data. The consistency between dune and ventifact orientation supports their use as indicators for local wind regimes and can be used confidently to interpret local wind regime on Mars. Remote sensing tools were shown to provide accurate representations of real-world landforms, ensuring their use in place of in-person field techniques for Martian research. Difference in dune and ventifact orientations suggest a change in local wind regime and potentially a shift in Martian atmospheric circulation.

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SOS - Save Our Soils via strategic geoconservation and heritage protections

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08I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 9:35 AM - 11:05 AM

Saving Our Soils - vulnerable to erosion, compaction, pollution, burial and hazards - is of dire urgency, given that less than 30% of the world's soils remain in acceptable condition. However - what of the cultural and intrinsic values of soils, in a world dependent on their utility and service provision? Here, I describe how we may optimally valorise and conserve soils, as heritage geomorphology - geoheritage.

Using Australia as a case study - I propose a framework to assess and prioritise soils for geoconservation, integrating scientific, cultural, and geosystem service (GSS) values and incorporating vulnerabilities and risks. I show how soils can be evaluated and valorised using assessment criteria adapted for soil-specific indicators of fertility, structure, earth history, susceptibility, and cultural relevance. In presenting these significance values and unique vulnerabilities (sensitivities and exposure considerations) of soils, I show how and where soils of geoconservation and heritage significance can be identified and prioritised.

The construction of this framework highlighted the often competing territorial conservation and human development objectives that impede current soil geoconservation. Like many territories, systematic and representative heritage geoconservation of soil is hindered in Australia by an agricultural paradigm, regulatory fragmentation, protected areas elevation bias, and a narrow interpretation of significance. Fertile soils are rarely reserved, while depauperate soils are broadly, but incidentally protected. Paleosols rich in earth history and rarity significance value, remain largely unrecognised by virtue of documentation via single-area studies.

Existing policy instruments prioritise soil hazard and pollution avoidance over intrinsic heritage protections. Even the extensive geographic extent of reserve protections afforded by Indigenous Protected Areas (IPAs) often skew towards preserving marginal soils, raising concerns of environmental and cultural justice.

The repositioning of soils as heritage geomorphology is essential for effective geoconservation. Successful soil geoconservation will require assessment instruments that embrace utility and cultural value.

The relationship between rock mass strength and geomorphology

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

This study presents the results of rock mass rating of outcrops found in three study areas exposing Mesozoic formations in the Bükk Mts. Based on the results, we try to characterise the resistance of geological formations against denudation. Furthermore, we intend to study the spatial relationship between the resistance of rock masses, or that between resistance and valley density or other morphological parameters.

Rock Mass Rating (RMR) developed in the engineering practice is also suitable for the qualification of natural rock masses exposed in outcrops. RMR values are obtained by adding the scores of certain parameters, with a maximum of (modifying the original) 120. Three parameters – unconfined compressive strength, RQD value, distance between discontinuities – were measured in each outcrop, while the other three – conditions of discontinuities, orientation of discontinuities and the presence of water along discontinuities – were evaluated in each outcrop.

Based on the RMR measurements, around 60% of the surveyed rock masses are satisfactory while almost 40% are qualified as favourable. The outcropped rocks have relatively large unconfined compressive strength in general, however, RMR qualification, based on several parameters, indicates rather moderate or weak rock mass strength. This can be explained primarily by the presence of discontinuities. Less divided and less weathered, compact rock masses show greatest RMR values while rock masses with chess-table-like dissection or strongly folded and deformed, show moderate or low RMR values.

Rock masses with greatest strength (highest RMR values) are the most uniform, least divided rock masses which are found generally inside structural blocks. In contrast, least resistant rock masses with smallest strength are divided strongly by discontinuities, strongly deformed, almost grinded rock masses which can be found at the intersection of major valleys, i.e. at the intersection of major faults along the edge of structural blocks.

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Mapping Seabed Geomorphology for Sustainable Offshore Renewable Energy Development in Australia

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05E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 11:35 AM - 1:20 PM

Australia's transition to net zero includes installation of offshore renewable energy infrastructure, with the first areas for offshore wind licences declared in Bass Strait in 2022. Multiple uses in and around the declared areas, including the proximity of marine parks, demands a comprehensive understanding of the seabed to balance new energy developments with a sustainable ocean economy. Here, we present a comprehensive regional assessment of seabed geomorphology and explore the relationship between seabed features, processes and benthic habitat distribution by integrating diverse datasets and advanced analytical techniques to unlock insights critical for sustainable offshore development.

Our methodology integrates bathymetry grids, extensive seabed sediment sampling, sediment and hydrodynamic modelling, seabed imagery and sea-level history to characterise geomorphic features and evaluate their stability across multiple spatial scales. The assessment reveals diverse geomorphological landscapes including erosional features such as lowstand marine terraces, rocky marine channels, and deep scour holes, alongside accretionary features including well-preserved marine and aeolian dunes and beach ridges, convex shorefaces, and tidal current ridges. The distribution of these features provides insights into seabed stability and sediment transport for assessing infrastructure suitability. In data-rich areas, particularly the Beagle Marine Park within Bass Strait, we explore the potential of using seabed geomorphology as a proxy for seabed processes and benthic habitat distributions at regional scales.

By delivering foundational geoscience mapping products, our work reduces uncertainty and enables regional risk assessments for project proponents and regulatory assessors. It also supports environmentally responsible development in line with national environmental legislation. Future research will extend validated models from high-resolution studies to declared offshore wind areas across Bass Strait, addressing critical data gaps and enhancing the understanding of the seabed to inform sustainable offshore energy development.

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Predicting climate change impacts on Intermittently Open/Closed Estuaries in Victoria, Australia

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Intermittently open/closed estuaries (IOCEs) are dynamic and sensitive coastal systems, with entrance processes influenced by catchment inflows, wave climate, and tides. Climate change will alter these drivers, with major implications for physicochemistry and ecological functioning. Key uncertainties include the timing and magnitude of change, how responses vary with estuary morphology and hydrology, and whether sea level rise will increase openness by enlarging tidal prisms – or instead promote closure through landward berm migration and increases in berm height. This study assesses how projected changes in wave climate, streamflow, and hypsometry (driven by sea level rise and basin inundation) will influence entrance functioning of IOCEs in Victoria, Australia. Victoria is an ideal a natural laboratory due to spatial variation in climate projections, with western catchments expected to experience earlier and larger rainfall and streamflow declines than eastern ones. The region also contains IOCEs spanning diverse morphologies, infill states, and closure regimes. For 20 IOCEs, continuous daily time series of mouth state (spanning 8-40 years) were compiled and paired with physical process data. Estuaries were first classified on the basis of their morphology and opening/closure regimes and baseline datasets established. Downscaled climate projections were then incorporated into empirical and machine learning models to simulate future changes under mid-century (2050) and late-century (2070) scenarios. Complementary morphodynamic modelling at selected sites explored how morphology modifies process responses in more detail. Results indicate climate change will shift the timing, duration, and frequency of opening events, though impacts vary widely depending on local geomorphology and catchment conditions. Some estuaries are projected to trend toward more persistent closure, while others may experience increased openness. These findings emphasize the vulnerability of IOCEs to interacting climatic and morphological drivers and highlight the need for adaptive, site-specific management strategies.

Holocene infill history and environmental change in a wave-dominated barrier estuary: Kokura Inlet, New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Kokura Inlet, a barrier-enclosed estuary near Nelson, New Zealand, is now largely infilled with sediment. Located in a tectonically active region and subject to significant post-European land-use change, it offers an ideal case study for understanding Holocene estuarine evolution and more recent anthropogenic impacts. This study reconstructs the paleoenvironmental history of Kokura Inlet to determine whether its infilled state is the result of recent or mid-Holocene sedimentation. We used a multi-proxy approach combining vibracoring, stratigraphic analysis, XRF, foraminiferal analyses (modern and fossil), and radiocarbon dating. Stratigraphy from the northeast basin reveals a sharp transition from silty estuarine muds at the top of the cores, to a 0.30 m thick, subangular gravel layer at 0.72-0.85 m depth, followed by a sharp transition back to clayey muds containing marine shells. This abrupt gravel layer likely reflects the seaward edge of the fluvial bayhead delta, with evidence of erosion and channel switching. Radiocarbon dates below the gravel cluster between 6.5 and 6.0 ka, suggesting rapid infilling soon after the post-glacial marine transgression. Fossil foraminiferal assemblages indicate distinct shifts in environmental conditions, including assemblages of more marine and lower intertidal species below the gravel layer, an absence directly above the gravel layer, and an abundance of low- to high-marsh species at the top of the core. This supports our interpretation of a shift from open marine to more brackish conditions during the early-mid Holocene, potentially coincident with barrier formation, followed by progressive shallowing and declining marine influence. The rapid mid-Holocene infilling at Kokura Inlet is similar to other estuaries in the region. Ongoing research will investigate the influence of recent catchment land-use change, with plans for more extensive coring, dating of younger sediments, and comparison of fossil and modern foraminifera. Finally, sediment fingerprinting will allow for the quantification of source inputs within the catchment.

The geomorphic evolution of the Entrance Point foredune ridge plain, Victoria, Australia

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03E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 4:00 PM - 5:30 PM

Prograded coastal barriers, including relict foredunes and beach ridges, record the position of past shorelines. They provide a ‘geoarchive’ of past environmental processes – specifically sediment supply, sea level, waves, and climate. At Entrance Point, the 3 km-wide coastal plain contains >80 undated foredune ridges backed by older parabolic dunes. Its latitudinal position makes it a key site for reconstructing Southern Hemisphere climate, waves, and sea-level history, which remain poorly constrained in this region. This study reconstructs the evolution of Entrance Point using 23 stratigraphically paired Optically Stimulated Luminescence dates, LiDAR morphometric analysis, and stratigraphic data. The most landward parabolic dune is 44±2 ka old and sits atop an abandoned marine cliff. Seaward of the dune, foredune ridges are 6.3±0.4 to 0.14±0.01 ka old and completely infill the former embayment. The oldest foredune set (6.3±0.4 to 4.1±0.3 ka) are the highest and most widely spaced, having prograded 0.2 m/year. A 15 m high relict foredune marks the boundary to the next set (1.60±0.10 to 0.51±0.06 ka), which prograded 0.5 m/year. The outer 1 km consists of “spit-like” recurved ridges 0.40±0.06 to 0.14±0.01 ka old, with progradation rates >3 m/year. Changes in coastal orientation are evident with truncation of ridges to the north. Over past decades, the southern half of the plain has advanced >5 m/year, while the north erodes. The 44 ka dune formed when sea level was 40–60 m lower, exposing much of the shelf. During the post-glacial marine transgression, reworked shelf sands provided a temporary sediment source for the older foredune ridges. Sands from adjacent Corner Inlet then supplied sediment for the younger ridges. Today, tidal currents erode the northern end of the plain. This work provides the first chronological framework for Entrance Point and contributes to broader research on Holocene and modern coastal change in Victoria.

Impact of water abstraction on sand and fine sediment deposition in gravel-bed braided rivers: modelling event-scale sediment dynamics

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03A: Learned lessons about anthropogenic drivers in the river evolution, Auditorium, February 2, 2026, 4:00 PM - 5:30 PM

Fine sediment deposition in gravel-bed rivers can adversely impact habitat quality, and resuspension can result in poor water clarity. This study investigates event-scale fine-sediment dynamics to understand how water abstraction changes sediment deposition in gravel-bed braided rivers. We developed a two-dimensional (depth-averaged) model of a six-kilometer reach of the Rangitata River (Canterbury, New Zealand). Continuous records of suspended sand, silt and clay concentrations were monitored at an upstream flow recorder site and used to provide boundary conditions to the model. Six real flood events, each with distinct flood and sediment signatures, were simulated in the model. Each event was simulated with a range of realistic water abstraction scenarios to investigate how flood characteristics and water abstraction interact to influence sediment deposition. While sediment deposition varied between flood events, scenarios with water abstraction consistently resulted in greater total sediment deposition compared to those with natural, unmodified flow. Flood recession characteristics were also found to have a controlling influence on sediment deposition. Floods with longer recessions resulted in greater deposition, and events with anticlockwise hysteresis—meaning more sediment was transported during the recession phase— also resulted in greater deposition. The insights from this study will help guide flow allocation decision making, as well as helping to separate out the effects of water abstraction from other changes, such as climate change impacts on upstream flow and sediment concentration.

Landslide prediction using an ensemble of rainfall thresholds under data uncertainty.

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Empirical rainfall thresholds for landslide prediction are based on data related to rainfall duration, cumulative rainfall and the landslide occurrence time. However, this data often carries significant uncertainties, which must be addressed, particularly in early warning systems. These uncertainties stem from various sources, including the diverse origins of landslide information (e.g. newspapers, blogs, databases and reports) and the expert judgement used to link landslide events to rainfall records. Inaccuracies in landslide location and timing, along with inconsistent mapping, are the main causes of uncertainty in this data.

To mitigate the epistemic uncertainties affecting model parameters, this study presents an ensemble approach. This approach uses four distinct models to estimate the probability of a landslide occurring and combines their predictions through a voting scheme. The four methods employed are: a Frequentist ordinary Least Square (FLS), a Frequentist Quantile regression (FQR), a Bayesian Quantile Regression (BQR), and a machine learning SYmbolic Regression. Each method essentially acts as an independent expert, providing an estimate of the minimum cumulative rainfall required for a landslide at a given rainfall duration.

The level of agreement among these 'experts' is assessed by counting how many predictions fall above, below or within the uncertainty range of the four thresholds. The prediction with the most votes is then taken as representative of the rainfall condition, while the level of agreement or disagreement indicates the uncertainty in the final prediction. This novel, robust framework offers a practical way to incorporate uncertainty into rainfall thresholds, ultimately enhancing landslide risk management decisions.

Spatio-temporal evolution of human exposure to landslides in Lisbon and the Tagus Valley

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07C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 5:00 PM - 6:30 PM

Landslides are an increasing global threat, driven by climate change and rapid urban expansion. More frequent and intense rainfall events are expected to exacerbate slope instability, while urban sprawl places more people and infrastructure at risk, altering the spatial patterns of exposure.
This study focuses on the Lisbon and Tagus Valley region, Portugal, which has undergone major urban transformations in recent decades. It comprises two main steps: (1) developing a present-day landslide susceptibility map using a 30-year multi-temporal landslide inventory (over 4,000 records) and a bivariate statistical model, validated with ROC curves and the Area Under the Curve; and (2) assessing changes in human exposure in landslide-prone urban and non-urban areas between 1995 and 2021.

Building footprints (2011, 2021), official land use/land cover maps (1995, 2010, 2018), and census-based population (2011, 2021) models were integrated. A function linking building density to urban/non-urban extent was derived from the 2011 building data and the 2010 land use/land cover map, and then applied to estimate the number of buildings in 1995 and 2018. The 2018 estimates were validated using 2021 data.

To refine population estimates, a dasymetric approach was used to allocate residents to individual buildings, including by age group, across both urban and non-urban areas. This method captured both the expansion of the built environment and evolving population distribution patterns.
By overlaying these dynamic layers with landslide susceptibility data, the study provides a detailed spatio-temporal assessment of exposure evolution across the 52 municipalities and 355 parishes of the Lisbon and Tagus Valley region from 1995 to 2021.

Chronology of Pliocene-Pleistocene Fluvial Terraces in the Southeastern Alpine Foreland (Europe, Slovenia)

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02B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 2:00 PM - 3:30 PM

The Pliocene and Pleistocene periods in the European Alps and their forelands were strongly influenced by an interplay of glacial-interglacial cycles and tectonic processes. These changes were among strongest in the highly dynamic European Alps and their foreland, where the deposition and aggradation of Pliocene- Pleistocene terrestrial deposits influenced caused by climatic and tectonic processes took place. In the Southeastern Alpine Foreland (Europe, Slovenia) Pliocene-Pleistocene fluvial sediments were deposited in several intramontane basins: the Slovenj Gradec, Nazarje, Celje, Drava-Ptuj, Velenje, and Krško Basins. These fluvial deposits are either preserved in terrace systems or can be accessed in the basin fill via drillings. The oldest Pliocene-Early Pleistocene terraces are located at the highest landscape position and the youngest, Holocene terraces occupying the lowest positions. The main objective of this study is to unravel and correlate the geochronology of the basins to improve morphostratigraphic models using their sedimentary record. This requires a holistic approach including geomorphology, sedimentology, provenance analysis and chronology. Age dating has been so far applied in the Krško, Velenje and Drava-Ptuj Basins, employing radiocarbon, luminescence, and cosmogenic radionuclide dating. In the Krško Basin, the highest terrace group ranges from 1.2-2.9 Ma and 500-700 ka, the middle terrace group ranges from 95-152 ka, and the lowest terrace group ranges from 13 to 20 ka. In the Velenje Basin, a single age for the highest terrace group returned an age of approximately 2.7 Ma. In the Drava-Ptuj Basin the lowest terrace group was dated to 19-20 ka. The age dates of different terrace levels within Krško, Velenje and Drava-Ptuj Basins are in very good agreement. The overall aim of this study is to provide incision rates in the basins and improve our understanding of landscape evolution of regional Pliocene-Pleistocene basins in the Southeastern Alpine Foreland.

Rock-slope failures as a proxy of a paraglacial denudation crisis. Examples in the Icelandic Westfjords (Dýrafjörður and Önundarfjörður areas)

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10G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 2:30 PM - 4:00 PM

Rock slope failures (RSFs) are widespread in Iceland, particularly in the Westfjords, where inherited glacial topography and steep relief promote gravitational instability following deglaciation. This study aims to constrain the timing and magnitude of postglacial RSFs in the Dýrafjörður and Önundarfjörður regions in order to refine the paraglacial chronosequence and assess their sedimentary contribution to Holocene landscape evolution.

A total of 17 RSFs were analysed using Schmidt hammer exposure age dating, calibrated against radiocarbon dating from organic material collected within or adjacent to the RSF deposits. For each site, block morphometry was documented to characterise transport and depositional mechanisms, while RSF deposit volumetric estimates were derived from field mapping, orthophotography, and high-resolution digital elevation models (DEMs).

The results show that RSFs occurred between 10.7 and 3.3 ka cal BP. Several detachment zones exhibit evidence of polyphased RSFs spanning up to 3,500 years. Estimated individual RSF volumes range from a few million to over 20 million m3. The temporal distribution of events reveals a distinct concentration during the early Holocene: ~50% of the total RSF-derived sediment was deposited within 2 kyr of deglaciation, and ~95% within 4 kyr. A pronounced peak in RSF activity is observed between 7 and 6 ka cal BP, marking a period of increased geomorphic instability.

These results indicate a paraglacial denudation crisis of limited duration, however high geomorphic impact, characterised by intense mass-wasting and substantial sediment delivery. Given the size and coherence of RSF deposits, holocene fluvial and aeolian dynamics are largely ineffective at reworking or evacuating the debris. It seems that only the next ice age might rework such sediment volumes.

Understanding geohazard processes through virtual reality gaming

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

One of the main aims of study programmes on geography-related subjects is to foster the students' understanding of geomorphic processes. Practical constraints often force curriculum developers to stick to traditional learning formats, with limited options for the creation of exciting and innovative learning environments. We attempt to close this gap by creating a freely available physical geography computer game, with a particular focus on geomorphic hazards such as landslides and volcanic eruptions. The primary target audience will be bachelor students, but the environment will be flexible enough to be adapted to the needs of high schools, stakeholders, and interested general public. It will be optimized for immersive virtual reality platforms, but also available as a desktop application in order to increase reach and accessibility. The game is developed with Unreal Engine 5. The scene of the game is an 80 km x 80 km landscape featuring all major geomorphic landforms and biomes in a logical arrangement, from the equator to high latitudes, and from high mountains to the deep sea. Terrain elevation is scaled by 1:10, meaning that the highest mountains peak at roughly 900 m. Players will move through the landscape using different means of transport and guided through the tasks. Tasks will be related to each other and will focus on gaining a deep understanding of geohazard processes in an and exciting interactive way. Rewards will be awarded on the successful completion of specific tasks.

We are currently developing a prototype which is then intended to be exposed to the target audience, so that students are invited to add their own ideas and that the game will be gradually enhanced and improved. It will be made available to the public as soon as considered mature enough.

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The past and the future of landslide runout modelling

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13C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 11:35 AM - 1:05 PM

All models are wrong, but some are useful – for a certain purpose. Landslide runout models, for the purpose of understanding, predicting, and communicating the dynamics of landslide processes, go back to the sturzstrom model of Albert Heim published in 1932. The Voellmy model was developed in the 1950s as a response to some catastrophic snow avalanches in the European Alps. More complex approaches appeared since the 1980s, and operational mass flow simulations have been used in risk management since the turn of the millennium. With increased physical understanding and computational power, model development shifted towards two- and multi-phase models suitable for complex processes. In the early and mid-2020s, such models have been used within multi- or interdisciplinary analyses of major landslide disasters. They have proved successful for reconstructive simulations, whereas major challenges remain in regard to predictive simulations. At the front of research, full 3D models use the power of game engines. At the same time, experts dealing with every-day operational landslide risk management prefer simpler approaches, such as derivatives off the Voellmy model, with manageable parameterization. This is the manifestation of a simplicity-complexity dualism in landslide modelling, where “pragmatists” in practice have different views than “detailists” in science, the latter postulating a need for complex, parameter-hungry models representing the processes in all detail. This dualism might become more pronounced in future, with widespread decrease of computer literacy and opening of a “modelling gap” between those understanding models and those just using models. To some extent, AI might be a game changer in landslide runout modelling, but the speed at which different levels of AI integration will occur yet remains unclear. Another evolving field consists in the use of model results for science communication, where VR might play a central role.

Study on the coupled evolution of geomorphology, climate and ecology in the western Pamir Plateau since the late Cenozoic

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04K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 3, 2026, 9:35 AM - 11:05 AM

The Pamir Plateau, known as the “Roof of Central Asia”, serves as not only a key structural-geomorphic hub for the Tibetan Plateau’s northwestward expansion, but also a major climatic barrier modulating mid-latitude westerlies and the Indian monsoon, resulting in windward precipitation unloading while leeward foehn drought, with mean annual precipitation fluctuating dramatically between 50-300 mm. The strong hydrothermal gradient shapes an ecosystem controlled by altitude and precipitation, transitioning from low-altitude temperate deserts to mid-high mountain grasslands/shrubs, and further to high-altitude alpine meadows and periglacial sparse vegetation. Thus, exploring the climate-ecological evolution and formation mechanisms of Pamir Plateau is vital for understanding regional Earth-system interactions and providing evidence for the Tibetan Plateau’s uplift history and climate-environmental impacts. In our study, pollen will be selected as core proxy due to its sensitive response to geomorphology, climate and ecology, and investigates along eastern-western Pamir will be conducted as follows: 1) 51 collected surface soil pollen samples will be used to clarify spatial patterns of drought-tolerant desert vegetation, alpine meadows and mountain forests, and pollen-climate-diversity relationships and transfer functions will be quantified in combined with remote sensing and meteorological data. 2) The Cenozoic strata in the western Pamir Plateau have been surveyed. Zircon U-Pb dating and magnetostratigraphic analysis will be conducted on 3 suspected volcanic ash samples from the Dhoak Pathan Formation (Middle-Late Miocene to Pliocene) and 168 paleomagnetic samples from the Kamlial Formation (Middle Miocene), so as to establish an accurate chronological scale for the study area. 3): Identification and statistics of the obtained pollen samples will be carried out to reconstruct climate-plant diversity and altitude history since the Miocene. 4) Multiple models will be used to provide key evidences for the comprehensive analysis of the coupling relationship between tectonic uplift, climate change and biological evolution in the Pamir Plateau.

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Holocene extreme flood events in the Yi and Shu river basins of the Haidai region (Shandong Province, China)

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03B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 4:00 PM - 5:30 PM

Modern floods in the Yi and Shu river basins (YSRs), the largest mountain torrent channels in the Haidai region, Shandong Province, China, are often triggered by monsoonal rainfall, shaping the fluvial landscape through frequent inundations. However, our understanding of flood events remains limited due to short observational records and their limited spatial distribution. The lack of long and complete palaeoflood records limit our understanding of extreme flood events, hindering risk prediction and prevention efforts. In this study, we examine the sediment characteristics of two palaeoflood profiles in the YSRs and, based on twelve optically stimulated luminescence (OSL) ages, four 14C ages, and grain size-sensitive components, identified three exceptional palaeoflood periods: 4.1–3.9 ka, 3.4–2.9 ka, and 0.88–0.7 ka, along with a less severe flood period during 0.7–0.1 ka. An analysis of pollen records, stalagmite data, historical flood records, and El Niño-Southern Oscillation (ENSO) activity reveals a strong correlation between palaeofloods in the YSRs basin and other major rivers (Yellow River, Huai River, Han River, and Yangtze River) with a significant negative correlation to the intensity of the East Asian Summer Monsoon and a positive correlation to the ENSO intensity. These palaeoflood events are typically closely linked to global climate shifts during the late Holocene, including the 4.2 ka event, the 2.8 ka event, and the Little Ice Age. Simultaneous occurrences of climatic deterioration (arid and cold) and palaeofloods during 4.1–3.9 ka and 3.4–2.9 ka may have contributed to cultural disruptions during the Late Longshan Culture period and the decline of the Shang culture in the Haidai area. We argue that these hydroclimatic events are regional expressions of global climate phenomena, and the identified palaeofloods offer key insights into how East Asian rivers respond to global climate change.

Assessment of seasonal flood hazard using remote sensing

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09D: Engineering Geomorphology AND Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 11:35 AM - 1:05 PM

The basic principle of flood risk management is a continuous cycle of flood risk assessment, which provides the most suitable data for decision-makers to choose the best measure to decrease flood risk. Multiple factors need to be accounted for, and some are more variable than others. The impact of climate change on flood hazard in Central Europe remains uncertain. Yet we can observe the influence of increased average global temperature in the trend of decreasing number of days with snow cover. Moreover, changes in land cover during the year also impact the rainfall-runoff process in the basin. Absence of foliage alters surface roughness, and uncut vegetation can be swept by heavy rainfall, reducing the infiltration capacity of land cover. To better understand flood hazard and its variability during the year, modern methods and datasets are needed. Satellite scanning technologies provide high-density and high-quality data with rich historical archives. Together with the use of new methods of machine learning algorithms (random forest), it offers quick identification of land cover properties for large areas in near-real time. On the other hand, detailed LiDAR produces big data for generating digital elevation models with high resolution for large areas. Our aim is to use these datasets as input for rainfall-runoff modelling to find differences in flood hazard during different seasons of the year and discover which factors influence flood hazard most.

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Spatio-temporal occurrence of deep-seated landslides in the Curvature Carpathians of Romania (Vrancea seismic region) within a multi-hazard assessment framework

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12C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 9:35 AM - 11:05 AM

The Curvature Carpathians of Romania (Vrancea seismic region) represent one of Europe’s most important and active multi-hazard hotspots. A wide range of predisposing, conditioning and triggering factors contribute to the occurrence of a large spectrum of landslide types (from shallow translational earth slides and flows in the outer hills to deep-seated rock slides in the inner mountains). Intense seismicity (thirteen earthquakes of Mw>7, seven of Mw>7.5 and three of 7.9<Mw>7.7 in the last three centuries) significantly amplifies regional slope instability. Among the latter, deep-seated landslides are particularly important: they serve as paleo-environmental markers and are crucial for understanding long-term landscape evolution, hazard dynamics and risk management needs, especially under climate change and increasing human pressure. Despite their high density and strong connectivity, especially the temporal occurrence pattern of such deep-seated landslides remains incompletely understood. This limits the knowledge of triggering mechanisms, thresholds and recurrence intervals, which is essential to produce robust hazard/risk scenarios. This study presents an in-depth analysis of historical landslides records (1990-2025), alongside investigations of older, dormant and relict landslides for which age determinations have been pursued. A special focus is on earthquake-induced landslides, conditioned in their morphology and morphodynamics by the complex seismic-climatic relationship. These landslides are key in estimating and quantifying single-hazard and multi-hazard risks. This paper aims to support understanding of deep-seated landslides types, failure mechanisms, morphometric characteristics and sensitivity to topoclimatic conditions. By refining this knowledge, the paper emphasizes the growing importance of new emerging concepts like multi-hazard impact chains, systemic vulnerability and compound disaster risk, as well as climate variability and change in shaping future multi-hazard/risk management strategies.

Quantifying Landscape Response to Glacial-Interglacial Climate Forcing in Southern Patagonia, Argentina

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08G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 9:35 AM - 11:05 AM

Spectacularly-preserved fluvial terraces along Atlantic-draining rivers in Argentine Patagonia archive information about the processes driving landscape evolution. New detailed mapping of terraces from the Río Santa Cruz and Río Shehuen (50ºS) evidence a regional-scale incision. However, the timing and driving mechanism of tilting and incision remain debated. Radiometrically dated basalts that flowed over existing terraces document the existence of eastward-draining paleo-valleys by 3.2 Ma. We determined the age of 11 unique terrace surfaces with cosmogenic ^{10}Be exposure dating of 64 samples obtained from surface cobbles and amalgamated pebbles, as well as a depth profile. Inheritance-corrected terrace ages range from 33 ka to 1.5 Ma, and are in agreement with regional proxies for the timing of Patagonian glaciations. These are the oldest surfaces to be dated in Southern Patagonia. Our results show a regional long-term uplift of the Patagonian foreland at a rate of 130–180 m/Ma, and an onset of rapid incision starting at 1 Ma. Our new exposure ages are comparable to dated fluvial terraces of other Patagonian rivers and Andean geomorphic archives recording increased incision after ~1 Ma. While the onset of fast incision aligns with the decline of greatest ice extent in Patagonia and the Mid-Pleistocene Transition, terrace ages and geometry underscore the need to link net incision to regional geodynamic processes. The observations cannot be explained by climate-forcing alone, but likely relate to the evolution of the mantle underlying the slab window. Our study highlights the complex interplay between climate-driven factors and regional geodynamics in shaping the fluvial landscape of southern Patagonia.

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Decadal-Scale Surface Displacement Analysis of South Island (NZ) from Sentinel-1 Radar Data

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10D: Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 2:30 PM - 4:00 PM

This paper presents the results of a ground surface displacement analysis of the South Island area of New Zealand, based on radar data from Sentinel-1 satellites as part of the Copernicus mission. The dataset included nearly 7,000 SAR images from 2014-2025, processed using the Small Baseline Subset (SBAS) radar interferometry method. On this basis, nine independent time series were generated, covering different satellite flight paths.

Analysis of the results made it possible to identify areas showing significant ground surface displacement, both of a landslide nature and related to subsidence or anthropogenic activity. Particular attention was paid to mountainous regions and areas transformed by human activity. The SBAS results were additionally combined with analysis of secondary parameters such as coherence and amplitude of the radar signal, which allowed more precise recognition of changes in land cover and surface properties.

The results provide valuable information on contemporary ground surface dynamics on a regional scale and can be applied to geomorphological studies of active slope processes, slope stability, land use changes and natural hazard monitoring, among others. The work highlights the potential of satellite radar methods as a tool to support long-term observations of large-scale geomorphological processes.

Microtidal beaches under pressure: long-term (1956-2023) multifactorial drivers of shoreline change in the Balearic Islands, Spain

Dr Miquel Mir-Gual[1], MSc Jaume Company[1], MSc Francisco Cuello-Llobell[1], MSc Alexandre Moragues[1], Dr Julián García-Comendador[1], Dr Joan Estrany[1]
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01E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 11:40 AM - 1:10 PM

Understanding long-term shoreline dynamics in insular and tourism-dependent coastal settings is essential to anticipate the geomorphological and socioeconomic impacts of climate change. The Balearic Islands (W Mediterranean) provide an ideal natural laboratory to assess long-term shoreline dynamics, due to their diversity of beach types, orientations, and levels of human impact. The region is characterised by low tidal energy but is increasingly affected by both anthropogenic and climatic pressures. A multidecadal analysis of 22 beaches across the archipelago was conducted, combining historical shoreline positions (1956–2023) -extracted through the ArcGIS SEATool- with hydrodynamic datasets -wave climate and sea level anomalies from Copernicus Marine Service- and qualitative factors -orientation, beach type, and coastal engineering-. This integrated database (>80,000 records) enabled a comprehensive assessment of both morphological trends and the process-type controls shaping shoreline behaviour. The analysis revealed a marked spatial variability in shoreline changes, where most beaches exhibited erosional trends (mean Linear Regression Rate ≈ –0.25 m yr-1), although certain morphotypes, such as open beaches with northern exposure, evidenced pronounced retreat (>–0.5 m yr-1). In contrast, sheltered pocket beaches and nourished urban beaches tend to remain relatively stable or even accrete. Island-scale differences also emerge, with northern Mallorca and Eivissa showing stronger erosional signals compared to southern Menorca and Formentera. These trends were significantly modulated by wave exposure and orientation, while human interventions (nourishments, groynes) exerted a critical influence on local shoreline resilience. Despite being apparently stable under low tidal energy, Mediterranean microtidal beaches were demonstrated highly sensitive to the feedbacking interaction between geoforms, wave dynamics, and human management. By linking historical shoreline evolution with ongoing sea-level rise, this study provided new insights into the vulnerability of insular coasts to near-future climate scenarios, contributing to broader discussions on coastal adaptation strategies in microtidal settings worldwide.

1205

Observing Deltaic Surface Water Elevation with an Integrated SWOT-Based Workflow

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08F: River Deltas: Dynamic Systems Under Climate and Human Forcings, Conway 1, February 5, 2026, 9:35 AM - 11:05 AM

Monitoring complex wetlands and deltaic systems is essential for water-resource management, flood-risk assessment, and for understanding hydrological and ecological processes in the context of climate change. The launch of the Surface Water and Ocean Topography (SWOT) satellite mission offers unprecedented opportunities for surface hydrology by providing high-resolution data on the height and extent of open-water and flooded-vegetation bodies.

This paper presents the development and application of a comprehensive methodological workflow for processing SWOT Level 2 Pixel Cloud (L2_HR_PIXC) data to characterize in detail the hydrological dynamics of several deltas and wetlands (e.g., Rhône, Danube, and Mississippi deltas). The workflow is implemented entirely in the Python programming language, addresses the full processing chain from data acquisition to final analytical products, and is available on GitHub.

A classification algorithm is applied to the raw data to refine the distinction between water and land, improving the standard product classification. The filtered points are interpolated into a regular 30 m grid using a hybrid k-nearest neighbors (KNN) method, then spatially aligned and aggregated into a spatio-temporal data cube, forming the basis for multi-temporal analysis.

Key final products derived from this data cube include maps of mean daily water level; maps of temporal variability highlighting areas with the greatest fluctuations; a spatially weighted water-frequency map; anomaly maps; and minimum and maximum water height and extent maps, which, when integrated with wind speed and direction, river discharge, and wave conditions, allow us to better understand ecosystem dynamics and ongoing processes. The final accuracy of the water-surface elevation estimates is quantitatively assessed through validation against water-level data measured at in situ stations. Initial validation of SWOT data against these in situ measurements revealed a high level of accuracy ($R^2 > 0.8$). Understanding these systems and how they will respond to climate change depends on monitoring these processes.

Widespread landslides across southern Appalachia following Hurricane Helene in September 2024: A truly historical and catastrophic geomorphic event

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05C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 11:35 AM - 1:20 PM

The southern Appalachian Mountains, USA, have been shaped by erosion over millions of years. In historical times this includes decadal-scale storm sequences that trigger hundreds or even thousands of landslides. In September 2024, Hurricane Helene along with a two-day predecessor storm emerged as one of the largest of these recorded erosional events with disastrous consequences. Helene tracked into the steep, rugged, and already soaked terrain of the Blue Ridge Escarpment, rainfall broadly exceeded intensity-duration thresholds for shallow landslide initiation. Combined with the heavy predecessor rainfall, 72-hour precipitation totals recorded over 781 mm. This prolonged and intense rainfall, paired with hurricane-force winds gusting over 170 km/h triggered widespread landsliding, tree blowdown, and destructive flooding across Georgia, Tennessee, Virginia, South Carolina, and especially North Carolina. Through a combination of field reconnaissance, mapping from aerial and satellite imagery, and other reports, the U.S. Geological Survey and collaborators characterized the landslide event and published a preliminary inventory with 2,217 landslides, hundreds of which impacted critical infrastructure, damaged private property, and directly caused at least 24 fatalities. Landslides typically initiated as shallow translational failures, some with impressive scars exposing weathered bedrock. In many cases, several landslides coalesced, transitioning into debris flows with remarkable mobility, traveling over ten kilometers at devastating speeds. Additionally, numerous hillslope “blowouts” occurred under artesian conditions, highlighting the excessive groundwater pressures driving the geomorphic responses. Mapped landslides and tree blowdown clustered around southeast facing slopes, which bore the full force of orographically enhanced rain and wind. Our initial observations of general spatial patterns and specific landslides elucidate how landslides mobilized woody debris and delivered massive sediment loads to channels, streams, and ultimately reservoirs. These findings underscore the geomorphic significance of this event, particularly in the context of historical hurricane-triggered landslides across this geologically complex mountain range.

Landslides: from landscape evolution to geohazards and tools for disaster-risk reduction

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04J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 9:35 AM - 11:05 AM

While geological processes act over long periods of time to control landscape form, much of the physical work related to the downslope movement of sediment is due to episodic and catastrophic landslide events. As populations move into more mountainous and hilly terrain, these geohazards also pose a clear threat to public safety and economic wellbeing. This intersection of geology and society presents an opportunity to apply knowledge in geomorphology, hydrology, and mathematical modeling to develop tools that can help us to not only better understand the Earth but also provide timely and effective warnings to reduce landslide-related losses. This presentation will focus on how traditional analysis of simple topographic features such as slope, relief, and drainage area, along with emerging data-driven and physics-based modeling are being leveraged to research that benefits the public, decision makers, and advances scientific understanding of landslides.

Avulsion and low flow channel incision affect inundation in semiarid floodplain wetlands.

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[1]Macquarie University, Sydney, Australia, [2]Department of Climate Change, Energy, Environment and Water, Dubbo, Australia

11A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 5:00 PM - 6:30 PM

Dryland rivers and wetlands are reworked under by episodic erosion and deposition during seasonal, intermittent, or ephemeral flow regimes. However, channelisation of wetlands due to erosion is an ongoing problem in Australia and around the world. Anthropogenic changes, combined with future climate change projections, are set to accelerate this phenomenon. Avulsion, the process of channel relocation on a floodplain, redistributes flow and alters inundation patterns. Excessive channel erosion can lead to changes hydrology and may reduce floodplain inundation, ultimately affecting wetland ecological health. This study addressed the relationships between channel erosion, morphometrics, hydrology, and inundation along Gum Cowal, in the eastern Macquarie Marshes, Australia. This system sits on a tipping point between increased erosion and reduced inundation and has a downstream decline in mean peak annual discharge of 18% due to distributary channels and overbank flooding. Spatial data analysis, field measurements, and HEC-RAS hydraulic modelling were used to assess channel forms and processes. Symptoms of erosion, including changes in channel size and shape, hydrology, and nearby inundation, varied between sites and over time. Hotspots of change included bifurcation and avulsion points, incising low flow channels, and return gulling channels. For example, a major avulsion accounted for ~12% of total channel capacity in 2008, but this increased to 15% in 2024 due to erosion and enlargement. There was similar diversity in the underlying factors contributing to erosion at these sites, such as roughness, modelled flow depth, velocity, shear stress and stream power. Modelling showed that increased roughness scenarios can help reduce flow velocity and thus reduce erosion risk, highlighting the importance of incorporating roughness into river and catchment management strategies. Understanding the relationships between avulsion, erosion and inundation can assist restoration activities to support ecosystem health management.

Multi-metric Assessment of River Hydromorphology for Reach Prioritisation and Implementation of Nature-based Solutions

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Given the overwhelming importance of hydro-morphological parameters in stream restoration frameworks, a multi-metric, eco-geomorphic approach was adopted to gauge river health status of a tropical river in eastern India (River Silabati), where such prior studies are scarce. While the Morphological Quality Index (MQI) aptly identified the causes of morphological disturbances within the reaches, site-specific Horton Water Quality Index (WQI) values highlighted the direct relation that channel morphology and water quality have on stream ecology. The channel morphological condition was also correlated with vegetation indices like the Qualitat del Bosc de Ribera (QBR), Riparian Strip Quality Index (RSQI) and Normalised Difference Vegetation Index (NDVI), to obtain a holistic picture of overall stream health. Results show an overall moderate to low channel morphological quality (0.68) and similarly deteriorating riparian health conditions (almost 80% reaches are strongly altered), due to anthropogenic causes such as extensive riverbed sand mining, deforestation and riparian zone land-use transformations, which facilitate bank erosion and excessive sediment contribution to the channel. The implementation of nature-based solutions in combating the issue of riverbank instability along the affected reaches was also examined. Vetiver grass buffers were planted on test plots near eroding banks. The grass' dense over-ground growth reduced river flow velocities by 0.8-1.0 m/s (based on HEC-RAS 1D simulations), along the outer bends of meanders in otherwise erodible banks, due to the increased roughness. Its deeply-penetrating fibrous root system enhanced the soil physical structure and reinforced riverbanks, with Vetiver grass treated plots showing increased saturated hydraulic conductivity rates, higher organic matter content and percentage of water-stable macro aggregates and a declining bulk density. The cost-effectiveness of Vetiver grass buffer implementation against that of incorporating hard engineering structures (at 1/10th the cost), further advances its efficacy for riverbank stabilisation in the identified morphologically degraded channel reaches, particularly in resource-poor locales.

Late Holocene Channel Adjustments from Meandering to Low-sinuous along the Lower Subarnarekha River in Eastern India: Implications of Paleoclimatic Changes

Dr Sayoni Mondal[1], Prof. Manoj Kumar Jaiswal[1]
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03B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 4:00 PM - 5:30 PM

Throughout the Late Holocene, river responses to tectonic deformations, climatic perturbations and eustatic changes have sculpted fluvial landscapes globally. Such river responses mostly manifest through changes in channel planform morphology, induced by discharge and sediment fluxes. Investigating these channel pattern changes become especially important while discerning palaeohydrological conditions and river behavioral trajectories, which have implications for river management and restoration, particularly where riparian lands are intensely cultivated or settled. Although such channel pattern adjustments are relatively well-researched for planform transitions between meandering and braided streams, similar transitions from an initial meandering to laterally stable, low-sinuous courses are far less understood. This study examines river responses to climatic and eustatic changes during the Late Holocene in the Middle-lower Subarnarekha River basin in eastern India. The presence of incised meanders on upper terrace surfaces, lateral meander bend migration signatures and well-defined scroll bar sequences all point towards a change in the region’s hydrological regime and highlights the trunk-tributary responses to such adjustments. The scroll bar sequences and paleo-meander cutoffs were studied using a combination of sediment textural analysis, ground-penetrating radar (GPR) surveys and optically stimulated luminescence (OSL) dating techniques, along with historical maps (1780–2000 CE), to reconstruct the evolutionary trajectory of this river and its possible paleoclimatic forcings. Cartographic analyses revealed the paleo-meander belt width to be about 2680 m, within which the present active channel width is about 1460 m. Bankfull paleo-discharge was estimated using channel dimensions of remnant cutoff meander bends. This was then related with changing monsoonal regimes during the Holocene, as discerned from various climate proxies. Initial results suggest that these meander cutoffs started forming during 1 – 2 ka in response to monsoon induced discharge fluctuations. The variations in dates discerned from tributary and trunk river terrace deposits denote differential incision rates and timelines in the region.

Understanding Uncertainty in Landslide Mapping: Towards Better Inventories and Safer Decisions

Dr Alessandro Mondini[1], Dr Michele Santangelo[2], Mr Boyun Yu[3], Professor Mio Kasai[4], Professor Takashi Oguchi[3], Dr. Fausto Guzzetti[1]
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02C: Addressing Uncertainties in Landslide Prediction Across Spatial and Temporal Scales, Dobson 2, February 2, 2026, 2:00 PM - 3:30 PM

Landslides are present on all continents, playing an important role in the evolution of landscapes. They also pose a serious hazard in many areas of the world. Landslide inventory maps document the extent of landslide phenomena in a region and provide information that can be used to investigate the distribution, types, patterns, recurrence, and statistics of slope failures.

Despite their importance, landslide maps and their systematic updates remain surprisingly limited, often produced on demand or as academic exercises. We believe this is mainly due to the intrinsic difficulties in their production and uncertainties inherent in preparing landslide inventories. Landslide inventories are rarely evaluated. The quality of a landslide map, which depends on the accuracy, type, and certainty of the information reported, is difficult to assess, limiting its use, in particular in a decision-making context.

This talk aims to review, compare, and confront past and present works on landslide mapping, looking for common and diversified trends to identify unique and shared needs, as well as best practices, particularly concerning the validation and quality assessment of the products. By highlighting the consequences of overlooking inventory reliability and the lack of standard approaches, we hope to raise awareness in both the scientific and operational communities. Our goal is to stimulate a broader discussion on how uncertainty and validation gaps can undermine the effective use of landslide maps for hazard assessment, risk mitigation, and land-use planning, impacting the safety of communities, the allocation of resources, and the credibility of geoscientific advice.

Trunk glacier vs local ice cap: Lateglacial moraine suite marks sudden local advance at the ice-decay

Camilla Vidi[1], Dr Giovanni Monegato[2], Dr Sandro Rossato[2], Arianna Randazzo[4], Tommaso Trentini[3], Prof. Alessandro Fontana[1]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

During the Last Glacial Maximum the southeasten European Alps were occupied by an extensive glacial system dominated by the Adige glacier, the largest of the southern side. In the prealpine sector, before reaching the foreland, this glacier was up to 1400 m thick. It flowed into multiple tributary valleys and had several transfluence into adjacent catchments significantly shaping the landscape. One of these transfluences occurred in the Terragnolo Valley, where the Adige Glacier faced the flow of the local apparatus that flowed down from the Pasubio ice cap (2200 m a.s.l), whose thickness was in the order of some hundreds of meters. A very thick glacigenic succession characterizes the sector in which the two systems merged, about 10 km into the Terragnolo Valley. The deposits in this area are dominated by local bedrock clasts (mostly carbonates), while those related to the trunk glacier (including crystalline and volcanic rocks) are marked by few scattered boulders.

Following the onset of deglaciation after 18.5 ka, the trunk glacier rapidly collapsed; whereas, the local glacier flowed down to 650 m a.s.l. In the Valle dei Lombardi, a left tributary of the Terragnolo system, a local ice snout formed a suite of four lateral moraines, which are connected to glaciofluvial deposits that show high depositional dip at the outlet of the valley and ascribed to dead-ice melting. These landforms showed that rapid glacier advances and stabilizations occurred in a relatively short period of time. The study site also shows how glacier activity led to sectors of high rates of glacigenic deposition and fast landscape reshaping during the onset of the ice-decay.

Lateglacial glacier advances in the southern Dolomites (NE Italy), geomorphological and chronological constraints

Dr Giovanni Monegato[1], Dr. Lukas Rettig[2], Prof. Adriano Ribolini[3], Prof. Matteo Spagnolo[4], Dr. Sandro Rossato[1], Prof. Paolo Mozzi[2]
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01G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 11:40 AM - 1:10 PM

The Dolomites host one of the most superb alpine landscapes of the Earth; they were heavily shaped by Alpine glaciations and, during the Last Glacial Maximum (LGM, 26.5-19 ka), an intricate network of glaciers, with a thickness up to 1000 m, filled their main valleys.The downwasting of the glaciers began at about 18.5 ka and lasted less than two millennia. All the major valleys experienced a dramatic ice downwaste at the beginning of the Oldest Dryas (18.9-14.6 ka), and in the second half of this cold stadial a stabilization of the glacier's snout took place in many catchments. Suites of well-developed frontal and lateral moraines record this phase of glacier readvance. The study of moraines located on the southern side of the Lagorai Mountains and in the Pale di San Martino massif, and the relative 10Be and 36Cl surface exposure dating of erratic boulders, reveal two major Lateglacial stabilizations of the glaciers before the Bølling-Allerød Interstadial and a third during the Younger Dryas stadial (12.9-11.7 ka). The presence of rock-glaciers, reshaping part of the moraines, indicates subsequent phases of periglacial activity. The Equilibrium Line Altitudes (ELA) of these Lateglacial glaciers were about 300, 450 and 650 m higher than that of the LGM in the Venetian Prealps (Rettig et al., 2023). Our data provide valuable insights into the chronology of the post-LGM ice decay and into the climatic conditions in different parts of the Dolomites during the Lateglacial.

A landscape analysis to drive water resilience: infiltration basins in sub-basins of the Ivaí River, Southern Brazil

Dr Eduardo Morais[1], MSc Mariana Tondati[1], Dr Américo Marques[1], Dr Marta Souza[1], Dr Otávio Montanher[1], Dr Hélio Silveira[1], Dr Cíntia Minaki[1], Dr Vanderlei Grzegorczyk[1], Dr Edison Fortes[1], Dr Édipo Cremon[2]
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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Infiltration basins are an important strategy to mitigate water scarcity. The disconnection of hydrological and sedimentological flows caused by such structures can ensure delayed runoff, increase groundwater recharge during dry periods, and reduce river siltation. These measures address the growing concern surrounding water resources management. However, identifying suitable areas for the installation of such structures and integrating these measures into hydrographic basin planning remains a challenge. In this context, the Ivaí River basin (36,662 km²) stands out, characterised by intensive land use for cropping (soybeans and maize) and hosting the longest free-flowing river in southern Brazil. Initial investigations in the Alonzo River sub-basin (2,824 km²) – selected due to its lowest specific discharge, high sediment yield, and unregulated tributaries – employed map algebra with fuzzy logic applied to pedological and geomorphological data, indicating that the viability of such structures is enhanced by the presence of latosols and slopes between 5% and 12%. As a continuation of the research, this next step will conduct a more detailed analysis based on field data and geoprocessing in sub-basins representative of the geomorphology of the Ivaí River. The analyses in the Andirá (258 km²) and São Pedro (139 km²) sub-basins include infiltration-rate measurement, morphometric indices, and calculation of water surplus. Water availability will be estimated using a simplified hydrological model based on precipitation and evapotranspiration data. The morphometric analysis will consider slope, flow accumulation, and aspect values. Infiltration rates will be obtained through in situ measurements with an automated digital permeameter. Subsequently, these variables will be integrated through map algebra and the results validated using topographic data and drone imagery. The study involves engagement with municipal authorities and other stakeholders to support the dissemination and application of scientific knowledge.

A million-year history of terrestrial and marine environments for northeast Australia from palaeoecological and sedimentological analysis of marine cores

Professor Patrick Moss[1,3], Associate Professor Gavin Dunbar[2], Dr Caroline Brownhall[3], Dr Zoe Thomas[4], Professor Chris Turney[5], Professor Helen Bostock[3], Emeritus Professor Peter Kershaw[6]
[1]Queensland University Of Technology, Brisbane, Australia, [2]Victoria University of Wellington, Wellington, New Zealand, [3]The University of Queensland, Brisbane, Australia, [4]Southhampton University , Southhampton, United Kingdom, [5]Heriot-Watt University, Edinburgh, United Kingdom, [6]Monash University , Clayton, Australia

07F: Tropical coral reefs and reef-lined coasts AND Delta Geomorphology Observed from the Past to the Present: Interactions of Natural Processes and Anthropogenic Influences, Conway 1, February 3, 2026, 5:00 PM - 6:30 PM

The Ocean Drilling Program (ODP) Leg 133 collected sediment cores from 16 sites (ODP Sites 811 to 826) from the carbonate platforms and troughs of northeast Australia between Latitudes. 15oS and 20oS. A key focus was to investigate the development of the Great Barrier Reef (GBR) and its relationship with the Marion and Queensland Plateaux. Site 820 proved to be a key record, through the provision of a high-resolution sedimentological record that is thought to cover a significant proportion of the Quaternary. A range of proxy data (pollen, charcoal, molecular biomarkers, oxygen isotope, particle size, elemental and carbonate mineral composition) from this sediment record, as well as the nearby Site 822, provides insight into terrestrial and marine environmental change for at least the last million years. In particular, it covers the Mid Pleistocene Transition (MPT), which observed the shift from 41,000-year obliquity forced glacial/interglacial cycles to the current 100,000-year eccentricity dominated cycles, as well as the development of the GBR. This presentation will discuss how the MPT impacted the Wet Tropics terrestrial and marine environments, including evidence of long-term changes in vegetation and fire regimes, as well as its potential role in the development of the GBR. In addition, the broader impacts of the Quaternary evolution of the GBR on terrigenous sediment transport into the Queensland Plateau will be examined, particularly in terms as an indicator of reef formation and implications for mangrove growth on the continental shelf.

1210

The Human Footprint of Dredging and Disposal in Large Navigable River Corridors

Professor Joann Mossa[1], Dr. Yin-Hsuen Chen[2], Ms. Sienna Silvest[1]
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04I: Human Footprint in River Basins, Conway 4, February 3, 2026, 9:35 AM - 11:05 AM

Dredging large navigable rivers for deep draft vessels or building major engineering projects requires the disposal of sediments, typically in nearby areas. This study examines anthropogenic landforms created and quantifies the geomorphic transformation of fluvial landscapes through dredge material disposal and discusses lessons for sediment management. We use hydrographic surveys, Lidar DEM of Difference (DoD), historical maps, and satellite imagery to interpret the variety of anthropogenic changes. Channel margin disposal sometimes results in enlarged sand bars. Disposal within wing-dike fields directs the flow towards the center of the river. When sediment disposal occurs at upland sites, landforms include floodplain mounds of varied sizes, which can reenter the river channel through lateral erosion. When dredges dispose of sediment in the thalweg, it then gets reworked by the river, creating a perpetual dredging cycle. Dredge material forms the basis of many artificial or enlarged islands, sometimes touted as habitat-building projects. This presentation overviews these anthropogenic and fluvial landforms and management issues created through intensive riverine dredging on the Apalachicola, Mississippi, Atchafalaya, and Savannah rivers and elsewhere. Understanding the long-term geomorphological impacts of dredging and dredge material disposal provides valuable insights for sustainable river management, offering a pathway to balance navigation and flood mitigation while minimizing unintended consequences.

Multiscale mass wasting in a passive margin canyon system: Evidence from Pegasus Canyon, offshore New Zealand

Ms Hanna Marxen[1], Dr Joshu Mountjoy[2], Dr Rachel Barrett[1], Professor Sebastian Krastel[1]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Submarine landslides occur on continental margins worldwide and pose a significant geohazard due to potential tsunami generation and more directly-induced damages, such as destruction of submarine infrastructure. Particularly high densities of landslide scars occur in submarine canyons and associated channel systems. To assess the hazard potential of landslides in these canyons, it is crucial to determine their triggering mechanisms. However, proposed mechanisms are manifold, and the role of tectonics as a primary driver for large scale slope failure remains widely debated. Pegasus Canyon, a submarine canyon cutting into New Zealand's continental shelf off the South Island's East Coast, shows an abundance of landslide scars ranging from very small to >5 km3. The canyon sits just beyond the high ground shaking zone of the Hikurangi Subduction zone and, therefore, provides an ideal research area to investigate landslide distribution in a submarine canyon system that can be compared with canyons on active tectonic margins.

During cruise SO310 in early 2025, Pegasus Canyon was mapped extensively with a Parasound (sub-bottom) system (vertical resolution ~20 cm), providing a dense grid of data over various landslides in the canyon. The data is used to investigate landslide events at high resolution, enabling a detailed mapping of landslide volumes and investigation of their temporal distribution.

The Parasound data image widespread landslide deposits. Some areas of the channel axis are characterised by clusters of numerous stacked deposits, while others show few or no deposits. Contrasting to seemingly recent landslide deposits based on bathymetry data, our data show a drape of younger background sedimentation covering some deposits, highlighting the importance of sub-bottom data for assessing the age of landslides. Additional sediment cores collected during the cruise provide further constraints on the timing of these events, enabling comparison of possible triggering mechanisms and improved hazard prediction for future events.

Dynamic geomorphic processes in New Zealand’s large alpine lakes

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03C: Marine and lacustrine geomorphology - mapping and applications, Dobson 2, February 2, 2026, 4:00 PM - 5:30 PM

Seven of Aotearoa New Zealand’s ten largest lakes are in glaciated alpine catchments. Repeated glaciations have carved out deep and steep-sided glacial troughs, which have become large and spectacular lakes, following major glacial retreat approximately 15,000 years ago. Lakebed geomorphic sediments and landforms record the impact of early-stage progressive deglaciation, ongoing sediment infilling and erosion to the present day, as well as the overprinting influence of tectonics and, most recently, anthropogenic modification. These dynamic environments are a source of natural hazards from landslide generated tsunami, earthquake generated seiche and shoreline collapse. Analysing and understanding the geomorphic processes is the key to determining the level of associated hazard and risk. Lake basins also offer an analogy for geomorphic processes in ocean basins, with dynamic processes occurring over accelerated timespans due to the relatively high magnitude of sediment input and steeper submerged slopes.

Between 2016 and 2024 we collected multibeam bathymetric, seismic and core data over the second, third and seventh largest glacial trough lakes; Lake Whakatipu, Lake Wānaka and Lake Takapō, in Te Waipounamu South Island. In Lake Whakatipu and Lake Wānaka we have repeat bathymetric data over the Rees-Dart and Godly delta-channel systems.

These three lakes show contrasting geomorphic expression of a range of dynamic processes enabling type characterisation of alpine lakefloor geomorphology. Between them they exhibit the expression of deglaciation, large mass movements, shoreline mass failure and the input of large volumes of sediment delivered by high powered rivers draining the young and rapidly uplifting Southern Alps. Sediment distributary systems all include some form of submerged delta system but have formed highly varied lakefloor channel systems. These channel systems appear to be active at a sub-annual scale and may be representative of the most dynamic submerged channel systems in Aotearoa New Zealand.

Complexity and legacy of past sedimentary events in an Alpine megafan (Brenta River, Northeastern Italy)

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Fluvial megafans are complex distributive sedimentary systems that are, by definition, very wide (thousands of square km) and with long radius. They are characterized by downstream sediment sorting, from a steep gravelly–sandy proximal tract to a low-gradient, fine-dominated distal part. Channel belts that radiate from the megafan apex are subject to rapid changes through avulsion, that can dramatically shift river courses potentially during a single event.

Owing to their huge dimensions, megafans are mostly studied through remote sensing, with the availability of only few control points such as exposed stratigraphic sections or, more commonly, cores. Scant control on the geology of megafans results in poor knowledge of their long-term evolution and bring about a tendency of oversimplifying the complex interplay between autocyclic processes (e.g. rising natural levees and channels along fluvial ridges that enhance lateral hydraulic gradient and, in turn, crevassing and avulsion) and allocyclic forcing (e.g., active tectonics ,climate and base-level changes).

The distal tract of the Brenta megafan - the widest among those extending at the southern foot of the European Alps – was interested by geological surveys within the CARG project (Geological Mapping of Italy at scale 1:50,000), as well as other dedicated research projects. This allowed a comprehensive understanding of its dynamics since the Last Glacial Maximum (LGM), as well as glimpses of its evolution during the previous glacial-interglacial cycle.

We present the main turning points that characterize the Brenta megafan’s evolution (LGM aggradation/progradation, development of post-LGM incised valleys, major avulsions and activation of megafans’ sectors in the Holocene). We discuss how the legacy of past sedimentary events influences present life on the megafan, such as groundwater protection exerted by the “caranto palaeosoil” in the underground of Venice, flood hazard, and the amplification of seismic hazard in urban areas along the sandy fill of incised valleys.

Rise and fall of the Roman city of Altinum in the Venice Lagoon, as seen from its harbour

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10F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 2:30 PM - 4:00 PM

Ancient harbours are pivotal infrastructures for the development of coastal settlement systems, as well as for the functioning of seafaring and land routes. The importance of historical and archaeological investigation of harbours is accompanied by an equivalent interest for geoarchaeological research. A major relevant point is that the sedimentary fills of harbour basins are often excellent sedimentary archives, that may preserve proxies for the reconstruction of palaeoenvironmental change, relative sea level and anthropogenic impact on the landscape.
Our investigation concerns the harbour basin of the Roman city of Altinum on the inner shore of the northern lagoon of Venice (Mozzi et al., 2012). The harbour was mapped in the Valle Rossa area through remote sensing (Ninfo et al., 2009). Geophysical surveys, archaeological materials found in surface surveys and shallow stratigraphic sections, as well as the radiocarbon dating of poles that support canal banks, confirmed that the harbour was built around the 1st century CE (Beltrame et al., 2024).

Here, we present the results of the sedimentology, radiocarbon dating, palynology and micropaleontology of the sedimentary fill of the basin from cores. These new data allow to trace the evolution of the harbour from the Imperial Age to the Late Antiquity. They further allow to discuss the geomorphological evolution of this lagoon sector and the environmental changes that contributed to the development of the city of Altinum, and led to its abandonment in the early Middle Ages. The fall of Altinum induced the starting of several settlements in the islands of the lagoon, among which Venice soon became the dominant one.

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Globally coherent glacier retreat during Termination 1: evidence for summer warming during Northern Hemisphere Stadials

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08G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 9:35 AM - 11:05 AM

Globally coherent glacier retreat during Termination 1: evidence for summer warming during Northern Hemisphere stadials

Recent high-resolution alpine moraine chronologies have revealed unexpected glacier retreat in the Northern Hemisphere during Heinrich Stadial 1 (18 – 14.7 ka) and the Younger Dryas (12.9 –11.6 ka). Extreme stadial seasonality has been hypothesised to reconcile these glacier records with temperature reconstructions. However, other regional scale syntheses resolve that glacier behaviours were largely consistent with annual mean temperature trends during these events, leaving the global picture unresolved.

This research addresses this uncertainty using the global dataset of alpine moraine exposure age samples. We produce a dataset of over 700 equilibrium line altitude (ELA) reconstructions across 5 continents using a standardised approach to determine moraine ages and ELAs.

We resolve globally coherent ELA rise beginning during early Heinrich Stadial 1 (17.8 ± 370 ka), contradicting models of asynchronous inter-hemispheric deglaciation. Critically, transient ELA reconstructions show that Northern Hemisphere midlatitude glacier retreat preceded the rise in regional mean annual temperatures with 95% confidence. Minimum rates of ELA rise were 119 ± 65 m/kyr during Heinrich Stadial 1 and 110 ± 80 m/kyr during the Younger Dryas, providing compelling evidence of summertime warming occurred during stadials.

These findings resolve an emerging debate by demonstrating globally coherent glacier behaviour during the millennial scale climate events of Termination 1. This is best explained by extreme Northern Hemisphere seasonality during Greenland stadials, raising a critical question: what mechanisms drove summertime warming during these periods of overall hemispheric cooling?

Paleoshoreline displacements at Lake Taupō record exceptional normal fault offsets in the aftermath of the 232 CE Taupō eruption

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06D: Dynamic Landscapes: Tectonic Geomorphology of Aotearoa New Zealand, Dobson 3, February 3, 2026, 2:30 PM - 4:00 PM

Phases of accelerated normal faulting in the Taupō Volcanic Zone have been demonstrated to be triggered by rhyolite eruptions, yet little is known about how the Taupō Fault Belt responds in the aftermath of caldera-forming events, particularly the 232 CE Taupō eruption. To address this issue, we conducted paleoseismic trenching coupled with remote and field analyses of the Whakaipō Fault (north Taupō) and the displaced post-232 CE paleoshorelines intersected by this structure. The throw profiles along the Whakaipō Fault reveal increasing throw in proximity to Lake Taupō, highlighting the importance of Taupō volcano (in particular the 232 CE caldera margin) for localising fault strain. Paleoseismic trenching exposed a ~50º dipping un-degraded paleoscarp draped by fall deposits of the 232 CE eruption, implying that fault slip occurred in the days to months preceding the eruption. Analysis of fault and paleoshoreline displacements at Whakaipō Bay on the northern shoreline of Lake Taupō suggest that two main phases of slip on the Whakaipō Fault occurred: (1) an "aftermath" phase, occurring over a ~10-20-year period after the 232 CE eruption, during which 5-10 m of throw was accrued locally on the fault; and (2) a subsequent "longer-term" phase through to the present day, during which 2.8 ± 0.3 m of fault throw has accrued. Faulting during the aftermath phase is estimated to account for ~75% of the total extension accommodated locally on the Whakaipō Fault since 232 CE, and demonstrates that exceptionally large (>5 m) normal fault displacements may accrue along the Taupō Fault Belt in association with caldera-forming eruptions.

Field measurements and model predictions of turbulent kinetic energy in mangrove canopies: comparisons between sparse subtropical and dense tropical environments

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03E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 4:00 PM - 5:30 PM

It is well established that the presence of aquatic vegetation such as mangroves can alter hydrodynamics and influence sediment transport in coastal environments. A recent paradigm suggests that turbulent kinetic energy (TKE) serves as a better predictor of sediment motion rather than being controlled by bed shear stress, as in open-channel flows. Consequently, models to predict the combined bed- and vegetation-generated TKE have been developed. However, formulations were based on laboratory-derived results with uniform vegetation. How well these laboratory-based formulae perform in a natural setting with complex flows and heterogeneous vegetation (e.g. with trees, saplings, and roots of different sizes) remains unknown.

We test the formulations in two different environmental settings. First, formulations are compared to measurements from an intertidal subtropical sand-flat during an experimental period with negligible wind-wave activity. The flat is populated by a stand of small shrub-like avicennia mangroves (~1m tree height and ~0.1-m high pneumatophores). The existing formulations for TKE were found to perform well in the field, but only when using measured values for horizontal eddy length-scales. These length-scales were around 10 times the pneumatophore stem diameter, and instead corresponded to length-scales of small very sparse saplings in the vicinity. These led to notably larger TKE values than found in laboratory experiments undertaken using similar vegetation to the pneumatophores. Second, we explore differences to the TKE measured in the root canopy of large tropical Sonneratia mangroves (~10-m tree height and ~0.5-m high pneumatophores), in a muddy system with moderately large waves.

The results emphasize the need to account for multiple length-scales of vegetation, and formulate parameterisations including the wider environmental setting when predicting TKE even at the small scale.

Remote Sensing of Vegetation Loss and Landslide Occurrences Following Hurricane Helene and the Table Rock Fire in the Southern Appalachians

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

As climate change accelerates, the frequency and overlap of extreme events are increasing, resulting in compounding disturbances with amplified impacts on forested, mountainous regions. This study examines how sequential disturbances from Hurricane Helene (September 2024) and the Table Rock Fire (March 2025) affected vegetation loss and landslide occurrences and susceptibility along Upstate South Carolina's Blue Ridge Escarpment. Using a multi-sensor remote sensing approach, including Landsat, Sentinel-2, and airborne LiDAR, pre- and post-disturbance vegetation conditions were mapped and analyzed using the Normalized Difference Vegetation Index (NDVI), Enhanced Vegetation Index (EVI), and Normalized Burn Ratio (NBR). Results show that strong winds and intense rainfall from Hurricane Helene caused significant canopy loss, windthrow, and numerous landslides. The accumulation of downed tree biomass and standing deadwood likely increased fuel availability for the subsequent Table Rock Fire, the most severe wildfire in the area's recorded history, thereby elevating the risk of future landslide hazards. It is critical to monitor areas of heavy canopy loss for potential landslide activity in the near future. The findings highlight the value of remote sensing for multi-hazard assessment and support the advancement of climate-resilient land management strategies in the southern Appalachian region. These natural events were also used as teachable moments, integrated into classroom instruction to provide authentic student experiences through place-based and problem-based learning approaches. As educators, it is essential to equip the next generation of scientists, scholars, and citizens with the awareness and skills needed to apply advanced technologies for mapping and monitoring environmental hazards. Products from this study include a landslide inventory map of recent and historical events, spatial data products for the study area, and a lab manual designed for use in classrooms worldwide to support similar hazard analyses.

Rock Glacier Detection and Characterisation Based on InSAR Analysis in the Austrian Alps

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rock glaciers are valuable indicators of alpine permafrost and play a key role in understanding high-mountain geomorphological and hydrological processes. Their movement patterns reflect permafrost dynamics and can be used to assess responses to climate change as well as be used to give a first-order estimate of relative ice content. In this study, we use Interferometric Synthetic Aperture Radar (InSAR) techniques based on Sentinel-1 satellite data to detect and characterise active rock glaciers in the Austrian Alps.

Our study includes data selection and preparation (including SAR images, a digital elevation model (DEM), and a rock glacier inventory) interferometric processing using InSAR Scientific Computing Environment (ISCE), and time-series analysis with Miami InSAR Time-series software (MintPy) to derive velocity maps. We extract polygons based on the InSAR movement rates through segmentation and clustering techniques and then compare the results with both an existing manually prepared rock glacier inventory and outlines generated using a deep learning method. Specifically, we (1) evaluate the suitability of InSAR results for confirming or disconfirming rock glacier locations, (2) propose ways to improve the delineation of active rock glaciers by integrating InSAR results and investigate the spatial variability of rock glacier movement within individual landforms, (3) identify factors that may influence the InSAR results, such as topography, and (4) propose a classification scheme distinguishing rock glaciers based on their movement rates.

The results include maps of rock glacier velocities, adjusted rock glacier outlines, a proposed classification scheme, and an exemplary assessment of factors influencing the capability of InSAR for rock glacier detection and characterisation. This study demonstrates the potential of InSAR for the mapping and classification of rock glaciers. Our findings can support natural hazard management and provide a basis for improved remote sensing-based analysis of changing landscape features and landforms in various regions.

Earth Observation-Derived Landslide Information to Support Humanitarian Aid

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09D: Engineering Geomorphology AND Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 11:35 AM - 1:05 PM

Landslides result in numerous fatalities and significant infrastructure damage each year, leading to enormous individual and economic losses. Due to climate change and its associated effects, the frequency and magnitude of landslides, rock falls, and mudflows increase . Humanitarian organisations, such as Médecins Sans Frontières (MSF), are at the forefront of disaster response in such situations. Timely, reliable, and up-to-date information is crucial for supporting effective hazard and damage assessments to facilitate both rescue operations and humanitarian relief.

Earth observation (EO) data and technologies have proven their value in supporting emergency response and disaster risk management following landslide events. However, despite the constant improvement and further development of EO techniques within academic research, they are rarely tested under working conditions, such as directly supporting humanitarian aid with relevant landslide information during emergencies . Moreover, existing solutions rarely align with the specific user requirements and information needs of humanitarian organisations that arise during different phases of the disaster cycle. Therefore, this study aims to generate targeted landslide information from EO data to support humanitarian aid. The landslides triggered by Tropical Cyclone Freddy in Malawi in 2023 are used as an example.

We test and evaluate different landslide mapping tools and methods using both optical and radar satellite data to create, provide, and communicate EO-based landslide information to the humanitarian community in emergency situations where time pressure, data scarcity, unreliable connectivity, and unsafe field conditions are common. We assess and identify suitable approaches for producing targeted landslide information for specific situations and customise them to the operational needs of MSF. To ensure effective communication, we combine the knowledge gained through EO with essentials of risk communication to empower humanitarian aid staff in responding to landslide events. Thus, we facilitate the transition of knowledge from scientific research to practical applications in humanitarian aid.

Statistical and Numerical Models for Landslide Susceptibility along the National Highway in J&K, India.

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07C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 5:00 PM - 6:30 PM

Jammu and Kashmir, Northern-most region of India is considered as one of the most landslides-prone area due to its unique geological and environmental setting. This research aims to develop landslide susceptibility maps along NH-1D by employing Index of Entropy (IOE), Logistic Regression (LR) and Certainty Factors (CF) models. Initially, a total of 317 active landslides were identified using data obtained from the Border Roads Organisation (BRO) in Srinagar, Sonamarg and Kargil. Subsequently, this study analyzed ten landslide causative factors, including geomorphology, stream power index, NDVI, topographic wetness index, distance to road, lineament density, drainage density, plan curvature, sediment transport index and slope. The IOE, LR, and CF models were employed to assign weightage to thematic maps based on their relative importance within the study area, with their performance compared using metrics like accuracy, specificity, sensitivity, precision, area under the curve (AUC), and receiver operating characteristics (ROC). The resulting susceptibility maps from IOE, LR, and CF models were categorized into five susceptibility classes: very high, high, moderate, low, and very low. The IOE model exhibited superior performance in landslide prediction, achieving an AUC of 0.8814 compared to 0.8456 and 0.8260 for LR and CF models, respectively. Integrating the results from all three models achieves an overall ROC success rate of over 80% accuracy: 88.14% for IOE, 84.16% for LR, and 82.60% for CF. The present investigation reveals the efficacy of landslide susceptibility maps for land-use planning and monitoring purposes. All models exhibited good accuracy in predicting landslide susceptibility along the NH-1D road section. These maps will serve as valuable tool for forecasting landslides occurrences and implementing hazard mitigation measures.
Keywords: - Landslide Susceptibility; Planning; Monitoring; IOE; LR; CF; Accuracy; Precision; AUC; ROC.

Marine and coastal spatial planning; the need for standardised geomorphology mapping methods and tools

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Australia's extensive ocean estate offers significant opportunities for emerging industries, including offshore renewable energy, carbon capture and storage, and hydrogen storage, which are critical to achieving the nation's net zero targets. However, only 35% of the continental shelf has been mapped in sufficient detail to inform government and industry decisions. Pre-competitive geoscience data, including bathymetry compilations and seabed geomorphology maps, help identify areas suitable for offshore infrastructure and provide crucial regional context for environmental impact assessments. This information is vital for reducing investment risk and ensuring compliance with government policies and regulations.

Australia's seabed is characterised by diverse and often overlapping geomorphologies that have evolved via processes operating at varying spatial and temporal scales. Effective marine and coastal geomorphic interpretation requires the integration of high-quality bathymetric, sediment, and subsurface data. Resulting geomorphology maps synthesise these complex datasets into accessible formats, supporting informed decision-making across scientific, industrial, and policy domains.

To ensure quality map products it is imperative that they are produced using consistent methods for various stakeholder groups — within and beyond Australia's Exclusive Economic Zone. To this end, Geoscience Australia has co-led the International Seabed Geomorphology Mapping Working Group (ISGM) — a collaborative initiative with partners in the UK, Norway, Ireland, and Australia. This group has developed a novel, globally applicable mapping approach (Dove et al., 2020: https://zenodo.org/record/4071940; Nanson et al., 2023: https://zenodo.org/record/7804019). The implementation of this approach is supported by bespoke GIS analysis tools (Huang et al., 2022: https://dx.doi.org/10.26186/146832), open-access digital vocabularies (Wells et al., 2025: https://doi.org/10.26186/150006), and an Esri cartographic style file (in prep) to support consistent visual representation of geomorphic complexity. These resources are available via the ISGM webpage (https://www.geomorph.org/international-seabed-geomorphology-mapping-working-group/).

This poster presents an overview of the ISGM method and its supporting tools. We welcome discussions on how these resources can support your mapping initiatives.

An international approach to marine and coastal classification: glossaries and tools to support consistent mapping of diverse geomorphologies

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05E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 11:35 AM - 1:20 PM

Marine and coastal geomorphology is inherently interdisciplinary, involving the interpretation of diverse landforms shaped by complex hydrodynamic, sedimentary, tectonic, and biogenic interactions. As the global ocean economy expands, geomorphic data is emerging as an increasingly critical resource for supporting evidence-based decision-making. Geomorphology maps have the potential to communicate essential baseline information to a broad range of users, and standardised, multi-scalar, inter-jurisdictional approaches can provide consistent representation at local through international scales. However, the development of seabed geomorphology maps is challenged by the heterogenous coverage, resolution, and quality of input submarine data.

To help meet this challenge, the International Seabed Geomorphology Mapping Working Group (ISGM)—comprising representatives from geoscience agencies and universities in the United Kingdom, Norway, Ireland, and Australia—developed a two-part approach. This method separates morphological mapping from geomorphic interpretation, constraining the uncertainty inherent in interpreting processes and stratigraphy to a second, dedicated step. In Part 1, bathymetric shapes are mapped and classified using standardised Morphology Feature terms (Dove et al., 2020: https://zenodo.org/record/4071940). In Part 2, a standardised database framework and glossary, which contains over 400 terms structured across 11 overlapping depositional environments and geological domains, is used to assign these shapes with their geomorphic interpretation (Nanson et al., 2023: https://zenodo.org/record/7804019). The two-part framework was developed using an Ocean Best Practice approach and incorporates established literature and terminology.

The implementation of the two-part mapping approach is supported by a suite of published open–access digital vocabularies (Wells et al., 2025: https://doi.org/10.26186/150006), bespoke GIS analysis tools (GA-SaMMT: https://doi.org/10.3389/fmars.2023.1236788; CoMMa: https://doi.org/10.1016/j.geomorph.2024.109227), and a cartographic style file (in prep) that will support users to consistently illustrate the geomorphic complexity represented by their maps. We will present applied examples that demonstrate the utility of this approach across a range of marine environments. These supporting products are available for download at https://www.geomorph.org/international-seabed-geomorphology-mapping-working-group/ .

Australia's Cenozoic megafans and associated large accretionary fluvial systems

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01B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 11:40 AM - 1:10 PM

Australia is the world's lowest and flattest continent with the most negative water balance. Gentle Cenozoic tectonism has formed numerous moderately depressed basins, mostly on the eastern half of the continent, that have accumulated substantial alluvium across diverse climatic zones. While megafans predominate, a minority are axial systems confined in large valleys. We propose the generic term large accretionary fluvial systems (LAFS) to describe all that are >~1000 km2. Australia has 61 LAFS totaling 480,000 km2 or 6.3 % of the continent. Divisible into two primary types, Type 1 (n = 51) are laterally unconstrained, hence are megafan in planform with distributive flow networks and cover 400,000 km 2. Type 2 (n = 10) are valley confined, cover 81,000 km2, and are dominated by semi-parallel anabranching channels. Both can be further differentiated by their distal components into three subtypes: terrestrial; coastal delta; playa delta. Type 1 has the most variable gradients and those in arid central regions are the steepest. Type 2 has some of the lowest gradients, even in arid regions. The largest catchments tend to form the largest Type 1 LAFS whereas valley confinement means this does not apply to Type 2. The largest LAFS form in more humid regions and the smallest in arid regions. Australia's LAFS have primarily been constructed by over loaded, avulsing, low sinuosity, anabranching and braided rivers, mostly during enhanced fluvial episodes of the Quaternary. Meandering is an essentially incisional process except in tidal reaches. In Australia's monsoon north, LAFS remain weakly aggradational and are continuing to prograde. The remainder are largely relict but yield chronostratigraphic evidence of pronounced growth during the Pleistocene. Australian LAFS range from thin single storey to multistorey, reaching depths of several hundred metres. They are potential sources of groundwater and often feature aeolian dunes and lunette lakes.

Why alluvial rivers meander, braid and anabranch while very few run straight.

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12B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 9:35 AM - 11:05 AM

Earth is a geologically active planet of moving tectonic plates that generate uplift and form surfaces of highly variable relief. It also has an abundance of water and a powerful solar-driven hydrological cycle creating a moist atmosphere of plentiful orographic and convectional precipitation. Water has a low viscosity so even over gentle gradients it flows readily, especially at depths common in streams, but over a hard rocky crust that greatly resists erosion. Consequently, most rivers are overpowered for the work they must do to move imposed sediment loads. Least action principle requires that such overpowered rivers minimise instability (action) by maximising their expenditure of surplus energy. Alluvial rivers self-adjust their boundary nonlinearly to optimise stability. When overpowered, they expend surplus energy by forming flow-resisting ripples, dunes, bars, riffles, reconfigured cross sections, and by developing anabranching, meandering, and braided planforms. A small number of rivers, usually near baselevel, are underpowered, aggradational, and unstable. Some adjust morphologically to conserve energy by interacting with riparian vegetation to modify their cross section and planform towards the optimum stationary equilibrium state with a scale-invariant H number of 0.3 (the proportion of shear for movement of bedload relative to width-depth ratio). Straight anabranches appear to be the most common form of stationary equilibrium channel. The Australian tectonic plate is particularly illustrative of this full range of imposed energy conditions and alluvial-river responses. New Zealand is dominated by steep overpowered rivers that braid to maximise friction and expend surplus energy, yet they remain overpowered and incising. The rivers on the New Guinea foreland and in the Murray-Darling basin of Australia are less powerful and meander to more moderately expend energy, albeit also remaining overpowered and incisional. Arid, tectonically torpid inland Australia has an abundance of nearly straight, energy-conserving, anabranching, stationary equilibrium channels.

Beachrock Diagenesis, Paleoenvironment, and Holocene Relative Sea-Level Reconstruction in a Tropical Island Arc Setting (Philippines)

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Beachrocks are indicators past relative sea level (RSL) and have been valuable markers due to their presumed rapid cementation and minimal burial compaction effects compared to other sedimentary proxies. However, their formation ranging from supratidal to subtidal zones poses wide uncertainties in constraining their indicative meaning and reference water levels. In this study, lithofacies, petrographic, and geochemical analyses were integrated to interpret the paleoenvironment and diagenetic processes of two emergent, parallel beachrocks (BRS1 and BRS2) in a wave-dominated microtidal tropical island arc of southwest Panay along the Negros Trench forearc in the Philippines. Seven lithofacies were delineated with the top unit having seaward-dipping foreset cross-stratifications, but the underlying lithofacies vary laterally with the occurrence of massive, cm-scale trough cross-stratifications, and hummocky cross-stratifications, as well as basal conglomerate and coralline framestone. In some sections, lithofacies with parallel stratification intertongues with the previously mentioned upper and lower lithofacies due to vertical and lateral shifts in shallow marine environments. Petrography, SEM-EDX, and δ13C–δ18O ratios of the cement indicate at least two cementation phases in predominantly marine pore water with the latter phase characterized by micritized cement. We interpreted a subtidal, upper shoreface paleoenvironment of beachrocks with an indicative meaning between mean lower low water and wave base. Bulk radiocarbon dates of beachrocks indicate that the topmost lithofacies of BRS1 formed during 5855–4508 cal BP, whereas BRS2 formed during 3128–1825 cal BP. With the constrained indicative meaning and C-14 dating, we reconstructed a relative sea-level history during the Holocene along the Negros Trench forearc. The RSL misfits of beachrocks were generally higher compared to published Holocene glacial isostatic adjustment (GIA) models which we attribute to tectonic uplift after ~1800 cal BP. This study highlights the advantages of integrating these analyses in constraining the potential diagenetic processes, paleoenvironment, and indicative meaning of beachrocks.

Drivers of landscape change at two southern Indian Ocean islands during the Late Pleistocene to Holocene

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06G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 2:30 PM - 4:00 PM

This study investigates landscape change on two southern Indian Ocean islands (Marion Island (46°S, 37°E) and the Kerguelen Archipelago (49°S, 69°E)) during the Late Pleistocene to Holocene, using cosmogenic 36Cl exposure dating as the central tool for reconstruction. A total of 91 36Cl cosmic-ray exposure (CRE) ages of glacial landforms from both islands were used to produce a consolidated chronology which spans from ~63 ka to 17 ka ago. Glacier culminations are interpreted at ~60.6 ka, ~51.4 ka (Marion Island) and at ~42 ka (both islands). CRE ages of bedrock surfaces (~48 ka to ~17 ka) and erratics (~63 ka to ~20 ka) from both islands indicate multiple periods of retreat, interrupted by still stands, throughout MIS 3, MIS 2 and, particularly, the gLGM. The deglaciation patterns seen on the islands are ascribed to the fluctuations of sea surface temperatures and sea ice extent in, specifically, the western Indian Ocean sector. At Kerguelen, evidence for glacial culminations is also found for the latter end of the gLGM, but evidence of glacial advances is markedly absent on Marion Island. This is attributed to the influence of island topography and physiography on local equilibrium line altitudes. At the peak of the gLGM during sea level low stands and extensive sea-ice, Marion Island would be starved of moisture inputs earlier than the more southern Kerguelen Archipelago with a significantly higher topography. At Marion Island, cosmogenic exposure ages suggest that regions now hosting mires were ice-free since ~31 ka, yet peat initiation lagged by over 20,000 years. This delay is attributed to suboptimal climatic conditions following deglaciation, including low SSTs, expanded sea ice, and low sea levels, which inhibited peat development. Peat formation began primarily during the Holocene Climate Optimum, when environmental thresholds (warmer SSTs and air temperatures and elevated moisture availability) were met.

Field and numerical investigation of tracer dispersion in colonies of patchy submerged aquatic vegetation.

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03E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 4:00 PM - 5:30 PM

Vegetated ecosystems show great promise as Nature-based Solutions (NbS) for mitigating natural hazards in coastal and estuarine environments. In nature, aquatic vegetation is fragmented occurring in patches especially in early stages of colonization. The patchy nature leads to complex inter-patch hydrodynamic interactions which influence colony development and particle dispersion. Previous studies have been limited to examining flow behaviour around individual circular patches, pairs of patches, and submerged canopies; however, there is a notable scarcity of research investigating the interactions between multiple patches, particularly under real tidal conditions without the constraints of laboratory experiments or simplified numerical simulations.

We present results from a field experiment examining flows within a random array of 20 patches of vegetation (`pneumatophore') mimics on an intertidal sand flat. Patches were composed of vegetation mimics with the same vegetation density. Over the course of the experiment, the vegetation densities of the patches were systematically varied to represent dense, intermediate, and sparse patch cases. The flows were observed by capturing drone footage of Rhodamine WT dye releases. Results show that the dye resides longer in shallower and denser conditions. However, when the water depth exceeds 4 times the height of the vegetation, the density of the patches has a minimal effect on the dye dispersion.

Data from the field experiment is also used to validate complementary numerical simulations, which are undertaken to expand the parameter space of the study, in particular by varying the spatial arrangements of patches. We present the dependencies of the flow dispersion on submergence ratios, vegetation densities, and patch configurations.

Dating Pleistocene pluvial lake shorelines in the Great Basin, USA using rock surface luminescence dating techniques: approaches for challenging lithologies

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09H: The signature of climate change in arid landscapes, Conway 3, February 5, 2026, 11:35 AM - 1:05 PM

This study examines the feasibility of dating pluvial lake beach ridges using rock surface luminescence dating techniques. Dating pluvial lake highstands in the internally drained Great Basin of the US helps us understand the timing of changes in precipitation and temperature patterns in western North America during the Late Pleistocene. Within our study area in the south-central Great Basin, luminescence ages of sand-size particles have successfully dated aeolian influxes of sand during arid intervals, but have not successfully dated the highstand beach ridges, the best preserved of which are largely gravel.

Directly dating when these gravel clasts were last exposed to sunlight via luminescence is ideal but their limestone and volcanic lithologies prove challenging. Our tests and measurements from limestone and volcanic rocks show promise. Polymineral extracts from limestone clast surfaces from Coal Valley exhibited infrared (IR) signals with low to moderate fading rates and properties suited to single-aliquot regenerative (SAR) dose measurement protocols. Ages calculated using the minimum dose model straddle the C-14 age estimate of the Pluvial Lake Coal highstand with one age consistent with the C-14 at 1σ.

Crushed slices from volcanic clasts from Cave Valley could be dated using a high-temperature (290°C) post-infrared infrared (PIRIR) signal with a correction for fading. Many ages obtained from volcanic clast surfaces were observed to be several thousand years younger than the independent age control of ~16-18 ka, possibly due to bioturbation. Surprisingly, however, there is congruency between luminescence-depth profile plateau ages calculated from inside the volcanic rocks and independent age control. This suggests that some volcanic rocks were small enough to have been bleached throughout their entire thickness in the Late Pleistocene pluvial lake beach environment and that PIRIR signals that record the time of beach ridge formation may be preserved within the rock sub-surface.

Exploring the representation of individual trees in statistical landslide susceptibility models

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The increasing frequency and intensity of storms due to climate change highlights the need for more detailed spatial information to guide erosion control and land use planning. While traditional data-driven shallow landslide susceptibility models perform well at a catchment scale, they generally lack the spatial resolution to account for the influence of individual trees at hillslope scales. To address this, the called TIMSS (Tree Influence Model on Slope Stability) framework was previously developed to quantify the effectiveness of trees for mitigating rainfall-induced shallow landslides (Spiekermann et al. 2021). TIMSS provides a statistical representation of the combined hydrological and mechanical influence of trees on slope stability inferred from their spatial relationship with landslide erosion features. The role of tree roots in soil reinforcement depends on the characteristics of root networks that vary between individuals and species, where root density generally declines with depth and distance from the trunk, while increasing with tree age and size.

Our research, conducted on pastoral hill country in New Zealand's North Island, explored different ways of incorporating TIMSS into shallow landslide susceptibility models, focusing on four widespread tree species groups: conifers, eucalyptus, poplars/willows, and kānuka/mānuka. We fitted various TIMSS models, including those separated by species groups, tree age (proxied by height), and sample size, as well as a species-agnostic (merged) model. Using a morphometric landslide susceptibility model as a baseline, we investigated how the predictive performance was altered by including these various TIMSS models as additional variables during cross-validation. This research aims to better quantify the potential benefits of planting a range of native and exotic tree species for erosion control, thereby informing optimal planting designs to reduce landslide erosion.

References

Spiekermann, R. I. et al. Quantifying the influence of individual trees on slope stability at landscape scale. Journal of Environmental Management 286, 112194 (2021).

Monitoring spatio-temporal variations in subaqueous deposited sediment using proximally sensed data cubes

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rivers and streams transport sediment from terrestrial sources to freshwater, estuarine, and marine environments, with a cascade of impacts occurring along the transport pathway. Where sediment deposits in excess quantities, it degrades ecosystems, threatens biota, and negatively impacts cultural and recreational values.

Limiting the environmental, economic, and social impacts of fine sediment requires a spatial understanding of where sediment is being deposited in damaging quantities to identify at-risk ecosystems, and target mitigation efforts to areas where they will be most effective. National policy in New Zealand requires deposited sediment to be monitored, and management actions to be undertaken where deposited sediment coverage exceeds ecological thresholds. Monitoring efforts presently rely on visual estimation of sediment cover, with observer bias and accuracy limitations making it difficult to robustly assess state and trend and determine the need for management interventions. These limitations also present challenges for modelling efforts related to understanding the drivers, dynamics, and impacts of deposited sediment.

We present the development of a portable handheld sensor platform and machine learning pipeline for quantifying and characterising fine sediment deposits in wadeable streams. Housed in an underwater viewer, the platform fuses a visual-to-near-infrared (VNIR) snapshot camera with ranging sensors to capture a co-registered hyperspectral-topographic data cube of the streambed in situ. Using image segmentation and spectral analysis, the data cube is analysed to quantify deposited sediment areal coverage and texture, respectively. Preliminary results of model development will be presented.

This technology has the potential to improve the accuracy, precision, and transferability of deposited sediment datasets, providing a more robust understanding of sediment dynamics, ecological thresholds, identification of at-risk ecosystems, and targeting of mitigation efforts.

Bridging theory and practice in geomorphology education

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11D: Geomorphology Education for Disaster Risk Management, Dobson 3, February 5, 2026, 5:00 PM - 6:30 PM

Geomorphology education has been primarily focused on scientific explanation of landforms, their formation processes and surficial materials with less attention on the practical application. This presentation aims to share the course design outcomes in bridging geomorphological theory and practice for undergraduate students in Geography, non-Geography postgraduate students on continual professional development (CPD) course at universities in Hong Kong as well as geologists and engineers in a global consultancy firm.

The undergraduate course design incorporates “applied geomorphology” and “geomorphological techniques” themes showcasing international consultancy project case studies to broaden students’ knowledge in theory and practice. The design of postgraduate CPD course and professional training modules in consultancy targets to relate to the current local practice in natural terrain hazard assessment, working through steps systematically to develop a geomorphological model for cost-effective monitoring or mitigation works.

Based on the course evaluation results, despite different learning settings, both students and practitioners highly value interactive lectures coupled with real project case studies. In particular, the practical sessions such as field trips, laboratory simulation, hands-on exercises in air photo interpretation and hazard assessment, help them better understand the geomorphological concepts and apply the techniques more effectively.

The discussion demonstrates that knowledge and skill transfer gap could be bridged by enthusiastic geomorphologists who have teaching and training experience working in both the academia and the industry. In addition to emphasizing the fundamental concepts, practical application of geomorphology should be preferably introduced at undergraduate level. The effectiveness of teaching and learning can be enhanced through engaging activities with real work examples.

The “learning by doing” or experiential learning approach adopted in geomorphology is well-received by students at university and practitioners on professional development in consultancy. Sharing real-world project experience benefiting global communities appears to be an impactful element in geomorphology education.

Exploring Sub-Antarctic Marion Island's Aeolian Processes and Dynamics

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06G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 2:30 PM - 4:00 PM

Understanding aeolian processes and sediment dynamics on Sub-Antarctic Marion Island is crucial for assessing environmental changes in polar and subpolar regions. This study investigates sediment saltation thresholds and sediment flux at two distinct sites, Mesrug (46º 56'42.36" S, 37º 49'59.02" E) and Santa Rosa (46º 56'47.83" S, 37º 43'46.46" E), using high-resolution meteorological and sediment transport measurements. Climatic factors, including wind speed, wind direction, soil moisture, air density, and rainfall, were recorded at 5-minute intervals with the Pace Scientific XR5 logger. Aeolian sediment transport was monitored using Big Springs Number Eight (BSNE) sediment traps placed at various heights (z = 0.05 − 0.7m) above the surface. Sampling was conducted through inter-annual (April 2021–April 2022) and high frequency (September 2021–April 2022) protocols, ensuring robust temporal resolution. Additionally, spatial analysis utilizing UAV-based surveys (DJI Phantom 4 Pro) facilitated the creation of digital surface models through Agisoft Metashape v.1.2.1. Findings provide insights into site-specific aeolian dynamics, contributing to broader geomorphological and climatic studies of sub-Antarctic regions.

Mangrove Forests, a Nature-Based Solution for Enhancing Resilience to Anthropogenic Impacts in the Red River Delta Coast (Vietnam)

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08F: River Deltas: Dynamic Systems Under Climate and Human Forcings, Conway 1, February 5, 2026, 9:35 AM - 11:05 AM

Mangrove forests serve as a nature-based solution for reducing incoming wave energy, providing coastal protection services that benefit millions of people and yield significant socio-economic gains. In this study, we investigated the variability of the mangrove shoreline along the northern Red River Delta coast in Vietnam over a 39-year period (1984–2022). Annual mangrove shoreline positions were extracted from high-resolution Landsat satellite imagery to assess shoreline variability. Empirical Orthogonal Functions (EOFs) were applied to the demeaned dataset to identify the dominant modes of shoreline position variability. The results indicate that the mangrove shoreline evolution can be divided into three distinct periods: (i) 1984–1992, a relatively stable phase with a shoreline advance of +1 m/yr; (ii) 1992–2009, a period of rapid seaward expansion at a rate of +83 m/yr; and (iii) 2009–2022, characterized by continued but slower seaward movement at +17 m/yr. With the mean shoreline position removed, EOF analysis revealed two contrasting phases in coastal dynamics: an initial period of severe erosion followed by rapid accretion. The first EOF mode, accounting for approximately 78.8% of the variability, is strongly linked to mangrove plantation efforts. The second mode, explaining around 11.43% of the variability, is likely influenced by sediment deposition and redistribution processes, which are affected by changes in sediment load from the Red River system as well as longshore and cross-shore sediment transport. Notably, despite a significant decline in riverine sediment discharge, from 114 to 10×10^6 tons/year between 1958 and 2022, the ongoing seaward expansion of mangrove forests continues to act as an effective countermeasure, supporting the stabilization and development of the delta.

Wind erosion on agricultural lands associated to extreme meteorological conditions within Eastern Romania

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07H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 5:00 PM - 6:30 PM

Land degradation through water erosion is a well-known ecological threat in the hilly areas and temperate climate of Romania. Nevertheless, remarkable events of wind soil erosion during extreme meteorological conditions have become a common occurrence in the last decades. Thus, in the context of the global climate change, wind erosion contributes to the intensely degradation of the cultivated fields through the physical removal of the most fertile portion of the soil that can lead to substantial yield reduction. Natural soil nutrients and surface-applied chemicals can also be carried along with soil particles, contributing to off-site impacts. Under this background, the assessment of the erosional effect of wind erosion on agricultural lands is becoming a current issue of great interest. Based on stationary studies and field campaigns conducted over the last decade, and by using GIS&RS techniques, we noticed that the maximum intensity of the process is related to extreme meteorological events such as winter blizzards or spring & summer storms. They occur more frequently all year round, being empowered by pre-existing local conditions in terms of soils, landforms, land cover & land use increasingly impacted by human activity. The results show that, in the case of a single extreme blizzard event of January 5-8, 2017, over 34% (2089 km2) of the total studied area were heavily affected by wind erosion. Also, the specific wind erosion rate on fallow land could be ~5.9 t·ha-1, resulting in 2.04 t·ha-1 for the entire area. Hence, by summing up the effects of such singular events occurring throughout the year, wind erosion constitutes one of the important geomorphological processes of soil degradation on agricultural lands in this part of Europe.

“The Anthropocene is Plastic”—Geoarchaeological Perspectives on People Impacting Earth Processes & A Rationale for Defining a Geologic Timeframe

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06I: Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 2:30 PM - 4:00 PM

Because humans have fundamentally impacted Earth processes, defining an Anthropocene is logical. But lacking a specific chronostratigraphic type section or golden spike of inception the International Union of Geological Sciences (IUGS) opposes its formal definition. We can pinpoint the ascendant human impact on the geologic record with plastics because people are unique producers of these unnatural petrochemical polymers that release potent greenhouse gases (GHGs) methane and ethylene throughout their lifecycle from their production through degradation. Plastics are human trace fossils and they leave a distinctive, recognizable footprint in Earth’s geologic record, as well as our moon, Mars, asteroids and outer space, which is littered with debris from spacecraft launched since the mid-20th century. Plastics are ubiquitous ‘new forms of pollution’ found at all scales (micro- to macro-) in every Earth environments and biomes, and within organisms at all trophic levels. Plastics are now in sediments, and documented as part of the rock cycle, forming new types of rocks that record a narrow timeframe of human activity. The “Plasticene” is defined as a specific time in human technological innovation when plastics we developed became common in tools and our activities, with a precise onset defined +/- 50 years; Archaeologists interpret plastics as “historic trash” markers using the ‘Seven Ages of Materials” (Smith and Vignieri, 2021):
Stone Age: 2,500,000–3,200 BCE
Bronze Age: 3,200–1,200 BCE
Iron Age: 1,200 BCE –100 CE
Glass Age: 1300 CE–present
Steel / Aluminum Age: 1800s
Plastic Age: 1900s–present
The Anthropocene is therefore NOT relative term; it is plastic. The Plastic Age or Plasticene is in full flex. Plastics identified and measured in soil and sediments are documented as indicators of human activity and impact. Petrochemical innovation, fossil fuel combustion and plastic creation are directly intertwined with human agency. Plastics are the latest innovations in the human tool kit.

Impact of past and future sea level rise and storms on the coast of the Delaware Estuary, USA

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04E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 3, 2026, 9:35 AM - 11:05 AM

The coastal geomorphology along the Delaware Estuary is controlled by modern processes and the ancestral landscape. Paleogeomorphology includes fluvial landforms of lower Delaware River that drains across the coastal plain. As a result of Holocene sea-level rise (SLR) the river has been transforming into a funnel-shaped estuary. The modern Delaware Estuary is fringed by tidal salt marshes and its coastline continues to change due to accelerated SLR, isostasy, and local processes. Widening of the lower estuary caused the transition from tidal wetlands to fetch-limited barrier islands.

We used salt marsh sediments to study past sea-level history and stratigraphic relationships to reconstruct the impact of paleo-storms on the coastal landscape. We used ArcGIS to develop a Digital Elevation Model for the coastal zone and applied probabilistic projections of future RSL to identified coastal landscapes at high risk for inundation by the end of the 21century.

Coastal communities around the Delaware Bay will experience more frequent flooding due to storms as surge levels increase with SLR. We applied SLOSH model calibrated to historical hurricane parameters to predict the impact of future storms for each SLR scenario. Results indicate a non-linear trend predicting a higher increase for storm surges than for sea level. Predicted max storm surges may exceed ~ 1.3 m above the observed data. Therefore, coastal areas without a protective dune system, should be considered at immediate risk from coastal flooding and coastline protected by dunes most likely be over washed during storms. Shoreline erosion, and more frequent storms combined with SLR will increase vulnerability of many coastal areas in the future. Our results should be of particular interest for stake holders, natural and historic preservation planners, and cultural resources managers to develop most effective protective policies and preservation strategies.

Toward a predictive model for evaluating river-avulsion dynamics using experiments and numerical modeling techniques

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13B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 11:35 AM - 1:05 PM

River avulsion is the process whereby water flow diverts from a primary channel into an alternative pathway, either establishing a new channel or exploiting a prior one. A nascent channel that facilitates an avulsion usually initiates as a crevasse, maturing by increasing its size through bed scour and bank erosion. If the evolving channel accommodates ever-increasing amounts of water and sediment, it can potentially capture upstream flow, resulting in abandonment of the prior (parent) channel. Predicting the dynamics of channel growth and development during the avulsion process is important due to impacts of uncontrolled events on the environmental system, and society and its infrastructure.

Current numerical models are limited because of a lack of data: avulsions are infrequent and require years to decades to complete, and therefore monitoring is limited. A lack of observations of the hydrodynamic properties and sediment-transport processes means that there are assumptions inherent in avulsion models. For example, models assume constant and equal downstream boundary conditions, whereby geometric properties of the bifurcated channels are fixed.

We use a suite of physical experiments to document and measure scores of avulsions. The experiments reveal two avulsion types: one with significant aggradation in a bifurcated channel that leads to closure and abandonment of both downstream channels, accompanied by upstream migration of the bifurcation bar. For the second avulsion type, a change in the bifurcation-bar geometry facilitates increased water flow into one of the channels, with deposition closing the other channel. The data are used to develop a two-dimensional numerical model that predicts channel avulsion evolution by assessing sediment-transport processes in the channels and near the bifurcation point. We demonstrate that a temporal variation of force balance corresponds to divergent sediment transport processes, resulting in either incision or deposition. This model predicts the type and duration of natural avulsion events.

Uncovering the cultural-environmental history of a lagoon in Pitu'paq, Cape Breton with the Unama'ki Institute of Natural Resources

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Pitu'paq (Bras d'Or Lake) is a complex estuarine ecosystem that occupies inner Unamak'i (Cape Breton Island), Nova Scotia, Canada. Twelve percent of Pitu'pok's 1272 km long coastline has been classified as gravel barriers enclosing coastal ponds, lagoons, and wetlands; features that have enormous cultural and ecological value to the Mi'kmaq Nation and the other residents of Unamak'i. Today the barriers and lagoons have been developed into harbours, roads, and recreational areas, but have also been used for 1000s of years by the Mi'kmaq for aquaculture. What began as a government study of the age and dynamics of two, barrier-protected lagoons in central Pitu'paq via documenting past environmental changes preserved in pond/lagoon strata, has slowly evolved into a partnership with the Unama'ki Institute of Natural Resources (UINR; a non-profit natural resource management organization that works on behalf of the five Unamak'i Mi'kmaq communities) to investigate the timing of the inception and abandonment of oyster aquaculture in Amaguadees Pond. The reasons for abandonment seem to be linked to palaeoenvironmental change inside the lagoon, likely caused by barrier dynamics. Baseline data with which modern and future coastal dynamics may be compared, including barrier responses to both faster and slower rates of RSL rise, are critical information for the coastal communities, governments, and other stakeholders to determine barrier vulnerability to future sea-level rise, coastal erosion, and concomitant cultural and ecological impacts. The journey of this research from its origins as a government geological survey project to curiousity-driven research done in partnership with UINR and other residents of Unamak'i will be presented.

Boulder Barricades in northeastern Norway: age, formation, long-term landscape development, and ecological value

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02F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 2:00 PM - 3:30 PM

Ice rafting in arctic and subarctic coastal zones can produce boulder-strewn tidal flats, low-tide boulder barricades (LTBBs), high-tide boulder barricades (HTBBs), and intertidal boulder barricades (IBBs). Older, glacioisostatically-uplifted boulder barricades have also been observed, positioned well above the modern coast and morphologically distinct from raised beach ridges (raised boulder barricades; RBBs). Though research on this cold-climate coastal landform is scarce, a recent study of boulder barricades in Ungava Bay, Canada, proposed that specific topographic, geological, and coastal properties and processes determine where boulder barricades can develop. In this study, all four forms of boulder barricades were identified and mapped inside an individual fjord on northern Varanger Peninsula in eastern Finnmark, Norway, and the criteria proposed in the Ungava Bay study put to the test. Field measurements on clast sizes and observations of other physical properties and environmental settings are presented, including results from a new technique for auto-segmenting and -measuring the boulders, cobbles, and gravel from digital photographs. The first relative sea-level curve for this area was also developed as a part of a larger study and applied here in the determination of the ages of the boulder barricades. Lastly, biogeographical surveys on and inside the modern and uplifted boulder barricades demonstrate the important ecological role these landforms play and their long-lasting impact on arctic landscapes.

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Linear dune orientation and slope asymmetry under contemporary wind regimes in arid Australia

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09H: The signature of climate change in arid landscapes, Conway 3, February 5, 2026, 11:35 AM - 1:05 PM

Arid and semi-arid regions contain most of the global aeolian sand cover, often visible as extensive dune fields of different dune morphotypes that result from the environment and climate at the time of dune formation or activity. Linear dunes – the most common morphotype on Earth – cover one third of Australia's mainland, forming an anticlockwise dune whorl. The exact processes and timing that led to its formation e.g., dune activity during intermittent, heterogeneous growth periods or during continent-wide glacial-interglacial aridity phases, such as the Last Glacial Maximum (LGM), remain unknown. The orientation and shape of these mostly immobile sand ridges may serve as a proxy for past wind systems, so comparison to modern-day sand fluxes may help addressing the question: are modern wind systems similar to those during dune activity, and could they form a dune whorl? By comparing net sand flux directions from ERA5-Land data with signed dune orientation, we are not only able to identify 'optimal' threshold velocities – an expression of potential vegetation cover – but also the associated sand flux roses for the entire continent. These 'optimal' flux roses allow for a classification of wind regime modality and angles between modes – crucial factors for dune morphology. This approach enables us to assess across-crest transport and potential asymmetry in sand flux magnitude on both sides of the dune, combined with dune slope asymmetry, to: i) evaluate whether modern wind regimes are similar to wind regimes during dune formation or activity, and ii) determine the influence of larger wind systems (e.g., Westerlies, Monsoon) on individual dune fields on a continental scale. The country's largest landform pattern grants valuable insights into Australia's past, current, and future landscape development and climate – especially in areas that often lack climate proxies or require sparse and labour-intensive sampling strategies.

Utilising analogue experiments to advance the understanding of mountain river dynamics

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Knickpoints are highly complex and impactful geomorphic features, with influences both internally (changes to the longitudinal profile) and externally (through channel-hillslope interactions) of channel systems. Owing to the wide impacts that knickpoints can have on landscape evolution, gaining a thorough and mechanistic understanding of knickpoints, is imperative to understanding the impact that knickpoint retreat has on channel systems. Despite this, the challenges associated with accurately modelling mountain channel dynamics are two-fold: (1) The extensive spatial and temporal scales over which knickpoints, and landscapes evolve, make in-situ data collection of knickpoints very difficult. (2) The multitude of complexities that occur in the natural environment, make the isolation of individual controls, difficult. To combat this, we use novel numerical methods when analysing data from laboratory experiments to advance understanding on how autogenic knickpoints impact mountain river dynamics. We use the FLOODOS hydrodynamical model to simulate water flow over digital elevation models generated from sub-millimetre resolution point clouds of a well-established laboratory set-up. From here, the DEMs and water surface maps were analysed using MATLAB to produce shear stress was maps that were then averaged and stacked to create visual representations of how shear stress varied across the channel reach through time. A threshold was then applied to delineate a knickpoint reach where channel slope significantly steepened above this value. This novel technique allows for the exploration of many knickpoint parameters including morphology, retreat rate and initiation. Assessing how these parameters change under different constant forcing conditions, through these novel analysis techniques has led to many key findings in the study of autogenic knickpoints. Here, we present the methodologies of analysis to illustrate how combining numerical modelling and laboratory experiments can be highly advantageous in the understanding of mountain river dynamics that are traditionally difficult to study in-situ.

The processes governing autogenic knickpoint generation and migration in mountain catchments

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08A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 9:35 AM - 11:05 AM

Knickpoints have been recognised as key features in fluvial geomorphology since the late 19th century owing to their wide-ranging impact on channel systems. Furthermore, their impact is not confined to channel systems, owing to channel-hillslope interactions. The result is that knickpoints are key determinants of landscape evolution and as such, a thorough mechanistic understanding of knickpoint dynamics is imperative to understanding how landscapes change through time. However, knickpoint processes remain poorly understood and unquantified, partly due to the large spatial and temporal timescales over which they evolve making in-situ measurements of knickpoints challenging, and partly due to the complexities of multiple factors operating in the natural environment that impact knickpoint retreat. Traditionally, knickpoint initiation has been considered to be the result of large, discrete, external perturbations, including fault rupturing, large shifts in climate conditions and lithological heterogeneity. More recent work has focused on a new initiation mechanism where knickpoints may form from planar homogenous beds, in the absence of external forcing. These knickpoints are termed ‘autogenic’ and are formed from internal feedback between flow hydraulics, sediment transport and bedrock incision. Here we present a series of analogue flume experiments from the Universite de Rennes to assess the impact of sediment flux, base-level fall rate and bedrock strength on knickpoint dynamics. We find that knickpoint retreat rate is set by bedrock strength, whereas the spacing between knickpoint initiation is controlled by base-level fall rate. Furthermore, we find that sediment flux and base-level fall rate are key determinants of knickpoint morphology. This study provides key insight into how autogenic knickpoint dynamics are impacted by sediment flux, base-level fall rate and bedrock strength and provides a starting point for accurately modelling how knickpoint dynamics vary between channel systems.

Multi-million-year stability of ice sheet thickness and bedrock erosion on the central Antarctic Peninsula

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04G: Antarctic Geomorphology, Conway 2, February 3, 2026, 9:35 AM - 11:05 AM

The Antarctic Peninsula Ice Sheet (APIS) is one of the fastest warming regions of Antarctica and has the potential to change rapidly. Understanding the extent and timing of glaciation and deglaciation over long-term climate cycles is essential for predicting future ice mass change and sea-level rise. However, the thickness history of the APIS is poorly constrained because there are limited terrestrial records. Here, the data gap is filled by measuring cosmogenic nuclides in samples from high elevation nunataks in the APIS interior in northeastern Palmer Land, central Antarctic Peninsula. Cosmogenic 10Be, 26Al, and 21Ne data indicate that rock surfaces >150 m above the current ice surface have been ice-free for millions of years. Rock surfaces closer to the ice surface have been intermittently buried by non-erosive ice. These results contrast even the most conservative numerical models of APIS thickness which require over 300 m of thickening in this area at the LGM, and indicate that substantial ice thickening only occurred in the south of the Peninsula. Additionally, the long-exposed granitic bedrock appears to have been eroding at 9 ± 2 cm/Myr; amongst the slowest erosion rates recorded on Earth. This means that subaerially exposed bedrock on the Peninsula has been preserved over >5 Ma of glacial-interglacial cycles under limited erosion.

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Traditional and modern approaches for river and catchment management in Japan to cope with water and sediment disasters

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08A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 9:35 AM - 11:05 AM

Various ideas and techniques for river and catchment management have been developed in Japan, a country prone to water and sediment disasters. Like New Zealand, Japan has steep mountainous environments due to active tectonics and volcanic activities, reflecting the subduction of oceanic plates. In addition, heavy rainfall frequently occurs over Japan because of the activities of the meiyu (baiu) front and typhoons. The combination of these natural conditions often leads to landslides, debris flows, and flash floods, threatening people and societies. Therefore, traditional methods to cope with these hazards were developed in Japan. For example, Shingen Takeda, a feudal load in the 16th Century in central Japan, constructed a unique open levee system on an alluvial fan to reduce the power of flood discharge and avoid disastrous destruction of farmland and villages. Western erosion and flood control technologies were also introduced after the mid-19th Century. Their applications to various areas in Japan provided lessons for methodological improvement. They resulted in more effective techniques that helped disaster risk reduction in Japan and elsewhere, especially in developing Asian countries. However, in recent years, modern controlling methods have shown limitations in Japan, which is subject to more intense rainfall due to global warming and more substantial human impacts on land. For instance, landslides and river levee breakage recently occurred in unexpected locations in Japan. The recent financial situation of national and local governments also restricts large-scale civil engineering works. Consequently, traditional methods of river and catchment management are receiving more attention. Such methods often consider local geomorphological conditions well because ancient people tried to control hazards effectively with relatively small human work. In other words, geomorphological knowledge and approaches are becoming more essential today for effective river and catchment management against disasters.

Creating learning materials for geography education in regions affected by the 2024 Noto Peninsula Earthquake

Assoc. Prof. Takuro Ogura[1], Dr. Hiroyuki Yamauchi[2], Dr. Tatsuto Aoki[3], Prof. Nobuhisa Matta[4], Dr. Kotaro Iizuka[5], Dr. Yoshiya Iwasa[6], Dr. Takayuki Takahashi[7], Dr. Kiyomi Hayashi[3], Dr. Tsuyoshi Hattanji[8], Prof. Norikazu Matsuoka[9], Prof. Takashi Oguchi[5]
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11D: Geomorphology Education for Disaster Risk Management, Dobson 3, February 5, 2026, 5:00 PM - 6:30 PM

The 2024 Noto Peninsula Earthquake (Mw 7.5) caused extensive damage in the Ishikawa Prefecture and surrounding areas, with considerable coastal uplift and tsunami flooding. No earthquakes exceeding Mw 7.0 have been recorded in the Noto Peninsula in the past century, making this disaster unprecedented in living memory. Therefore, we aim to support disaster prevention education by developing learning materials using unmanned aerial vehicles (UAVs). We captured High-definition topographic data collected from UAV-LiDAR and UAV-SfM, which were processed into digital 3D models, spherical panorama images, and 3D printings. These materials are designed to provide detailed and intuitive representations of post-disaster landforms and to use as educational tools in schools. The learning materials were introduced during a workshop for teachers in disaster-affected areas, which featured hands-on activities to help participants familiarize themselves with the materials and explore their practice in geography and science classes. Feedback from participants indicated that these tools were highly effective in enhancing classroom learning. The results of this study are expected to contribute to the preservation of disaster records while enhancing disaster awareness in educational settings and local communities.

Educational dissemination of traditional flood-related knowledge using the Eco-DRR digital database

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02I: Living with geomorphic change, Conway 4, February 2, 2026, 2:00 PM - 3:30 PM

Unprecedented climate change has intensified flooding worldwide, and Japan now experiences severe flood events almost every year. Traditional flood-control facilities (TFCFs), such as the rounded-gravel levees characteristic of the Eco-DRR approach, have long mitigated flood risk, sustained local livelihoods, and enriched river-floodplain ecosystems. Yet rapid urbanization and the consequent loss of floodplain functions have accelerated the physical degradation of TFCFs across many watersheds. We built a multi-layered Eco-DRR digital database that integrates UAV-LiDAR point clouds, georeferenced historical maps, field surveys, and interview transcripts to safeguard and mobilize this knowledge. Leveraging these datasets, we created an integrated workflow for locating and analyzing Saruo structures, a distinctive class of TFCF, in the Echi River basin, Shiga Prefecture, Japan. Our analysis shows that while some Saruo have been heavily modified by repeated flooding, vegetation encroachment, and urban growth, others remain largely intact. The contrast between residents' recollections and present-day landscapes exposes the limits of memory-based reconstruction. Beyond serving as an analytical backbone, the database became the hub of our educational outreach. Interactive web-GIS viewers, VR panoramas, and 3D-printed landform models automatically generated from the database were deployed in local museums and university classes. These activities engaged floodplain residents and preservice teachers, aiming to pass traditional flood knowledge to future generations. Participant feedback indicates that the visually rich, data-driven materials significantly improved understanding of TFCF locations and functions, underscoring the value of an Eco-DRR-based dissemination strategy.

Karst landscapes as archives of deep human history: Geoarchaeological perspectives from the Currais de Pedra region, Central Brazil

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Karst areas developed in carbonate rocks are widely recognized for their geoarchaeological relevance, as they preserve important records of past human occupations. In Brazil, where hot and humid climates predominate, karst environments, especially rock shelters and cave entrances, stand out as privileged contexts for the preservation of archaeological remains. These systems should be considered strategic for understanding early human settlement patterns in the Americas, as they offer key insights into the remote occupation of the New World. This study focuses on the Currais de Pedra in northern Minas Gerais, Brazil, a region with evidence of human presence dating back at least 12,000 years. The research aimed to understand how ancient human groups interacted with the physical landscape elements such as rocks, soils, landforms, and vegetation, revealing different spatial strategies over time. Lithological analysis indicates a preference for specific types of limestone, particularly more massive and less laminated varieties like calcarenites, for the production of rock art panels. The soils show geochemical anomalies, with elevated phosphorus concentrations, suggesting anthropogenic enrichment in an environment where this element is naturally scarce. The landform organization reveals that flat surfaces controlled by horizontal bedding planes were used as circulation routes, with occupations concentrated at the base of rocky massifs, in shelters formed by collapses, and on slopes between massifs. Vegetation analysis indicates more stable occupations in forested areas located in valley bottoms, massif edges, and near wetlands, in contrast with more sporadic use of the exposed limestone pavements on the summits. The karst landscape of Currais de Pedra provides a vivid testimony of early human adaptation in the carbonate terrains of Central Brazil and reinforces the idea of karst as a natural archive of deep human history.

The 1983 rainfall-triggered landslide event. The first 'complete' event-based landslide inventory for the northern Lisbon region

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12C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 9:35 AM - 11:05 AM

Rainfall-triggered slope instability is one of the most significant geomorphological hazards in Portugal. Since the 1950s, the occurrence of landslides associated with rainfall in the Lisbon region has been documented. However, although numerous landslide inventories exist for this study area, no complete regional, rainfall-triggered, event-based landslide inventory has been available until now.

On the 18th and 19th of November 1983, the Lisbon region experienced a period of heavy and short-duration rainfall. This event triggered a large number of landslides, particularly in the region north of Lisbon, and therefore is recognized as an instability event of regional significance.

The main objective of the present study was to systematically inventory the landslides triggered during the November 1983 event, based on interpretation of vertical panchromatic aerial photography dataset taken just after the landslide event in December 1983, at a scale of 1:15,000. For the event-based landslide inventory, 284 aerial photographs were analysed, covering the entire study area, which was defined as the area that recorded a daily rainfall amount above the regional reference threshold (~120 mm).

The study resulted in a survey of 1,112 landslides occurred during the 1983 event. Additionally, 48 landslides associated with the event were mapped outside the study area. This validates the previously defined study area limits to some extent, given that the landslide density is lower outside the study area. Globally, the total unstable area reached 83ha during the event, resulting in a landslide density of 0.83 landslides/km² (622.4 m²/km²) and an average landslide size of 747.3m². Mostly landslides were shallow translational (31.2%) and rotational (36.6%) slides, along with deep-seated rotational slides (24.9%). Landslides were predominately concentrated in the northern part of the study area (Arruda dos Vinhos, Alenquer, and Sobral de Monte Agraço), where the highest rainfall levels were recorded.

Millennial and contemporary dynamics of the barrier estuary entrance at Moruya, Australia

Dr Thomas Oliver[1], Professor Andrew Short[2], Dr Toru Tamura[3]
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05F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 11:35 AM - 1:20 PM

Along the coastline of southeastern NSW, barriers and estuaries have developed over the Holocene. Barriers have often impounded estuaries forming so called ‘barrier estuaries’, which have infilled to differing degrees (maturity) due to variable inputs of terrestrial, marine and biotic sediment. This study presents optically stimulated luminescence (OSL) dates, sediment coring, historical maps and charts, aerial photography and airborne LiDAR to reconstruct the millennial and contemporary history of the Moruya River barrier estuary entrance. OSL dating of small estuarine beaches located well inside the present-day entrance reveals they were active between 7000–5000 years ago. At this time, the entrance was far more open and a large flood-tide delta likely helped to infill a wide immature estuary. Continued building of the Bengello Beach prograded barrier to the north, and the development of Moruya Heads barrier to the south progressively constricted the river entrance from 4500 years. Several more estuarine beaches developed behind the Moruya Heads barrier and are dated to ~4400 and ~2800 years ago. Concurrently, the open mud basin of the Moruya River estuary likely infilled with fluvial sediment. Following the arrival of Europeans in the region in the early to mid-1800’s, engineering works were undertaken in stages to train the estuary entrance. OSL ages from a series of low-energy beaches which were formed as a result of the progressive engineering works, concur with the historical records. These engineering works have further constrained the entrance and modified the estuary hydrodynamics, changing sediment transport pathways and the ecological regime of the lower estuary and its potential response to rising sea level.

Assessing Use of High-Resolution Satellite Imagery for Shoreline Change Analysis

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09E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 11:35 AM - 1:05 PM

As climate changes, 3 anticipated consequences in Atlantic Canadian coastal areas are: i) an acceleration in rates of relative sea level rise, ii) an increase in the frequency and magnitude of major storms, and iii) a decrease in winter sea ice. All 3 factors are expected to drive increases in rates of shoreline change. Shoreline change caused by Hurricanes Dorian (2019) and Fiona (2022) likely exemplify these consequences.

The overall goals of the project were to: i) assess whether high-resolution satellite imagery can now be practically used to monitor shoreline change in Atlantic Canada, and ii) document the workflow(s) needed to do this. Historically, new aerial photography was collected at a decadal scale, and the digital tools to process imagery were rudimentary by today’s standards. Satellite imagery from previous decades is usually not of sufficient resolution to monitor shoreline change at the scale desired (e.g., Landsat imagery at 30 m per pixel).

Cape Jourimain, NB, Canada, was used as a test site, because there are a range of shoreline types present there, including salt marsh, sand dunes, and till bluffs, making it ideal for testing purposes. High-resolution satellite imagery (0.3-0.5 m per pixel) was obtained in 2025 to map the present shoreline at Cape Jourimain (e.g., Pléiades, Pléiades-Neo, SkySat, Maxar, etc.). Shoreline change relative to the late 1990s was measured using the Digital Shoreline Analysis System (DSAS) and AMBUR project tools. These tools provide a robust, standardized, and replicable method of measuring shoreline change. With current digital tools and high-resolution satellite imagery now being collected at a weekly time scale, frequent monitoring of shoreline change (e.g., after a major storm) is increasingly possible. This paper presents the results of our assessment and recommendations for future work.

Can landslide debris provide long-term natural defence in sheltered coastal environments?

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Coastal cliff erosion presents a significant management challenge, particularly in densely populated cities where land loss threatens infrastructure and property. Hard engineering structures, such as seawalls and revetments, are commonly used for erosion mitigation, yet they often disrupt natural sediment dynamics and lead to unintended geomorphic consequences. In contrast, nature-based approaches that leverage existing coastal processes are gaining recognition for their potential to enhance resilience while maintaining natural sediment pathways. In sheltered environments like Waitematā Harbour, Auckland, New Zealand, landslip debris accumulating at the base of retreating cliffs may act as a self-sustaining buffer against erosion, offering a potential alternative to conventional hard protection.

This study assesses the necessity of hard stabilisation structures in sheltered coastal environments where recent cliff failures have been triggered by extreme rainfall rather than coastal processes. Using several sections of Auckland's coastline as case studies, it analyses historical cliff retreat rates, sediment dynamics, and policy frameworks to determine whether landslip debris can provide effective long-term erosion mitigation. Drawing on insights from the principles of geomorphic equilibrium, this research explores how landslip debris contributes to dynamic cliff stability in coastal systems. Preliminary observations and analyses of time-series aerial photographs, satellite imagery, and pre-and-post event photographs indicate that landslip debris accumulation at the cliff toe dissipates wave energy, stabilises slopes, and moderates erosion rates.

Here, we highlight the tension between private property protection and broader coastal management objectives. This work evaluates Auckland's coastal management decisions within the framework of the New Zealand Coastal Policy Statement, which emphasises working with natural processes. By examining sites where landslip debris has been retained as a natural buffer, the study explores the feasibility of integrating nature-based solutions into planning frameworks. This research advances sustainable coastal adaptation by critically evaluating the geomorphic, ecological, and policy trade-offs between debris retention and hard protection.

Rock Glacier Thermal Regimes in the Marginal Periglacial Environments of the Southern Carpathians

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Significant environmental transformations, including permafrost degradation, are unfolding in high-altitude mountainous regions as a result of ongoing climate warming. In marginal periglacial mountain areas, permafrost is patchy and confined to locations with favorable conditions for its preservation. In the Southern Carpathians, its presence is closely associated with rock glaciers. Ground surface temperature measurements were employed to assess energy exchange processes at 25 sites with a high probability of permafrost occurrence. Long-term ground temperature monitoring from 2011 to 2024 revealed low mean annual ground temperature (MAGT) values at the study sites, ranging from −2.5°C to 1.5°C. Intense ground cooling is facilitated by the high porosity of coarse debris, which allows for efficient ventilation. The pronounced surface cooling observed in early winter is largely driven by internal ventilation processes, such as advection and convection, which appear to sustain permafrost in coarse debris above 2100 m. BTS measurements further corroborate this, indicating extremely cold ground temperatures beneath a substantial late-winter snowpack. Although temperature fluctuations vary significantly from year to year, a consistent warming trend is evident across all datasets. MAGT is closely linked to air temperature, which has shown a notable warming trend over recent decades—the average temperature during the last three decades was approximately 1°C higher than the 1961–1990 baseline period. Winter equilibrium temperatures are mainly influenced by the ground freezing index prior to the onset of snow cover. At the monitoring sites, snow cover duration has shortened, with insulating snow forming later and enhancing ground cooling during early winter.

Impact of Land Abandonment, Decontamination, and Refarming on Sediment and Radiocesium Transport in the Upper Kuchibuto River Basin, Fukushima

Professor Yuichi Onda[1], Mr. Taichi Kawano[1], Mr. Fumiaki Makino[1], Dr. Shaoyan Fan[1], Dr. Junko Takahashi
[1]University of Tsukuba, Tsukuba, Japan

10B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 2:30 PM - 4:00 PM

Following the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident in March 2011, large quantities of radioactive cesium-137 (^{137}Cs) were released into the environment. In the upper Kuchibuto River basin, located 35 km northwest of the FDNPP, fallout-contaminated farmlands were abandoned and transitioned into grassland. Subsequent government-led decontamination efforts, including topsoil removal and application of weathered granite soil, enabled partial resumption of farming. To assess the downstream impacts of land abandonment, decontamination, and refar,omg, we conducted an integrated analysis using long-term data (2011–), remote sensing, sediment flux, stable isotopes, and radiocesium measurements at seven nested catchments (0.05–135 km^2). Automated hydrological and turbidity monitoring began in July 2011. In Yamakiya, upstream decontamination began in 2013 and evacuation orders were lifted in 2017. Remote sensing of NDVI confirmed widespread bare land expansion during decontamination (2013–2017). This corresponded with sharp decreases in suspended ^{137}Cs concentrations in decontaminated zones due to dilution by low-activity soils. Estimated sediment contributions from decontaminated areas were ~30–60% upstream and ~30% mid- to downstream during the decontamination phase. Changes in sediment hysteresis patterns indicated that large volumes of decontamination soil entered the river, with portions deposited in the channel and later remobilized during flood events, likely reaching downstream by 2015–2016. A positive correlation between forest-derived sediment (estimated from $\delta^{13}C$ and TC) and suspended ^{137}Cs suggested higher contamination levels when forest soil dominated. While decontaminated soils diluted suspended ^{137}Cs concentrations, increased sediment loads temporarily elevated total ^{137}Cs flux. After farming resumed, both sediment discharge and suspended ^{137}Cs levels declined, indicating stabilization of sediment and contaminant transport.

Catchment-scale geomorphic assessments to inform flood modelling and post-Gabrielle flood resilience in Tairāwhiti/Gisborne, Aotearoa New Zealand

Dr Lenka Ondrackova[1], MSc Selene Conn[2], Prof Ian Fuller[2,3], Dr Scott Barnard[4], BSc Joss Ruifrok[1], BSc Nick Gordon[1], MSc Rose Coulter[4], MSc Khendra Harvey[2], BSc Nicole Cameron[2]
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08B: Predicting and responding to geomorphic change: case studies from Aotearoa New Zealand, Dobson 1, February 5, 2026, 9:35 AM - 11:05 AM

Since 2017, Tairāwhiti has been severely impacted by multiple extreme weather events. The most significant was Cyclone Gabrielle in February 2023, which brought a peak rainfall of 488 millimetres (in 48h) at Hikuwai. Gisborne city and surrounding coastal townships experienced devastating consequences from the resulting flooding and landsliding, including loss of life, widespread property and land damage, road closures, collapsed bridges, and water supply disruptions.

Rivers in the Gisborne region already have among the highest specific sediment yields in the world and storms of the magnitude and intensity of Cyclone Gabrielle further charge these overloaded systems. Effective flood modelling must consider these sediment inputs, which can engender significant bed aggradation, worsen flooding and result channel avulsion risks. To inform flood modelling, our geomorphic assessment adopts a – catchment-scale perspective, from source zones to accumulation areas within river channels and floodplains. Key data inputs include landslide and gully mapping, susceptibility and connectivity analyses, aerial imagery, photogrammetry, LiDAR and bathymetric LiDAR data, cross-section surveys, and evaluation of flood levels and silt deposition from previous events.

Engagement with local communities and understanding the historical and cultural value of the landscape will be essential components of this project, ensuring that proposed solutions are grounded in local knowledge and values, and that they are fit for purpose. This comprehensive analysis will enhance our understanding of flood risk, guide future development, and strengthen the future flood resilience of our communities.

This is a significant challenge in our highly erosion-prone region, where sediment dynamics and historical land use changes play a critical role in current and future flood risk. Our approach integrates flood modelling with geomorphic change analysis to better understand future flood risks and explore and support flood mitigation recommendations following the ‘PARA’ framework to be delivered within the next 5-7yrs.

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Hypogene cave of the Mežica Mississippi Valley-Type Pb-Zn mine (Carinthia, N Slovenia)

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07B: Karst geomorphology, Dobson 1, February 3, 2026, 5:00 PM - 6:30 PM

This study presents preliminary analyses of an isolated hypogene cave (length: 223 m; vertical extent: 104 m; volume: 243,000 m^3) located approximately 500 m below the surface within the Mežica mine. The cave was discovered during historic mining activities along the 8th horizon (+510 m a.s.l.) at the turn of the 19th and 20th centuries and was almost entirely flooded at the time of discovery. It lies within the ore-bearing Union Fault system and is developed in Middle Triassic Wetterstein carbonates, which host Mississippi Valley-Type mineralization.

The cave morphology includes a steep, box-shaped upper passage, a large central breakdown chamber, and a lower elliptical phreatic channel, which reaches the current groundwater level (+416 m a.s.l.). Although the cave walls are largely of collapse origin, wall features—such as cupolas, wall and ceiling half-tubes, mega-scallops, and feeders—are indicative of slowly ascending phreatic flow. In its lower section, the cave intersects geodes and fractures lined with hydrothermal calcite crystals. Both the cave walls and calcite crystals are weathered and coated with a thin brown patina composed of various oxide minerals. No evidence of surface water seepage has been observed in the cave (e.g. flowstone formations) nor traces of fast, turbulent flow (e.g. small scallops).
Most of the cave floor is covered by gravel and megablocks that form a fan descending into the main chamber. This collapse material, along with the rocky cave floor, is overlain by a cohesive, brown clay layer up to 0.5 m thick, characterized by desiccation polygons.

It is hypothesized that hypogene speleogenesis in the Mežica mine district occurred in association with tectonic and magmatic activity along the regional Periadriatic Fault zone. This includes regional uplift, an increased geothermal gradient and CO_2 influx, and subsequent cooling, CO_2 phase separation and/or degassing, and mixing of deep-seated hydrothermal waters with meteoric waters.

The rapid lithification of coasts: Interactions between legacy mine waste and marine processes

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Recent works have shown how humans are now the main geomorphic agents on our planet, releasing and transporting vast quantities of natural material. Large quantities of natural material that has been excavated and transported by humans is deposited as waste on earth’s surface. Waste material is also produced when manufacturing anthropogenic geomaterial (e.g., slag, cement kiln dust). Here, we document a rapid ‘anthropoclastic rock cycle’ in a coastal setting, with the formation of an anthropogenic rock through the erosion, transportation, deposition and lithification of legacy waste material, that has occurred over <150 years. Derwent Howe (Cumbria, UK) was a site of steel making since around the start of the 20th century with production ceasing in the 1980’s. Large amounts (26,729,599 m3; 56 million tonnes) of steel slag was deposited as waste material at the foreshore, forming 3 extensive (maximum ~30m in height, 3km wide) cliffs of lithified material. We document the interaction of marine processes with lithified anthropogenic geomaterials and document a 'Anthropoclastic rock cycle' where lithified slag deposits are eroded, transported, reworked, and deposited by marine processes. We use sedimentary logging, facies analysis, clast analysis and SEM datasets to demonstrate the rapid (~decades) lithification of the reworked material, that has since transformed the coast at Derwent Howe from a ‘soft’ coast to a coast that has a rocky foreshore and cliff face. The documentation of this processes opens many questions relating to the potential challenges (e.g., implications for biodiversity and modification of marine processes to hard rock coastlines) and opportunities, including CCS potential of reworked steel slag sites and engineering of coastlines for protection against rising sea levels and increased coastal erosion, while challenging our understanding of aggrading rocky coasts

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Growth law for distributary landforms on Earth and implications for Mars

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04B: Distributary landforms: past, present and future, Dobson 1, February 3, 2026, 9:35 AM - 11:05 AM

Allometric scaling, a scaling relationship between the size of a body part and the size of the whole-body during growth and between species, has been a cornerstone for ecology and evolution since the 20th century. Here, we test this hypothesis to investigate if distributary landform growths (e.g. distributive fluvial systems and river deltas) are predictable on follow similar patterns. This knowledge gap is critical as predicting the growth rates implies we could predict their morphodynamic evolution, maintaining their sustainability under external forcings and predicting processes associated with distributary landforms on other planets. Despite different process responsible in shaping distributive fluvial systems and river deltas, our preliminary findings show a consistent slope-area and apex-to-toe-area scaling and normalised shoreline length-area (Lshore*-A*) scaling from 1,967 distributary landforms on Earth and Mars. Consistent allometric scaling from distributary landforms discovered here evidence that their growth is predictable by following a simple semi-circular growth law of Lshore*~A*0.5. The law proposed here provide a universal understanding of distributary landform allometric growths that could aid in maintaining their sustainability and predicting their future evolutions or past processes responsible for shaping them.

The impact of atmospheric rivers on water flows and sediment fluxes in headwater streams of British Columbia

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08J: Responses of geomorphic processes and earth surface systems to extreme weather and climate events, Conway 5, February 5, 2026, 9:35 AM - 11:05 AM

Each year, western British Columbia experiences numerous land-falling atmospheric rivers (ARs), some of which can have devastating hydrological and geomorphological impacts on watersheds. In November 2021, an AR caused >200 mm of rainfall in a couple of days in parts of south-west British Columbia. This resulted in widespread flooding and mass movement events, disruption to road and rail infrastructure, and damages estimated at billions of CAN$. Given concerns associated with climate change, we monitored two remote headwater streams in the Nechako River Basin over two field seasons to investigate the impact of land-falling ARs on water flows and the associated fluxes of suspended sediment. Numerous ARs were monitored with some causing >100 mm of rainfall in 2 days. Results show that ARs resulted in pronounced increases in water flows and suspended sediment concentrations (often >200 mg/L) causing excessive sediment fluxes that were orders of magnitude greater than fluxes prior to these events. These findings have important implications for understanding how watersheds respond to extreme weather and climate events.

Alluvial Fans on Mars: Global Distribution, Morphology, and Stratigraphy

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02D: Planetary Geomorphology, Dobson 3, February 2, 2026, 2:00 PM - 3:30 PM

Fan-shaped sedimentary landforms on Mars preserve a record of past surface runoff and offer insight into the planet's climatic evolution. Using 6 m/pixel global CTX imagery, we conducted a global survey of fan-shaped deposits, resulting in ~1,500 landforms. Based on surface morphology, we classified these into four morphologic types: alluvial fans, channelized scarp-fronted fan deposits (SFDs), smooth SFDs, and terraced SFDs. Alluvial fans are concentrated in the high southern tropics to southern mid latitudes, while SFDs are more common near the equator. Both occur at lower elevations than Late Noachian–Early Hesperian valley networks, indicating a shift in the spatial and temporal distribution of stable liquid water.

Alluvial fans within craters preferentially occur on north-, south-, and east-facing slopes with high rim relief, consistent with solar-influenced orographic precipitation and snowmelt runoff. We quantified the morphology of each fan and its contributing catchment, finding consistent scaling relationships across Mars, suggesting similar formative processes globally. Although there is limited stratigraphic evidence for deltaic deposition, many channelized and terraced SFDs terminate in closed basins, supporting a delta interpretation based on prior physical experiments. Crater count data indicate that most fans postdate the valley networks, with formation continuing into the Hesperian and Amazonian, implying sustained or episodic fluvial activity late in Mars' history.

Ongoing work compares the morphology of fan catchments on Mars and Earth using circularity metrics, Hack's Law, and hypsometric analysis to infer climate-driven controls. We are also using 1 m/pixel HiRISE stereo-derived DEMs to map stratigraphic layers within Martian fans, quantify bed geometries, and reconstruct depositional environments. Together, these analyses will provide constraints on the hydrology, timing, and climate conditions during the era of fan formation, illuminating Mars' transition from its early wet periods to the dry world we observe today.

Sediment production and transport processes in an arctic post-glacial watershed-fan system in the Aklavik Range (NWT, Canada)

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09G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 11:35 AM - 1:05 PM

Arctic landscapes are among the most vulnerable on Earth to climate change, largely due to the rapid degradation of permafrost. In steeper bedrock-dominated terrains, warming permafrost can lead to increased sediment production via mass wasting events and amplify the delivery of sediment to channels and lakes. However, there is a fundamental lack of data on current rates of sediment production and transport in Arctic watersheds, especially those still responding to post-glacial perturbations, making it impossible to predict the responses and rates of sediment transport processes under future climate change.

To address this, we have been conducting a field-based study of the Black Mountain catchment in the Aklavik Range (Canada). This site was chosen due to the presence of an alluvial fan that post-dates the retreat of the Laurentide Ice Sheet (LIS), providing a closed system where we can consider how both paraglacial and periglacial processes have influenced physical weathering and transport rates through time. Using a suite of geochronometers, we show that local erosion has increased by an order of magnitude or more (~1 mm/yr) from its background state (~0.05 mm/yr) since the retreat of the LIS. From surficial and sedimentological mapping, we show that while both fluvial and debris flow processes deliver sediment to the fan, almost 70% of the fan was deposited under fluvial conditions in the past. Using data from a snowmelt-induced runoff event, we were able to test several sediment transport models developed for temperate alluvial systems. We therefore constrain modern-day annual sediment fluxes by fluvial processes (~0.25 mm/yr). Rates of sediment delivered by mass flows is more stochastic – but may be 1-1.5x fluvial fluxes.

These results combined with field observations suggest that accelerated anthropogenic warming may be increasing sediment supply to the fan, leading to fan aggradation and potentially increased debris flow activity.

Shape Matters: Intrinsic Grain Geometry Controls the Gravel-Sand Transition

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The gravel-sand transition (GST), the downstream shift from gravel- to sand-dominated bedload, is a spatially consistent feature of foreland basin rivers, typically occurring within a few kilometers of the mountain front. Traditionally, the GST has been attributed to mechanisms such as gravel attrition, reduced gravel supply due to increased accommodation space, or enhanced sand supply that inhibits gavel transport. However, these explanations do not align with field observations from the proximal Himalayan foreland, where the GST consistently forms at similar distances from the mountain front, despite (1) the dominance of abrasion-resistant quartzite gravels, (2) spatial variability in accommodation, and (3) substantial sand influx from tributaries. This spatial consistency suggests that external forcings alone cannot fully account for GST formation. This study investigates whether intrinsic grain-scale properties, specifically gravel shape, regulate the spatial position of the GST. We develop a force-balance model that quantifies gravel mobility as a function of particle shape, defined by axial ratios that influence the surface area exposed to fluid drag and lift, as well as the particle's tendency to rotate under flow. Simulations across varying sand concentrations reveal shape-dependent differences in transport potential. We evaluate this model using field data from modern piedmont rivers and stratigraphic exposures of paleo–foreland basin deposits in the northwestern Himalaya. Results show that the GST consistently coincides with a sharp increase in the abundance of low-mobility grain shapes. These clasts inhibit downstream transport, promoting gravel accumulation and a transition to sand-dominated bedload. Increasing sand concentrations downstream further amplifies this effect. Our findings identify grain shape as a fundamental control on GST formation—operating independently of tectonic or climatic influences—and suggest that shape-mediated transport thresholds have influenced sediment dynamics throughout the geological past.

Classifying estuarine geomorphic vulnerability to relative sea level rise in tectonically active Aotearoa New Zealand

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08B: Predicting and responding to geomorphic change: case studies from Aotearoa New Zealand, Dobson 1, February 5, 2026, 9:35 AM - 11:05 AM

Estuaries are dynamic landforms that are increasingly affected by sea level rise (SLR). SLR has the potential to impact their morphology, function, and long-term resilience. In tectonically active settings, relative sea level change is shaped not only by eustatic SLR but also by local processes such as vertical land movement (VLM) and sediment dynamics. In New Zealand, uplift or subsidence often exceeds rates of eustatic SLR, controlling the extent of estuary inundation. This is further modulated by the supply and storage of sediment within the estuary central basin, influencing the capacity of estuaries to adapt morphologically. Despite this, VLM and sediment supply and storage are often overlooked in predicting the timing and magnitude of estuary response to SLR. This research develops a national-scale framework for assessing estuarine vulnerability to relative SLR, accounting for these additional driving processes, to support long-term hazard management and planning.

300 estuaries were analysed using multivariate cluster analysis to group systems based on geomorphic and catchment characteristics. Attributes used include VLM, specific sediment yield, current deposition rates, and hydrodynamic forcing. This classification informed the parameterisation of a Coastal Vulnerability Index, which ranks estuaries based on their susceptibility to relative SLR. The results highlighted the spatial variability of estuary behaviour and could pinpoint systems that deserve urgent attention. The above analyses also revealed end-member systems for further investigation.

This research provides a first-order assessment tool for estuarine management and planning, grounded in geomorphic understanding. The classification will inform the next phase of a larger project, which involves modelling future morphodynamic change in representative systems. By identifying estuaries most at risk from relative SLR, while accounting for VLM and limited sediment supply, the approach supports a more targeted response to future geomorphic changes.

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Palaeohydrography of ancient Tanais in the context of the development of the Don River delta in the late Holocene

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11F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 5:00 PM - 6:30 PM

Tanais, the northernmost Greek colony, was described by Strabo as a port town located on a river and a lake. Today, the remains of Tanais look over a dying arm of the Don River delta 8 km from its mouth. However, during the period when the ancient settlement was active, the hydrographic situation was different. Some researchers believe that Tanais was located on the marine edge of the delta, while others think it was situated on the sea coast. To clarify the hydrographic situation in the area of Tanais, a complex analysis of the sediments unearthed by drilling in the supposed port area was conducted. The analysis included lithology, bulk chemistry, and mollusc fauna as well as radiocarbon dating. It was found that in the first centuries AD, the now inactive river branch was 1.5 times wider and deeper than now, allowing it to serve as the main transport route in the delta. In order to assess the dynamics of the delta's advancement, a number of hand cores was made over the delta's edge. It was found that in the area of Tanais, the marine edge of the delta was located between the 5th and 3rd millennia BC. During the period of post-Polemonian Tanais, in the 2nd and 3rd centuries AD, it was located 5-6 km downstream from Tanais. An estimate of the rate of delta advancement, between 1.2 and 2.8 km per year, shows that at the time of its founding in the 3rd century BC, Tanais was 3.5-5 km away from the mouth of the river. The location of the trade settlement within the delta arm, instead of on the coast, was due to the need for protection of the port from destructive sea storms. Financial support from Project 075-15-2024-554 by Minobrnauki RF is acknowledged.

Investigating the role of geomorphology in the liquefaction-induced damage to airport infrastructure

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Liquefaction-induced ground failure represents a major hazard to critical infrastructure, with airport facilities being particularly vulnerable to differential settlements and lateral displacements. Beyond their economic significance, airports serve as emergency means during seismic events, making their resilience to earthquakes a priority. Recent seismic events, including the 2001 Nisqually and 2023 Türkiye earthquakes, demonstrated the severity of liquefaction effects at airports such as King County (BFI) and Hatay (HTY), where damage to runways, taxiways, and apron areas was extensively documented.

This study introduces a practical, rapid assessment tool for preliminarily identifying areas prone to liquefaction and analyzing the risk to airport infrastructure on a regional scale. Using Kavala International Airport (KVA) in Greece as a case study, we initially compiled a geomorphology-oriented map based on a combination of geological and remote sensing data. After identifying surface geological units, liquefaction susceptibility was assessed. The liquefaction susceptibility map serves as the base layer for evaluating the probability of liquefaction and computing the expected permanent ground displacements (PGD) using FEMA's HAZUS methodology. Finally, considering the PGD values as intensity measures, the vulnerability of airport infrastructure such as runways, taxiways, and aprons is analyzed. In the case of KVA, this analysis resulted in a total loss of €5 million. Validation of the proposed methodology was achieved through the case studies of Oakland (OAK), Hatay (HTY) and King County (BFI) International airports, where extensive liquefaction phenomena were documented. Highlighting the importance of geomorphological analysis in liquefaction risk assessment, this framework supports preliminary planning and mitigation strategies aimed at enhancing the seismic resilience of airports located in liquefaction-prone regions.

Quantifying the liquefaction- related potential of geomorphological features on regional scale

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09D: Engineering Geomorphology AND Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 11:35 AM - 1:05 PM

Soil liquefaction is a seismically induced phenomenon that occurs in saturated, non-cohesive soils under undrained conditions, inducing severe failures to man-made environment. The evaluation of the liquefaction hazard at a site/region involves several steps, starting from the assessment of the liquefaction susceptibility to the calculation of the liquefaction potential.

As it has been shown by recently published studies, a strong correlation between geomorphological features and liquefaction manifestation exists. Specifically, the occurrence of liquefaction is basically dictated by the type of predominant material, the general stratigraphic succession and the depth of water table. In addition, it is accepted that the stratigraphy of the soil layers is one of the parameters that influences the production of liquefaction-induced ejecta. However, a quantitative correlation between geomorphology and liquefaction potential at a regional scale has not been established yet. The goal of this study is to investigate this relationship between surficial geological units and the spatial distribution of liquefaction phenomena by considering data derived by recent seismic events. By combining historical and remote sensing data, it was feasible to reconstruct the evolution of meandering fluvial systems, delineating the different types of geomorphological features.

Afterwards, a correlation of the density of liquefaction manifestations (ejecta and lateral spreading) with the geomorphological units took place and Liquefaction Weight Factor (LWF) for each type were assigned. The outcome of this study indicates that the highest LWF values correspond to point bars and abandoned meanders, verifying the strong correlation between these geomorphological formations and liquefaction occurrence. In contrast, the floodplain units exhibited lower weight factors, and consequently a lower reduced susceptibility. These findings highlight the value of detailed geomorphological analysis in improving regional liquefaction susceptibility/hazard assessments.

Global losses to sandy coast ecosystem services under SLR-induced coastal erosion

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01E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 11:40 AM - 1:10 PM

Coastal zones provide essential ecosystem services for humanity, especially food provisioning, protection against extreme events, economic benefits from tourism and cultural relevance. However, they are under increasing threat from human activity, including climate change-induced sea level rise that increases coastal erosion. Here, we value ecosystem services at risk of sandy coastline erosion worldwide in view of climate change. We build upon recent data advances describing global coastal characteristics, projecting erosion extent and valuing ecosystem services. We evaluate the effect of sea level rise, possibility of landward migration of coastal systems as well as ambient change related to geomorphological and human management factors. We find that 2.7-4.5% of the services provided by sandy coasts could be lost by 2150, depending on the warming scenario, but 13-21% of specifically coastal ecosystems. Particularly endangered are the prevention of soil degradation, moderation of extreme events, and tourism. The Caribbean, Central America and Western Asia would lose the highest share of their services, particularly Small Island Developing States (SIDS). Inland migration of sandy coasts, where possible, could reduce losses by 26-32%, but most coasts have limited retreat space due to anthropogenic or topographical barriers. We show that current ambient coastline change trends could substantially exacerbate the impacts, unless they are reversed by effective coastal management practices. Finally, we discuss the sensitivity of the results especially in relation to uncertainty of sea level and coastal erosion projections and the data on anthropogenic or topographical barriers.

River sand and gravel mining: A global synthesis of drivers, extents and impacts for sustainable management

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Sand and gravel are mined from rivers globally at unprecedented scales, yet the full extent and impacts of this extraction remain underrecognized relative to other environmental crises. Here we present a comprehensive review of riverine sand and gravel mining (SGM), synthesizing 279 studies published over the last five decades within a novel Driver-to-Management Pathway for Sustainable Mining (DMPSM) framework. This framework links the drivers of SGM, the spatial extent of extraction, and the resulting hydrogeomorphic impacts to inform sustainable management strategies. Our synthesis reveals pronounced spatial and scalar mismatches among the scales of drivers, extraction, and impacts: the socioeconomic drivers of sand demand often act at regional to global levels, whereas extraction extents are poorly quantified at local scales, and impacts can propagate far beyond mining sites, complicating effective governance. Excessive sand removal disrupts sediment budgets, triggering riverbed incision, bank erosion, and channel instability. These geomorphic changes steepen hydraulic gradients, lower alluvial water tables, and reduce hyporheic exchange, collectively degrading riverine habitats and water resources. We further find that SGM impacts are compounded by multiple anthropogenic stressors: upstream dams trap sediment, land-use changes increase sediment demand, and climate change alters flow regimes, creating compounding feedbacks that accelerate channel degradation. Our global synthesis underscores the urgent need for improved monitoring across scales and integrated management and governance strategies to bridge these disconnects. Aligning extraction with natural sediment replenishment, strengthening regulatory frameworks and enforcement, and enhancing stakeholder engagement are critical steps to mitigate SGM's cumulative impacts and ensure sustainable river basin management.

Spatial variation of planform changes through an entire river following an extreme flood in southern Korea: a “segmented continuity” concept

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08J: Responses of geomorphic processes and earth surface systems to extreme weather and climate events, Conway 5, February 5, 2026, 9:35 AM - 11:05 AM

Two major frames have been adopted to explicate fluvial processes: the river continuum concept that overlooks the river in a longitudinal continuity and the process-domain concept that series of discrete segments with specific process-dominant zones constitute the whole river. In the summer of 2020, a 1-in-over 200-year rainfall event caused a record-breaking extreme flood along the Seomjingang River in southern Korea. This study investigates the planform changes following the flood along the 135 km entire main stem of the river. By comparing pre- and post-flood Sentinel-2 images, planform changes were detected at the level of individual 10x10 m grid cells. The analysis of satellite images revealed that there were ca. 78 ha net deposition with a total of 195 ha deposited area and 117 ha eroded area.

There was clear distinction between upper and lower reaches, spanning 91 and 44 km, respectively. Along the upper reach, spatial variation of deposited area was associated with shear stress and herb cover, whereas in the lower reach, the variation was accounted for by sand%, shear stress, and specific energy. For the eroded area, spatial variation of upper reach was explained by W/D ratio, shear stress, and specific energy, whereas no significant predictors were identified for the lower reach. Across the entire river, the variation of the deposited area was modeled using sand%, channel width, shear stress, and wood cover. The model for eroded area had limited explanatory power.

This study highlights the necessity of distinguishing between upper and lower reaches when explaining geomorphic changes following an extreme flood. While there was a clear discontinuity in changes between the upper and lower reaches, consistent processes that help explain the variability across each reach were also observed. We propose that a “segmented continuity” can be a helpful framework understanding fluvial processes along the entire river.

Can ridge rents in Arthur’s Pass National Park record past large earthquakes?

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The 1929 Mw 7.0 Arthur’s Pass earthquake was the largest recorded earthquake in Aotearoa New Zealand since the 1888 Amuri earthquake. It received little study at the time, due to its remote alpine location and because it was overshadowed by the destructive Mw 7.3 Murchison earthquake three months later. Subsequent work identified coseismic landslides and proposed that the 1929 Arthur’s Pass earthquake ruptured the newly mapped Poulter Fault. The recent release of new airborne lidar data enables a more detailed assessment of possible coseismic deformation associated with the 1929 Arthur’s Pass earthquake. Preliminary mapping has revealed numerous short (<1–2 km) uphill-facing scarps in higher elevation parts of mountain ranges and no through-going continuous fault trace. These scarps have apparent normal slip that are consistent with ridge rents (also referred to as sackungen, gravitational faults and antislope scarps). Worldwide, the role of strong earthquake shaking in the formation and/or reactivation of ridge rents is unclear. However, the higher density of these scarps near the modelled epicentre and along a zone of coseismic landsliding suggests that they may be related to the 1929 Arthur’s Pass earthquake. To test this, we plan to extract cores from ridge-top tarns adjacent to scarps and date organic material to help constrain the timing of their formation. We will combine these field data with high-resolution ground motion simulations from several plausible earthquake sources, to test whether ridge rents can help constrain the earthquake source. On- and off-fault paleoseismology techniques have been successfully applied in Aotearoa New Zealand, but dating material from ridge rents has not yet been tested. If successful, this methodology will provide a widespread record of strong ground motions for a poorly understood earthquake. Additionally, it will provide a new tool to investigate earthquake behaviour in bedrock fault settings, inaccessible through traditional paleoseismic techniques.

Predictors for total bed material load and active width in coarse-bedded braided rivers

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12B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 9:35 AM - 11:05 AM

Coarse-bedded braided rivers show complex behavior, including anabranch confluence scour, fan-like deposition downstream of such scour holes, incisional narrowing to form new anabranches and subsequent widening, bar migration and curvature-driven anabranch migration. Yet the sustained repetition of these patterns suggests a statistical uniformity which could allow a macroscopic description of the mean total bed material transport and mean total active width of such rivers. Gravel-bed rivers are rigorously scalable to the laboratory using coarse sand or fine gravel. Here we combine a quasi-theoretical formulation for near-threshold channels (Parker, 1979; Phillips et al., 2022) with a dimensionless relation for resistance (Li et al., 2014) to determine these relations up to two order-one dimensionless constants, which are evaluated using the laboratory experiments of Bertoldi et al. (2009). The chief governing parameter involves a multiplicative combination of dimensionless stream power and a power of slope. The relations, when upscaled to field scale, are used to illustrate a) the long-term aggradational or degradational response to changing gravel supply and b) the response of gravel load and active width to a flood hydrograph.

Connectivity Across Seasonal and Annual Scales Within a Landslide Scar in Northern Japan

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03J: Landscape conditioning for cascading sediment hazards in Pacific steepland catchments, Conway 5, February 2, 2026, 4:00 PM - 5:30 PM

This study examines connectivity within a landslide scar in Northern Japan across both seasonal and annual timescales using Structure from Motion (UAV-SfM) photogrammetry. The Yahata landslide scar consists of a main section (2.8 ha) and four smaller sections (0.5–0.8 ha each) contributing sediment to the apex of a large, dormant fan. Over a period of three years, UAV imagery was collected at seven intervals from 10.2018 to 10.2021 to calculate high-definition digital elevation models and orthoimages complemented by interval camera photographs to support process interpretation.

A distinct seasonal connectivity patterns were identified. In winter, material weakened by freeze-thaw weathering resulted in small-scale rockfalls on rock slopes delivering sediment into the channels of all landslide sections. While hillslopes were highly connected to the channels, channels remained disconnected from the fan. Conversely, summer exhibited reduced rockfall activity, whereas slopes remained linked to channels, but with a lower degree of connectivity. In smaller sections, only minor debris flows occurred in summer, leading to limited sediment accumulation in the lower channel reaches and minimal connection to the fan. The main section exhibited different behavior: gully erosion and debris flows were more frequent. These processes scoured channel deposits, often depleting in-channel storage before the subsequent freeze-thaw season. Consequently, sediment could be transferred to the fan apex indicating more continuous slope-to-fan connectivity.

On an annual scale, the small sections maintained their slope-to-channel connectivity pattern, with sediment accumulating in the lower channel reaches. However, the main section frequently experienced complete channel storage depletion after the debris flow season, reducing the system to a direct slope-to-fan coupling.

This study underscores that these connectivity patterns are dynamic and could be further altered by rare, high-magnitude rainfall events or earthquakes, which may dramatically change sediment transfer pathways and connectivity degrees throughout the landslide system.

Mapping gully morphology and sediment connectivity from high-resolution geospatial datasets and precision surveys in a lateritised geomorphosite of Eastern India

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The Garhbeta region, in the Paschim Medinipur district of West Bengal, eastern India, suffers from severe gully erosion in a lateritised terrain, which has been denoted as a national geomorphosite. Mapping of these fine-scale geomorphic features is facilitated by the use of very high resolution geospatial datasets, integrated with precision ground surveys, which reveal the gully morphology and extents and pathways of sediment loss. A two-metre resolution bare-earth DTM was used to accurately extract the gully network following a pixel-based morpho-unit classification and a 'depth-to-bed-from-shoulder' approach (the elevation difference from spur top to gully bed). High-resolution terrain data from latter-day UAV surveys highlight the major topographic changes in this gully field. Multiple close-range photogrammetry datasets prepared using the Structure-from-Motion (SfM) technique, in combination with DGPS surveys further reveal the micro-topographic changes in individual landforms, which are brought about not only due to surficial erosion but also by the development of touristic trails across this geomorphosite. Digitisation of individual rill-heads and gully perimeters from successive high resolution images (IKONOS, GeoEye, Worldview and CartoSat) revealed gully expansion extents, along with CA-Markov based simulation of the gully tract's growth, which was validated using latter-day images. Use of the SedInConnect toolbox was done to map the structural sediment connectivity within this gully field and discern the pathways of sediment loss, along with local blockages. Morphometric assessment of the gully sub-basins revealed the newer, smaller gully basins in the western and south-western parts to be presently more erosive and expanding faster than the eastern larger, older basin, while suffering substantial volume loss. These basins also have steeper gully longitudinal profiles, with higher stream gradient index values and hypsometric integrals. The ascertained expansion rates typify lateritic gullying in a sub-tropical climate, and denote the utility of such very high resolution geospatial datasets in mapping gully tracts.

Last of a Summer's Sand: River hollowing, Planform Morphology and Water Quality Changes from In-stream Mining in southern West Bengal

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04I: Human Footprint in River Basins, Conway 4, February 3, 2026, 9:35 AM - 11:05 AM

Numerous sand bed rivers of West Bengal in Eastern India have been modified markedly due to sustained, seasonal sand mining in the aftermath of the summer monsoon, thereby generating a new class of anthropogenic riverbed landforms. A classification of these features was undertaken, based on their dimension, pattern, position and permanence and whether they were created by excavation, planation or accumulation processes. Nomenclatures such a sand bridges, sand hollows and sand pools are suggested, while the seasonal and yearly variations in their patterns and areal extents are mapped from multiple Google Earth and IRS Resourcesat-2A LISS-IV MX images. High-resolution DEMs from Cartosat-1 stereo images and UAV surveys are used to discern the volumetric changes in the mined river reaches and the amount of sand extraction that occurs from each reach, revealing how this alters over the course of the sand mining season. The identified landforms primarily vary based on the river width and the history and regularity of sand mining in the examined reach. These features induce marked channel shifting, concomitant riverbank erosion and a considerable loss in the river’s longitudinal connectivity, especially in narrower rivers. Continued sand mining also exposes coarser substrates on the riverbed, that alters the hydromorphological behaviour of the channel. Simulation modelling (HEC-RAS 1-D) reveals the alterations in in-stream flow patterns and velocities within mining sites, in comparison to that in unaffected reaches. Turbidity and total suspended sediment estimates in the mined reaches were extracted from multi-year and multi-seasonal Sentinel-2A images via the Google Earth Engine platform. Field measurements of water quality parameters using a depth-wise YSI ProDSS instrument provided validation for the image analysis. Turbidity levels are expectedly higher within sand mining reaches, with river disconnections deteriorating the ambient riparian habitat, that results in the death of fishes and a drying out of disconnected pools.

Hillslope instability and landslide formation under heavy rainfall conditions in complex terrain and deep soils of Northern Vietnam

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05J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 11:35 AM - 1:20 PM

Tropical regions experience high rainfall intensities during prolonged summer monsoon seasons. High rainfall sums, increased soil saturation, and pore water pressure are the main triggering factors of landslide formation. In Northern Vietnam, landslides are a constant geohazard that occur yearly, frequently in spatiotemporal clusters. In the present study, we documented and analyzed six landslide forms in two regions: Ho Bon and Xuan Minh. For these sites, we aimed to define the impact of terrain topography, bedrock configuration, and soil physical and chemical properties on hillslope instability and landslide formation. Loose and intact soil samples were collected and analyzed using various laboratory methods: particle-size distribution, the content of carbon (C), nitrogen (N), iron (Fe), and aluminum (Al), and their amorphous (Feox, Alox) and free (Fed, Ald) forms. X-ray fluorescence (XRF) and X-ray diffraction (XRD) methods were applied to determine major elements and mineral composition.

Six shallow landslides analyzed in this study developed under prolonged rainfall events in September 2022 and August 2023. All landslides developed on steep and forested slopes. Deep soil profiles reaching saprolite were documented at all sites. There was a clear separation between the regions regarding soil chemical and physical properties. Soils developed on hydrothermally altered trachytes from HoBon contained a statistically higher proportion of clays and silt fraction. At HoBon, clays formed a low-permeability layer on the sliding surface, which led to excessive pore water pressure and mineral lubrication. We also found that the soils formed on granitic gneiss saprolite in Xuan Minh featured coarse-grained material. Samples from this site also had a lower void ratio and porosity than HoBon samples. These results suggest that although particle size distribution is a key soil property in landslide studies, no generalization is possible regarding this factor for the study sites.

1005

Quantifying contemporary erosional dynamics of alluvial gullies using high-resolution LiDAR-based terrain analysis

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02H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring AND Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 2:00 PM - 3:30 PM

Once initiated, gully development proceeds through headward retreat and volumetric expansion, with rates influenced by both extrinsic and intrinsic factors. Quantifying these rates is critical not only for understanding the erosional processes driving gully evolution but also for informing effective management and remediation strategies. In this study, morphometric and terrain analyses were used to quantify headcut retreat and volumetric change across 15 alluvial gullies using high-resolution LiDAR-derived Digital Elevation Models (DEMs) from 2022 and 2024. The study was conducted in a semi-arid catchment draining into the Great Barrier Reef. Over the two years, annual headcut retreat rates ranged from 0.13 to 0.56 m yr^{-1}, while annual volumetric losses ranged from 0.01 to 118.32 m^3 yr^{-1}, with all gullies showing net erosion. Sediment loss was dominated by erosion of gully slopes and walls—including sidewalls and retreating backwalls—which accounted for 30 to 90% of the total eroded volume. Headcut retreat contribution ranged from 6 to 50%, while the gully channel erosion had the lowest contribution, ranging from 1 to 22% of the total eroded volume. Headcut contribution was highest for gullies with a high catchment-to-gully area ratio. In all gullies, less than 6% of the gully area showed evidence of active surface erosion. A strong positive correlation was observed between headcut retreat rate and upslope catchment area, highlighting the influence of upslope catchment on gully development. A moderate positive correlation between volumetric loss rate and the width-to-depth ratio suggests that direct rainfall impact may contribute to volume loss in wider gullies. Although preliminary and based on a short timeframe, these findings offer valuable insights into short-term dynamics of alluvial gullies and contribute to the development of more targeted and effective gully erosion management strategies.

Cool fans: Morphology and sediment transport processes of Arctic fans, Aklavik and Canyon Ranges, NWT, Canada

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Despite the ubiquity of alluvial fans across tectonic, climatic, and planetary settings, studies of fans are commonly confined to arid, desert settings. Unlike their warm and dry counterparts, permafrost-dominated, Arctic fans are uniquely shaped by frost-based processes, including permafrost degradation and solifluction. These conditions introduce new mechanisms for sediment transport and generate a system that is uniquely sensitive to climate. In light of a rapidly warming modern climate, it is essential we build an understanding of Arctic alluvial fan processes to improve our understanding of fan morphologies across climate settings. In this study, we examine the morphometry and sediment transport processes of 43 permafrost-underlain fans from the Aklavik Range of the Richardson Mountains (Northwest Territories, Canada). We compare these Arctic fans to 12 alluvial fans from the Canyon Ranges of the Mackenzie Mountains (Northwest Territories, Canada), a region with discontinuous permafrost, ~450 km southeast of the Aklavik Range, but with a similar tectonic and climatic history. All fans in this study are part of broader fan-canyon systems that formed in response to Laurentide Ice Sheet retreat following the Last Glacial Maximum. For each fan, we use the 2-m resolution ArcticDEM to measure catchment area, fan area, fan slope, Melton ratio, and concavity indices. We apply these metrics to identify debris flow- versus fluvial flow-dominated fan systems and the impacts of permafrost and Arctic climate on fan morphology. In addition, we use fan and catchment volumes to estimate erosion rates since the retreat of the Laurentide Ice Sheet. Initial results indicate that 58% of the mapped Aklavik Range fans are fluvial-flow dominated. Our findings provide a new dataset of fan morphology in an understudied climate setting, allow for insight into sediment transport processes in climate-sensitive regions, and build understanding of potential changes in sedimentation in a rapidly warming Arctic.

A landscape in perpetual motion: Past, present and near future of the Acheloos delta, Greece

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07F: Tropical coral reefs and reef-lined coasts AND Delta Geomorphology Observed from the Past to the Present: Interactions of Natural Processes and Anthropogenic Influences, Conway 1, February 3, 2026, 5:00 PM - 6:30 PM

The present study investigates the alterations of the coastal area of the Acheloos' deltaic complex (E. Greece) for the last 20 ka and the shoreline response to the anticipated sea level rise, according to various sea-level rise prediction scenarios. The distant and near past were reconstructed through the interpretation of seismic data, sediment cores and historical aerial imagery, while the future state was evaluated considering the IPCC sea-level rise projections, adapted to the specific geomorphological and sedimentological characteristics of the study area. The results indicate a significant alteration of the area throughout the Holocene, primarily driven by the constant sea level fluctuation, while for the recent past, severe erosion has been observed in the entire study area, in places reaching 250 m (~3.4 m/yr) for the past 75 years. The IPCC predictions for 2100 suggest a continuous reduction of the delta, by 10% to 20% of the present area, while considering the most extreme climatic scenario, the percentage of the lost area could reach up to 60% of the total deltaic plain. Regardless of the prevailing scenario, it was estimated that for each 0.1 m of sea-level rise, the average land loss at the deltaic area is approximately 2.8 km^2.

Environmental Aquatic Impacts of a Contaminated Debris Flow Originating from a Failed Mine Tailings Pond in British Columbia, Canada.

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13D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 11:35 AM - 1:05 PM

In August 2014, the tailings storage facility of the Mount Polley gold-copper mine in British Columbia, Canada, failed catastrophically releasing 25 million m3 of contaminated liquids and solids into the environment. This represents the second largest mine spill in the world. Most of this material flowed down Hazeltine Creek, eroding a further 1 million m3 of topsoil and channel material, and was deposited in Quesnel Lake, a large, deep lake that is important for migratory Pacific salmon and other resident fish species such as trout. This tailings and scour-rich flow resulted in a thick bottom deposit in the west basin of Quesnel Lake and an extensive fine-grained plume of soils and contaminants that moved up-lake, out of the lake and slowly settled to the bottom. Over the decade since the spill the aquatic impacts of this material have been assessed, and while the magnitude of the effects has decreased the frequency of disturbance has been sustained. Overturn energy in this dimictic lake results in resuspension of fine, contaminated in fall and spring which then is available for transport throughout the system and uptake by lower levels of the food web. The main findings to date, focusing on the timing and movement of contaminated sediment as well as their impacts on the food web including biofilm, plankton and invertebrates will be presented.

Landslide Lab: A 3D Application for the Interactive Exploration of Landslide Classifications

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11D: Geomorphology Education for Disaster Risk Management, Dobson 3, February 5, 2026, 5:00 PM - 6:30 PM

Understanding the diversity and complexity of landslide processes is important for both natural hazard awareness and geoscience education. Landslide Lab is a 3D application in the conceptional phase of development. It is based on the updated Varnes classification by Hungr et al. (2014) and intended to enable users to interactively explore the 32 different landslide types through visual learning. Landslide process simulations can be triggered by users via the configuration of material, movement type, volume and velocity class. The application is envisioned for a wide audience, including students, educators, and the general public.

The development of Landslide Lab comprises two main work packages: (i) The creation of a set of dynamic simulations representing the various landslide types; (ii) The design and implementation of an interactive educational environment in which users can adjust parameters and observe the resulting landslide process characteristics. The central challenge is the creation of a set of simulations that effectively capture the diversity of landslide types while maintaining clarity, flexibility, and visual consistency. The software package Houdini is investigated for the generation of those procedural simulations responding to user-defined parameter adjustments. Unreal Engine 5 will be used to create the interactive environment, including the user interface, parameter controls, and explanatory overlays. Combining the strengths of both programs enables the integration of informative visualizations in the form of dynamic 3D simulations with an intuitive, game-based learning experience.

We develop Landslide Lab as a freely available application for virtual reality and desktop platforms with the goal to make landslide science more accessible. By translating a scientific classification system into an interactive educational tool it supports natural hazard education, enhances science communication, and promotes broader engagement with geoscience concepts.

Reference: Hungr, O., Leroueil, S. & Picarelli, L. The Varnes classification of landslide types, an update. Landslides 11, 167–194 (2014). https://doi.org/10.1007/s10346-013-0436-y

Diachronic analysis of urban expansion to understand geomorphological controls and anthropogenic forcings on city growth: Rome case study (Italy)

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Growing urbanization and expansion of cities pose significant threats to both the natural environment, due to excessive land consumption, and the urban fabric itself. Cities are inherently sensitive ecosystems, vulnerable from an ecological perspective and highly susceptible to natural risks increased by global changes. This trend of rapid urbanization is particularly pronounced in Asia, Africa, and South America, where urban development models often differ considerably from those historically seen in Europe. Nevertheless, several European cities are also experiencing substantial expansion, leading to evident problems that challenge the notion of sustainable development.
The progressive urbanization of European cities, therefore, represents a compelling area of investigation within urban geomorphology. In this dynamic and constantly evolving global landscape, urban geomorphology offers crucial insights into understanding the complex interplay of natural, historical, and anthropogenic forcings that shape landscapes. It also sheds light on the rationale behind past and present settlement choices in relation to natural morphology.

Our study specifically addresses the complex case of Rome (Italy), a city with approximately 3000 years of continuous history, making its urbanization complex and multi-layered. This required a multi-temporal and multidisciplinary approach for a thorough geomorphological investigation. Key questions driving our research included: how to precisely define the boundaries of current urban areas; how to effectively map this progressive urban growth over time; and what factors influence the direction of the city's expansion.

Results from our previous studies, combined with new data collected, culminated in a significant output: a comprehensive mapping of the city's progressive expansion. By comparing this with spatial and temporal evolution of anthropogenic landforms, we were able to dissect how both historical reasons and pre-anthropogenic morphology conditioned the directions of the city's expansion over millennia.

This research supports future urban planning for Rome and provides a valuable reference for analyzing cities globally with similar characteristics.

The effect of anthropogenic morphogenesis on plant spatial distribution in urban environments

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The ongoing urbanization trend makes it essential to improve scientific knowledge about the relationships between urban habitats and species. For instance, enhancing our scientific knowledge of the interplay between geomorphology and vegetation in urban ecosystems may effectively support restoration actions. To support biodiversity in environments transformed by anthropogenic activities, restoration actions based on landscape classification according to Potential Natural Vegetation (PNV) are crucial.

In deeply urbanized areas, the prevailing landforms and processes are related to anthropogenic erosion and accumulation, which profoundly changes natural morphology and impacts natural morphogenetic processes.

PNV types, strictly related to environmental land units defined by the combination of macroclimate, lithology, and geomorphology, are highly correlated with topographic position, which can be altered by anthropogenic morphogenesis.

In this context, we investigated the case study of Rome city (Italy), surveying urban geomorphology and its determinism on shifts in biodiversity support capacity and PNV.

Anthropogenic transformations of Rome's landscape have been characterized using morphometric analyses of previously surveyed landforms. Multitemporal digital elevation models allowed volumes of anthropogenic accumulation to be quantified (differences of digital elevation models, DoD), and soil and drainage changes due to altered slope shapes (slope, curvature, aspect; raster of differences, RoD) to be estimated.

Vegetation surveys were performed in artificial contexts, both inside (altered plots) and outside (control plots) anthropogenic landforms, to assess shifts from low-disturbed successional models due to geomorphological alteration.

Results highlight that forests on anthropogenic landforms diverge from natural ones in terms of species composition, being characterized by invasive, nitrophilous, and transitional species.
The described interdisciplinary approach, based on modern investigation methods and field research, allowed us to increase knowledge about how humans, as morphogenetic agents, interact with the biological world.

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Baseline silicate weathering rates and CO2 drawdown from an agricultural landscape

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09C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 11:35 AM - 1:05 PM

The weathering of silicate rocks at the Earth's surface is an important component of the global inorganic carbon (C) cycle resulting in fluxes of 90–140 megatonnes C y-1 from atmosphere to oceans. The flux results from reaction of silicate minerals with carbonic acid (CO2+H2O) generating carbonate alkalinity in the oceans (HCO3- and CO32-), which through the biological pump is transferred via marine carbonate and the rock cycle back to the atmosphere by volcanism and metamorphism. Earth's climate has been regulated by a silicate weathering-climate negative feedback whereby increased atmospheric CO2 enhances the hydrological cycle thereby accelerating weathering and drawing down CO2. This response occurs over million year timescales and has ensured climate stability and resilience to perturbations. Accelerating the weathering of silicate rocks by applying them in a ground form over agricultural landscapes, known as enhanced rock weathering (ERW), may act as a highly effective climate change mitigation strategy, capable of sequestering a proportion of anthropogenic greenhouse gas emissions. Agricultural landscapes comprise 41% of the continental landmass and are well equipped for spreading silicate rocks without compromise to food production. However, silicate weathering in agricultural landscapes is complicated by an abundance of acids other than carbonic, generated by fertilisers and enhanced nitrification. We assessed the variability of silicate weathering processes within a grazed pasture landscape formed in loess in Southland, New Zealand to better understand baseline CO2 drawdown from which the efficacy of ERW could be determined. We quantified HCO3- flux normalised for catchment area in drainage water from two small catchments (< 5 ha) and found it varied by more than a factor of 2. We discuss reasons for the variability, compare these rates to large catchments with minimal agricultural footprint, and hopefully present results of HCO3- flux following recent amendment with crushed basalt at 50 t ha-1.

A field-based approach for flow typologies determination and analysis of their impacts on control works in a mountain catchment

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10A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 2:30 PM - 4:00 PM

A common approach to control sediment transport during floods involves the use of hydraulic structures installed within channel networks. During such events, sediment dynamics can vary depending on topographical, physical and hydraulic factors, leading to different geomorphological forms. While channel control works play a role in regulating the sediment transport, fluxes might affect the structures integrity as well. Transport mechanisms generate deposits with different morphological and sedimentological characteristics, which can be analyzed in the field using a post-event protocol to determine the dominant flow typologies along the channel network. The study focuses on the Vegliato Torrent (Italy), a 4.4 km2 mountain catchment with a 3 km long main channel divided into 50 sub-reaches and characterized by the presence of 22 structures. The basin was affected by a flash flood in 2021. The transport typologies considered in this study are debris flow, debris flood, hyper-concentrated and water flow. These flow typologies are associated with the characteristics of hydraulic structures, evaluated using two parameters: the Maintenance Priority index (MPi), which reflects the state and functionality of the control works, and the Sediment Continuity Ratio (SCR), which indicates the extent to which a structure promotes or disrupts sediment continuity during an event, also comparing to the other structures.

The results show that 55% of the main channel is characterized by debris flow. Debris flood is also widely prevalent (43%), while only a few sub-reaches exhibit water flows (2%). The analysis shows that 67% of the damaged or low functioning structures that also promote sediment continuity are located within debris flow sub-reaches. Furthermore, around 50% of the structures that are efficient and promote discontinuity are located in debris flood sub-reaches. These results provide important guidance for authorities in developing sediment transport management plans and interventions, considering both transport typologies and hydraulic structures functionality.

Accounting for Extreme Events to improve River Mobility Mapping

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01I: Living with geomorphic change, Conway 4, February 2, 2026, 11:40 AM - 1:10 PM

In flood risk management, various approaches exist to map fluvial corridors which include future river mobility, but they usually rely on the projection of historical rate of annual migration of the channel. In the context of more frequent extreme hydrological events, the limitations of these approaches have become apparent, since in some geomorphological contexts, a single event can result in much greater mobility than would have been anticipated on the basis of average historical rates. This research addresses the question: How can event-driven river mobility be effectively mapped, and what methodologies are best suited for this context?

The main objective of this study is to develop and test methodological approaches for incorporating event-driven mobility into river mobility mapping. Specifically, the research aims to (1) identify explanatory variables for event-driven mobility due to lateral migration, widening and avulsions, and (2) apply predictive methods that account for event-driven dynamics.

The methodology relies on the analysis of historical and recent river channel paths for 5 rivers located in southern Quebec (Canada) using GIS and remote sensing to quantify lateral mobility processes. Multivariate analyses are conducted to identify variables that explain event-driven mobility for homogeneous reaches, and predictive models are tested to assess their applicability in the Quebec legal context.

Expected results include a comprehensive database of river mobility trajectories allowing to improve the characterization of event-driven mobility processes, and to examine the key variables influencing various types of lateral mobility. The research anticipates producing new mapping tools and methodologies that can better inform flood risk management and land-use planning in Quebec.
By explicitly addressing the impact of rare, high-magnitude events—which are difficult to integrate into mobility mapping—this work seeks to advance both scientific understanding and practical management of river systems under increasingly variable climatic conditions.

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Eroding soil organic carbon in Arctic deltas

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08F: River Deltas: Dynamic Systems Under Climate and Human Forcings, Conway 1, February 5, 2026, 9:35 AM - 11:05 AM

Arctic river deltas connect the northern continents to the Arctic Ocean, modulating riverine fluxes of water, sediments, nutrients, and heat. Deltas also directly impact particulate and nutrient fluxes to the coast, depositing sediment to build new land and eroding existing deposits as channels migrate. In the Arctic, older delta deposits are often comprised of permafrost and rich in carbon. Erosion of these permafrost soils may move large quantities of sediments and carbon from these terrestrial stores into the coastal ocean, potentially impacting marine ecosystems. We conducted an analysis of Landsat imagery and soil organ carbon (SOC) data for six high-latitude deltas to quantify their rates of bank erosion and to estimate resulting SOC fluxes. We compared our calculated SOC fluxes from erosion in the deltas to available estimates of annual riverine total organic carbon (TOC) fluxes taken upstream of the deltas. Our results suggest that erosion of existing deposits on the deltas may produce annual SOC fluxes that are up to 27% of the incoming river TOC flux, suggesting that measurements of riverine TOC fluxes taken upstream of the delta may be significantly underestimating organic carbon fluxes to the coastal Arctic ocean. Future studies should work to understand transport pathways and times through Arctic river deltas to determine how much carbon is actually transported from deltaic landscapes into the ocean and how much is redeposited within deltaic systems.

Landslides, permafrost, and active tectonics: Susceptibility analysis for the Kluane Lake area, southwestern Yukon

Miss Catalina Pino-Rivas[1], Sergio A. Sepúlveda[1], Panya Lipovsky[2], Yosire Martinez[3]
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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Permafrost degradation is increasingly recognized as a trigger of slope instability in cold mountainous environments, particularly in regions undergoing rapid climate warming. In Southwestern Yukon, Canada, landslides related to thawing permafrost are becoming more common, yet little is known about how the presence of permafrost and its degradation interact with seismicity to influence slope failures, especially in bedrock. Despite ongoing research on permafrost-related landslides in other parts of the world (e.g. the European Alps), comparable studies in Canada—especially those related to seismically active areas—are scarce.

The goal of this study is to evaluate landslide susceptibility in the Kluane Lake area of southwestern Yukon, using a combination of geological, geomorphological, hydrological, and permafrost-related variables, including seismic parameters representing a potential M7.0 earthquake on the Denali Fault. The study area spans approximately 250 km from the White River to the Aishihik River and covers about 70 km from the southwestern Kluane Lake to Gladstone Lakes. It is intersected by the Alaska Highway Corridor, which traverses northwest into Alaska, and it's located along the Denali Fault System.

We conduct a binary logistic regression statistical analysis to perform a susceptibility analysis, using predictor variables such as slope angle, aspect, lithology, distance to active faults, and mapped permafrost distribution. The analyses uses the landslide inventory currently available for the region, and includes the modelled peak ground accelerations for a hypothetical M7.0 event on the Denali Fault System. We also aim to analyze seismic patterns such as ground motion directivity and topographic amplification.

With this, we aim to identify the main controlling factors for landslide susceptibility in this permafrost-seismic context. This research will contribute to a better understanding of landscape response in high-latitude tectonically active regions. The findings have direct implications for geohazard assessment and also for infrastructure development in permafrost-rich, earthquake-prone terrains.

Does subglacial groundwater flow pose a threat to radioactive waste repositories?

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

During large continental glaciations, groundwater flow beneath ice sheets undergoes a complete reorganization. Subjected to significant pressure from the overlying ice and driven by a hydraulic gradient that mirrors the ice surface slope, subglacial groundwater—fed by the melting ice—penetrates deeper into the bed, flows faster, drains from the ice sheet interior towards its forefields, and interacts with dissolvable rocks. Where the hydraulic capacity of the substratum is insufficient to absorb all meltwater from the ice/bed interface, subglacial channels form, leading to deep erosion in tunnel valleys that can exceed 500 m. These phenomena must be considered when planning the long-term safety of radioactive waste repositories (RWRs) in regions expected to experience ice sheet overriding during future glaciations.

Here, we apply a three-dimensional steady-state numerical model of groundwater flow to assess potential subglacial drainage during a prospective glaciation in northwestern Germany, where RWRs are under consideration. Our Finite-Difference model includes 38 fully saturated hydrostratigraphic units (aquifers and aquitards) extending to a depth of ~2.5 km, overlain by a future ice sheet with its bed pressurized to the flotation level. The model domain is uniformly discretized into a grid of rectangular cells (1000×1000 m). Model simulations show that groundwater flow concentrates in well-permeable formations, with flow direction generally oriented from the ice sheet interior towards its margin and discharge occurring at its forefield. An estimate of the water budget indicates that the substratum may not be able to drain all meltwater from the ice/bed interface, potentially leading to enhanced erosion in these areas. Consistent with earlier studies, our results suggest a complete reorganization of groundwater flow dynamics compared to the present system, with the ice sheet's impact on groundwater appearing negligible at depths greater than the critical threshold of 600 m relevant to RWR planning.

The record of a Late Pleistocene glacial flood in western Denmark: processes, landforms, and deposits

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08G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 9:35 AM - 11:05 AM

Rapid releases of glacial meltwater have left distinct footprints across the Central European Lowland. Deeply incised tunnel valleys, oversized ice marginal spillways, fields of megadunes, and glacial curvilineations carved by cataclysmic drainage events occur along the southern margin of the last (Weichselian) Scandinavian Ice Sheet margin. These meltwater releases contributed significantly to continental-scale sediment re-distribution and landscape shaping and may have influenced climate by introducing large volumes of freshwater into the oceans.

Here we document, for the first time, evidence of a major glacial flood in Denmark. The flood occurred at the margin of the Weichselian ice sheet during early deglaciation and retreat from its outermost position around 21,000 years ago. The meltwater, discharging through several prominent tunnel valleys, was funneled at the ice forefield and then flowed along the ice margin to the North Sea generating a field of megadunes clearly discernible on LiDAR images. The 47 mapped megadunes reach heights of up to 2.2 m (mean 1.1 m) and widths of up to 320 m (mean 138 m) covering an area of approximately 18 km2. Excavations, Ground Penetrating Radar surveys and luminescence dating reveal that the megadunes consist of poorly bleached parallel- and cross-bedded meltwater sand and gravel, with occasional large-scale foresets indicating palaeoflow directions perpendicular to the dune crests. Estimates of flow conditions utilizing different empirical approaches suggest water depths between 9 and 21 m, flow velocities between 1.5 and 14.5 m/s and water discharges between 82,000 and 1,400,000 m3/s.

Our findings underline the importance of glacial meltwater as a land-shaping and sedimentological agent acting along the margin of a retreating ice sheet.

Bedload transport capacity in the Alps under the influence of climate warming

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

As climate warming accelerates glacier melt and alters hydrological regimes, sediment transport dynamics - particularly bedload transport - are expected to undergo significant changes. This study investigates the evolving bedload transport capacity in rivers across the Alps, focusing on catchments in Switzerland and Italy, from the present day through to 2100. We assess projected hydrological shifts and their implications for bedload mobility, and try to link transport capacity with bedload supply and availability across these alpine regions.

To simulate future discharge, we employ a semi-lumped hydrological model incorporating a dynamic glacier evolution parametrisation, driven by several climate scenarios at daily resolution. For ensuing sediment transport capacity computations, simulated daily discharge is downscaled to an hourly time step using an entropy-based approach: we convert daily mean discharge values into sub-daily flow duration curves, effectively representing diel melt-driven discharge variations. Bedload transport capacity is then estimated using the Wilcock and Crowe equation, enabling an assessment of the maximum bedload transport capacity in response to evolving discharge conditions.

Beyond transport capacity: Modelling bedload dynamics in a sediment-limited Alpine river network

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02J: Mountain sediment cascades and landscape response to changing climate, Conway 5, February 2, 2026, 2:00 PM - 3:30 PM

Quantifying bedload transport in Alpine river systems is challenging, largely due to the complex interplay between hydrology, sediment supply, and channel morphology that govern these dynamics. Direct measurements are difficult, often dangerous and logistically demanding, while indirect monitoring methods, though promising, are still limited and rarely capture network-scale dynamics that control sediment fluxes. Traditional prediction approaches rely on stream power-based equations that tend to assume unlimited sediment supply, frequently resulting in substantial overestimations of transported volumes.

To overcome these limitations, we have adapted the D-CASCADE model - a network-scale framework designed to simulate sediment connectivity and account for supply constraints - for application in steep, coarse-grained mountain catchments. The model integrates approaches for estimating flow hydraulics and bedload transport capacity suitable for Alpine environments and supports multi-grain size transport simulations.

For the first time, we validate the model against continuous bedload data collected since 2014 at the outlet of the Sulden/Solda catchment (Italian Alps). Our best-performing simulation predicts transported volumes within one order of magnitude of measured values, significantly improving on traditional methods, whilst maintaining a plausible grain size distribution. Beyond outlet fluxes, the model reconstructs sediment connectivity across the catchment, identifying sediment production, transfer, and deposition zones and quantifying transport path lengths. Through our hypothesis on the functioning of sediment routing within the system, D-CASCADE can generate the bedload fluxes measured at the outlet and, in doing so, overcome the limitations of sediment transport formulae. D-CASCADE's capacity to operate at flexible temporal resolutions - from hourly to multi-decadal timesteps - makes it a powerful tool for both reconstructing historical bedload dynamics and simulating future sediment transport scenarios under changing climatic conditions. This work highlights the potential of network-scale models to bridge observational gaps, improve hazard and sediment management strategies, and support sustainable river basin planning in Alpine regions.

Long-Term Modelling of Indigenous Landscape Evolution: Insights from Case Studies in Aotearoa New Zealand

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Indigenous communities maintain deep and enduring connections to their ancestral lands, shaped by cultural and spiritual relationships. In Aotearoa New Zealand, Māori worldviews are animist and holistic, understanding the landscape as a living presence with profound spiritual significance. As climate change drives gradual but significant environmental shifts, these ancestral landscapes are increasingly exposed to changing gemorphic processes. Māori have strong interests in long-term management of their landscapes, and addressing these challenges through a geoethical framework requires integrating Māori knowledge into landscape evolution approaches that promote ethical, inclusive, and culturally grounded responses to environmental change.

Landscape evolution models (LEMs) offer a powerful means of projecting long-term terrain dynamics through numerical simulations. However, despite their potential, there remains a notable gap in their application to cultural heritage and Indigenous landscapes. Existing studies often lack the precision needed to accurately predict when and where specific impacts to sites of interest to Indigenous peoples will occur, overlooking the crucial spatiotemporal dimensions that shape real-world risk. Furthermore, current approaches have largely excluded stakeholder engagement, missing the opportunity to incorporate the knowledge, priorities, and values of affected communities into the modelling process.

This study uses numerical modelling to investigate long-term landscape evolution of Indigenous landscapes of importance to Māori communities that include historical and archaeological sites, and geological/geomorphic features. The modelling tasks employ Landlab, a Python-based framework developed to simulate Earth surface processes. The study characterises when and how culturally significant points of interest are likely to be impacted by landscape change. The modelling results are geovisualised in formats accessible to non-specialist audiences, with feedback from Māori communities to ensure the research is informed by cultural values and contributes to sustainable planning and management of these sites.

Quantifying the Influence of Erodibility Factor on Hillslope Processes in Landscape Evolution Models

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07J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 5:00 PM - 6:30 PM

Climate change is reshaping hillslope processes such as erosion, landslides, and soil creep by intensifying precipitation, altering vegetation cover, and accelerating permafrost thaw. Though often subtle in the short term, these changes cumulatively increase slope instability and elevate the risk of infrastructure failure, including road washouts, pipeline ruptures, and foundation damage. Traditional hazard assessments typically focus on short-term or localized threats, whereas landscape evolution models offer a broader perspective by simulating long-term interactions among climatic, tectonic, hydrological, and geomorphic processes. These models capture terrain dynamics over decadal to millennial timescales, offering critical insights for infrastructure planning and risk mitigation in a range of geomorphic settings.

Effective landscape evolution modelling requires well-defined input parameters that govern key geomorphic processes. Among these, sediment and bedrock erodibility significantly influence erosion rates and landscape transformation. However, empirical values for these parameters are often unavailable, particularly in data-scarce regions. Researchers frequently rely on published data or analogues from geomorphologically similar areas. Complicating matters further, erodibility is temporally variable, influenced by factors such as weathering, vegetation shifts, and climate-induced changes in material properties. To ensure credible model outputs, it is essential to test the sensitivity of simulations to these uncertain and dynamic parameters.

This study utilises Landlab, a Python-based modeling toolkit for simulating Earth surface processes, to investigate long-term hillslope evolution and its implications for nearby infrastructure. The primary objective is to evaluate how variations in sediment and bedrock erodibility affect model outcomes. To account for parameter uncertainty and assess model sensitivity, we implement Monte Carlo simulations, enabling a statistically robust analysis. This approach provides a deeper understanding of the relationship between erodibility variability and landscape change, supporting more resilient infrastructure design in the face of climate-driven geomorphic transformations.

Tracing Climate Imprints in Channel Heads: A Morphometric Study Across Precipitation Gradient (Negev, Israel)

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Understanding the formation and spatial distribution of channel heads is critical for interpreting denudation processes and landscape evolution, particularly under changing climatic conditions. While most previous studies have focused on humid regions, this research investigates channel head development across a precipitation gradient – from semi-arid (370 mm) to arid (90 mm) zones – in the Negev Desert, Israel. The study explores how climate variability and bedrock properties control channel head morphometry and initiation, offering insight into the mechanisms of surface lowering and sediment transport in drylands. Based on detailed field surveys of 100 channel heads, key morphometric parameters were measured, including local slope gradients, headcut and channel bottom lengths, and contributing area dimensions. Statistical analyses using Principal Components Analysis (PCA) and Analysis of Variance (ANOVA) revealed that both climatic and geological factors significantly influence channel head characteristics. In areas with higher rainfall, channel heads tend to be deeper and more elongated, reflecting more intense runoff and erosion. Conversely, in arid zones with erosion-resistant lithologies, channel initiation required larger contributing areas and occurred on steeper slopes, indicating more threshold-controlled processes. Three dominant factors were identified in driving channel head development: the geometry of contributing areas (mainly governed by bedrock lithology), local slope gradients, and precipitation amount. Channel head density, serving as a proxy for denudation intensity, showed a strong inverse correlation with bedrock resistance ($r = -0.69$) and weaker associations with rainfall intensity, precipitation erosivity, and vegetation cover. Slope-area relationships further demonstrated that in semi-arid zones, channel heads primarily initiate at valley heads, whereas in more arid settings, they occur across hillslopes and transition zones. These findings underscore the sensitivity of drainage networks to both long-term geological frameworks and contemporary climate regimes, offering important implications for understanding denudation in the context of ongoing climate change.

Spatiotemporal patterns of moraine formation and preservation across the Southern Alps/Kā Tiritiri o te Moana

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01G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 11:40 AM - 1:10 PM

The Southern Alps/Kā Tiritiri o te Moana are a key location in the Southern Hemisphere to study the response of glaciers to palaeoclimate change. However, moraine formation in response to non-climatic controls can lead to misinterpretations in palaeoclimate reconstructions from moraine sequences. The aim of our research is to investigate how the timing of moraine formation varies across the Southern Alps/Kā Tiritiri o te Moana and to identify sources of geomorphological uncertainty in the relationship between palaeoclimate change and glacier change.

Ice-marginal moraines were remotely mapped from aerial imagery and LiDAR-based DEMs to investigate the distribution and geomorphology of moraines across the South Island/Te Waipounamu. Existing geochronological data (n = 1441) for glacial landforms produced using terrestrial cosmogenic nuclide exposure-age dating, luminescence dating, and radiocarbon dating were compiled in a meta-analysis to compare the timing of geomorphologically similar moraines. Remote mapping will be compared with field-based mapping and new terrestrial cosmogenic nuclide exposure-age dating of Late Quaternary moraines at two locations—Haupapa/Tasman Glacier and Te Anau—in summer 2025–2026.

Terrestrial cosmogenic nuclide exposure ages reveal regional peaks in moraine formation around the Little Ice Age, the Last Glacial Maximum and potentially the Antarctic Cold Reversal. The timing of these glacial events varies with latitude. Remote mapping of moraines in Southland using new LiDAR data from LINZ revealed well-preserved ice-marginal moraine sequences around Te Anau. The asymmetric basin topography is similar to the setting of the Pukaki Valley, but the glacial geomorphology suggests that the glaciation at Te Anau was more dynamic. Our preliminary results highlight the variability in moraine-building processes and the timing of glacier change across the Southern Alps/Kā Tiritiri o te Moana, which will be investigated further in the field.

Challenging Authorised Heritage Discourse: Recognising Indigenous Cultural Geomorphology in Australian Conservation Planning

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08I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 9:35 AM - 11:05 AM

Cultural geomorphology—the intersection of landforms, meaning, and identity—offers an important yet underutilised lens for understanding geomorphological heritage in Australian settler-colonial contexts. While geoheritage is increasingly recognised for its scientific, educational, and aesthetic values, Indigenous geocultural values remain marginal in conservation planning. This research addresses this gap by developing and applying a novel framework for identifying and classifying geomorphological heritage with Australian Indigenous cultural significance.

Through mixed-methods content analysis of protected area management plans across Tasmania, New South Wales, and Indigenous Protected Areas, this research utilised a design thinking methodology to develop a heuristic framework for identifying geocultural values. The framework distinguishes between two tangible categories—geological artefacts and landforms as cultural sites—and two intangible categories—geodiversity as cultural narratives and cultural practices in geodiversity. This classification aims to move beyond the dominant focus on tangible features in heritage assessments by recognising the cultural significance embedded in both physical and experiential relationships with landforms.

Findings indicated that state-managed reserves predominantly emphasised tangible values—particularly geological artefacts—while intangible connections to geodiversity, such as those expressed through stories ceremonies, and relational land-based practices, remain underrepresented. Indigenous Protected Areas demonstrated more holistic recognition of geocultural values, recognising both tangible and intangible value more frequently. Deeper analyses revealed that planning language and institutional governance often constrained what was considered legitimate heritage, with classifications and legislative systems rarely accommodating Indigenous perspectives.

This research contributes to heritage geomorphology by offering a categorical framework that expands conventional understandings of geomorphological heritage. It highlights the need for inclusive methodologies that acknowledge both the physical characteristics and the cultural significance of landforms. By integrating and recognising Indigenous and Western knowledge systems, this approach strengthens the protection, management, and interpretation of geoheritage and promotes more equitable conservation outcomes.

1206

Disrupted geomorphic and biotic stream connectivity in stream-lake catchments in paraglacial regions

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11B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 5:00 PM - 6:30 PM

Ecological and geomorphic theory assume longitudinal connectivity of stream networks; the seminal concepts of the river continuum concept in ecology and downstream hydraulic geometry in geomorphology rest on the foundations of longitudinal connectivity. Even though exceptions to unidirectional downstream trends have been described, the idea of longitudinal connectivity in streams still underlies many assumptions in ecology and geomorphology in terms of, for example, seed dispersal and sediment connectivity. We test whether these concepts apply in naturally disconnected stream networks in paraglacial regions with mainstem lakes and coarse glacial legacy sediment. We determined downstream hydraulic geometry relationships (DHG) for channel width and inventoried riparian vegetation in each new process-domain (rapids, flats, lakes) along continuous ~10 km segments in two catchments in northern Sweden. We compared one catchment above and one below the former highest coastline (FHC), which separates areas that have been glaciated from those that were glaciated and then below sea level prior to isostatic uplift; due to the previous deltaic and marine setting of the catchment below the FHC, more fine sediment is available so that the streams have the potential to self-adjust. DHG relationships were very weak, indicating that although channel width increases in the downstream direction, there is very large local variation in width, within and among process domains; however, the relationships were slightly stronger in the catchment below the FHC, where there was also an effect of lakes, causing wider channels downstream of lakes. Riparian vegetation richness did not increase markedly downstream as expected in a connected stream network, and there are very weak relationships between riparian vegetation composition similarity among reaches and distance between reaches, indicating that hydrochory is interrupted in naturally disconnected stream networks. Formerly continentally-glaciated catchments are thus highly fragmented and local factors steer geomorphic form and biotic organization.

Tree-ring records of extreme avalanche events in Greater Caucasus Mountains

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Snow avalanches are known to occur in both glaciated and deglaciated high-mountain environments. In glaciated areas, they are major contributors to glacier mass balance and the redistribution of on-glacier debris cover, while in recently deglaciated areas, they frequently disturb forest ecosystems. In remote areas of the Greater Caucasus Mountains, the spatial and temporal occurrence of snow avalanches remains largely undocumented. This study aims to reconstruct the spatio-temporal variability of snow avalanches and to assess the patterns of snow activity in recently deglaciated high-mountain areas of the Greater Caucasus Mountains. A tree-ring approach was used for the reconstruction, based on the identification of growth anomalies recorded in the annual rings of trees disturbed by snow avalanches. Trees located within two avalanche paths investigated exhibit external signs of multiple disturbance events due to the mechanical impact of avalanches. Growth anomalies identified within the rings of disturbed trees sampled were used to reconstruct the history of extreme snow-avalanche events with annual resolution. The reconstructed frequencies indicate a general decreasing trend in the occurrence of large snow avalanches over recent decades. Further studies of this kind should be extended to additional avalanche paths in deglaciated areas of the Greater Caucasus Mountains, to enable a broader regional assessment of snow-avalanche frequency trends.

Tree-ring reconstructed activity of debris flows and snow avalanches in the Făgăraş Mountains (Southern Carpathians, Romania)

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13G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 11:35 AM - 1:05 PM

Debris flows (DFs) and snow avalanches (SAs) are currently the main sediment transport processes in the Făgăraş Mountains (Southern Carpathians, Romania). Along DF tracks and SA paths, trees are frequently subjected to mechanical impacts, which are subsequently recorded in the annual ring structure as growth disturbances. In the absence of instrumental monitoring of geomorphic activity in these high-mountain environments, dendrogeomorphic methods provide a valuable proxy for reconstructing the spatial and temporal occurrence of DFs and SAs, with annual to sub-annual resolution.

This study aims to reconstruct the frequency and recurrence of DFs and SAs through the identification and analysis of growth anomalies in tree-ring series of disturbed trees induced by these processes. Dendrogeomorphic investigations were conducted on multiple forested debris cones where both geomorphic processes co-occur, allowing for a comparative dendrogeomorphic approach. Increment cores, cross-sections, and wedges were sampled from Norway spruce (Picea abies (L.) Karst.) trees disturbed, yielding a multi-decadal chronology of geomorphic disturbance events extending back to the early 20th century.

The present study confirms the efficacy of tree-ring analyses for detecting and differentiating between DF and SA events using the scar seasonality as characteristic growth anomaly in trees disturbed by both SA and DF extreme events. These findings underscore the value of dendrogeomorphology as a robust method for reconstructing high-magnitude geomorphic events in data-scarce mountain areas, and for improving the understanding of sediment dynamics and geomorphic hazards in the Făgăraş Mountains.

DANube SEdiment Restoration (DANSER): Towards deployment and upscaling of sustainable sediment management across the Danube River basin in Europe

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07A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 5:00 PM - 6:30 PM

DANSER aims at addressing the urgent need for sustainable sediment management solutions at the river basin scale, focusing on the Danube River-Black Sea system in Europe. Foci are demonstration of multidisciplinary innovative and holistic solutions and developing deeper insights into the sediment status and cause-effect relationships (e.g. via spatio-temporal mapping of fluvial processes, sediment transport modelling, sediment dating, 3D historical reconstruction, river processes forecast simulations, sediment budget analysis, connectivity modelling and interventions, stakeholder-engaged sediment parametric evaluation and co-management, interlinkages with biodiversity (patterns), water quality and climate change effects). This EU-funded (HORIZON-MISS-Danube & Black Sea Lighthouse) project seeks to restore sediment balance, improve sediment flow and quality together with EU- and other international stakeholders (existing bodies, digital platforms, events and know-how). In an ample coverage throughout 3 DEMO areas incl. 13 pilot sites, 7 sibling locations, and 6 associated regions (AR), the DANSER approach will develop, validate, and promote key active and passive measures to mitigate human interference in the sediment flow, related biodiversity and ecological aspects and possibly recover the sediment balance and quality in critical stretches of the basin. In this presentation, we aim to provide an overview of the strategies and actions for the Upper Danube region, further show the importance of using geomorphology in river (sediment) management.

Think Connectivity?

Prof. Tony Parsons[1], Dr Ronald Pöppl[2]
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09B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 11:35 AM - 1:05 PM

From time to time a concept enters geomorphology that is transformative in the way we think about and understand how landscapes function. One such concept that may fit this description is that of Magnitude and Frequency. In this paper we seek to explore the question whether the concept of connectivity can be afforded the same status. Certainly the concept has found its way into a significant number of publications. Starting in the 1980s there has been a more-or-less exponential growth in the annual number of publications employing the concept. But have these publications been transformative or, as has been suggested, no more than old wine in new bottles?

Over the Under: Examining the role of tectonics in the evolution of sandstone tablelands through statistical analysis of drainage networks

Mrs Wioleta Porębna[1, 2], Associate Professor Marek Kasprzak[1], RNDr., PhD Filip Hartvich[2], RNDr., PhD Petr Tábořík[2], PhD Filip Duszyński[1], Professor Piotr Migoń[1], Phd Milena Różycka[1], PhD Kacper Jancewicz[1]
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05D: Advances, challenges and future directions in Tectonic Geomorphology AND Seismic Related Cascading Hazards: How Can They Contribute to Improve Paleoseismic Studies?, Dobson 3, February 3, 2026, 11:35 AM - 1:20 PM

Recent work in sandstone tablelands significantly contributed to the better understanding of rock breakdown patterns and the evolution of residual landforms. However, regional controls imposed by tectonic regime are rarely addressed. This study, conducted within the sandstone-dominated tablelands of Central Europe, focuses on the spatial distribution of valleys, their morphometric features, and the impact of geological controls on the distribution of valley forms and their diversity.

We assessed the relationships between rock strength and discontinuities and the geometry of valley networks, and traced the effects of tectonic control and the role of subsurface processes in the formation of sandstone canyons. The erosional dissection pattern was analysed using a series of primary and secondary topographic indices obtained from airborne LiDAR-based DEM, subject to cluster analysis in the next step. Field investigations included geophysical surveying employing Electrical Resistivity Tomography (ERT) and on-site validation of analyses derived from the DEM through detailed landform mapping.

This multi-threaded inquiry led to the conclusion that relief evolution of sandstone tablelands is not solely controlled by surface processes, but by a complex interplay of tectonics, lithology, and weathering mechanisms. The pre-existing fault systems and joint patterns often dictate drainage orientation and erosion susceptibility, leading to differential weathering and localized incision. This integrated perspective challenges earlier models and highlights the importance of considering both deep geological structures and modern surface dynamics when interpreting such landscapes. Sandstone tablelands should be viewed as dynamic systems shaped by multi-scale interactions, rather than considered as passive remnants of the past erosion.

Rethinking glacial cirque evolution: interglacial sediment contributions in Quaternary cirque widening, Westfjords, Iceland

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10G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 2:30 PM - 4:00 PM

The glacial origin of cirques is widely accepted, attributing these formations to the erosive action of glaciers. However, several studies have challenged this hypothesis by highlighting the gap between glacial erosion rates and cirque volumes. Can this gap be resolved by integrating the contributions of interglacial processes and landforms, such as paraglacial rock-slope failures (RSF) and scree deposits, into cirque development? The challenge lies in estimating and assessing the contribution of interglacial sequences to the widening of cirques.

This study focuses on eight cirques located in the Icelandic Westfjords. Carved into a basaltic plateau, their shapes are easily discernible, making them an ideal study area for this project.
RSF and scree deposit volumes are quantified for each cirque based on field observations and analysis of aerial photographs and a digital elevation model. The current cirque volumes are then estimated to calibrate this sediment production. The objective is to construct a Holocene reference model of interglacial sediment production, and to extrapolate it to the entire Quaternary (22 interglacial cycles). Two extrapolation methods are used: a percentage reduction in cirque volume extrapolated to 22 interglacial cycles and the calculation of paraglacial, periglacial and glacial denudation indices.

The results show that RSFs represent 62% of interglacial sediment production, and scree 38%. The contribution of para-/periglacial processes to shaping each cirque varies, but on average, over 22 interglacial periods, 39% of each cirque is widened exclusively by interglacial processes. Two cirques demonstrate a predominance of non-glacial processes in their formation.

This volumetric quantification enables cirque evolution models to be refined on a Quaternary scale by incorporating interglacial sequences into their evolution. The results highlight the importance of slope dynamics in widening cirques and encourage reconsideration of the exclusively glacial origin of these emblematic landscapes. However, glacial sequences remain essential for evacuating interglacial deposits.

Waipounamu Erosion Surface, New Zealand, and West Antarctic Erosion Surface are subglacial floors formed during the Cretaceous Plenus Cold Event

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05G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 11:35 AM - 1:20 PM

The Waipounamu Erosion Surface (LeMasurier and Landis 1996) is a strikingly planar landform evident throughout the upland areas of New Zealand. Except where modified by Cenozoic erosion the surface is of very low relief. The Waipounamu Erosion Surface is identifiable in offshore seismic sections and as an exhumed erosion surface throughout ~10^6 km^2 of the greater New Zealand region. It is the geomorphic expression of a heterolithic unconformity separating Cenomanian and older rocks from overlying Campanian and younger strata.

The Waipounamu Erosion Surface is currently regarded as a subaerially developed feature modified by marine processes. However, such an origin is difficult to reconcile with the observation that the oldest post-erosional sediments resting on the surface are non-marine. The surface cannot have developed primarily via subaerial erosion because the span of time available (the 17 m.y. between eruption of the 100 Ma Stitts Tuff and ~83 Ma deposition of Haumurian (basal Campanian) sediments resting unconformably on the erosion surface) is insufficient for subaerial processes to reduce pre-existing topography to an extensive planar landform.

The Waipounamu Erosion Surface and the correlative West Antarctic Erosion Surface, which truncates rocks as young as 90 Ma, both developed at high paleolatitudes. Both formed penecontemporaneously with the Plenus Cold Event (ca. 94 Ma) which briefly punctuated an otherwise-very-warm mid Cretaceous. While an origin involving a combination of subaerial and marine erosion has been proposed by LeMasurier and Landis (1996) for both surfaces, these enigmatic planar destructional features can more plausibly be interpreted as subglacial floors formed beneath extensive continental ice sheets that nucleated during the Plenus Cold Event.

Reference:
LeMasurier W. and Landis C.A. 1996: Geol. Soc. Am. Bull. 108: 1450-1466.

Climate Cooling and Enhanced CO_2 Drawdown: A Paradox of Silicate Weathering

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08C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 9:35 AM - 11:05 AM

Silicate weathering is a key geological pathway for long-term CO_2 removal, converting atmospheric carbon into dissolved carbonate alkalinity. This process provides a negative climate feedback, whereby increased GHG climate forcing enhances silicate weathering and consumes atmospheric CO_2; modelling studies suggest it damps climate perturbations over 10^4–10^5-year timescales. Here, we test (1) the climate sensitivity of silicate weathering; (2) response timescales; and (3) the strength and sensitivity of climate feedbacks over orbital timescales. Our study is in the Oregon Coast Range where long-term uplift (0.1–0.3 mm y^{-1}) and erosion generate hillslope soils with short residence times and abundant weatherable minerals. We use a sedimentary archive of eroded hillslope soil at Little Lake spanning the last ca. 40 ka to estimate the flux of carbonate alkalinity and hence CO_2 drawdown. A flux of dissolved inorganic C (DIC) was estimated from the state of weathering of the sediment relative to the bedrock (Tyee Formation), scaled by the soil production rate (estimated from cosmogenic 10Be concentration) assuming steady state hillslope erosion. We estimated alkalinity generated via weathering by calculating excess positive charge in the balance of conservative cations and anions released during bedrock–soil conversion, and equating that to HCO_3^-; then scaled by the same soil production rate. Finally, we compared the DIC flux (equal to CO_2 consumed) to semi-quantitative paleo-temperature and precipitation records from pollen analysis and a CO_2 record. Contrary to expectations, CO_2 sequestration increased from MIS 3 to MIS 2 (LGM) as the climate cooled and pCO_2 declined. This pattern arose from greater sensitivity of weathering to mineral supply rate (soil production), which was higher in MIS 2, than to climate-influenced weathering kinetics (rainfall and/or temperature). We conclude the silicate weathering–climate feedback does not operate at orbital timescales in the weathering environment of this humid, mid-latitude mountain range.

Visual Story-based Geomorphological Map (VSGM): An Innovative Tool for Enhancing Landslide Risk Communication in Indonesia

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Geomorphological maps are essential for landslide hazard assessment and risk reduction, yet their adoption remains limited in developing countries like Indonesia, particularly among non-expert stakeholders. To address this gap, we developed Visual Story-based Geomorphological Maps (VSGM), a novel communication tool designed to make geomorphological data more accessible to practitioners such as disaster management agencies and local NGOs.

The VSGM combines a derivative geomorphological map, a visual storytelling comic, and an instructional sheet, co-created with multidisciplinary experts and end-users to ensure practical relevance. The VSGM goals are to improve landslide hazard awareness and support localized risk mitigation planning. We evaluated the tool's effectiveness through qualitative interviews, assessing usability and user perception.

Results demonstrate that the VSGM achieves satisfactory cartographic quality while ensuring user-friendly design, enabling users to quickly grasp its purpose. Beyond information delivery, the tool facilitates practical problem-solving, eliciting strong perceptions of usefulness, positive emotional responses, and a high willingness to adopt it in real-world scenarios. This study highlights the potential of storytelling and co-production approaches in making geomorphological knowledge more accessible, ultimately fostering better communication between scientists and practitioners. By improving the visibility and utility of geomorphological data, the VSGM framework can contribute to more inclusive and effective landslide risk reduction efforts in Indonesia and similar contexts.

Keywords: Geomorphological maps, Visual storytelling, User-friendly design, Communication tools, Landslide risk reduction.

Long-term debris-flow reconstruction in Bîlea Lake sediments (Southern Carpathians) reveals the sensitivity of alpine environments to large-scale atmospheric circulation

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

This study reconstructs sedimentation patterns and debris-flow (DF) contributions in Bîlea Lake (2030 m asl) over the past 15,000 years (Late Glacial to Holocene) using a multi-proxy approach. An 8.15-meter sediment core was retrieved and analyzed using sedimentological (grain size, LOI), geochemical (XRF Itrax scan), and paleoecological proxies (pollen, plant macrofossils, chironomids). A robust age-depth model based on 22 radiocarbon dates supports the chronology.

The stratigraphy and multi-proxy data reveal three distinct sedimentation phases driven by climatic and geomorphological controls. The first phase (15.3–14.2 cal ka BP) reflects glacial and immediate postglacial conditions, marked by coarse, angular clasts in a silty-sandy matrix. A lacustrine phase follows (14.2 cal ka BP–present), characterized by layered sediments, but interrupted by a ~5,000-year interval (ca. 13–8 cal ka BP) of low accumulation, likely due to limited sediment supply.
A debris-flow index (DFi), developed from lithogenic (Ti, Si), redox, and organic proxies [ln(Mn/Fe), ln(Incoh/Coh)], indicates that DF activity was confined to the Holocene. Four distinct intervals were identified: 8.2–4.7, 4.7–3.2, 3.2–1.6, and 1.6 cal ka BP–present.

The earliest Holocene phase (8.2–4.7 cal ka BP) was characterized by seasonally dry continental conditions with intense convective summer rainfall and snowmelt-driven runoff in early summer, which promoted conditions for frequent and large DF occurrences. After 4.7 cal ka BP, increased Mediterranean moisture modulated slope processes and sediment input, leading to finer sediment texture and lower accumulation rates. In this context, DF events became more variable, with intervals of fewer DFs (4.7-3.2 cal ka BP) and high-magnitude events at 2.9, 1.9, and 1.4 cal ka BP. Signs of anthropogenic impact appear around 3.7 cal ka BP and intensify over the last two millennia. Overall, the results highlight the sensitivity of alpine lake sedimentation to atmospheric circulation patterns and long-term climate variability.

Extreme rainfall, flooding, and dams as drivers of the Teesta river corridor change in the Darjeeling Himalayas

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

River corridors in mountainous regions are dynamic areas where geomorphic processes, ecological functions and growing human pressures converge. This study examines the interaction between natural extremes, such as intense rainfall and glacial lake outburst floods (GLOFs), and human activities, such as dam construction and changes in land use, in reshaping the Teesta River corridor in the Darjeeling-Sikkim Himalayas (India).

The Teesta, originating in northern Sikkim and draining into the Brahmaputra, flows through a region receiving up to 6000 mm of annual rainfall, with monsoonal discharge peaking at 1500 m^3/s. The study focuses on a 28 km-long, 600 m-wide river corridor where two major hydropower dams were constructed between 2004 and 2016. Using satellite imagery (Corona, SPOT, Google Earth), hydrological records, and field data, we trace channel and land use changes over six decades (1965–2024).

Results reveal that an extreme rainfall event in October 1968 (~750 mm in three days) generated a peak discharge of 17,000 m^3/s, raising water levels by 20 m and aggrading the riverbed by 7 m. A comparable impact followed the 2023 South Lhonak Lake GLOF, which transported ~270 million m^3 of sediment and destabilised over 67 km of the Teesta channel including analysed corridor. Dam construction has disrupted sediment transport along 70% of the river. Specific stream power exceeding 300 W/m^2, once a key driver of natural channel shifts, is now increasingly regulated by hydropower operations. Forest cover declined from 71% in 1965 to 59% in 2024, driven by flooding, built-up expansion, and reservoir inundation.

These findings emphasise that cumulative human interventions can rival or even surpass natural events in terms of their impact on fluvial change. Recovery times from such disturbances can take decades. Restoring and preserving riverine resilience amid escalating anthropogenic pressures will require adaptive, multidisciplinary and nature-based approaches.

Comparison between manual and automated methods in doline delineation: a Cantabrian Mountains (Spain) and Tasman Mountains (New Zealand) case study

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05B: Karst geomorphology, Dobson 1, February 3, 2026, 11:35 AM - 1:20 PM

Studies of karstic landforms, such as dolines, have advanced in recent years due to technological advances and the rise of automated detection methods. Such methods offer notable strengths, but their limitations are sometimes overlooked in modern literature. To compare these automated methods to traditional manual methods, we selected two karstic massifs in the Cantabrian Mountains (northern Spain) and two karstic massifs in the Tasman Mountains (north of New Zealand's South Island) as study areas. Light Detection and Ranging data were converted into high-resolution Digital Elevation Models, which were used to identify and map dolines in the study areas. Automated detection was performed using a Geographical Information System and included: (i) a depression-filling method which draws the lowest point of the rim of a doline; and (ii) a sky-view factor method which draws the outermost closed contour of a doline. Both methods were calibrated to ensure non-karstic depressions were excluded. The manual method considered the presence of depressions (previously detected) and used photointerpretation to manually draw the curvature of a doline. Preliminary results (doline count, shape and size) varied substantially between methods. These differences were unequally distributed, with outcomes differing especially in areas with uneven topography, varied lithology and differential dissolution rates, but being relatively similar in areas of homogeneous characteristics. These discrepancies highlight the influence of local characteristics on the performance of automated methods, something that has been overlooked in modern studies promoting the use of such methods. Their widespread adoption and their perception as being the gold standard, largely stemming from their time-saving capacity, have led to a decrease in the use of traditional methods, occasionally at the risk of compromising accuracy and scientific rigour.

Drainage reorganization in the Negro River (Amazonia): insights from luminescence dating and sediment provenance

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02B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 2:00 PM - 3:30 PM

The Negro River is the main tributary of the Amazon, and it plays a crucial role in shaping the region's landscape and biodiversity. However, the lack of absolute ages of the sedimentary deposits has hindered understanding how paleohydrology has changed over the Quaternary. We reconstruct geomorphological evolution of the middle Negro River over the past 400 ka using geomorphological maps, sedimentological and provenance data, and new luminescence ages. The fluvial deposits are arranged in extensive terraces, which reflect lithological controls and the presence of the paleochannel systems. Quartz optically stimulated luminescence (OSL) and feldspar post-infrared-infrared stimulated luminescence (pIRIR) dating indicate terrace ages between 390 and 103 ka and floodplain deposits younger than 31 ka. Provenance analysis based on quartz blue OSL (relative intensity of the first second of light emission, BOSL1s) sensitivity indicates mixing of Andean and cratonic sediments in the terraces (BOSL1s = 20-24%), which were possibly reworked after weathering to form floodplains (BOSL1s = 36-46%). The modern configuration of the Negro River is influenced by lithological variations in the watershed and marginal fluvial systems. Late Pleistocene megafans from the northeast redirected the channel southwest. An abandoned west-east paleochannel system shaped the interfluve between the Negro and Solimões Rivers, until a major drainage network reorganization around 100 ka diverted the Japurá River southwestward to become a tributary of the Solimões River. This shift had biogeographical impacts and probably explains the extent of the Jaú endemic zone. These findings establish a new chronological framework for the evolution of the Solimões-Negro interfluve, which has profound implications for Amazonian biodiversity. (FAPESP grant #2022/03007-5)

Depression development in Gonghe Basin, northeastern Qinghai-Tibetan Plateau: An approach to estimation of dust emission during the last glacial

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06H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 2:30 PM - 4:00 PM

Understanding mineral dust emissions from source regions is essential for grasping the dynamics of dust cycles and interpreting dust records in areas downwind. However, geological records that document variations in dust entrainment are limited due to significant wind erosion in these source areas. In this study, we investigated a depression located in the Gonghe Basin on the northeastern Qinghai-Tibetan Plateau. This depression covers approximately 1,000 km² and is situated below 2,975 m a.s.l. At the elevation, one of the terraces of the Yellow River, known as the second Tala (= 'flat terrain'), is extensively spread, representing the initial surface from which the depression developed. The surface of this terrace is relatively flat and shows no evidence of later fluvial erosion, indicating that rivers like the Shazhuyu River from the western basin have not flowed over this surface, marking a shift to an endorheic system in the western Gonghe Basin. Within the depression, there are 3 to 4 levels of tiered landscapes featuring flat surfaces and steep edges. The exposed cliffs along these tiered terrains reveal the typical Gonghe Formation, which consists of fine-grained fluvio-lacustrine sediments resulting from basin filling. It is proposed that dust emissions from the desiccated beds of terminal lakes periodically lowered the ground surface, creating the abandoned tiered landscapes. Additionally, during wetter periods, these tiered terrains may have expanded laterally due to the influence of rivers and lakes. Based on absolute luminescence dating, it is believed that the depression formed during the last glacial period, approximately 86,000 to 15,000 years ago. The average rate of deflation was estimated to be around 1.6 mm per year, which is comparable to rates observed in the Bodélé depression in Chad. These findings indicate that wind-driven depressions in dust source areas could provide valuable insights into historical changes in dust emissions.

Applications of Tectonic Geomorphology in Engineering and Geohazards Assessments in Australia

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09D: Engineering Geomorphology AND Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 11:35 AM - 1:05 PM

Geomorphic analyses of fault-associated topography can be combined with field techniques to characterise earthquake hazards and inform decision-making in areas of existing and / or planned infrastructure . I will present an overview of tectonic geomorphology case studies in diverse areas of Australia and New Zealand where applied research has contributed information relevant to land use planning and infrastructure. A specific focus will be given to the mapping of neotectonic and active faults.

Temperature-Driven Rock Slope Dynamics: Insights from Crack Meter Monitoring

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06J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 2:30 PM - 4:00 PM

Rock slope dynamics result from a complex interaction between geological structure and external climatic/weather factors. In this study, we present a statistical analysis of crackmeter time series aimed at identifying the influence of meteorological and thermal variables on surficial joint displacement dynamics. The data were obtained from monitoring four rock slopes in Czechia, which differ in their lithological (sandstone, granite, limestone), and morphological characteristics, altitude, and aspect.

Each site is equipped with a modular monitoring system comprising crackmeters installed in selected joints of partial blocks, a weather station located directly within the slope, and a thermal probe placed in a 3-meter-deep sub horizontal borehole. In total, 22 crackmeters monitor the displacement of 11 blocks representing different expected dynamic types – from purely thermally induced expansion/contraction, to toppling, sliding, and wedging destabilization.

The dataset includes at least two years of hourly-resolution time series, enabling the assessment of both short-term (diurnal) and long-term (seasonal) block behavior. The analysis focuses on the relationship between joint displacement and climatic variables, primarily air temperature, solar radiation, and subsurface thermal conditions. The study also includes an analysis of borehole temperature data, which allows comparison of the thermal regime between sites. These differences between blocks are likely driven by factors such as slope orientation and local microclimatic conditions.

The results reveal significant variability in block response depending on geological and morphological context—some blocks exhibit purely thermally driven cyclic behavior, while others show combined effects of thermal expansion and gravitationally induced destabilization. This study emphasizes the need for site-specific monitoring approaches and highlights the importance of long-term, high-resolution data for understanding rock slope surficial dynamics. The findings contribute to a better understanding of the role of climatic variables in rock slope stability and provide a framework for future modeling of slope behavior.

Maximum floodwater depth and volume estimation of the 2025 channel country floods using SWOT data

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03H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 4:00 PM - 5:30 PM

The Lake Eyre Basin (LEB) is the largest dryland basin in Australia and the fourth largest dryland basin globally. It comprises large unregulated rivers with high transmission losses. The basin's terminal lake Kati Thanda–Lake Eyre (KT-LE) has filled significantly three times since 1900,with 1974 marking the wettest year and largest filling on record. However, in 2025, the basin experienced the third-largest recorded precipitation event, with rainfall exceeding 400 mm over 3 – 5 days. This unprecedented rainfall triggered widespread flooding across the Channel Country, with major tributaries such as the Diamantina River and Cooper Creek producing significant runoff volumes of water draining toward KT-LE. Notably, floodwaters travelling down Cooper Creek, produced peak discharge values at Innamincka township larger than the previous 1974 record. The magnitude of the flood caused extensive damage to agriculture, infrastructure,and local communities.

Assessing such a significant flooding event is critical for developing effective future mitigation and adaptation strategies. However, a major challenge in monitoring floods of this scale within the LEB is the scarcity of in-situ gauging stations. The nearest gauging station is approximately 300 km from the terminal lake, reflecting the basin's vast remote geography and complex channel network. This data gap emphasizes the importance of satellite-based flood monitoring systems.

The recent launch of the Surface Water and Ocean Topography (SWOT) mission in December 2022 presents a promising solution. SWOT provides near-global surface water observations at a 21-day repeat cycle, with water level estimation accuracies within 10 cm. Some of the recent SWOT studies demonstrates substantial potential in flood monitoring by capturing flood depth inundation dynamics with high spatiotemporal resolution. In this study, we present a novel methodology to estimate the maximum flood volume and depth of the 2025 LEB flood event using SWOT and LiDAR data focussing on Cooper Creek and the Diamantina River.

1090

Evaluation of Geomorphological Dynamics of River Ganga in Prayagraj, Uttar Pradesh, India

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06I: Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 2:30 PM - 4:00 PM

River Ganga in Prayagraj, Uttar Pradesh, India is a significant cultural and religious site and this heritage should be protected. Study of the geomorphological dynamics of the Ganga River in Prayagraj may be helpful to know the causal factors controlling channel shifts as well as exploring different role of various factors responsible for the present channel capacity and associated problems.

Present work aims to investigate the factors driving channel migration, evaluate the river's sensitivity and its relation with geomorphology and anthropogenic activities.

The study adopts relatively new approach to identify site specific conditions for mapping historical channel shift and relationship among tectonics, hydrology and sedimentation pattern. Also, potential impact of human activities on river dynamics and geomorphology of River Ganga in Prayagraj will be evaluated.

Keywords: Geomorphological dynamics; Channel shifts; Anthropogenic activities; Tectonics; Hydrology; Sedimentation pattern

Revisiting process, form and change in dryland rivers... and their wetlands

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01A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 11:40 AM - 1:10 PM

Rivers and wetlands are key components of dryland environments, connecting landscapes and providing lifelines of water and hotspots of aquatic ecosystem function. Addressing three key themes, we revisit the core concepts of process, form and change in dryland rivers and extend our view to their wetlands, which are arguably overlooked landscape features. First, we explore similarities in dryland river processes and spatial patterns, drawing on examples from central Australia, southern Africa, South America, North America and India. Downstream declines in trunk stream discharge and stream power are common, with concomitant reductions in channel size and sediment transport capacity. This tends to lead to avulsion and multi-channelled river forms with zones of channel breakdown, including floodouts, where river channels terminate on unchannelled floodplains. In some settings, diverse wetlands with varying hydroperiods dominate the lower reaches, ranging from permanent floodplain marshes to ephemeral lagoons and lakes. Second, we identify an emerging regional/global trend of mid-late Holocene declining discharge that has led to significant dryland river change. In several cases, large, single-thread, meandering palaeochannels have become smaller, anastomosing modern rivers with a greater propensity for channel breakdown. Finally, within the overarching concept of river resilience, we discuss potential future fluvial adjustments and change. In the light of Holocene trends, and 21st century land use and climate scenarios, we outline potential future trajectories that may involve additional step changes in river process and form, and address the vexed notion of 'recovery' in dryland rivers and wetlands. Priorities for future research and applications include the need for field data and model outputs from understudied dryland regions, the development of deeper collaborations with cognate disciplines including archaeology and ecology, and the need for two-way learning and engagement with Indigenous peoples, local communities, and other stakeholders.

Hydrogeomorphic adjustment of the Nile River in Egypt during the Holocene

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11F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 5:00 PM - 6:30 PM

The Egyptian Nile is a dynamic river, with evidence of Holocene channel adjustment preserved on and within its floodplain. Shifting Nile channels and flow regimes influenced centres of power, culture, and pyramid construction in ancient Egypt. While previous studies documented fluvial and geoarchaeological change in the Delta, and in reaches near major monuments and cultural centres, this research seeks to quantify and understand patterns, mechanisms and implications of river adjustment at the valley-scale. Synthetic aperture radar imagery, digital elevation data, and historical maps were used to identify and trace Nile palaeochannels near archaeological sites. Geomorphic, topographic, and geophysical surveys, with deep sediment coring, revealed the morphology and sedimentology of the former channels. Upstream, near Luxor, the mid-late Holocene channel was more sinuous with sandy bars and islands than present, being dominated by lateral migration. Downstream, between Lisht and Giza, the now-abandoned Ahramat Branch ran for ~64 km along the Western Desert margin, where >30 ancient pyramids are concentrated. This branch was ~8 m deep and ~700 m wide, similar in width to the modern Nile. Diminution and abandonment of the Ahramat Branch occurred due to avulsion sometime after the Middle Kingdom, likely driven by decreasing floods and increasing aridity in the region. Later pyramid construction in the New Kingdom moved toward the centre of the Nile Valley. Sediment samples reveal deep layers of coarse sand with gravel with much finer overlying deposits, indicative of a transition from high- to low-velocity flow regime before a penultimate infilling stage dominated by wetland silt and aeolian sand. Since the Nile was (and still is) a cultural artery for Egyptians, understanding human responses to river adjustment can inform future research to prioritise archaeological excavations and protect Egyptian cultural heritage sites.

Coastal Tectonics and Relative Sea Level Deduced from Late Quaternary Coral Reef Terraces: Examples from the Philippine Islands

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03F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 4:00 PM - 5:30 PM

Emergent marine and coral reef terraces are often observed along carbonate coastlines in the Philippines. Given the tectonically active setting of the archipelago–bounded by subduction zones and traversed by intraplate faults–the development of terrace platforms after the mid-Holocene highstand has been attributed to local tectonics. Here, we present case studies in major (Luzon, Mindanao, Samar, Cebu, Bohol, Siargao) and small coral islands (Poro, Cabra, Nogas) of the Philippines, where Late Pleistocene and Holocene marine terraces are well preserved. While the number of terrace steps and uplift rate vary from place to place, relatively higher Holocene uplift rates (0.8 to 1.5 mm/yr maximum) are observed in coastlines facing the Manila and Philippine subduction zones on the west and east, respectively. Meanwhile, islands in the Visayas region yield lower uplift rates (0.3 mm/yr). The spatial distribution, age, and deformation pattern of terrace platforms have provided additional insights into the mechanisms of emergence and nature of causative faults (i.e., coseismic uplift produced by offshore faults). Using the latest tools and approaches in estimating relative sea level, we also reappraised published coral reef terrace data in select sites to estimate the local indicative meaning and reevaluate the uplift rate in these regions. Despite their wide indicative range, coral reef terraces have been useful in reconstructing paleo-sea levels (i.e., as marine-limiting indicators) and in estimating long-term tectonic deformation.

Deep ocean floor analysis to define a Regional Plan to use the Remote/Relict Marine Sediment Deposits

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Maintaining the quantity and quality of beaches is an essential challenge for regions with a strong tourist vocation.

Sicily is the largest region in Italy, the largest island in the Mediterranean and has the highest number of UNESCO sites, testifying to the cultural stratifications that have occurred over the last 2-3000 years. Despite this, the 1745 km of coastline, including smaller islands, of which 714 km of mobile coasts divided into 712 beaches that are administratively referred to 123 coastal municipalities, represent an indispensable driving force for tourism linked to the 4S (Sea, Sun, Sand, Summer).
In the recent past, defence against erosion has been entrusted to rigid structures (groynes, breakwaters and seawalls) that have sometimes protected the areas behind them, but have always triggered erosive processes downdrift.

For softening the impact of existing structures and expanding eroded beaches with artificial nourishment interventions Regional Government has drawn up a new Plan for the management of the Remote/Relict Marine Sediment Deposits.

To achieve adequately sustainable interventions, it is not possible to use subaerial quarries whose environmental wounds are difficult to hide and heal; therefore, research and mapping of the R/RMSDs was undertaken, based on the geomorphological potential of the different stretches of seabed, their uses and the different degrees of protection for environmental, military and logistical constraints.

This activity was aimed at an analysis by exclusion of use of the different parts of the seabed, starting from data obtained from oceanographic campaigns of seabed sampling, benthos study, seismic reflection surveys, and arriving at those areas and potentially usable where there are reasonably sediments compatible in size, colour and composition with their use for the reconstruction of eroded beaches recreating the conditions of resilience necessary to counter not only human abuse, but also the coastal effects of climate change.

Monitoring of coastal geomorphology to support a resilient oriented defence system

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10E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 2:30 PM - 4:00 PM

In Sicily, the largest island in the Mediterranean, the strong urbanization of the 70s and 80s and the subsequent intensive agricultural use triggered important erosive processes that were remedied by building rigid defence works that moved the same damage under the waves.

In 2015, following survey campaigns conducted in 2003 and 2010, the Province of Ragusa (SE Sicily) decided to intervene to secure a part of the coastline threatened by erosion.

With a different sensitivity than the current one, 25 breakwaters and an artificial nourishment of 100,000 cubic meters with "compatible" quarry material were planned to protect only 5 km of the 11.2 km of monitored coastline; in addition, specific naturalistic engineering interventions were planned for the restructuring of the dune system and a short drainage barrier in front of the Marina di Acate seafront.

In 2025 the project was finalized and, having started an in-depth topographical - evolutionary monitoring of the shoreline via drone, bathymetric using satellite and multibeam images and sedimentological (granulometry, composition, colour) of the emerged and submerged beaches, it was highlighted how the retreats were modest and localized, while the dunes were further degraded by agricultural exploitation and the seafront was a victim of urban neglect.

In this perspective, in the Environmental Impact Study phase, as an alternative to the initial project, with the support of the previous monitoring, the following was proposed: 1) an artificial nourishment with approximately 1 million cubic meters of sandy material, with a strong quartz component, coming from Remote Submerged Marine Deposits/Wrecks (DMSR), over the entire intervention area, 2) the installation of removable defence structures, made up of perforated mega-Jerseys, filled with water to provide greater protection of the most exposed points (dune areas and seafront) and 3) the strengthening of the dunes through naturalistic engineering interventions.

Distribution and possible depositional environments of chloride-bearing deposits in Mars’ Northern Hemisphere: High-resolution assessments using HRSC, CaSSIS and HiRISE images

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Chloride-bearing deposits on Mars are critical indicators of the planet’s past aqueous history, as they represent some of the latest episodes of surface liquid water activity. First identified by Osterloo et al. (2008) using THEMIS thermal infrared data, subsequent global surveys (Osterloo et al., 2010) expanded the inventory of these deposits. Although spectrally featureless across most of the VNIR and IR ranges, chlorides exhibit a distinct pink-to-purple hue in high-resolution color imagery such as HiRISE IRB and CaSSIS NPB composites. Leveraging this characteristic, Bickel et al. (2024) applied neural network techniques to existing CaSSIS observations to produce an updated catalog of these visually distinct deposits, identifying ~136 new candidates across the Martian northern hemisphere, including in regions like Oxia Planum, Chryse Planitia, and Arabia Terra—key targets for both past and upcoming exploration missions.

Recently, Rangarajan et al. (2024) noted that this pinkish appearance in HiRISE/CaSSIS colour composites may not be unique to chlorides, and may correspond to other alteration minerals such as kaolinite, hematite, and alunite that also show positive CaSSIS RED-NIR spectral slopes. However, they also show that a separation between these different mineral phases may be possible using strategically computed spectral parameter maps. In this study, we perform a detailed, high-resolution re-evaluation of these selected northern hemisphere sites using CaSSIS four-point I/F spectra in combination with context from HiRISE, and topographic information from HRSC digital terrain models. This integrated approach aims to refine the mineralogical interpretations, assess the stratigraphic context, and explore the depositional environments of these candidate sites. Understanding the compositional diversity and geological settings of these deposits will enhance our knowledge of late-stage aqueous processes on Mars and inform future exploration strategies, and these findings will be particularly relevant for selecting scientifically valuable targets for ESA’s ExoMars Rosalind Franklin rover, scheduled for launch in 2028.

Patterns and Potential Consequences of a Changing Sulfur Cycle in High Elevation Wetlands

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07G: Cryosphere Processes and Mountain Hydrology, Conway 2, February 3, 2026, 5:00 PM - 6:30 PM

Warming temperatures, ice thaw, and changes in hydrology are increasing bedrock weathering in alpine regions across the globe. As a result, alpine ecosystems are experiencing increasing inputs of bedrock-derived sulfate, which have the potential to change sulfur (S) biogeochemistry in alpine wetlands. We compared S and carbon (C) concentrations and sulfate reduction rates (SRRs) across three wetland types in the Colorado Rocky Mountains, USA: snowmelt-fed wetlands (SFWs), periglacial solifluction lobes (PSLs), and subalpine wetlands (SAWs). We found that each wetland had a unique combination of organic C and sulfate content, which supported different SRRs. Subalpine wetlands had high organic C, low sulfate, and high SRRs. Snowmelt-fed wetlands had low C, low sulfate concentrations, and moderate SRRs. Periglacial solifluction lobes had low C, very high sulfate concentrations, and low SRRs. With continued warming, SAWs have the greatest potential to release more C to the atmosphere, SWFs may decrease in size and experience changes to their plant community composition, and PSLs may become sources of acid rock drainage. These data demonstrate different biogeochemical fates of S and C in three wetland types present across alpine landscapes, and notable consequences for biogeochemical cycling as warming continues.

Biogeomorphological feedbacks and nested scales of sediment dynamics in mangroves: Insights from erosion pins and traps in Western Port, Australia

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01K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 11:40 AM - 1:10 PM

Understanding the spatial scaling of sediment erosion and deposition in mangrove ecosystems is important for predicting their geomorphic stability with sea-level rise. We measured sediment dynamics across temperate mangrove forests in Western Port Bay, Victoria, in a set of experiment using a high-resolution array of over 100 erosion pins repeated across five geomorphologically distinct sites, and a campaign of spatially dsipersed sediment traps deployed across vegetation and hydrological gradients. We analysed vertical sediment displacement over 18 months to identify spatial patterns of erosion and accretion across nested scales and sediment trapping across 13 tides. At fine spatial scales (<100 m^2), sediment dynamics were highly stochastic: individual pins frequently alternated between erosion and deposition, with no statistically significant correlation to vegetation density, elevation, or proximity to tidal channels. The coefficient of variation in vertical displacement at individual pins exceeded 50% in many cases, underscoring the temporal and spatial unpredictability of sediment processes at micro-scales. This variability is attributed to localised hydrodynamic turbulence, root-structure interference, and episodic sediment pulses. In contrast, broader spatial patterns (up to 1 km^2) revealed consistent net sediment accretion across all sites, with mean accretion rates ranging from 2.1 to 5.4 mm yr^{-1}. These rates were not significantly influenced by short-term variations in suspended sediment concentration or wave energy, suggesting that regional-scale forcings—such as estuarine sediment supply and prevailing hydrodynamic regimes—exert dominant control over long-term sediment budgets. These findings reinforce the biogeomorphological principle that mangrove sedimentation is governed by scale-dependent feedbacks: while fine-scale processes are chaotic and difficult to predict, landscape-scale sediment dynamics exhibit greater coherence and resilience. This has important implications for restoration and management, indicating that interventions targeting microtopography or vegetation density may yield limited benefits, whereas maintaining regional sediment connectivity and hydrodynamic regimes is critical for long-term shoreline stability.

Will the river do the work? A practical guide for assessing river recovery potential

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04A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 9:35 AM - 11:05 AM

River channels globally have undergone significant modifications, resulting in degraded habitats and reduced biodiversity. River restoration is increasingly being used to reverse this damage. While this delivers the desired results, such an intensive approach to restoration is expensive, making it unfeasible to apply to the scale of the problem. Instead, the 'Will the River Do the Work' approach guides river practitioners to identify where passive approaches to restoration - which encourage the river to adjust and self-heal – can be applied. This uses the concept of 'Recovery Potential' as a measure of a reach of rivers ability to self-heal, implicitly linked to its energy environment and sediment load. This is assessed through the following steps:

1. Catchment-scale mapping of 'Recovery Potential' based on steam power for baseline rivers across Scotland.
2. A field assessment framework which assesses the geomorphic characteristics of a reach to create a more detailed and accurate assessment of 'Recovery Potential', grounding the larger scale analysis.
3. Descriptions of Active (traditional restoration), Assisted Natural Recovery (using wood or sediment introductions to kickstart and speed up recovery) and Passive (allowing natural recovery) approaches to restoration. This guides how 'Recovery Potential' can be used to select the most appropriate restoration approach, to maximise output and minimise cost. Case studies of delivered restoration schemes assessed based on their recovery potential and the restoration approach used are included to provide evidence of the applicability of this approach.

This framework provides a process-based, geomorphic approach to identify where less intensive, cheaper river restoration approaches can be applied. In lower energy or complex scenarios, more intensive restoration approaches will be necessary. However, where energy is high and constraints are fewer, lower cost passive approaches can be used to decrease the costs and increase the scales at which restoration can be applied.

ADCP measurements of bedload transport during both hydropeaking events and natural floods

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

A hydropeak is a rapid increase in river discharge induced by a hydroelectric dam when optimizing energy production. These flow fluctuations occur in many regulated rivers and can influence sediment transport and fluvial habitat. The present study investigates the relative importance of hydropeaks versus natural floods for bedload sediment transport in the Ésera River, Central Pyrenees, Spain. An acoustic Doppler current profiler (ADCP) was used to measure both stationary time series and spatial distributions of apparent bedload velocity, which is the bias induced in ADCP bottom track velocity (Doppler sonar) due to bedload transport.

Data were collected from the road bridge at the Santaliestra monitoring section, which is approximately 13 km downstream from the hydropower plant. A total of 29 of the stationary ADCP apparent bedload velocity measurements distributed across the channel section were coupled with synchronous adjacent physical bedload samples collected with a Helley-Smith sampler. The physical bedload samples were processed in the laboratory to obtain fractional bedload transport rates. The ADCP apparent bedload velocity data were processed using advanced data filtering techniques. Fractional results aligned with calibration relations developed in other rivers with similar mixed sand/gravel bed materials. Transport of sand produced lower mass transport for the same apparent bedload velocity than transport of gravel.

A total of 13 spatial surveys of apparent bedload velocity were obtained for different flow rates, during both hydropeaking events and natural floods. Initial observations suggest hydropeaks may in some cases transport more sediment than natural floods, depending upon sediment availability as a function of the time history of natural flood and hydropeak sequences.

Linking permafrost thaw to enhanced rock organic carbon oxidation in Arctic landscapes

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08C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 9:35 AM - 11:05 AM

Arctic permafrost landscapes are becoming more geomorphically active as rising air temperatures and increasing summer rainfall deepen the seasonally thawed layer. This deepening may potentially enhance rock weathering rates by bringing unweathered bedrock into contact with air, water, and microbial communities. In Arctic settings underlain by sedimentary rocks, enhanced oxidative weathering of petrogenic organic carbon (OCpetro) may increase CO_2 release to the atmosphere. While these weathering reactions influence atmospheric CO_2 concentrations, the links between permafrost thaw and oxidative weathering remain poorly understood. We hypothesize that active layer deepening increases OCpetro supply to the weathering zone and deepens hydrologic flowpaths, thereby accelerating oxidative weathering. We test this hypothesis in the Brooks Range of northern Alaska, where organic carbon-rich sedimentary bedrock (up to 6 wt% OC) underlies mountainous terrain. Our study focuses on the Atigun and Canning River catchments, where nearby permafrost monitoring stations show evidence for active layer deepening over the past decades. We analyzed water, sediment, and bedrock chemistry from mainstem rivers and tributaries across varying discharge conditions. We tracked OCpetro oxidation using dissolved rhenium (Re), a redox-sensitive trace metal that co-occurs with OC in shale and is released during oxidative weathering. Re concentrations in these catchments are 3-10x higher than the global average (~30-100 pmol/L), with seasonal dynamics. In spring, when the thawed layer is shallow, Re concentrations decline with increasing discharge, while in summer they display chemostatic behavior with discharge. These patterns suggest that OCpetro oxidation is supply-limited during the period of early thaw and becomes kinetically limited in summer when the thawed layer is deeper. Preliminary catchment-scale flux estimates indicate that CO_2 release from OCpetro oxidation exceeds fluvial export of particulate OC (both biospheric carbon and unweathered OCpetro). We propose that permafrost active layer deepening thus enhances CO_2 release via rock organic carbon oxidation in Arctic watersheds.

San Lorenzo River Lagoon – 12 Years of Adventure Leading To An Innovative Culvert Bypass System

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10E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 2:30 PM - 4:00 PM

The San Lorenzo River Lagoon in Santa Cruz, California, is a bar-built estuary that opens and closes seasonally. Following the construction of the Santa Cruz Harbor and associated jetties in 1964, sand impoundment has widened the beaches along Seabright Beach, Main Beach, and Cowells Beach. This widening has altered the natural opening and closing dynamics of the San Lorenzo River Lagoon. The closed lagoon summer condition raises a myriad of often competing management challenges, including protection of endangered species habitat, public (beach and marine) safety, water quality, historic cultural resource preservation, coastal access, recreation, and community flooding.
Beginning in 2013, the City of Santa Cruz (City) began a process to identify a long-term solution and move away from a long-standing practice of emergency permits and unmanaged illegal breaching that has proven to be detrimental to endangered species protection. Through the process, the identified solution known as the San Lorenzo River Lagoon Culvert Bypass System (CBS) was designed, permitted, and finally completed, with operations beginning in late August 2024.
The CBS is the first of its kind in California —conceptually engineered to balance competing management challenges and assist in managing coastal bar-built lagoons. Several components of the CBS include an infiltration gallery that removes salt water from the bottom of the lagoon and a larger pipe that stabilizes water levels through an overflow weir.

During the interim decade, a variety of mouth management tactics were tried led to a low flow breach protocol which mimicks a natural tidal exchange avoiding rapid dewatering.

After completion, the CBS successfully discharged saline bottom water into the ocean. Data show an increased freshening of the bottom water layer improving DO, and moderating rapid temperature increases. This presentation will share lessons learned on low flow breaching with implications for lagoon management around the world.

Landslide hazard evaluation strategies for safety improvement and conservation of unstable small towns of the southern Italy

Assoc. Prof. Paola Revellino[1], Assoc. Prof. Vincenzo Allocca[2], Dr Riccardo Altieri[2], Professor Domenico Calcaterra[2], Professor Pantaleone De Vita[2], Assoc. Prof Diego Di Martire[2], Professor Francesco Maria Guadagno[1], Assoc. Prof. Luigi Guerriero[2], Dr Guido Leone[1], Professor Maria Rosaria Pecce[2], Dr Chiara Spagnolo[1], Assoc. Prof. Francesco Vespasiano[1]
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12C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 9:35 AM - 11:05 AM

The Apennine Mountains of southern Italy are disseminated of historical small towns, the so called “borghi”, very often located in hilly geomorphological frameworks. Many of them are undergoing severe degradation processes due to depopulation, abandonment, lack of maintenance and slope instability phenomena. Landslides are often the main cause of damages to buildings and local population, representing a further factor accelerating depopulation of the inner areas of southern the Apennine. The preservation of these towns, which are a unique cultural and architectural heritage, requires specific interventions, whose planning need a deep knowledge of slope instability processes in terms of spatial distribution, controlling-triggering factors, and temporal evolution of the deformations.

This work presents a study dealing with the landslide hazard affecting three historical towns of southern Apennine. Being located in different geological and geomorphological contexts, the study sites are characterized by landslide processes with different deformation modes, spanning from slow and continuous displacements to abrupt triggering. We combined classical approaches in landslide mapping and monitoring, such as surveys, morphological analysis by high-resolution digital elevation models (DEMs), visual analysis of orthophotos, and in-field measurements, with the analysis of interferometric radar data provided by two different satellite missions (Sentinel-1, COSMO-SkyMed). Specifically, data analyzed consists in long-lasting (multi-annual) InSAR (Interferometric Synthetic Aperture Radar) time series of surface displacements. The statistical analysis of this time series allowed us to investigate spatial distribution of displacement rates and identify critical zones in the urban areas, as well as to identify acceleration phases of the deformation, and possible links with rainfall events and the seasonal hydrological pattern.

The research activity was developed in the context of the LIVES project (LIVing in unstable historical towns: landslide hazard Evaluation Strategies for safety improvement and conservation), whose objective is developing strategies for landslide hazard monitoring and mitigation in unstable towns.

Reshaping of gravel bedforms by tidal currents in Cook Strait/Te Moana o Raukawakawa

Dr Sally Watson[1,2], Dr Peter Russel[3], Dr Marta Ribo[4], Prof Craig Stevens, Dr Erica Spain[1], Dr Alan Orpin[1]
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03C: Marine and lacustrine geomorphology - mapping and applications, Dobson 2, February 2, 2026, 4:00 PM - 5:30 PM

Cook Strait/Te Moana o Raukawakawa is known globally for its vigorous tidal flows, ocean waves and winds, and dynamic seabed environment. This narrow passage of water is also the primary connection between Aotearoa New Zealand's main islands, hosting a busy shipping passage and subsea cables (i.e., HVDC Inter-Island link). During a multibeam hydrographic survey in 2017, a unique helical network of gravel bedforms on the continental shelf (~50-100 m water depth) was revealed for the first time. These bedforms were subsequently resurveyed using the same multibeam system in 2020 and 2021, documenting morphological changes to plan-view dune geometry and bifurcation of crestlines over annual timescales. Modelling suggests that average hydrodynamic conditions in Cook Strait are capable of mobilising coarse-grained seabed substrate (i.e., sand to gravel), indicating that the observed morphological changes could be a snapshot of continuous incremental modification, rather than only during infrequent, high-magnitude events.

In 2023, a rare data co-collection opportunity arose to resurvey this set of extraordinary bedforms seven times over at near-daily intervals to assess high-frequency morphological changes. These novel remapping campaigns spanned a range of tidal conditions (e.g., flood, ebb and slack) and included coincident water-column measurements, including multibeam backscatter, ADCP velocity, direction and turbulence. Initial results indicate that the gravel waves are highly dynamic over the week-long survey, with vertical changes of up to 1.5 m and horizontal shifts up to 15 m. The maximum observed change between 3–5 August coincided with the 2nd largest spring tide of the year. This study provides the first high-frequency multibeam dataset documenting daily seabed change in Aotearoa New Zealand. Unravelling the frequency, variability, magnitude and mechanisms driving bedform change has implications for ocean dynamics and marine habitats. In addition, this location is of high importance for present and future seafloor and near-bed infrastructure.

Geomorphological observations providing new insights on flow transformations: from debris flow to high-density turbidity current during submarine canyon flushing event.

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06E: Marine and lacustrine geomorphology - mapping and applications, Dobson 4, February 3, 2026, 2:30 PM - 4:00 PM

Millions of tons of sediment is flushed through submarine canyons during infrequent high-magnitude events, transporting coastal sediment to the deep ocean. However, observations related to individual canyon flushing events are challenging due to the destructive nature and infrequency of flushing events.

Here we present high-resolution multibeam bathymetry collected in October 2020 using an Autonomous Underwater Vehicle (AUV), that have enabled us to reconstruct transformations of flow dynamics during the 2016 submarine canyon flushing event in Kaikōura Canyon, New Zealand.
Our detailed geomorphological observations show the presence of grooves and erosive scours at mid-canyon, co-existing with depositional coarse-grained bedforms, suggesting a transformation of flow, from concentrated debris flow to dilute turbidity current. From mid- to lower canyon, gravel waves cover the canyon floor, varying in size, planform crest shape, and orientation. These variations record changes in the turbidity current dynamics, with variations of threshold shear stress and flow acceleration both across- and downcanyon.

Our study offers new insights into the processes that create and shape nearshore bedrock-incising submarine canyons, enhancing our understanding of sediment dynamics and erosion in bedrock submarine canyons worldwide.

Luminescence in the Cryosphere: Benefits and Challenges

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Luminescence dating provides an age estimate for the last time mineral grains were exposed to light, providing sediment depositional ages. Advances in optically stimulated luminescence (OSL) dating of quartz and infrared stimulated luminescence (IRSL) dating of feldspar have revolutionized the ability to obtain ages from settings lacking organic material or older than the age-range for radiocarbon (>50 ka). These advances have allowed application of OSL/IRSL to nearly every setting, including glacial, proglacial fluvial and lacustrine and periglacial settings. The benefits of OSL/IRSL dating are also coupled with challenges related to incomplete solar resetting (partial bleaching) of the luminescence signal in ice-proximal settings, which are commonly associated with turbid water and mass-flow conditions. Careful selection of sediments with evidence of grain sorting in shallow tractive flow can alleviate some problems with partial bleaching. Small-aliquot (<20 grains) and single-grain dating are commonly able to isolate the population of grains that were exposed to sufficient sunlight (<10s of direct sunlight exposure for OSL, >100s for IRSL) prior to deposition. This is more important for Holocene and late Pleistocene samples, where residual, non-zeroed doses can be greater than 50% of the burial dose. OSL is preferred for late Pleistocene deposits given the faster solar bleaching for quartz. However, the lower maximum age range for quartz OSL is commonly <100-200 ka. In older deposits, feldspar IRSL dating is advantageous, not only due to its older age range (up to 1Ma), but also because quartz OSL signals in sediment derived from freshly eroded bedrock are commonly not suitable for dating due to weak luminescence signals. We present examples of the benefits and challenges of luminescence dating in the cryosphere. Strategies for successful application of OSL/IRSL dating are presented along with lessons learned and novel approaches to apply newly developed luminescence techniques to these challenging settings.

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The demonstration sites network : 15 years of monitoring to assess the effectiveness of hydromorphological river restoration in France

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

France's rivers have been largely altered by human activities. Hydromorphological restoration aims to re-establish their physical and dynamic characteristics, which support the good ecological status required since 2000 by the Water Framework Directive for all European rivers.

The increasing number of restoration projects and studies assessing their effectiveness are showing positive overall effects on certain biological indicators (species abundance and diversity), but ecological responses remain variable.

Since 2010, the French Biodiversity Office, the Water Agencies, INRAE and a number of technical partners, including river managers, have been setting up a network of demonstration sites for hydromorphological restoration. This network includes around fifty restored sites, covering seven ambitious types of restoration : remeandering, removal of cross-cutting obstacles, modification of bed geometry, ponds bypass, return to the talweg, removal of bed and bank fixations, addition of sediments.

Within this network, standardised monitoring, known as minimum scientific monitoring, is being implemented on restored sites. Protocols make it possible to collect data over ten years on three compartments: hydromorphology (channel geometry, habitats, riparian vegetation, granulometry), physico-chemistry (pH, temperature) and hydrobiology (fish, macroinvertebrates).

A first appraisal carried out on 26 restored sites highlights the wide variability in ecological and hydromorphological responses, depending on the type of restoration, objectives, time elapsed after the work and the local context. Works aimed at reconstituting the alluvial mattress or removing cross-cutting structures offer faster ecological responses. Works that encourage the reactivation of processes, lateral mobility and the diversity of facies and habitats by remeandering would have more lasting ecological responses.

Finally, the importance of rigorously implementing long-term monitoring is highlighted for a proper assessment of restoration effectiveness.

The aim is to improve practices and makes river managers able to design appropriate, ambitious and replicable projects of restoration to achieve good ecological status as required by the Water Framework Directive.

Defining morphological units from UAV images to study the evolution of bars in an active meandering gravel bed river

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

In an active meandering river, gravel bars are in continuous evolution, allowing for the renewal of habitats that are extremely valuable for both faunistic and floristic biodiversity. The presence and characteristics of these bars are directly related to discharges variability in flow rates and bedload supply and to the lateral mobility of the bed. In low-energy rivers, the equilibrium on which these dynamics rely is fragile and is often disturbed by anthropogenic activities. To better understand these relationships, we studied five river reaches of the Armançon river, a low energy but still very dynamic gravel bed river of central France. Overflight campaigns using Phantom 4 RTK drones were carried out annually between 2021 and 2025 to collect high-resolution photogrammetric data on twelve bars and associated opposite banks. The surfaces of the bars were divided and classified into 10 different morphological units (MUBs) based on the local slope, tangential curvature and elevation from the water level. The evolution of these MUBs as well as the size and volume of the bars, the particle size on bars and the river sediment mobility were monitored over the 4 years of the study. These factors were then linked to the river hydrology and the vegetation evolution on the bars. Our results show a progressive evolution of the bars and their MUBs, well correlated with bank retreat during the first two years of the study. This was followed by a massive transformation of the bars but relatively limited bank retreat in the third year, following a 20-year return period flood that occurred in May 2024. Through this study, we also demonstrated the benefits of defining Morphological Units on Bars (MUB) to better describe the evolution of the bars and understand their progressive stabilization and encroachment by vegetation.

Methodological advances in sea level rise vulnerability assessment for the sustainable coastal management in a changing climate

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01E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 11:40 AM - 1:10 PM

In this study, we present an analysis of peer-reviewed papers that address the issue of sea level rise (SLR) in low-lying coastal areas, such as alluvial coastal plains, sandy beaches, and river delta mouths, which are particularly vulnerable to both temporary and permanent sea level variations (SLVs). The analysis is based on a selection of documents identified through targeted research queries conducted in the Scopus database.

A subset of these papers, specifically those published in the last five years, was further examined to focus on the methodological approaches used to assess the impacts of SLR on coastal systems in the Mediterranean region. Additionally, the study evaluates the suitability of the applied methods, assessing their applicability to specific aspects of coastal vulnerability analysis.

Our findings show that, globally, the number of peer-reviewed publications focusing on the vulnerability of coastal zones to SLVs that consider local geomorphological settings and projected SLR has steadily increased since 2008, with publication peaks observed in 2021 and 2023.

Regarding methodological approaches, GIS-based static methods emerged as the most widely used, followed by model-based approaches. Moreover, while there has been no significant shift in the types of methodologies applied, more recent studies increasingly rely on higher-quality input data. This improvement is attributed to the availability of: (i) more refined sea level projections from high-resolution models; (ii) high-resolution digital elevation models (DEMs); and (iii) advanced satellite-derived data for the accurate assessment of vertical land movements (VLMs). As a result, modeling analyses require substantial computational resources, making them particularly suitable for studies focused on smaller geographic areas.

Geomorphic expression and significance of an enigmatic regional geologic structure bisecting southern Tasmania

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Modern LiDAR provides new insights on the extent, form, and landscape influence of a major structure bisecting southern Tasmania. Twentieth-century geologic mapping identified several north-trending, broadly parallel features, including juxtaposed Permo-Triassic sedimentary sequences, Jurassic dolerite dikes, and short fault segments. LiDAR-derived bare-earth elevation models detail those features but also reveal numerous intervening analogues and more muted lineaments. Closely spaced, aligned landforms – including straight ridges, elongate depressions, slope breaks, and linear streams – delineate a slightly arcuate, >100-km-long structure extending from the south coast at Randalls Bay to central Tasmania near Bothwell. Lineaments farther north crossing Central Plateau suggest a length >140 km. The structure's origin is uncertain, although its scale, persistence, and geologic features support a regional fault system, likely inherited from the underlying Proterozoic basement. Bedrock relationships indicate that the structure penetrated Palaeozoic-Mesozoic cover sequences prior to shallow Jurassic plutonism during Gondwana's breakup and experienced substantial vertical movement following Triassic aggradation. An extensive dolerite dyke revealed by aeromagnetic anomalies seemingly exploited this conduit while dilation of associated thick dolerite sills probably induced differential uplift. Given lacking conspicuous sediment-cutting escarpments and limited European-era seismicity, Neotectonic rupture is unlikely but requires detailed study to assess. Regardless of its origin, this structure has strongly controlled Cenozoic landscape evolution including Quaternary slope movements. Local physiography reflects its structural grain, variously influencing fluvial, colluvial, and periglacial processes. Abundant large (10^1-10^2 ha) landslides occur within ~10 km of the structure. Many are probably late Quaternary in age given their clear features in LiDAR datasets and association with Holocene and latest Pleistocene landscape elements. Extensive slope failures along this structure likely reflect the combined influences of locally contrasting relief and tectonically reduced rock-mass strength, although seismic triggering cannot yet be ruled out. Ongoing geomorphic and geologic mapping across Tasmania suggests analogous, albeit smaller, features elsewhere.

Geomorphic evidence of landslide dams across mature southeast Australian landscapes

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05C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 11:35 AM - 1:20 PM

Attention to landslide dams has increased globally in recent decades but remains limited in Australia's comparatively stable, cratonic landscapes. The single Australian landslide dam occasionally noted in international literature, Victoria's 1952 Lake Elizabeth landslide, is largely unknown, even locally. However, geomorphic evidence of river-blocking landslides is widespread across southeast Australia. We identify and characterise several dozen confirmed and suspected landslide dams in uplands flanking Bass Strait using field observations, archival sources, and remote sensing. Beyond a few European-era events, most are of unknown, likely substantial age. Their impoundments range from ephemeral ponds to sizable persistent lakes, with wetlands and terraces indicating some previously larger waterbodies. Intermittent lakes form behind blocky, permeable dams below jointed, fine-grained igneous escarpments. Some record recurrent rockfall but others seemingly represent single large failures. Bouldery pseudokarst tunnels in granitic terrains may represent late-stage landscape recovery from large valley-blocking landslides. Eye-witness accounts and in-channel deposits suggest frequent dam formation and failure during debris flows. This reconnaissance inventory illustrates the broad-ranging settings, drivers, mechanics, and timing of southeast Australia's valley-blocking landslides and the consequent behaviour, stability, and longevity of those barriers. Tasmania and Victoria's landslide dams have caused local losses and close calls since 1800 but, so far, no casualties. In some settings, overlooking this phenomenon during risk assessment may miss important cascading hazard scenarios and potentially intolerable risk. Although geomorphically mature, tectonically benign settings produce comparatively few landslide dams, those same conditions favour barrier and impoundment persistence and could thus provide novel insights into their progressive modification. Recent, short-lived landslide dams elsewhere in Australia demonstrate the phenomenon's broader relevance. Systematic mapping will undoubtably identify many additional instances across the continent. Meanwhile, new understanding can be gained from detailed consideration of Australia's already-identified landslide dams and from comparison with regions where landslide dams have been more thoroughly studied.

Automated Analysis of New Zealand Historical Aerial Photographs: Geodetic Glacier Change Detection at Rolleston and Tasman Glaciers

Dr Benjamin Robson[1], Dr Jonathan Davidson[2], Dr Shelley MacDonell[2,3], Dr Heather Purdie[2], Dr Wolfgang Rack[2,4], Dr Rodrigo Gomez-Fell[2,3,4], Dr James Brasington[2,3]
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01H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring, Conway 3, February 2, 2026, 11:40 AM - 1:10 PM

Understanding long-term glacier change is crucial for assessing climate impacts on water resources, landscape evolution, and natural hazards in mountain regions. However, reconstructing historical glacier extents and volumes remains challenging due to the lack of consistent, high-resolution datasets. Aerial photographs offer a unique archive for such reconstructions, but traditional processing methods are time-consuming and manual, limiting their use at scale.

This study presents an automated workflow for processing historical aerial photographs combining Structure-from-Motion (SfM) photogrammetry with Ai-assisted image pre-processing and contrast enhancement, with LightGlue, an advanced AI-based image matching technique that is used to automatically collect ground control points. This pipeline is used to efficiently generate georeferenced dense point clouds and digital elevation models (DEMs) from uncalibrated, overlapping photographs.

We exemplify the workflow by generating multi-temporal DEMs over Rollerston Glacier and Tasman Glacier and deriving geodetic changes back to the 1960s by integrating the results with Pléiades data from the Pléiades Glacier Observatory (PMO) and airborne LiDAR surveys.

We will present preliminary results from both glaciers that demonstrate significant geodetic and aerial changes over time as well as outlines the potential challenges and opportunities on upscaling this analysis to fully utilise the extensive archive of aerial photographs covering Aotearoa New Zealand.

Bioconstruction of Murundun Fields by termites – the untold story of living organisms changing the Earth's surface

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03K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 4:00 PM - 5:30 PM

In the central region of Brazil, specifically in the grassland environment of savanna formations, multiple instances of peculiar micro-relief were reported, the origin of which was interpreted as the result of termite bioturbation processes. These micro-reliefs are called "murunduns". Each murundun is elliptical with 10m² of surface area and a mean height of approximately 1m. They don't occur in isolation but instead form groups that can reach several hectares, forming so called "murundun fields"; a unique feature typical for Central Brazil. The study carried out in the Canastra Range, a topographically elevated region in Minas Gerais state, indicates the occurrence of "murundun fields" associated with interfluvial regions and first-order springs. Our study seeks to understand the role of termites as living organisms contributing to the formation of ecosystem engineers of these microreliefs. The results show that the murundun occur predominantly over lateritic soils, where surface drainage is limited due to generally flat surface configuration, and therefore as the result the ground surface can become saturated. In such places soils feature a sandy-clayey composition with grassland vegetation dominating the landscape. Geochronological analyses by OSL showed that at a depth of 30 cm the age of soil material was 950 ± 145 years, while at a depth of 60 cm it reached 2,500 ± 390 years. X-ray diffraction analyses demonstrate a greater presence of gibbsite at the 20-30 cm, 90-100 cm and 100-110 cm horizons. It allows us to conclude that conditions of murundun formation , in addition to bioturbation, require high soil humidity and seasonal retention of surface water. The mapping of the "murundun fields", associated with the recurrent presence of termite colonies on murundun surfaces, supported by the evidence from open trenches across individual murunduns, demonstrate that termites play a preponderant role in the formation of this type of microrelief.

Mangrove forest extent and condition is dynamic and relating changes to sea-level rise is challenging

Professor Kerrylee Rogers[1], Dr Emma Asbridge[1], Dr Chris Owers[2], Mr Rogerio Goncalves[1], Associate Professor Sarah Hamylton[1], Dr Jeffrey Kelleway[1], Professor Richard Lucas[3], Professor Neil Saintilan[4], Professor Colin Woodroffe[1]
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01E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 11:40 AM - 1:10 PM

Changes to mangrove forests since the mid-Holocene, when global sea level largely stabilised, have generally been related to natural geomorphological and ecological processes; it is only recently changes in mangrove forest extent and condition could reasonably be attributed to anthropogenic pressures. Projections of the influence of relative sea-level rise (RSLR) on mangrove forests imply retreat of the seaward margin and extension of the landward margin. We used ~30 years of Landsat imagery and available airborne and drone-derived LiDAR data to evaluate evidence for these changes in open coast settings of northern Australia. This region includes a range of geomorphologically complex features such as cheniers, tidal creeks and spits. In contrast to highly populated coastlines, where infrastructure and assets cause coastal squeeze, landward expansion of mangroves in northern Australia is anticipated across the extensive low-lying coastal plains, which offer accommodation space under higher sea level scenarios. We found widespread occurrence of seaward progradation or shoreline stability; retreat of the seaward margin was uncommon. These observations are contrary to expectations under conditions of RSLR. Changes at the landward margin and the interior of forests were highly variable and temporally dynamic. Despite extensive dieback of mangroves in recent years, including events in the 1990s and 2015-2016, partial or even full recovery of mangrove cover was evident in subsequent years. Recovery of mangrove extent and/or condition following dieback events signals the cyclic influence of climatic variability and lunar recession on tidal inundation. Ongoing monitoring is therefore required to establish the periodic processes influencing mangrove forest extent and condition, particularly in the next 10 years when the lunar nodal cycle trends towards lower tidal amplitudes. These analyses are crucial for understanding the fate of mangrove forests exposed to RSLR and to provide confidence in mangrove blue carbon as a natural climate solution.

Structural controls on multi-crater vent morphology and carbon emissions linked to global warming events

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[1]University of Canterbury, Christchurch, New Zealand, [2]Geomar Helmholtz Centre for Ocean Research, Kiel, Germany, [3]UiT Arctic University of Norway, Tromsoe, Norway, [4]University of Oslo, Oslo, Norway

08C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 9:35 AM - 11:05 AM

Hydrothermal vent complexes (HTVCs) are found in sedimentary basins across the world. They develop from over-pressurization along margins of sill intrusions, leading to explosive release of fluids and sediments to the surface, thereby carving out craters. Associated large-scale transport of thermogenic greenhouse gases from the subsurface into the ocean-atmosphere system suggests that hydrothermal venting links the formation of large igneous provinces to global warming events. However, this link requires a better understanding of the geological evolution of HTVCs to assess their precise timing and carbon release potential. Field observations of exposed craters, as well as in-depth geophysical studies of buried craters, reveal that their morphologies vary in diameter and depth from tens to thousands of meters, also exhibiting internal structural differences. As tectonic, magmatic and fluidization processes imprint on the crater morphology, it indicates a variety of formation dynamics. In this study, we analyse the geologic evolution of the Modgunn vent crater by combining 3D seismic data of different frequencies. This HTVC is one of hundreds of complexes identified along the mid-Norwegian continental margin, with their formation potentially linked to the Paleocene-Eocene Thermal Maximum (~56 Ma ago). Essentially, the Modgunn vent shows an enigmatic multi-crater morphology, while its shallow subsurface setting enabled detailed mapping of the individual vent components. The spatial relation between sill intrusions, fluid conduits and internal craters suggests a potential structural evolution of such multi-crater vent morphologies, where each sill formed one smaller depression. There are also signs for the reuse of fluid conduits. We suggest that the evolution represents a self-accelerating mechanism, where folds of deeper sills trigger the transgression of shallower sills adding adjacent fluid conduits and craters. The resulting multi-crater morphology may therefore indicate a process, where multiple vents erupt and release carbon over a short time span, potentially initiating global warming events.

Portable (port-) OSL profiling:
A pivotal method for geo-archaeo-chrono-logical research

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Portable, pulsed-photon, Optically Stimulated Luminescence (portable/port-OSL) readers measure luminescence signals from bulk samples of sediments that have been deposited throughout the late Quaternary. The post-OSL signal depth profile reveals practical and preliminary chronostratigraphic insights for studying late Quaternary depositional palaeoenvironments. Vertical, horizontal and 2D-matrix port-OSL profiling has been found to be useful for interpreting sedimentary sections and their depositional processes during and after fieldwork, preferably where sediments are similar in mineralogy and particle-size. Such profiling can also prioritize sampling for OSL dating. Based on >100 research and salvage archaeological excavations in Israel, we review the methodological field and analytical approaches, main utilities and complexities of port-OSL profiling concerning in- and off-site contexts.

The port-OSL research of a wide range of depositional environments spanning prehistoric to modern periods, provide insights regarding the utility and constraints of port-OSL readers in geoarchaeological research. We demonstrate how port-OSL, even in non-uniform sediment mineralogy, and for thin and spatially constrained stratigraphic units that often characterize archaeological sites, can help detect crypto-stratigraphic boundaries, and attribute sediments to anthropogenic, natural or mixed forcings. In some sections, port-OSL signals can even be correlated to absolute and archaeological chronologies to produce site-specific or regional, port-OSL-based, age estimate functions. Altogether, port-OSL appears to be a fine tool for site and landscape excavations in service of a broad scope of field-based geoarchaeological research.

Tracing the Recess Peak Advance: Palaeoglacier and ELA Reconstructions from California's Sierra Nevada

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Palaeoglacier reconstructions of the Californian Sierra Nevada can elucidate the late Quaternary climate evolution of North America regions that were marginal relative to the Laurentide Ice Sheet and can help assess how much its influence extended southward within the continent. While much is known of the Sierra Nevada's Last Glacial Maximum (LGM), far less is understood about the climate and glacier changes that followed, i.e. during the deglaciation. Here we present the palaeoglacier reconstruction and equilibrium line altitudes (ELAs) of twelve, likely Recess Peak advance (~ 14 – 12.5 ka), glaciers from Yosemite and Sequoia Kings Canyon National Park.

These ELAs, in combination with other, independent climate proxies will eventually allow us to infer palaeoclimate conditions and assess what climate forcings drove the retreat, how strongly changes were driven by global and/or regional climatic trends, and the role of the Laurentide Ice Sheet. This is important in order to provide calibration/validation data for climate model hindcasts under altered boundary conditions and hence refine model predictions of future climate change.

Evolving landslide hazards: Assessing rainfall-induced landslide susceptibility following the 2016 Mw 7.8 Kaikōura Earthquake

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07J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 5:00 PM - 6:30 PM

The 2016 Mw 7.8 Kaikōura Earthquake in Canterbury, New Zealand, produced one of the most complex fault ruptures ever recorded and triggered intense ground shaking. This event initiated over 29,000 co-seismic landslides across ~10,000 km², primarily concentrated within a 3,600 km² area. Hillslopes experienced widespread damage, including cracking and dilation, leaving large volumes of debris stored in the landscape and increasing the potential for rainfall-induced landslides (RILs) on weakened slopes. However, the magnitude and evolution of this hazard remain poorly understood. To investigate post-seismic landslide dynamics, high-resolution surface change models were created using airborne LiDAR data collected immediately after the earthquake (November 2016) and during six subsequent surveys (through April 2019). These data, alongside aerial and satellite imagery, enabled identification and mapping of new RILs, as well as reactivation and remobilisation of existing landslides and debris during five major post-earthquake storms.

RIL susceptibility models for both pre- and post-earthquake conditions were developed using logistic regression and machine learning methods. These models, trained on two pre-earthquake and five post-earthquake RIL inventories, estimate the probability of landslide occurrence under specific rainfall conditions. Comparing pre- and post-earthquake models allowed quantification of changes in susceptibility and hillslope recovery over time.

Our findings show a significant reduction in rainfall thresholds required to trigger landslides post-earthquake, leading to increased RIL frequency. Post-earthquake slope failures included new landslides on weakened slopes, reactivation of existing landslides, and debris remobilisation - most commonly as highly mobile debris flows connected to the fluvial network. The highest RIL activity occurred during the first major storm after the earthquake, followed by a gradual decline in landslide frequency and size, suggesting progressive hillslope recovery. Continued quantification of post-earthquake landslide rates through LiDAR differencing and remote sensing provides critical insights into the trajectory and timescale of landscape recovery after major seismic events.

The New Zealand Landslide Database: The 2025 upgrade project

Ms Brenda Rosser[1], Regine Morgenstern[1], Biljana Lukovic[1], Alec Zoeller[1], Phil Scadden[1]
[1]GNS Science/Earth Science Institute, Lower Hutt, New Zealand

10D: Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 2:30 PM - 4:00 PM

A comprehensive and quality-assured geospatial landslide database is essential for understanding landslide activity, identifying triggering mechanisms, and developing models to forecast landslide hazard and risk in New Zealand. This need is increasingly urgent due to the effects of climate change, which are intensifying the magnitude and frequency of rainfall events and raising the likelihood of slope failure. In response, GNS Science has implemented major upgrades to the New Zealand Landslide Database (NZLD), enhancing its functionality and accessibility.

An initial upgrade in 2017 (Rosser et al., 2017) integrated multiple GNS Science landslide datasets into a unified spatial relational database. A second major upgrade in 2025, presented here, further improves the database structure, data quality, usability, and alignment with FAIR data principles. The upgrade focused on: 1) Designing a new relational database structure to incorporate current and future landslide mapping; 2) Consolidating, curating, and quality-assuring recent and legacy GNS Science datasets; 3) Enabling database access via a web map for GNS Science staff, collaborators, and the public; 4) Allowing external data downloads on a user-pays basis, depending on intended use. The upgraded NZLD is a world-class resource, supporting researchers, planners, engineers, insurers, and the public in landslide hazard and risk assessments. It includes:

- A structured geospatial relational database in PostgreSQL with ArcGIS integration, containing ~254,000 curated landslides with additional legacy data (~285,000 landslides) to be added following QA/QC. All records are assigned a data quality ranking;
- A web map application that allows users to view the landslides in the database via a customisable ArcGIS Online webservice, providing interactive access to landslide records. Data can also be accessed via a REST server for integration into other GIS platforms.

This talk will also provide context on the relationship between the NZLD and other landslide databases in New Zealand.

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Geophysical Imaging of a Dynamic Mixed Gravel and Sand Barrier: Progradational, Hydrogeological, and Channel Changes at Birdlings Flat, New Zealand

Miss Kalista Rossiter[1], Mr Ted Spinks[1], Mr Ben Souter[1], Mr Alex Blair[1], Dr Harry Jol[2]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Kaitorete Spit is a large mixed gravel and sand barrier, where longshore drift brings sediments from the Rakaia River and the coastal cliffs of the Canterbury Bight. Eastward progradation of the barrier in the early Holocene has resulted in the closing of marine embayments, forming Te Roto o Wairewa/Lake Forsyth. The opening of the lake through the barrier at Birdlings Flat has been performed historically by local Māori to aid eel migration which are an important food source, and continues periodically today. The objectives of the study are to image and understand the progradational nature of the beach facies, channel changes through the barrier, and saltwater intrusion at Birdlings Flat on Kaitorete Spit. A PulseEKKO Pro ground penetrating radar (GPR) system was used to collect data at 100 MHz (1 m antennae separation at 0.25 m step size), and at 200 MHz (0.5 m antennae separation at 0.1 m step size). Topography was measured along the survey lines using a Leica Rugby 840 laser levelling system and was used to geometrically correct the GPR data. Interpretations of the GPR data show dipping reflections indicative of oceanward barrier progradation of the beach facies, while signal attenuation indicates saltwater intrusion along the most recent beach ridge. When imaging along probable channels, erosional truncations are apparent on shore-parallel profiles and interpreted as the edge of former channels, and horizontal to sub-horizontal, continuous reflections suggest infill of a former channel. On the shore-perpendicular profiles, topography across the channel's axis is lower than the rest of the barrier, allowing saltwater to break overtop and rework the gravels behind the barrier, also resulting in signal attenuation reaching further inland than higher beach ridge profiles. Using GPR surveys we can improve the understanding of coastal barrier system models, which can aid future management of coastal environments.

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Geophysical Imaging of a Dynamic Mixed Gravel and Sand Barrier: Progradational, Hydrogeological, and Channel Changes at Birdlings Flat, New Zealand

Miss Kalista Rossiter

05H: Providing 2D & 3D Subsurface Imagery of Geomorphic Environments: Ground Penetrating Radar and Near-Surface Geophysics, Conway 3, February 3, 2026, 11:35 AM - 1:20 PM

Kaitorete Spit is a large mixed gravel and sand barrier, where longshore drift brings sediments from the Rakaia River and the coastal cliffs of the Canterbury Bight. Eastward progradation of the barrier in the early Holocene has resulted in the closing of marine embayments, forming Te Roto o Wairewa/Lake Forsyth. The opening of the lake through the barrier at Birdlings Flat has been performed historically by local Māori to aid eel migration which are an important food source, and continues periodically today. The objectives of the study are to image and understand the progradational nature of the beach facies, channel changes through the barrier, and saltwater intrusion at Birdlings Flat on Kaitorete Spit. A PulseEKKO Pro ground penetrating radar (GPR) system was used to collect data at 100 MHz (1 m antennae separation at 0.25 m step size), and at 200 MHz (0.5 m antennae separation at 0.1 m step size). Topography was measured along the survey lines using a Leica Rugby 840 laser levelling system and was used to geometrically correct the GPR data. Interpretations of the GPR data show dipping reflections indicative of oceanward barrier progradation of the beach facies, while signal attenuation indicates saltwater intrusion along the most recent beach ridge. When imaging along probable channels, erosional truncations are apparent on shore-parallel profiles and interpreted as the edge of former channels, and horizontal to sub-horizontal, continuous reflections suggest infill of a former channel. On the shore-perpendicular profiles, topography across the channel's axis is lower than the rest of the barrier, allowing saltwater to break overtop and rework the gravels behind the barrier, also resulting in signal attenuation reaching further inland than higher beach ridge profiles. Using GPR surveys we can improve the understanding of coastal barrier system models, which can aid future management of coastal environments.

Integrating Pixel- and Slope-Unit Descriptors in Landslide Susceptibility Mapping: application to the Ilopango Caldera, El Salvador.

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The selection of optimal mapping units strongly controls the skill of landslide susceptibility models to capture the real slope instability conditions. Among available options, pixels and slope units (SU) are the most widely used: pixel-based models capture local controls but often yield speckled outputs, whereas SU frameworks enforce geomorphic consistency at the risk of over-smoothing. To evaluate the effectiveness of integrating slope unit- to pixel-based predictors in explaining landslide spatial distribution, a test has been carried out in the northern Ilopango Caldera (El Salvador), which was affected by extensive debris flows and debris slides after the Tropical Storms “Amanda” and “Cristóbal” (29 May–7 June 2020). Two susceptibility models were prepared and their predictive performances compared: a baseline susceptibility model, classically set on pixel-based descriptors (outcropping lithology and a set of primary and secondary pixel-level attributes) and an enhanced susceptibility model, including also SU summary descriptors (means, 10th/90th percentiles, standard deviations) of the same topographic variables, and lithological proportions.

The baseline and the enhanced models were calibrated by applying Multivariate Adaptive Regression Splines (MARS) and Random Forests (RF) and evaluated through spatial k-fold cross-validation. The performance was measured using Area Under the ROC curve (AUC) and Cohen’s kappa (κ), while spatial coherence is assessed with Moran’s I.

Enhanced models consistently outperform baseline models in AUC and κ and produce maps with higher Moran’s I, indicating reduced speckle while preserving pixel-scale detail. The enhanced Random Forests configuration achieves the best overall performance.

According to the obtained results, the proposed procedure allows us both to retain the benefits of pixel- and slope units-based predictors and to limit their drawbacks.

This research was developed within the framework of the project “Establish and develop a degree program in Earth Sciences at the University of El Salvador” (CASTES), funded by the Italian Agency for Development Cooperation.

Setting standards for official landslide susceptibility mapping in Sicily: the ISPRA-CARG Map sheet n. 609-596 "Termini Imerese-Capo Plaia" (center-northern Sicily).

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The use of statistical methods for classifying the territory according to its propensity to landslides provides an objective and quantitative basic information layer suitable either for establishing land use planning rules or to produce event scenarios by integration with expected rainfall or seismic acceleration. At the same time, coping with the operational needs of technical functionaries and professional geologists requires to set functional map layout design/legends and associated prescriptive rules. Moreover, due to the general legal implications which arise in case of embedding of any susceptibility map, both the modelling and the restitution procedure have to be standardized. In this contribution, the first results of the CARG landslide susceptibility thematic mapping project ("Geologic and geothematic cartography"), which the Italian Institute for Environmental Protection and Research (ISPRA) is promoting and supporting on the national scale, are presented. In particular, the key study relates to the 1:50.000 Map sheet n. 609-596 "Termini Imerese-Capo Plaia" (center-northern Sicily) is presented for discussion. Landslide susceptibility models and associated maps were separately prepared for: a) earth-rock rotational/translational slides; b) earth flows; c) rock falls/topple.

Slope units and pixel partition were used for slope (flows, slides) and scarp (falls/topples) phenomena, respectively. Susceptibility modeling was performed, by applying Multivariate Adaptive Regression Splines (MARS) to regress the outcome (stable/unstable SLU/pixel status) on a set of covariates. Four classes of susceptibility were objectively derived by a recursive nested double application of the Youden-index criteria on the AUC plots.

Beyond the excellent quality of the obtained models (AUC>0.8), the contribution intends to give to the discussion an optimized proposals for map layout design, including accuracy/error maps and variable importance response validation results, slope units selection, criteria for defining the spatial connectivity of a susceptible unit and its surrounding susceptibility scenario.

Forward modelling of geomorphological and climatic controls on moraine building and preservation in the Southern Alps/Kā Tiritiri o te Moana

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05G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 11:35 AM - 1:20 PM

Glaciers and ice sheets fluctuate in response to climatic change and often record these changes by building ice-marginal (terminal and lateral) moraines. Therefore, glacial landscapes are a potentially valuable archive of terrestrial palaeoclimate change. Typically, a cooling climate causes glaciers to expand, and warming causes glaciers to shrink. However, the dynamic glacier response time and the influence of high-relief mountainous topography on glacier dynamics complicates this behaviour, such that ice-marginal moraines are not always a straightforward record of palaeoclimate change.

We used a higher-order ice-flow model to simulate changes in glacier erosion, ice extent and thickness in the response to Quaternary palaoeclimate and the resulting formation and preservation of moraines in a mountain landscape similar to the Southern Alps/Kā Tiritiri o te Moana. Our results show that the rate of palaeoclimatic change relative to a glacier's response time determines the geometry, number and position of ice-marginal moraines, that glaciers can build distinct moraines in the absence of climate change, and that the distance from the glacial maximum may not represent the chronological order of moraine formation. While moraines can be preserved despite erosion by various surface processes and by being overrun during subsequent glaciations, moraine sequences frequently contain gaps that could be misinterpreted as representing periods of climate stability. These results provide a theoretical basis for the interpretation of glacial landforms in the Southern Alps/Kā Tiritiri o te Moana and for using moraines sequences to reconstruct Quaternary palaeoclimate.

Artificial cavities and sinkholes in the hydrographic district of the Southern Apennines of Italy: findings, architectural variability and risk assessment

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The territory managed by the Hydrographic District of Southern Apennine (Autorità di Bacino Distrettuale dell'Appennino Meridionale), in southern Italy, is subject to geological hazards connected to the presence of anthropic cavities in the subsoil. These represents a serious problem, especially in intensely urbanized areas where the stability of urban structures is often compromised by the presence of underground voids, locally forming a well developed network of cavities , produced by decades of excavation activities. Objectives of the project were the census, analysis and evaluation of the cavity system on the territory of the district. Were analyzed all documentary sources that could provide information on the presence of cavities. The great heterogeneity of the data acquired made necessary to identify a homogenization and cataloguing system to be connected to the classification provided by the National Commission on Artificial Cavities of the Italian Speleological Society, which takes into account the construction typologies and those structural elements susceptible to trigger sinkholes. Data relating to documented sinkholes that occurred in the ADAM territory were collected, deriving from previous studies. By analyzing the available data, the spatial distribution of the documented sinkholes connected to artificial cavities was obtained throughout the territory considered.

The work is still in progress and many portions of the territory are still without data, or need to verify what has been identified with the survey framework set out herein. However, the acquired data is populating a DB which will constitute a unique document in Italy, including all aspects relating to artificial cavities which will form the basis for subsequent analyses, aimed at defining procedures for preliminary evaluation of the stability conditions of artificial cavities, detailed assessment at two pilot areas within the ADAM territory, including modeling analyses, and to establishment of actions addressed toward mitigation of the risk related to sinkholes.

Unravelling the role of the landscape modification and stratigraphic architecture in triggering land subsidence: the Volturno deltaic-coastal plain (southern Italy)

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10E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 2:30 PM - 4:00 PM

Most of the world's major river deltas and related alluvial coastal plains are sinking due to both acceleration in global sea level rise and land subsidence (LS) of human and natural origin. Aim of this research is to analyse LS and its main natural causes in the Volturno River (VR) alluvial and coastal plain (southern Italy).

The present geomorphology of the VR delta system and related strandplain is the product of complex, long-lived relationships between geological evolution and human impacts.

The main drivers of the changed landscape in the last centuries were assessed combining geological and historical data. Geological and geophysical data (about 1800 stratigraphic well logs and high resolution single channel reflection profiles) were used to reconstruct the stratigraphic architecture of the delta plain up to the continental shelf and the offshore delta. Cartographic sources from the last 150 years were acquired, georeferenced and managed into a GIS environment, to support geomorphological interpretation. Land use maps were reconstructed for the 1957, 1990 and 2012. The Late Pleistocene and Holocene reconstruction of the Volturno coastal plain evolution evidenced the control of climatic changes (and consequently sediment supply and global eustatic variations) on the depositional history. The present landscape appears largely inherited by the past MIS5 and LGM landscapes.

A progressive increment of anthropic forcing took place after 2000 yr BP but the strongest modifications of the landscape occurred since the end of the XVII century with reclamation interventions which promoted the development of agriculture and farming, urbanization and increasing landscape fragmentation. A severe coastal erosion followed in the second half of 1900. All these data were spatially superimposed on the present subsidence map reconstructed with InSAR data, highlighting the relationship between the different subsidence rates, offering a comprehensive and multidisciplinary reading of the various factors that influence LS.

Survival in a Narrow Niche: Debris Insulation and Climate Controls on Rock Glacier Persistence

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03G: Open session on rock glaciers dynamics, Conway 2, February 2, 2026, 4:00 PM - 5:30 PM

Despite their abundance in mid-latitude alpine regions, rock glaciers, characterized by thin profiles, slow deformation, and hummocky debris covering ice-rich cores, occupy a narrow climatic and geomorphic niche. Their formation requires two critical elements: rapid headwall erosion delivering abundant rock debris, and localized avalanche-fed snow accumulation below the regional equilibrium line altitude. Achieving a critical debris thickness defines a narrow climatic and geomorphic sweet spot for formation and persistence: too little debris results in inadequate ice-core protection, whereas too much snow accumulation promotes thicker, faster-moving glaciers that export debris downslope, precluding stable rock glacier development (Anderson & Anderson, 2025). Although these constraints are increasingly understood, the thermal processes driving debris-layer insulation, melt thresholds, and the long-term survival of rock glaciers remain poorly defined.

We address these gaps by developing a vertically resolved model that couples surface- atmosphere energy balance with subsurface thermal conduction. Our simulations highlight how modest variations in debris thickness and composition, particularly the inclusion of a saturated soil sub-layer, dampen conductive heat transfer and buffer seasonal temperature swings. In purely rocky debris covers (no fine-grained material), a thickness of roughly 3m is required to eliminate seasonal melt. By contrast, a mixed boulder-soil cover achieves comparable insulation at only ~1.5m, as so much energy is consumed by thawing soil. We identify critical climatic thresholds that, once crossed, trigger sustained melt, leading to slow, yet inexorable, ice-core loss over centuries to millennia. We also examine how latitude, topographic shading and snow dynamics govern the locations of rock glaciers. In this study we illuminate how debris-layer insulation, shaped by headwall erosion and snow accumulation, governs rock glacier formation, sustenance, and eventual decline. By pinpointing thermally driven thresholds underlying rock glacier stability, our results highlight their resilience under modest warming and their vulnerability to the further acceleration of climate warming

HIGH-RESOLUTION GEOPHYSICS FOR CHARACTERIZATION OF NEAR-SURFACE ACTIVE FAULTING IN FLUVIAL AND KARSTIC ENVIRONMENT - RAŠA FAULT, SW SLOVENIA

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Slovenia is located on a convergent boundary between the Adriatic microplate and the Eurasian plate, with relatively high seismic hazard in W Slovenia that is related to the Dinaric Fault System of dextral strike slip faults. After the Idrija fault, the second most important is more than 100 km long Raša Fault, composed of several segments and the slip rate roughly estimated on 0.7 mm/year. Due to its length, relatively large earthquake magnitudes are expected. The geomorphological trace of the Raša Fault is well expressed through prevailing carbonate rocks, while difficult to follow through siliciclastic rocks. Available geomorphic markers to study the fault activity are drainage patterns and Quaternary fluvial deposits, which are generally thin and mainly present along the Raša river and some tributary streams crossing the fault. The broader area is characterized by a complex regional geologic setting, overprint of various tectonic phases, low levels of deformations, high level of erosion and the influence of both karstic and slope mass processes, making it difficult to identify and characterize the fault-related deformations. Therefore, we employed an extensive GPR and ERT survey to study the deformations of geomorphic markers present along the Raša fault with supposed favourable sedimentary characteristics for paleoseismological trenching. Both methods were consistent in delineating lateral and vertical variations in sediment composition, along with strike-slip fault related level of deformations extending from the overlaying alluvial sediment deposits to greater depths in the bedrock. Thus, providing a crucial insight on the precise location of the fault zone and its extension bellow the Quaternary cover and contributing to the selection of candidate sites for consecutive paleoseismological investigations. Our study proved the importance of integration of different geophysical techniques in characterization of near-surface deformations along active strike-slip faults within complex environment.

3D channel: future for riparian biodiversity assessment and evaluation of the biogeomorphic interaction of the river channel from virtual reality

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04H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 3, 2026, 9:35 AM - 11:05 AM

Riparian zones rank among the most biologically diverse and productive ecosystems on Earth, influenced by river flow-related physical processes, such as erosion, sediment deposition, periodic flooding, and groundwater-surface water interactions. Feedback between flow, sediment dynamics, channel forms and riparian vegetation is explained as part of the function and changes of the riparian ecosystem in space and time. The main aim is the seamless generation of 3D point clouds that encompass the biophysical of the riverine ecosystem, consisting of species composition and properties, discharge, channel depth and grain size. Problematic is mutual assessment, data combination, and process-oriented assessment based only on traditional field methods. The three-dimensional stream morphology can be mapped at a very high resolution (several cm) that allows inferring process, volumetric changes detection, channel bathymetry, flow velocity or automatic grain size calculation of gravel-bed or submerged channel. Here we applied and compared the method for the combination of UAV-SfM point cloud (DJI Phantom and Mavic 3) with multispectral and RGB camera, point cloud from mobile laser scanner FARO ORBIS, and traditional TLS measurement (Riegl VZ-1000) for generating a complex 3D virtual model of the channel. These datasets were co-registered and combined to extract the physical factors and morphology of the channel, including the flow parameters (velocity, depth), the riparian vegetation, large woody debris detection, sediment distribution, tree detection, vegetation biomass estimation, morphological processes assessment and uncertainty analyses. This work was supported by the SRDA under Contract No. APVV-23-0265 and grant VEGA 2/0016/24.

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When geomorphology wins: the realities of managed retreat along rivers and coasts

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01I: Living with geomorphic change, Conway 4, February 2, 2026, 11:40 AM - 1:10 PM

Planning for the geomorphic consequences of climate change (e.g. enhanced coastal and river erosion) is a new battle in a long war: the war between the human desire for certainty and the realities of a dynamic landscape. Incremental geomorphic processes, whether subsidence, river bank erosion, or coastal erosion, are managed in the same basic ways. Adaptation provides an ecalating series of responses to these processes, including: avoidance, then mitigation, and finally to 'managed retreat'. In this paper I explore the realities of managed retreat. What does it really mean to declare that geomorphology has won? How is that decision made, and how are people, or whole communities, moved away? In poorer countries retreat is often the only option. What is the role of the geomorphologist in these decisions? I suspect that the issue of managed retreat is the most consequential topic facing geomorphologists incoming decades.

The impact of landscape scale changes in channel morphology on flooding: examples from SE Queensland, Australia

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11J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 5:00 PM - 6:30 PM

As ever more frequent floods impact the eastern sea-board of Australia, it is common (and reasonable) to see the hand of climate change, but over the last decade (and substantially before that) river channels have eroded and expanded. What is the contribution of these morphological and hydraulic changes on flooding? There was a surge of European research in the 1990s into the effect of deliberate river channelisation on floods, but here we consider the unplanned general expansion and simplification of large valley-floor channels across whole regions.

In south east Queensland we investigated the impacts of channel enlargement between 2011 and 2022 by assessing flood conveyance using LiDAR datasets captured in each period for case study areas in four rivers. Not surprisingly, the assessment found a reduced flood risk within the eroded waterways due to the widening of the channels and reduced floodplain storage. However, the larger channels delivered a larger flood peak more rapidly down-valley increasing flood heights in critical towns. The increases observed in this assessment (i.e. up to ≈10-15 % increase in peak discharge in some modelled flood events) have occurred as a result of erosional channel enlargement over 10-12 years. But these systems have been enlarging for the last 50-100 years and as a result significantly larger impacts on conveyance would be expected across this period. The magnitude of any downstream effects is complicated by floodplain constrictions that create flood backwaters. Managing future erosion will stop the morphological component of flooding from getting worse.

Recent reef flat growth rates determined from close-range photogrammetry: a case study from Tongatapu, Kingdom of Tonga

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06F: Tropical coral reefs and reef-lined coasts, Conway 1, February 3, 2026, 2:30 PM - 4:00 PM

Coral reef flats provide critical ecosystem services including food security, shoreline protection, and economic opportunities. However, they are increasingly vulnerable to climate change, including sea-level rise. If sea-level rise exceeds reef vertical accretion, low-lying coastal communities will face heightened coastal erosion and inundation. Despite the importance of vertical accretion, direct measurement of present-day reef flat accretion remains limited due to logistical challenges in high-energy reef flat and crest environments. Most current estimates of reef accretion are derived indirectly from geological reef core analysis or ecological carbonate budget modelling. While informative, these approaches may not accurately represent current in situ reef flat accretion processes. Recent advances such as accretion frames have enabled more direct measurement of reef accretion, yet remain spatially limited. Structure from Motion (SfM) photogrammetry, widely used for benthic cover mapping and coral colony growth, has recently been validated as a tool for detecting vertical reef flat accretion.

This study tests the suitability of close-range SfM photogrammetry and unmanned aerial vehicles (UAVs) for mm-scale detection of vertical reef flat growth. We applied close-range SfM in both a laboratory-controlled artificial reef setting and a field deployment on an outer reef flat in the Kingdom of Tonga, South Pacific. Reef plots (600 mm × 600 mm) were surveyed in 2023, 2024 and 2025 using consistent control points. Accuracy and precision were assessed through repeat surveys with no expected elevation change. Digital elevation models were processed and analyzed to quantify reef surface change over two years. Our results demonstrate that SfM photogrammetry can provide a reliable, repeatable, and practical approach to monitor modern vertical reef accretion. We also discuss the potential to spatially extend reef accretion studies using low-flying UAVs. These findings have important implications for long-term reef monitoring and for informing adaptation strategies in reef-fronted coastal communities.

Monsoonal Variability Drives Atoll Island Dynamics: Tepuka Islet, Funafuti Atoll, Tuvalu

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06F: Tropical coral reefs and reef-lined coasts, Conway 1, February 3, 2026, 2:30 PM - 4:00 PM

As low-lying atoll islands remain highly vulnerable to climate change, particularly through rising sea levels and oceanographic changes, understanding the role of monsoonal and seasonal wave forcing in shaping their stability is critical for adaptation and resilience planning. This study investigates the influence of wave energy variability on the morphological evolution of Tepuka Islet, located on the western rim of Funafuti Atoll, Tuvalu. Using a combination of multi-temporal Sentinel-2 satellite imagery, UAV-derived digital elevation models, and downscaled ERA5 wave reanalysis data, this research quantifies shoreline and topographic changes on Tepuka Islet from 2019 to 2025. The study specifically focuses on seasonal and interannual variations in wave energy and their relationship with sediment transport processes and geomorphic responses. Manual shoreline extraction techniques and topographic surveys are integrated with wave energy analysis to explore both horizontal (planimetric) and vertical (volumetric) island changes. Initial findings suggest that temporal variability of wave energy, driven by monsoonal shifts, plays a significant role in influencing sediment dynamics and shoreline mobility on Tepuka Island. Notably, sediment accretion and erosion patterns are shown to align with periods of energetic wave energy dominance, with heightened morphological activity during the austral summer and reduced movement during transitional monsoon phases when waves are less energetic and more variable. By linking wave forcing to observable morphodynamics shifts, this study provides empirical evidence of the sensitivity of atoll islands to wave-driven processes. The insights gained contribute to the broader understanding of sedimentological responses in coral reef–island systems and highlight the importance of incorporating seasonal oceanographic dynamics into coastal risk assessments for vulnerable Pacific atoll nations.

Assessing the effects of extensive bed material extraction on the granulometric and fluvial characteristics in a sub-Himalayan River in India

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03A: Learned lessons about anthropogenic drivers in the river evolution, Auditorium, February 2, 2026, 4:00 PM - 5:30 PM

The fluvial characteristics of the Lower Balason River have been significantly altered by anthropogenic factors involving urbanization, embankment construction, and extensive in-channel mining with an annual rate of 6.84×106 m3, which is comparatively much higher than all other channels of the European and American continents. For assessing the effects of this extraction, we have investigated the surface grain-size distribution of 49 gravel bars by field sampling and by hydraulic modeling along a 25-km river reach. We have categorized the channel into four sectors: transport-limited first and third sectors and supply-limited second and fourth sectors. The first sector, A, of the channel features an incised narrow channel, a relatively steeper bed slope, and accelerating sediment flux connectivity. In sector B, extensive mining in the channel bed, mid-Channel Islands, and surrounding riverbanks results in the expansion of the channel, causing a reduction in water surface slope, stream power, and bed shear stress, along with a substantial drop in grain size. Section C exhibits the densely populated floodplains and extensive bank stabilization resulting in deep, narrow channel width with increased stream power along with a modest rise in granulometric size and drop in sorting. The increased channel flow poses a threat to the stability of the foundation walls of bridges on the channel. In the terminal sector D, comparatively substantial bars were noted, where the mining activity again amplified, and as a consequence, the river bed degraded. The observed granulometric patterns suggest that the diminution coefficient of the coarser fraction (D95) is approximately 22% greater than that of the median size fraction (D50) and 48% greater than that of the finer size fraction (D5). This difference could be attributed to the outwashing of fine fractions of the bed material due to the extraction of larger particulates from the channel bed surface.

From coastal process understanding to Nature-Based coastal protection: Artificially Induced Natural Reefs

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Coastal erosion represents one of the most pressing challenges linked to the climate crisis, with projections indicating that 13–15% of global beaches will be eroded by 2050 and up to 50% by 2100. This process is especially critical in Mediterranean countries, where sea-level rise and intensified wave action accelerate sediment loss, leading not only to environmental degradation but also to severe socio-economic consequences, particularly in tourism-dependent regions.

Nature has traditionally mitigated erosion through the gradual formation of reefs (beachrocks) that dissipate wave energy before it reaches the shoreline. However, beachrock formation naturally requires thousands of years—time that the accelerating climate crisis does not allow. To address this gap, we introduce Artificially Induced Natural Reefs (AINRs), a nature-based solution that accelerates natural processes through a bio-mediated approach. By activating indigenous microbial communities, seabed sediments can be transformed into consolidated carbonate formations that function as reefs and act as natural breakwaters.

This methodology, developed under the Nature4Nature initiative, is based exclusively on natural materials from the site, ensuring no ecological disruption. It combines insights from geomorphology, geology, geochemistry, and applied microbiology, and has been validated through laboratory and field-scale experiments. The resulting reefs share the mineralogical and mechanical properties of long-standing natural reefs, offering durable, maintenance-free coastal protection.

Beyond erosion mitigation, AINRs provide multiple co-benefits: they enhance local biodiversity by creating marine habitats, preserve the aesthetic and recreational value of beaches, and can even support sustainable tourism activities such as diving. With a rapid implementation time (approx. two months) and resilience over the long term, this approach offers a scalable and environmentally friendly alternative to conventional hard-engineering or short-lived soft-engineering methods.

Quantifying temporal changes of vegetation recovery in landslides using uncrewed aerial systems

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06C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 2:30 PM - 4:00 PM

Landslides are important natural hazards that may cause severe damage to society. Landslides destroy vegetation on hillslopes by removal, resulting in unstable land and unprecedented surface erosion for many years. In this regard, vegetation recovery is important for hillslope hydrology and assessing future landslide probability in forest terrain. However, analysis of the vegetation recovery at landslide scars from traditional optical satellite and aerial images is often difficult due to the limitation of low spatio-temporal resolutions. This study detects the topographic characteristics of landslides triggered by heavy rainfalls and earthquakes and quantifies the temporal changes of the vegetation recovery in Aso volcano, Japan using uncrewed aerial systems with optical, infrared, and lidar sensors.

The co-seismic landslides initiated near topographic ridges were typically located on upside hillslopes of previous rainfall-induced landslide scars. The time series of normalized difference vegetation index (NDVI) showed rapid increases in landslide scars after the landslide events. The results indicate that NDVI at both landslide scars will reach the same level as the pre-landslide grass vegetation within 12 years. The slope aspect direction determines the topographic effects of grass vegetation recovery: The north- to west-facing landslide scars seemed to experience rapid grass vegetation recovery.

A High-Resolution Analysis of the Planform Dynamics and Sediment Fluxes on Coral Reef Platform Islands

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06F: Tropical coral reefs and reef-lined coasts, Conway 1, February 3, 2026, 2:30 PM - 4:00 PM

Coral reef islands, composed of, and sustained by biogenic sediments produced and supplied by the reefs, are highly dynamic at time scales from extreme events to decades. Projected changes to drivers affecting coral reef island dynamics have raised increased concern regarding the future response of coral reef islands, and they are considered highly vulnerable to climate change. Resolving the threats to reef islands is especially critical for inhabitants of mid-ocean island nations to inform adaption solutions.

Current research on the future responses of coral reef islands to climate change has focused on cross-sectional changes. However, as islands are also known to exhibit various forms of change in the horizontal plane, projecting future planform changes of coral reef islands is equally important. Resolving such planform changes and the volumetric fluxes of sediment are critical, though process data on these processes are scarce.

To address the gap in field measurements, we conducted a six-month field campaign at a coral reef island in the Maldives to characterize nearshore wave conditions and beach processes. We measured nearshore hydrodynamics using pressure sensors. Fortnightly Real Time Kinematic topographic surveys were conducted with an uncrewed aerial vehicle and GPS receivers to determine volumetric fluxes of sediment Additionally, depth of disturbance measurements were undertaken over two weeks.

We present an integrated dataset of nearshore hydrodynamics and sediment transport that documents substantive planform change and redistribution of sediment volumes around the island shoreline, in response to monsoon reversals in hydrodynamic regimes. These novel high-resolution analyses of sediment fluxes provide critical data to calibrate numerical models of reef island shoreline dynamics.

Landslide Monitoring Using RIEGL Terrestrial LiDAR and the Monitor + App for Real-Time Hazard Detection

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01C: State-of-the-art and new perspectives in long-term monitoring and analysis of landslide dynamics, Dobson 2, February 2, 2026, 11:40 AM - 1:10 PM

The RIEGL Monitor + App and TLS technology offers a real-time, data-driven approach to understanding and managing evolving landscape hazards. Its ability to remotely detect slope changes and trigger alerts supports risk-informed decision-making and enhances societal resilience.
With increasing demands for early warning and proactive hazard management, real-time, high-resolution monitoring has become indispensable. This presentation explores the use of RIEGL's Terrestrial Laser Scanning (TLS) systems - specifically in conjunction with the RIEGL Monitor + App - to deliver continuous, automated slope monitoring and early warning capabilities.

RIEGL's long-range TLS sensors, including the VZ-2000i & VZ-4000i series, can capture surface changes at distances exceeding 4.5 km. When paired with the Monitoring App, these scanners become a fully integrated 24/7 remote monitoring solution. The app allows users to automate scan intervals, visualize changes through an intuitive web viewer, and receive real-time SMS or email alerts when predefined deformation thresholds are exceeded.

This system supports hybrid data collection by integrating high-resolution LiDAR scans with prism-based monitoring, enabling comprehensive analysis of slope dynamics. Its lightweight, field-proven hardware and intuitive interface make it suitable for both temporary deployments and long-term installations in complex, hard-to-access environments.

Case studies will highlight how this integrated system has been used for monitoring active landslides and rock walls - providing early detection of deformation and contributing to safer, more informed decision-making. The combination of spatial precision, remote operability, and automated alerting makes the RIEGL TLS Monitor + App system an ideal tool for hazard mitigation.

Decadal geomorphological dynamics and vegetation development in the Calanchi Badlands of the Orcia Valley (Tuscany, Italy)

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08H: New frontiers in the study of erosion processes and geomorphic dynamics in badlands, Conway 3, February 5, 2026, 9:35 AM - 11:05 AM

Badlands in sub-humid environments are among the most dynamic landforms, evolving due to a complex interplay between water erosion processes and mass movements which act simultaneously and reinforce each other across multiple spatial temporal scales. For these reasons, the Italian sub-humid Badlands landforms (known locally as Calanchi and Biancane) have received growing scientific attention in recent years. The Calanchi in the Upper Orcia Valley (Tuscany,Italy) offer a valuable setting to investigate ongoing geomorphic changes and long-term denudation effects, as a series of spring field campaigns has been conducted since 2014, employing UAV-based photogrammetric surveys. This study presents a decadal investigation of geomorphodynamic change, incorporating UAV-derived vegetation data analysis through the Triangular Greenness Index (TGI), in order to assess the cause-effect relationship between the vegetation cover variations and a possible shift in prosesses domain. The required multi-temporal Digital Terrain Models (DTMs), DTM of Differences (DoDs), and Orthophotomosaics were produced using Structure from Motion with Multi-View Stereo (SfM-MVS) techniques applied to high-resolution UAV imagery acquired during the 2016, 2018, 2022, and 2024 surveys. The main objectives of this work are: i) to produce expert-based multi-temporal geomorphological maps of geomorphic process signatures to classify landforms and assess their spatial distribution over time; ii) to perform a change detection analysis aiming to quantify the effective surface evolution and identify geomorphological hotspots; iii) to analyse rainfall patterns and extreme precipitation events, evaluating their role in triggering geomorphic processes; iv) to explore the relationship between vegetation development and spatio-temporal morphodynamics. Preliminary results show a reduction in the extent of mapped geomorphic processes, with erosion rates remaining stable and vegetation cover increasing, particularly in the lower valley. Major landscape changes are mainly driven by low-frequency, high-magnitude events such as complex landslides, while water-driven erosion governs the more gradual and continuous evolution of the Badlands.

Preliminary Schmidt Hammer calibration curve against CRE ages and lichenometry dates from Holocene glacial and periglacial landforms in Northern Iceland

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

We propose a calibration curve for Schmidt Hammer (SHD) R-values based on exposure ages and dates from 34 sampling sites distributed across five glacial cirques in the Tröllaskagi Peninsula, northern Iceland. The investigated landforms consist of basaltic boulders from a range of glacial and periglacial features, including moraine ridges (some ice-cored), debris-covered glaciers, rock glaciers, and polished bedrock surfaces. At 29 sites, cosmogenic radionuclide exposure (CRE) ages were obtained, and mean R-values were measured on 30 boulders at the same locations using an N-type Schmidt Hammer. Lichenometry and SHD measurements were also applied in the same places to the most recent landforms at the vicinity of the current margins of debris-free glaciers.

Our results reveal a strong correlation between mean R-values and both CRE ages and lichenometric dates. Samples CRE dated between 9.5 and 12.3 ka yielded mean R-values ranging from 52.0 to 54.4, with one outlier at 58.0. Landforms representative of Neoglacial advances (CRE dated at 2.3–4.0 ka) exhibited mean R-values of 57–60, while those CRE dated to 1.0–2.1 ka, showed values between 60 and 68. The youngest landforms, dated through lichenometry, had R-values of approximately 68–69, while landforms formed during the past century (Little Ice Age) yielded values of 69–71.6.
Some scatter in the R-values is evident, likely reflecting minor lithological variability in basalt composition, the dynamic behavior of boulders within ice-rich landforms, and uncertainties associated with dating techniques. Nevertheless, our findings demonstrate that Schmidt Hammer testing offers a reliable and effective method for differentiating the relative ages of Holocene landforms in northern Iceland.

This work is supported by the project “Reconstruction of Neoglacial oscillations in Iceland” (PID2020-113798GB-C32) funded by MCIN/AEI /10.13039/501100011033

Deglaciation process in the Cantabrian Mountains (NW Spain) based on multiple 14C ages from glaciolacustrine sediments

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

During the Last Glaciation, differences in glacier dynamics have been observed across various mountainous and lowland areas, highlighting the importance of local factors in glacial behaviour. The Cantabrian Mountains, located in southwestern Europe, experienced significant glaciation during this period; however, the chronology remains poorly understood and is based on limited radiocarbon data.

In this study, several glaciolacustrine sediments and peat bogs at different altitudes and geomorphological settings were sampled using radiocarbon dating (^{14}C). The results indicate multiple deglaciation stages in the Sil River Basin, which hosted the largest glacial complex in the range. The lowest glaciolacustrine sediments, overlying till in a lateral valley of the Sil paleoglacier at 875 m a.s.l., date back to as early as 42,950 ± 564 and 42,674 ± 440 cal BP (two samples), confirming an early onset of deglaciation in these mountains.

A small pond at 1,450 m a.s.l. was formed around 28,025 ± 262 cal BP, suggesting substantial glacier retreat on the southern slopes, likely due to increasingly arid conditions. Meanwhile, a valley glacier over 15 km in length persisted on the northern slopes, as indicated by the formation of a lateral lake at 970 m a.s.l. around 24,497 ± 277 cal BP. Sedimentation in another lake at 1,400 m a.s.l., located on the margin of a glacier over 8 km long, began at 16,218 ± 154 cal BP. The final deglaciation of the cirques is marked by sediment accumulation in a small peat bog at 1,700 m a.s.l. The glaciolacustrine sequence there begins at 13,233 ± 68 cal BP, and peat layers formed at 11,889 ± 80 cal BP.
These results provide a comprehensive reconstruction of deglaciation during the Last Glaciation in southwestern Europe.

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Mapping alluvial fans and exposure on the West Coast of Aotearoa New Zealand

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Alluvial fans are widespread at the base of the Southern Alps along the West Coast of Aotearoa New Zealand’s Te Waipounamu (South Island). Heavy rainfall and earthquakes can trigger hazardous debris flows, avulsions and aggradation-driven floods on fans, which pose risks to life, infrastructure, and land use. Yet the regional extent of alluvial fans and their associated exposure remains poorly mapped.

This study presents a comprehensive dataset of alluvial fans across Westland District of South Island, combining geomorphic interpretation from aerial imagery, digital elevation models derived from 1-m resolution LiDAR, and field validation. The dataset provides a spatially detailed and classified fan inventory of Westland from regional- to local-scale. We identify and classify hazard characteristics of fan landforms based on relative age, expression and historical property damage claims across the region. In selected subregions we carry out higher-resolution mapping (1:5000 scale) and exposure assessments, including overlay analyses to quantify the presence and value of infrastructure, buildings, and land use within fan boundaries.

Our mapping identifies different alluvial fans intersecting with assets and land uses of local and national significance, and attempts to classify them by relative hazard. By identifying exposed areas and assets, this work supports future risk assessments and informs more resilient land-use planning on Aotearoa New Zealand’s dynamic West Coast.

Participatory Approaches to Geocultural Valorisation and Risk Assessment in Indigenous Territories in the Parecis Basin, Cerrado region of Brazil.

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09I: Heritage Geomorphology: a new branch of geomorphological studies? Concepts, methods and practices, Conway 4, February 5, 2026, 11:35 AM - 1:05 PM

Lack of known geocultural values can affect geoheritage interpretability and impede efforts by Indigenous Peoples to use their lands in accordance with their spirituality and desires for social, ethical, environmental and economic autonomy. Allowing First Nations peoples to use their own voice and to choose which sites or places are permitted to be discussed and considered in potential future geoconservation activities is a first step to self-determination and participatory land use for geotourism. We used participatory action research with Indigenous Tribes of Tirecatinga, Irantxe, and Utiariti Indigenous Territories in Brazil to highlight the cultural values of abiotic sites. The methodology involved primary and secondary data, including oral histories from Indigenous leaders, site degradation and threats assessment. With a new understanding of the geocultural values of the abiotic sites, we then evaluated risks to the integrity, geomorphic functions and cultural values. We identified 3 sites that had high value in ecological, aesthetic and geocultural domains. They exhibited aesthetic value due to their natural beauty, and rich spiritual interpretations. We also noted geoscientific, educational, and economic values, such as their role in regional geological understanding, non-formal education, and potential geotourism development. We found that risks decreased with reduced tourist accessibility and stronger territorial protections, irrespective of geocultural site geology or geomorphology. The framework is easy to use and can translate into actionable criteria for protected areas and other forms of statutory land use protections or geotourism planning and management. Most importantly, for the peoples of the studied Territories, it has provided them with an opportunity to show what is special and highlight their ongoing desire for formalised protection of their lands. Our approach emphasised territory-specific geocultural values and underscores the necessity of addressing both physical and cultural aspects of development on Indigenous lands and integrating Indigenous perspectives into geoconservation efforts.

Machine learning-based estimation of uplift-erosion parameter ratios from synthetic topography: applications to active mountain ranges

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05D: Advances, challenges and future directions in Tectonic Geomorphology AND Seismic Related Cascading Hazards: How Can They Contribute to Improve Paleoseismic Studies?, Dobson 3, February 3, 2026, 11:35 AM - 1:20 PM

One of the fundamental challenges in tectonic geomorphology is inferring uplift and erosional processes from topographic form. While landscape evolution models (LEM) excel at forward modeling, the inverse problem remains difficult due to non-unique and unstable solutions, and limited case studies with well-constrained process parameters.

We developed a machine learning approach to estimate log-transformed process parameters for steady-state, linear mountain ranges in convergent settings. For the training data, we used synthetic landscapes generated by a Landlab numerical LEM with uplift (U), hillslope diffusion (Kh), and stream incision (Ks) parameters. We added physical constraints to parameter combinations to ensure realistic relief and process representation.

To test robustness to measurement errors, we added noise to the landscapes' elevation data. We then extracted raster-based (elevation, gradient, and curvature statistics; hypsometric integral) and drainage network features, which were used to train models based on eight Scikit-learn algorithms: linear regression, lasso, k-NN, SVM, decision tree, random forest, gradient boosting, and neural network.

Model predictions were excellent ($R^2 > 0.922$, RMSE < 0.107) for parameter ratios (log [U/Ks], log [Kh/Ks]), showing robustness to the added noise. The neural network model performed best ($R^2 = 0.996$, RMSE = 0.022). However, performance on individual parameters (log U, log Kh, log Ks) was unsatisfactory.

Feature importance analysis identified five key parameter ratio predictors: mean elevation, elevation standard deviation, median hilltop curvature, and zero-order drainage properties (bifurcation and length ratios). It revealed a strong but previously unexplored relationship between zero-order drainage properties and landscape evolution parameters.

This study's synthetic data-driven approach to parameter inference addresses data limitations in tectonic geomorphology studies. It provides a generalizable framework for future testing of non-steady state conditions and LEM variants, and potentially, a practical tool for quantifying process parameters in tectonically active mountain ranges, such as those in the Philippines.

Turbidity assessment method to measure landform stability of a rehabilitated mine site

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10A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 2:30 PM - 4:00 PM

The Ranger uranium mine site in Northern Territory, Australia, is currently in the rehabilitation phase prior to final decommissioning. A number of Australian Government environmental requirements (ERs) have been mandated for the protection of the surrounding World Heritage listed environment of Kakadu National Park. One of the ERs stipulates "Erosion characteristics of the rehabilitated landform, as far as can reasonable be achieved, do not vary significantly from comparable landforms in surrounding undisturbed areas."

The Office of the Supervising Scientist is developing a methodology to use turbidity measurements upstream and downstream of the Ranger mine site to assess landform stability of the rehabilitated site. The aim is to develop a relatively simple-to-use assessment method to track the expected return to background sediment yields that is required to meet mine site closure. It will use continuous traces of turbidity measurements, upstream and downstream of the mine site in the adjacent Magela and Gulungul creeks, as its basis. After each wet season the area under the turbidity curves will be determined, using integration for both the upstream and downstream sites. The statistical average and measures of variability of net upstream-downstream turbidity area before rehabilitation define normal variation, for those years identified as no mine-related erosion. Net turbidity area is tracked on an annual basis against 'normal variation', applying standard control charting methodology.
This method will be presented and demonstrated using time-series datasets gathered from the creeks adjacent to the Ranger uranium mine.

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Living with the River: Reimagining River Management through Embedded Perspectives

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09F: Engaging the relational work of geomorphology, Conway 1, February 5, 2026, 11:35 AM - 1:05 PM

Traditionally, flood management has focused on structural interventions neglecting the river´s environmental, social, and historical values. This study explores how risk perception, community engagement, and historical knowledge can inform a more sustainable, inclusive river management strategy, focusing on the Tagliamento River in Italy, known as the last free-flowing Alpine river in Europe. We reflect on these topics through the double lenses of embedded scientists, both working on the Tagliamento and local community members with deep roots in the context of the river. Using a mixed-methods approach involving surveys, interviews, participatory mapping, historical and flood risk maps, we have examined how communities perceive flood risks and river values. We found a strong desire to preserve the river’s natural status while reducing risk, alongside significant gaps in public awareness and communication around flood preparedness. Historical storylines of villages adapting to the river’s dynamics highlight past ecosystem-based strategies that could inform future planning considering multiple hazards and community input in planning.

The research underscores the importance of incorporating local knowledge, interdisciplinary science, and active stakeholder participation into decision-making. Our program advances community-rooted, evidence-based research through the recent recognition of the Tagliamento Living Lab as a Water-oriented Living Lab. The Tagliamento Living Lab is an opportunity to learn from our embedded past and build paths to highlight our different and complementary perspectives as embedded scientists. We also share experiences that have forged our personal relationship with the river while living at different physical distances from the river, and how this distance affects our perception and work. Hence, the Tagliamento river can be a blueprint for integrating river conservation with multi-hazard risk mitigation.

Through our discussion, the Tagliamento emerges as both a natural and societal reference point, showing that long-term risk mitigation and river conservation can, and should, be pursued together through collaborative, ecosystem-based approaches.

The Power of Waves: Quantifying Coastal Boulder Transport Through Dimensional Metrics and Numerical Models

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Extreme wave events, including storms and tsunamis, have displaced large coastal boulders along coastlines worldwide. Numerous studies have examined these boulders to determine their transport mechanisms, yet distinguishing between tsunami- and storm-induced displacement remains challenging. Traditional approaches rely on incipient motion formulas to estimate the minimum flow velocity required to initiate boulder transport, but various theories and numerical models have been developed to simulate the wave dynamics responsible for their movement. Key boulder parameters—such as axial dimensions (a-b-c), volume, and projected surfaces—have been considered in several numerical and geophysical models. Additionally, integrating absolute dating techniques (e.g., ^{14}C, U/Th) with geophysical models has provided temporal constraints on displacements, aiding in the identification of causative wave events. To consolidate existing knowledge, we compiled a geodatabase containing dimensional parameters, wave flow estimates, and associated literature for prominent coastal boulders globally. Each entry includes geotagged locations, lithological data, absolute ages, and calculated minimum wave flow velocities under different models. Where supported by robust chronological, geological, and field evidence, we also discriminate between tsunami and storm origins. This dataset enables users to assess boulder displacement dynamics systematically and evaluate the most plausible triggering mechanisms.

Contrasting suspended sediment load and bedload cascades in an anthropogenically managed alpine catchment

Ms Chantal Schmidt[1,2], Dr. Louis König[3], Mr Raphael Eichenberger[1], Dr. David Mair[1], Prof. Fritz Schlunegger[1], Dr. Brian Mc Ardell[2]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

There is little research on how check dams impact the cascade of bedload and suspension material. We address this gap in the 12 km² Gürbe catchment (Swiss Alps), where sediment is generated by overland-flow erosion, fluvial incision, and landsliding. The torrent originates in low-erodibility Mesozoic limestones, then crosses highly erodible Flysch–Molasse units and glacial till. It steepens by 3° downstream of a knickzone where channels are incised >50 m into glacial till, before transitioning onto an alluvial fan ~2.5 km farther downstream. The steep reach between the knickzone and the fan is also the segment that has been engineered by ~100 check dams, and along which deep-seated landslides are perched on the hillslopes. Measurements of water fluxes and suspended sediment at 12 sites show that while runoff is generated throughout the basin, suspended loads are mainly sourced near the knickzone and in landslide-fed tributaries. During moderate thunderstorm flows, suspended sediment concentrations in the upper limestone region account for only 5–10% of peak values. Downstream of the incised knickzone, concentrations reach 50–80% of peak values (2,000–5,000 mg/l, depending on active sediment sources) measured at the fan apex – similar to values at the fan's distal margin. In contrast, repeated drone surveys reveal that bedload material is mainly generated trough episodic, localized sediment inputs leading to meter-thick deposition in the channel. The material becomes mobilized during subsequent moderate-flow events, making the channel a transfer system. However, in-between the check dams, cycles of sediment accumulation and evacuation occur out-of-phase. Accordingly, while check dams have not interrupted the downstream propagation of the suspension-load waves, they have partially disconnected the downstream propagation of bedload waves, at least for low- to moderate discharge flows, highlighting how anthropogenic structures impact the cascade of suspended and bedload material.

Advancements in Regional Scale Landslide Runout Modelling – A First Prototype

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13C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 11:35 AM - 1:05 PM

Assessing the impact area and velocity of a landslide is critical for evaluating risks to lives and infrastructure. Smooth particle hydrodynamic (SPH) -based numerical models are one tool that can be used to determine these critical parameters. However, these models have high computational costs when applied to at a regional scale, so empirical relationships (i.e., Fahrböschung) are preferred for runout assessment over large spatial areas. The latter, however, is prone to large uncertainties and often provide only spatial extents without calibrated information on debris depth or velocity, which is essential for detailed impact and risk analysis.

The SPH numerical method is well suited to being parallelized, and recent developments using a parallel GPU implementation has significantly reduced computational costs by more than two orders of magnitude. Within the Sliding Lands – Hōretireti Whenua Endeavour Program, we aim to use this advancement to provide predictions of the runout parameters for future landslides at a regional scale.

In the current contribution, we present a novel, GPU-accelerated and cluster compatible SPH model designed for high-performance landslide simulations, fully integrated with a newly developed algorithm for automatic input generation. We leverage data from over 1000 calibrated landslides in the Kaikōura Landslide Inventory V3, showcase early simulation results, and highlight the critical role of detailed mapping in achieving reliable calibration. Furthermore, we introduce enhancements to both the calibration methodology and evaluation metrics, pushing the boundaries of large scale, physics-driven landslide modelling.

A spatiotemporal analysis of historical flood episodes and climatic variability in southern New Zealand

Mr Alexander Schulte[1], Professor Lothar Schulte[1], Dr Juan Carlos Peña[2], Dr Filipe Carvalho[1], Professor Ian C. Fuller[3], Mr Sebastian Schulte[1]
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10J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 2:30 PM - 4:00 PM

New Zealand experiences frequent flooding, making historical flood data a valuable resource for understanding climate and flood trends in the Southern Hemisphere. This study reconstructs the spatial and temporal patterns of flood damage and associated climatic characteristics in its southernmost regions (43°–47°S) from 1862 to 2020 CE.

We developed three regional flood databases based on historical meteorological records from the New Zealand National Institute of Water and Atmospheric Research. A flood severity matrix—originally created for the Swiss Alps—was adapted for New Zealand's unique physical and socio-economic context. This matrix evaluates factors such as fatalities, peak flow accounts, inundated areas, landscape impacts, property loss, livestock death, and evacuation efforts.

A total of 295 floods were analyzed manually through over 8,000 data entries and 903 impact points across the West Coast (106 events), Otago (116), and Southland (74). Then this information was compiled into a GIS-compatible database with the help of AI (ChatGPT), under guided instructions. Despite automation, human oversight remains essential. GIS enables spatial visualization and deeper analysis, and current testing is focused on the Southland region.

The flood records reveal synchronous flood pulses around 1878, 1905, 1913, 1957, 1968, 1978, 1999, and 2008 CE. However, regional differences in physiography, catchment size, and location (western vs. eastern Southern Alps) result in some periods asynchrony. West Coast floods tend to coincide with a positive Southern Annular Mode and La Niña (positive Southern Oscillation Index). Otago floods mostly align with La Niña, while Southland floods are often associated with El Niño (negative SOI). Climatic influences were also reconstructed using Principal EOF analysis of Sea Level Pressure anomalies from the 20th Century Reanalysis Project.

Deciphering paleofloods and climatic variability from 4 ka floodplain sedimentary archives in pristine alpine catchments, New Zealand.

Professor Lothar Schulte[1], Professor Ian C. Fuller[2], Dr Filipe Carvalho[1], Professor Mark Macklin[3], Dr Juan Carlos Peña[4], Dr Sam McColl[5], Alexander Schulte[1], Dr Elena Muntán[1], Professor Antonio Gómez-Bolea[1]
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10J: Hydrological extreme events, climate variability and environmental changes: patterns, controls, and attribution across scales and landscapes, Conway 5, February 5, 2026, 2:30 PM - 4:00 PM

Studying past floods from historical and natural archives offers a unique opportunity to document large-magnitude, low-frequency flood events that occurred under a variety of climate and/or environmental scenarios. In the context of global change, assessing Southern Hemisphere flood trends is a significant goal, affording catchments with minimal human impact. Three such catchments: the Grebe, Eglinton (Fiordland), and Earnslaw Burn (Southern Alps), New Zealand, provide an exceptional opportunity to analyse climate change controls on flooding.

60 m of sedimentary cores was recovered from the landslide/alluvial fan-dammed Grebe (3800 cal yr BP) and Eglinton River (1250 cal yr BP) floodplains and Earnslaw Burn alluvial fan (760 cal yr BP), providing millennia-long sedimentary and geochemical proxies. Additionally, dendrogeomorphological studies were conducted to determine the minimum ages of levees and abandoned channels from 1702 CE onwards, and paleoflood records were compared with regional documentary flood records from the past 160 years.

The Zr/Ti, Si/Ti and Sr/Ti ratios, as well as factor analysis (Factor 1), of the 3,800-year-long Grebe River record, provide evidence of 15 discrete sedimentary flood pulses and seven major flood periods, with recurrence intervals ranging from 500 to 800 years. The 80-year-smoothed flood proxies (Gleissberg cycle) appear to align with with positive and negative anomalies in total solar irradiance (TSI) and Antarctic temperatures (EPICA Dome C). Two flood periods (1400–1200 and 1050–650 CE) occurred during periods of intensified Southern Hemisphere westerly winds. During the last millennium, centennial flood trends (Factor 1 and Zr/Ti) corresponded to positive Southern Annular Mode (SAM) trends, with flood pulses occurring during positive El Niño–Southern Oscillations. This pattern has also been reported in the historical flood damage index for the West Coast from 1864 to 2020.

Effectiveness of Native New Zealand Riparian Plants on Bank Stabilisation Using RipRoot and BSTEM

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06A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 2:30 PM - 4:00 PM

Little information is available about the effectiveness of New Zealand native species on reducing erosion. Quantitative data on root-reinforcement characteristics (tensile strength and root architecture) of 11 native species, each spanning a range of age classes were collected and analyzed. These were used to populate the root-reinforcement model RipRoot, embedded within the Bank-Stability and Toe-Erosion Model (BSTEM).

Data for common riparian-woody and herbaceous plants were collected and combined with data from A. Benson to establish species-specific relations between four age classes and diameter at breast height. These relations were coded into RipRoot. Results showed that Tī Kōuka/Cabbage Tree was by far the most effective plant at providing increased bank strength during the Juvenile and Early Mature phases. Houhere/Lacebark, Māhoe and Mānuka become important contributors in Maturity. Absolute increases in cohesion due to roots and overall effectiveness, however, varies by the composition of the bank materials. The herbaceous species afford little root reinforcement but are important in providing hydraulic roughness to limit erosion by flowing water.

An enhanced version of BSTEM (Ver. 5.5.1) was developed to include vegetation growing not just on the bank top but on the bank face as well. Improvements to RipRoot, include: (1) tensile-strength curves for each of the 11 species studied, (2) Age classes are used in place of the absolute age, (3) Vegetation assemblages can now be added on the bank face and combined with bank-top vegetation, (4) Both overstory and understory assemblages can be added on each surface, and (5) The graphical user interface has been much improved. In addition, the role of plants to shield bare surfaces from hydraulic stresses has been accounted for by allowing roughness to vary by layer. The enhanced and revised model is applicable for testing the role of vegetation in bank stabilization and developing appropriate planting plans.

The fate of dolines in an alluvial riverbed and its floodplain: interaction of karst and fluvial processes.

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06B: Karst geomorphology, Dobson 1, February 3, 2026, 2:30 PM - 4:00 PM

Dolines on floodplains tend to be filled by overbank deposits from rivers and are therefore often short-lived. There is little evidence worldwide on how these features interact with fluvial dynamics such as channel migration and avulsion. At Ripon Loop (Yorkshire/ UK) groundwater-induced dissolution of gypsum has created cavities at depth that propagate upwards through up to 30 m of glacio-fluvial deposits to form collapse dolines on the floodplain of the River Ure. It has been shown that dolines towards which the river channel migrated experienced dynamic growth and coalescence, perhaps driven by surface and subsurface flows of river water. In turn, these dolines acted as 'stepping stones' for the rapid incision of a chute channel that led to the cutoff of a large compound meander bend in 2019. This paper investigates the continued interaction between river dynamics and the dolines situated in the new chute channel as well as those, previously inactive, situated on the floodplain. Repeat UAV-based surveys combined with SfM photogrammetry and GIS analysis allowed appraisal of the trajectory of geomorphic change from 2020 to 2025 at various timesteps. The substantial widening of the chute channel allowed deposition of large bars which were then incised by the regrading channel. Hereby, fluvial dynamics of sediment deposition and erosion dominated surface geomorphology initially, with the dolines being associated with a range of bedforms. The ongoing substantial geomorphic adjustment of the chute channel drives bank erosion with the channel migrating tangentially towards previously inactive dolines. In the longer term a more complex pattern of interaction emerges, potentially driven by subsurface flows of river water towards dolines.

Where Does the River End? A Multi-Method Approach to Braided Riverscape Delineation on the Ashley River/Rakahuri

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Braided rivers are inherently dynamic and complex systems characterized by a matrix of continuously shifting and evolving channels and alluvial bars that make effective, accurate management of these environments challenging. In New Zealand braided rivers are prominent, but the fixed legal definition/s of a riverbed under the RMA (1991) is unsuitable for application to these dynamic systems and disregards the fundamental characteristics of these environments .

This study applies and compares three methods for delineating river corridors: Archival Landsat imagery analysis using Google Earth Engine, 2D inundation modelling through HEC-RAS, and valley bottom extraction inspired by the V-BET tool. These methods were applied to the Ashley River in Canterbury, New Zealand, focusing on the floodplain reach extending from the Ashley gorge to the coast.

Results revealed significant variability in the estimated corridor widths produced from the three methods, with notable differences between the topographically confined and unconfined sections of the study reach. The Landsat-based method offered temporal insights into active channel processes and dynamics whilst HEC-RAS simulations provided detailed hydrological data, and the V-BET-based delineation captured geomorphic features effectively and areas accessible to flood waters.

This research contributes to a more nuanced understanding of braided river systems and highlights a need for adaptive management approaches that reflect and account for the intrinsic dynamism of such systems. The scalability and application of this study to other New Zealand rivers with similar confined and unconfined reaches holds promise for improving river corridor management nationwide. Future advancement of this research could integrate historical aerial imagery databases to enhance delineation precision, provide validation and support policy development to ensure sustainable braided riverscape management amidst increasing environmental and developmental pressures.

Applications of Geomorphological Inventories for Landscape Conservation and Resource Management

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07I: Geomorphology for geoconservation, Conway 4, February 3, 2026, 5:00 PM - 6:30 PM

Geomorphological mapping is essential for supporting environmental management, reconstructing landscape evolution, quantify human impact, and informing studies related to geoheritage, tourism, education, and biodiversity. Geomorphological maps are often included into geodiversity assessments, developed using qualitative, quantitative or integrated approaches. This poster presents examples of geomorphological mapping applications in the contexts of landscape conservation and georesources.

1. Global-scale geomorphological elevation proxies to evaluate UNESCO Global Geoparks (UGGs): harmonized global datasets on lithology, soils and hydrology, supplemented with metrics derived from a global elevation model as a proxy for geomorphological features were statistically used to assess the representativeness in UGGs.
2. Geomorphological mapping for potential wilderness area assessment: A hierarchical geomorphological map was developed across the state boundaries of Austria and Liechtenstein using LiDAR data, aerial imagery, and field surveys. A weighting and ranking scheme was applied to identify and map potential high-value conservation areas based on standardized criteria (scientific relevance, frequency, vulnerability, and disturbance).
3. Geomorphological information for the energy transition: Geomorphological data are critical in minimizing the environmental impacts of increasing demand for lithium and rare earth elements. Lithium brine extraction in the Atacama Desert (Chili) was assessed in the framework of the Sustainable Development Goals (SDGs). Results show that almost all SDGs are directly or indirectly influenced, although uncertainties in the debate on the environmental impact of lithium brine extraction remain.

In the SW Pacific Ocean, ocean floor geomorphology, plate age, and the distribution of seafloor mineral resources (massive sulphides, polymetallic nodules, and cobalt-rich crusts) show positive correlations with bathymetry and seafloor age. Detailed evaluation of potential mining areas should include assessments that address potential impact on deep-sea landforms.
The examples highlight the importance of geomorphological assessments across terrestrial and marine environments, demonstrating their relevance in both natural and human-influenced landscapes.

Mapping coastal geodiversity dynamics in the Netherlands using palaeogeographical data, LiDAR, and deep learning techniques

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03E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 4:00 PM - 5:30 PM

The coastline and coastal geodiversity of the Netherlands have changed rapidly during the Holocene. These changes are the result of sediment supply, formation of beach barriers, aeolian activity, peat growth, and the development of tidal salt marshes. During the last ~1500 years, human activities such as coastal defense, urbanization, groundwater supply, dune sand mining, tourism/recreation, conservation practices, military use, agriculture, and forestry have resulted in coastal squeezing. Consequently, the future space for natural habitats is limited. Therefore, the development of comprehensive inventories is imperative to understand human impacts on coastal dynamics. The quantitative analysis of Holocene coastal dynamics was conducted by examining the cell-based variety of natural land cover for a total of thirteen paleogeographical maps, ranging from 11,000 BP to the year 2000. Results indicate that significant changes in the inland movements of the coastline and land cover occurred between 11,000 and 5,850 BP. Between 5,850 BP and 150 BP, there were changes both inland and seaward. From 150 BP to 2000, human activity has had a significant impact on coastal dynamics, leading to a shift in the natural balance of coastal geodiversity dynamics. In the ensuing study, a comprehensive geomorphology inventory was conducted of 45,000 hectares of coastal dunes, distinguished by dune ridges, wet and dry dune slacks, undulating terrain, open sand areas, stable dune blowouts, and beaches. This inventory was facilitated through the utilization of LiDAR-derived metrics and orthophotos, employing a deep-learning workflow. The overall accuracy of 0.87 demonstrates the potential of (semi-)automated approaches for mapping and monitoring coastal dune dynamics. Subsequent steps will entail the analysis and incorporation of the tidal systems into the existing inventory, with the objective of providing a framework to support management decisions in the context of both current and future coastal squeeze.

Integrated analysis of catchment geomorphic (dis) connectivity in a changing climate.

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11B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 5:00 PM - 6:30 PM

Climatic variability is a key driver of landscape development, particularly in controlling erosion and sediment transfer in seasonal landscapes. Here we report the first spatial-temporal sediment connectivity analysis from South Africa's Stillerust Catchment (Kamberg Nature Reserve), a steeply sloping, climatically responsive catchment where rainfall extremes trigger slope instability. We integrate multi-temporal remote sensing with geomorphometric modelling to quantify interaction processes among vegetation dynamics, erosion, and sediment flux.

A multi-method approach was adopted using Sentinel-2 imagery (2015–2024) to derive: (1) differenced NDVI (dNDVI) to monitor disturbance/recovery, (2) Bare Soil Index (BSI) erosion exposure maps, and (3) digitized mass movement features to validate models. These were combined with a structural connectivity analysis (SedInConnect model, 2m DEMSA2) to assess sediment pathways. The Index of Connectivity (IC) incorporated topographic, land cover, and hydrological controls on sediment mobility.

Results indicate that 72% of the digitized erosion scars also overlapped with recurring negative dNDVI (vegetation cover loss) and high IC values (>2.5), confirming slope instability hotspots under wet conditions. Positive trends in dNDVI were linked to IC declines (30–45%), demonstrating vegetation regrowth as a reason for sediment retention. High concordance (R^2=0.68) between BSI-derived bare soil and high-IC zones also confirmed sediment source areas. The dNDVI-BSI-IC framework successfully delineated ephemeral connectivity changes not recorded by static models.

This research drives sediment connectivity assessment forward through novel combination of dynamic vegetation indices, direct erosion mapping, and topographic modeling. Findings offer a transferable framework for measuring climate-forced sediment cascades with clear implications for slope instability management in the uKhahlamba-Drakensberg UNESCO site. The study demonstrates how emerging remote sensing techniques can contribute toward progressing geomorphic process understanding in data-poor, climate-vulnerable catchments.

Comparison of SIBERIA and SSSPAM Landform Evolution Models in a Constructed Post-Mining Landscape in the Hunter Region, NSW, Australia

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05J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 11:35 AM - 1:20 PM

Post-mining landscapes in Australian coal mines typically consist of reshaped overburden dumps designed to resemble natural terrain, often with rolling hills, controlled slopes, and erosion control structures. These landforms are capped with topsoil and revegetated using pasture species and native vegetation to integrate with the surrounding environment over time. Long-term erosional stability is a key concern, and landform evolution models (LEMs) is the most practical method to assess erosion rates and gully development. This study compares two LEMs: SIBERIA, a widely used first-generation model in the Australian mining industry, and SSSPAM, a state-of-the-art soilscape and landscape evolution model.

Model performance was assessed over a constructed post-mining landscape in the Hunter region of New South Wales, under scenarios of dense grass cover and bare soil. Simulations were conducted over 100 years using a high-resolution LiDAR-derived DEM at 1 m. Additionally, a 0.25 m DEM of a hillslope was smoothed by upscaling to 2 m to remove existing gullies, then regridded to 0.25 m to test whether observed gullies would re-form after three years of simulation.

Both models produced comparable erosion rates and similar gully patterns under both vegetation conditions. SSSPAM's performance was consistent with SIBERIA and aligned with erosion rates observed in nearby natural landscapes. The regridded DEM successfully reproduced field-observed gullies, supporting the models' capability to simulate gully formation accurately.

Interplay between seabirds colonies and morphodynamics of mountain slopes covered by permafrost in the Arctic (the ALLE-S project)

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01K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 11:40 AM - 1:10 PM

The ALLE-S project represents a pioneering, interdisciplinary initiative, exploring the intricate environmental dynamics between seabird colonies and mountain slopes they inhabit. The focus of the study is the little auk (Alle alle), an endemic for the Arctic seabird, and the interaction between the biotic and abiotic environment associated with the species. The objective of studies is to examine a thermal and biochemical effect of the little auk colonies on the permafrost, which will provide an insight into the question of the role played by seabirds little auk colonies in the formation and evolution of ecosystems in the polar regions. The studies provide a detailed description of the geo-environmental preferences of the little auk. This description is very much missing while both for predicting the birds important response to the ongoing climate changes and overall changes of the environment features (e.g. permafrost condition, slope stability, vegetation characteristics). A general hypothesis can be formulated, which indicates that the location of seabird colonies is not random and depends on a combination of internal and external structure of the slopes. The hypothesis is extended by the statement that permafrost under seabird colonies is more degraded than in control areas. Additionally, it is hypothesized that seabird colonies have an additive effect on the mountain slopes to the bio-weathering processes (biochemical and biomechanical) associated with the warming of the Arctic. Various research methods are used in the study of this relationship, including geophysical methods, ground temperature measurements using thermistors (in boreholes) and a thermal imaging camera, hydrochemical analyses of water, and experimental studies modeling different environmental conditions of biochemical weathering of rocks. Preliminary results of the studies conducted in the summer season of 2025 will be presented.

New insights on slope instability hazards in the Mount Meager Volcanic Complex, British Columbia

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07C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 5:00 PM - 6:30 PM

The Q̓welq̓welústen/ Mount Meager Volcanic Complex is an active volcanic centre in western Canada. The tectonically uplifted massif exposes basement rocks and highly altered volcanic rocks, whose landforms are shaped by glacial erosion. While the last volcanic eruption occurred over 2400 years ago, the occurrence of large volume landslides is frequent, including the 2010 rock avalanche in Capricorn Creek, the largest historically recorded landslide in Canada. In this paper, we summarise recent studies on landslide susceptibility across the volcanic massif, and as case studies on active slow, deep-seated slope movements and quick, rock fall-debris flows. The influence of the volcanic and glacial processes and morphology, as well as variable geotechnical conditions, is analysed. A susceptibility analysis using machine learning techniques identified glacially shaped morphologies and hydrothermally altered volcanic rock units as the main controls on the instabilities. Gravitational slope deformations are found in the western area of the complex in valleys affected by recent glacial retreat. Numerical modelling suggests that the in-situ stress state and rock structure control many deformation characteristics, with snowmelt inducing episodic movements, detectable by remote sensing. A recent rock fall in 2023 above the Mt Job glacier produced a long-runout debris flow. The failure was triggered after an anomalous rise in temperature in the mid-spring season. Runout models suggest the importance of snow entrainment and a low friction basal ice surface, resulting in high flow mobility. This study highlights the main factors and conditions that favour slope instability in deglaciating volcanic massifs in the context of climatic variations – these are crucial to better understand and increase preparedness for landslide hazards that pose potential risks for local communities and infrastructure projects.

Understanding Martian Dune Fields Through Mineral-Based Source and Sink Analysis

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03D: Planetary Geomorphology, Dobson 3, February 2, 2026, 4:00 PM - 5:30 PM

Martian dunes are deposits of wind-blowable sediments sourced through geomorphic work on bedrock, either directly by wind abrading sedimentary rocks using saltators as tools or indirectly by winnowing out movable grains from bedrock previously eroded through other agents such as water and ice. They are widespread across Mars due to the longevity of conditions for transport and a lack of tectonics to rejuvenate the surface. Linking these sedimentary sinks to their immediate sources can be a useful way of understanding the rate, timing, and method of erosion of Mars' surface, and therefore its climate. However, there remains ongoing debate about the distances over which these sediments are transported. Some localized studies indicate that dunes are sourced from nearby outcrops, other research suggests most sources are long erased and untraceable. In this study, we explore how Martian dunes relate to their source regions by using the mineralogical characteristics of Mars' surface by employing a new global hyperspectral cube derived from OMEGA/Mars Express data and other existing derived remote-sensing data. Preliminary results show that dunes formed in areas with impact-related and polar materials tend to be more mineralogically similar and closer to their sources. In contrast, dunes associated with volcanic and apron units are generally more distant and differ more in composition from their source regions. We also found that the distance between sediment sources and dune sinks doesn't vary much with the surface age. Geographically, dunes located closer to the poles are typically nearer to their sources compared to those near the equator. Regardless of latitude, most dune fields are found at lower elevations than the regions identified as their likely sources, suggesting a consistent topographic trend in sediment transport across the planet. These new data present an opportunity for a broad, consistent, global analysis of Mars' sediment cycle.

Community-Based Geomorphological Mapping as a Tool for Disaster Risk Communication in Taiwan

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11D: Geomorphology Education for Disaster Risk Management, Dobson 3, February 5, 2026, 5:00 PM - 6:30 PM

This study evaluates the practicality and effectiveness of community-based, 1:10,000-scale thematic geomorphological maps in communicating sediment-related disaster risks to non-geoscience professionals—specifically, local debris flow disaster prevention (DFDP) volunteers—in Taiwan. These maps, which include a main map, UAV imagery paired with 3D topographic models, and an explanatory booklet, aim to enhance disaster risk communication at the community level. To ensure relevance and usability, the mapping process actively engages DFDP volunteers, integrating their environmental knowledge, disaster experiences, and feedback on map design.

Workshops were conducted in 2024 and 2025 with DFDP volunteers across seven cities. Each session included a one-hour workshop followed by a paper-based questionnaire. Additionally, a series of in-depth meetings was held with volunteers in Hoya Village, Lugu Township—a community with a strong volunteer network and a history of debris flow disasters over the past two decades.

Feedback from more than 200 DFDP volunteers across Taiwan indicated strong appreciation for the maps' level of detail, visual clarity, and content richness. However, many volunteers expressed the need for more guidance on how to interpret the maps and accompanying materials. In Hoya Village, the participatory process significantly improved volunteers' understanding of local debris flow risks and fostered a greater sense of involvement. The findings suggest that community-based geomorphological mapping, when paired with local engagement, is an effective tool for disaster risk communication and volunteer empowerment—provided there is a strong, organized local support network in place.

Fire-Driven Rock Weathering: Implications for Denudation in Carbonate Terrains

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01J: Denudational Dynamics and Hazards in a Changing Environment, Conway 5, February 2, 2026, 11:40 AM - 1:10 PM

In our rapidly changing environment, wildfires play a critical role in accelerating rock weathering, thereby enhancing denudation and intensifying surface processes. While most scientific efforts regarding wildfires have predominantly focused on the effects of fire on vegetation and soils, the role of fire as an essential weathering agent has been largely overlooked. This study aims to evaluate rock decay processes during wildfires, in relation to ground temperatures and rock morphologies of limestone, dolomite, and chalk. In 2010, a major forest fire in Israel caused massive destruction of the exposed rocks and accelerated rock weathering over the burned slopes. While a detailed description of the bedrock exfoliation phenomenon was previously reported, here, we conducted an experimental open fire to determine the temperature and gradients responsible for boulder shattering. The results show ground temperatures of 700 °C after 5 min from ignition, while the peak temperature (880 °C) was reached after 9 min. Temperature gradients show a rapid increase during the first 5 min (136 °C/min), a moderate increase during the next 4 min (43 °C/min), and a slow decrease for the next 9 min (25 °C/min). After 12 minutes, all boulders of all formations were cracked or completely shattered. The behaviour of carbonate rocks upon heating was studied to identify the erosive effects of fire, namely the formation of new cracks and matrix deterioration.

Distribution and chronology of the Late Pleistocene permafrost on the East European Plain: GIS database

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Numerous periglacial features, such as pseudomorphoses of ice wedges, sand wedges, cryoturbations are widespread in the Eastern European Plain. Research in this area was actively conducted at the end of the last century, and one of the main achievements is considered by A.A. Velichko and his colleagues to be the identification of three chronostratigraphic cryogenic horizons: Smolensky, Vladimirsky and Yaroslavsky. Based on these data, a map was created estimating the maximum extent of the permafrost during the Valdai glacial epoch.

New data on two key areas make it possible to estimate the rate of permafrost degradation, its type, and the features of frost cracking during the final deglaciation in eastern Europe.

In the Late Glacial deposits of the Onega-Ladoga region (northwestern Russia), extremely rapid (1300-300 years) permafrost formation in the Younger Dryas is indicated. As a result of field and instrumental studies, two cryogenic complexes of different ages with different sets of periglacial features were identified. Important indicators of the periglacial environment have been identified - specific subaerial precipitation: niveo-aeolian sands.

In the upper reaches of the Severnaya Dvina River (northeastern Russia) at the end of the Bølling-Allerød interstadial (ca. 13.3-12.7 cal. kyr BP), conditions existed for the development of frost-resistant cracking. Freezing occurred in two stages – syncryogenic with the formation of ice-wedges and epicryogenic with the formation of composite ice-wedges.

These data became the basis for the creation of a GIS database. New research significantly expands our knowledge of paleocryogenic processes in the East European Plain, clarifying the chronology and mechanisms of permafrost. These data make it possible to more accurately reconstruct the climatic conditions of the past and their impact on geological and landscape processes. The studies were supported by grant of the Ministry of Science and Higher Education of Russian Federation (agreement № 075-15-2024-554 of 24.04.2024).

Deciphering the implications of greatly extended pre-Otiran ice advances in South Island, New Zealand

Professor James Shulmeister[1], Professor Glenn Thackray[2], Professor Tammy Rittenour[3], Dr David Fink[4], Mr Connor Dillon[4], Leighton Watson[1]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

During the Mid- to Late- Pleistocene ice has repetitively advanced from the Southern Alps down the major valleys of South Island. During the most recent (Otiran) glaciation ice reached the edge of the Canterbury Plain in the east and advances beyond the range fronts in Otago. In most cases these advances were 60-80 km from the current ice limits. In pre-Otiran glaciations ice advanced much further. On the Canterbury plains piedmont lobes extended tens of kilometers onto the plains while in the Clutha River system in Otago, maximum ice limits are about 70 km from Otiran limits. These greatly extended limits suggest very different climatic or tectonic forcings during earlier Pleistocene advances. We will examine geomorphic and other evidence from the Clutha and Rakaia systems to highlight the differences between younger and older advances. We will postulate likely changes in either ice volumes of ice accommodation, to explain these observations.

Monitoring Desertification in the Indian Thar Desert (1991–2024): A Remote Sensing and Artificial Neural Network Approach

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09H: The signature of climate change in arid landscapes, Conway 3, February 5, 2026, 11:35 AM - 1:05 PM

Desertification is a critical environmental concern in the Indian Thar Desert, where fragile dryland ecosystems are increasingly threatened by climate variability and unsustainable land use. This region, one of the most densely populated arid zones globally, is characterized by erratic rainfall, high temperature extremes, low vegetation cover, and intense human-livestock pressure. These conditions make the Thar Desert particularly vulnerable to land degradation, necessitating a robust, data-driven framework for monitoring and mitigation. This study aims to assess the spatiotemporal dynamics of desertification in the Indian Thar Desert from 1991 to 2024 using a multi-source remote sensing and machine learning approach. Landsat TM/ETM+/OLI, MODIS, and VIIRS satellite data were employed to derive key environmental indicators including NDVI, NDWI, LST, TCI, SAVI, and MSAVI. Temporal trends of NDVI, NDWI, LST, and rainfall were analysed using the non-parametric Mann–Kendall test and Sen's slope estimator to capture long-term climate variability and vegetation response. These trend-derived metrics were integrated into an Artificial Neural Network (ANN) model to identify nonlinear relationships between environmental drivers and landscape degradation. The ANN model exhibited strong predictive capability in delineating zones of high morphogenic vulnerability. Findings revealed significant vegetation change and temperature rise across large parts of the Thar Desert, closely linked to anthropogenic land stress. Field surveys supported satellite-based observations and reinforced the role of unsustainable practices in accelerating desertification. This study presents a scalable, transferable framework for desertification assessment using harmonized remote sensing and ANN modelling. It offers valuable insights for land degradation neutrality planning and sustainable land management in arid regions, particularly in the context of climate adaptation and ecological restoration in the Thar Desert.

Key words landscape,capability,predictive,morphogenic,vulnerability.

1305

Do historical records truly reflect the largest landslides? Insights from dendrogeomorphology

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The magnitude–frequency relationship is a fundamental tool for estimating landslide hazard. However, historical data on past landslide occurrences are predominantly derived from archival sources, which typically document only the largest or most impactful events. This reliance on incomplete records may lead to a significant underestimation or overestimation of landslide hazard. To address this issue, this contribution employs dendrogeomorphic methods to verify the temporal and spatial characteristics of six selected landslides, each with at least one historically documented reactivation. Tree-ring data were used to reconstruct landslide activity, allowing for a comparison between historically recorded events and previously unknown reactivations revealed through dendrogeomorphic analysis. Growth disturbances in affected trees were identified and analyzed to determine the timing and extent of reactivation events. The findings show that, for three of the six landslides, the historically known event was indeed the largest in terms of affected area during the period covered by tree-ring data. However, in some of these cases, the magnitude of movement—measured as the rate of rotation of landslide blocks—was found to be smaller than expected. Conversely, for other landslides where the reactivated area was consistently smaller than that of the historically recorded event, the movement magnitude was significantly greater. Notably, in one case, the historically known event was among the smallest, while most of the newly identified reactivations were larger in both area and movement magnitude. These results offer a novel and valuable perspective on the interpretation of historical landslide records and emphasize the importance of integrating dendrogeomorphic data to more accurately assess landslide hazard.

Geological Controls on Beach Morphodynamics and Rip Current Formation: A Case Study from San Giovanni di Sinis, Western Sardinia

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04E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 3, 2026, 9:35 AM - 11:05 AM

The morphodynamic behavior of beach systems is governed by the interaction of oceanographic processes, climatic influences, and the underlying geological framework. Among these factors, geological controls mediate complex interactions among sediment transport, wave dynamics, and coastal currents. These interactions—modulated by the morphology and spatial distribution of geological outcrops—determine beach shape and influence the beach response to storm events. This study investigates the role of geological controls on beach morphology and dynamics along a beach located along the Mediterranean Sea: San Giovanni di Sinis (western Sardinia, Italy). This beach is characterized by rocky headlands, cliffs, and submerged outcrops. Data collection spanned the period from 2008 to 2022 and included DGPS profiles, LiDAR datasets, and Digital Terrain Models derived from aerial photogrammetry. Morphological variability was assessed analysing a series of beach profile realized on both emerged and submerged beach area. Offshore wave data were sourced from the CMEMS Copernicus Marine Environment Monitoring Service.

Analysis of morphological and remote sensing data reveals that submerged geological outcrops promote the formation of a well-developed rip channel, which becomes active primarily during high-energy storm events. This rip current appears to facilitate offshore sediment transport, contributing to erosion of the subaerial beach and a reduction in beach volume. In contrast, sectors of the beach behind the shallow rocky outcrops close to the shoreline exhibited relatively limited morphological variability in response to storms.

Over the long term, the area influenced by the rip current has shown a loss in sediment volume and a shoreline retreat. These findings underscore the critical role of geological controls in modulating beach response to hydrodynamic forcing and highlight the need to incorporate geological variables into coastal monitoring and management strategies.

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The role of relative sea-level change in the retreat of a Scottish ice stream

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08G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 9:35 AM - 11:05 AM

The Minch Ice Stream was a major outlet glacier draining the NW sector of the British Irish Ice sheet during the Last Glacial Maximum (LGM). Previous work documents a rapid retreat of this marine-based ice stream at the end of the glacial period. Little is known about the role relative sea level (RSL) change may have played in its retreat. In this study we provide new RSL data from dozens of isolation basins and raised shorelines across NW Scotland. Our new results refine the timing and rate of retreat of the Minch Ice Stream with near complete demise of the ice stream by ~17 ka, slightly earlier than previously thought. Our new RSL records show spatially variability in RSL change across NW Scotland with a marine limit nearing 30 m across the Inner Hebrides islands of Rassay and Rona that decreases to near 10 m near the town of Ullapool. Our new records suggest that the front of the ice stream experienced RSL rise across its retreat path that may have exacerbated the role of marine ice sheet instability. Our results highlight the important role that ice sheet and sea-level change feedbacks play in the demise of ice streams.

Sediment flux variations across the Andes and Amazon lowlands throughout the Late Quaternary based on geomorphological and luminescence data.

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The unparalleled biodiversity of Amazonia results from complex interactions between biotic and abiotic processes. Key abiotic factors include regional climatic changes, river drainages, and the dynamic mosaic of upland and seasonally flooded terrains, which shape the evolution of the Amazon fluvial system during the Quaternary. Hydroclimatic variations drive sediment flux from the Andes to the lowlands, influencing nutrient supply, species distribution, and the establishment of ecological barriers. Understanding this sediment flux is crucial for assessing landscape evolution and biotic changes in the Amazon Basin. This research seeks to infer millennial-scale erosion rates and sediment flux patterns and explore their implications for landscape and biotic evolution during mid to late Quaternary times. We use Optically Stimulated Luminescence (OSL) dating to develop sediment deposition age models, complemented by TanDEM-X DEM processing to enhance our insights into the evolution of the Amazon lowlands. Initial findings indicate the formation and preservation of at least three fluvial terrace levels in the upper and central Amazon River, particularly near Iquitos in Peru. OSL ages obtained so far range from ~100 ka to the late Holocene. These terraces were mapped using high-resolution digital elevation models (12 m), refined to remove vegetation interference and delineate local basins. To encompass the entire Amazon basin, we are analyzing a newly collected sediment core near its mouth, preserving a continuous record throughout the late Quaternary (<120 ka). At the event, we will present comprehensive sediment age data, offering deeper insights into the Amazonian fluvial system's Quaternary evolution. This study is part of a PhD research project funded by FAPESP (2023/16001-8; 2022/03007-5).

The implementation, outcome and implications of a 30 year grade control and revegetation program in a medium-sized sand bed river.

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05A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 11:35 AM - 1:20 PM

The combined application of grade control and revegetation has been widely successful in arresting incision and driving recovery of small waterways and gullies. Grade control and revegetation have been proposed and, to a lesser extent, implemented, in medium-sized sand bed rivers bed rivers across Australia. However, the success or otherwise of this approach to the management of incision and acceleration of river recovery has not been clearly demonstrated.

We have compiled a unique dataset covering 30 years of investigations, interventions, and monitoring and evaluation for a 28 km long reach of the Cann River; a medium-sized sized sand bed river, in East Gippsland, Victoria, Australia, subject to historic channel incision.

The 30 year program of management has comprised successive investigations, implementation of interventions, monitoring and review. Community desires have shaped the type and scale of interventions, and have in turn been shaped by the response of the Cann River to those interventions. The site has a visual appearance of success with bank and bench vegetation establishment and limited bank erosion. However the monitoring data reveals ongoing channel incision, consistent with sediment transport exceeding the rate of sediment supply. The ongoing incision has the potential to undermine and result in the loss of the intervention measures.

In the absence of further intervention, the system will continue to incise until a new channel form establishes that matches sediment transport with supply and/ or the resistance of the bed and bank material exceeds the applied shear stress in flood events.

The paper provides an evidence base for and guidance on the application of the grade control and revegetation approach to the management of medium-sized sand bed streams. The learnings from the Cann River can inform the management of similar systems and the scale and type of intervention required to slow or arrest incision.

Pluto's Cryovolcanic Constructs – Icy Volcanism in the Distant Outer Solar System

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01D: Planetary Geomorphology, Dobson 3, February 2, 2026, 11:40 AM - 1:10 PM

Pluto's interior is composed of a rocky core/mantle and an icy exterior. Images from the New Horizons spacecraft flyby revealed a geologically diverse world, with many crater-free areas, implying ongoing resurfacing. Some resurfacing on Pluto is due to the sublimation and redeposition of volatile ices (e.g., N2, CH4, CO) in Pluto's thin atmosphere and the flow of volatile ice glaciers. In contrast, one large resurfaced area (at least 300x600 km) appears to be a form of water-ice+antifreeze cryovolcanism unique in the solar system (Singer et al., 2022).

This area contains extremely large mounds (50-100 km across and up to 7+ km high) that are overprinted by an undulating terrain composed of ~10-15 km mounds. The area has few to no craters. A few domes appear to show a superposition relationship where they overprint older terrain, but in general, obvious flow features are absent. The topography does not in any way resemble an erosional remnant. There are some fracture patterns in some areas, but no large collapse faults. The creation of very large topography (the largest scale domes/mounds), the regular undulating terrain, and the absence of craters, sublimation, or erosion features, has led to the idea that his area was resurfaced by material coming up from the subsurface.

We will discuss the morphological and compositional constraints and compare them to possible cryovolcanic formation mechanisms. The most promising emplacement mechanism is similar to dome growth models where there is a central vent and material piles up on top of the vent. The dome quickly forming a cooled carapace, and then continues to grow until arrested by the strength of a thick cooled outer layer (also similar in some ways to pillow lava formation).

Singer et al., 2022, Large-scale cryovolcanic resurfacing on Pluto, Nature Communications, 13, 1542. doi:10.1038/s41467-022-29056-3

Sediment Yield Variation and its Controlling Factors over Narmada River Basin, India

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04I: Human Footprint in River Basins, Conway 4, February 3, 2026, 9:35 AM - 11:05 AM

During the last century, riverine sediment load has been largely impacted by cumulative consequences of climate change and intensive anthropogenic activities. Assessing regional variation in sediment load, yield and their responses to the potential controlling factors are critical in developing the specific strategies for soil conservation. The present study has been attempted to investigate the spatial-temporal variations, trends, change point, periodicity in sediment load and yield over Narmada River basin and its relationship with geographic, climatic, and hydrologic factors. For this, daily sediment load and yield have been analyzed with non-parametric trend tests, Morlet wavelet transform, Pearson correlation coefficient and partial least square regression. The results have revealed a significant decline in annual and monsoon sediment load and yield over the basin. A total reduction of 31.42 ×106 t has been observed in sediment load during human-affected period (1.51×106 t) compared to the reference period (32.92 ×106 t). The anthropogenic activities have contributed (160 %) significantly in reducing sediment load; while changing climate has enforced a counteracting effect (-60%). Further, specific sediment load and yield have been found positively correlated with latitude, longitude, altitude, slope, Q10, rainfall amount, erosivity and seasonality. The results of partial least square regression indicated that the runoff variables (mean and maximum discharge, change in discharge from the previous day and range of discharge over the last 3 days) are major controlling factors as these variables have explained nearly 38 to 82 percent of variations in sediment yield. Remarkably, a large dissimilarity has been found in the dominant factors of sediment yield over the basin. This study offers valuable insights related to the effects of driving factors on sediment yield, which can be useful for policymakers in formulating guidelines related to regional soil conservation and to minimize the anthropogenic activities.

Investigation on behaviour of intermittent streams and its distinct impact on landforms in kalakankar region of Uttar Pradesh,India

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12A: River and catchment evolution, processes, and management, Auditorium, February 6, 2026, 9:35 AM - 11:05 AM

The Kalakankar region is a part of middle Ganga plain located in Pratapgarh district of Uttar Pradesh,India experiences a drastic and distinct geomorphic changes in landforms driven by the seasonal activity of intermittent streams. There are numerous streams mainly active during the monsoon months and originated from nearby uplands and flow temporarily across the landscape, leaving behind noticeable landform changes such as erosion, sediment deposition, channel incision, and landform modification. This study aims to investigate the localized geomorphic impacts of these seasonal streams using field-based methods.An intensive field survey have been conducted in order to identify geomorphic features such as rills, gullies, sheet erosion zones, depositional fans, and temporary channels were identified. In addition, soil sampling was undertaken across active streambeds and depositional zones to assess sediment type, grain size, and depth of deposition.Preliminary findings indicate that seasonal streams play a significant impact in the landscape of Kalakankar region and there is a drastic change in topography along the intermittent streams within short period of time. Features such as ephemeral gullies and silt-laden fans were commonly observed after heavy rainfall events, often cutting across village roads and farmland.Local interactions revealed that these geomorphic changes also influence land-use decisions, crop patterns, and infrastructure planning.

This study indicates that short-lived seasonal water flows can perform geomorphic changes and play a dominant role in changing the shape of micro-landforms in low-gradient floodplain environments. It underlines the value of integrating field-based observation with local knowledge for understanding dynamic fluvial landscapes like Kalakankar so there is need to correlate satellite derived data and field observation in order to suggest better land management planning and hazard mitigation strategies at micro level scale.

Keywords: Intermittent,Stream,Flood plain,Dynamic,Fluvial Landscape.

Morphodynamics of Meltwater Meandering Channels of Constant Curvature on Ice

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12A: River and catchment evolution, processes, and management, Auditorium, February 6, 2026, 9:35 AM - 11:05 AM

Meltwater channels play an important role in glacial hydrology, influencing surface ice dynamics and meltwater drainage efficiency. In meandering alluvial rivers, the transverse slope of the bed around a bend is related to curvature (bend radius) and controlled by the interplay between the secondary flow intensity and the action of gravity acting on sediment particles pulling them down the slope. In systems where sediment is absent, the controls ought to be different. In this contribution, we focus on meltwater meandering channels of constant curvature on ice to quantify the role of bend curvature, ambient water temperature, and flow velocity in setting the transverse slope of the channel around bends. Addressing this knowledge gap is essential for advancing our understanding of supraglacial hydrodynamics and morphological evolution of meltwater channels on ice. Laboratory experiments were conducted using large ice blocks carved into uniform U-shaped bends, following the foundational framework established by Rozovskii for flow in curved channels. Flow rate (1–10 L/min) and water temperature (0–10°C) were precisely regulated to capture a wide range of hydrodynamic conditions. High-resolution imaging, image-based velocimetry, and structure from motion were employed to quantify slope development, flow structure, and incision patterns. Preliminary findings indicate that transverse slope in meltwater channels is set by a balance between the centrifugal forces induced by secondary flow and ice surface melting dynamics rather than sediment interactions. These initial results suggest a set of physical mechanisms driven by thermal erosion in meltwater channels. Quantifying these processes has significant implications for understanding channel evolution and drainage efficiency of supraglacial streams and rivers, ultimately informing broader ice sheet runoff models, stability of ice shelf models, and climate-based meltwater runoff projections, especially in the face of a warming climate.

Mars-Earth Analogue: Apollinaris Mons-Emi Koussi region, record of geologic evolution

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03D: Planetary Geomorphology, Dobson 3, February 2, 2026, 4:00 PM - 5:30 PM

Analog studies assist in understanding the possible geological processes that shaped the earlier Earth and Mars. Both these planetary bodies underwent diverse activities like volcanic, fluvial, glacial, impact cratering, and aeolian. This study focuses on a region on Earth and Mars, where all such diverse processes co-existed in one location, and how they recorded the geological and environmental transitions. A detailed geomorphological study is carried out to understand the region around the shield volcano-Apollinaris Mons (Mars) and Emi Koussi (Earth). During the late Paleozoic Era, glacial activity happened in the Emi Koussi region, whereas on Mars it is during the Early Hesperian epoch. The glacial melt and the precipitation led fluvial channels dissected the Misissippian period Aorounga crater (Earth) and several Noachian-Hesperian unnamed Martian craters. The most striking similarity between craters on both planetary bodies is their ubiquitous presence of aeolian erosion, yardangs, and dune covers within and around the craters. Both Apollinaris and Emi Koussi are surrounded by one of the largest, most diverse dune deposits in their respective planetary bodies. Both regions witnessed the magma-water interaction bringing potential lacustrine environment within the caldera, whereas the region's geomorphology also revealed the paleo lakes and eroded mesas at their flank, which are interconnected to the paleochannels. Currently, the Emi Koussi region turned out to be one of the driest deserts on Earth, similarly, the Apollinaris Mons region also transformed and witnessed all geological activities, but much earlier than its counterpart. Both the Planets have experienced the same general climatic records, but Mars is half the size of Earth, and the scale of geological activities undergone is at least one order higher, which reveals the hostile environment on earlier Mars.

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Evolution of sediment grain size from source to sink in an alpine catchment, Inyo Creek California, USA

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08A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 9:35 AM - 11:05 AM

Size distributions of sediment produced on hillslopes and transported through river networks influence catchment dynamics from land-use impacts to landscape evolution. Sediment size governs partitioning of load between transport modes, regulates river incision into bedrock, and influences channel morphology. Sediment size depends on the lithologic, climatic, and geomorphic factors that control the initial size distributions produced by weathering and erosion on hillslopes, and the processes of physical wear and mixing of sediment in channel networks. Current understanding of these processes is not sufficient to predict evolution of size distributions from knowledge of catchment lithology, climate, erosion rate, and topography. To address these knowledge gaps, we investigated the life cycle of sediment size in Inyo Creek, an unglaciated catchment incised into the steep escarpment of the eastern Sierra Nevada of California, USA. The granitic lithology permits focus on the influence of local climate and erosion rate, which vary over 2 km of relief. We used field surveys to measure variation in hillslope surface grain size and bedrock fracture spacing with elevation. We sampled bed sediment at the catchment outlet, in 12 size classes from sand to boulders. From these samples we used detrital thermochronometry to infer source elevations and cosmogenic radionuclides to infer spatial patterns in erosion rate. We used laboratory experiments to quantify sediment susceptibility to fragmentation and abrasion in transport. We find that hillslope size distributions are bimodal, with a bouldery coarse mode that correlates with bedrock fracture spacing, and a fine mode that shifts from gravel to sand with decreasing elevation. Spatial patterns of sediment size production inferred from geochemical analysis can only be reconciled with field surveys by modeling particle fragmentation and abrasion in transport. Together, these results reveal the diverse influences of lithology, climate, erosion, and topography on the source-to-sink evolution of sediment size distributions.

Transport and Storage of Metal-Contaminated Sediments from Historical Zn-Pb Mining in Elm Creek, Picher, Oklahoma

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11B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 5:00 PM - 6:30 PM

Understanding the spatial distribution and transport dynamics of metal-contaminated sediments is essential for effective remediation of legacy mining landscapes. This study investigates sediment contamination in Elm Creek, which drains the Tar Creek Superfund Site (TCSS) near Picher, Oklahoma—part of the historically significant Tri-State Mining District (TSMD). Although the TSMD has been widely studied, few assessments have focused on sediment behavior in the central lowland prairie region of Oklahoma, where hydrologic and geomorphic conditions shape contaminant fate in distinct ways.

We find that metal-contaminated sediments have been dispersed up to 10 km downstream from the primary mill site, primarily within bed sediments. However, most contaminated material is stored in a fine-grained, aggrading reach immediately below the mill site. Sediment accumulation in this reach is promoted by a small upstream dam that limits transport capacity, as well as by beaver activity and associated riparian vegetation that enhances sediment retention. Suspended sediment concentrations show a slow temporal increase in contamination, suggesting gradual downstream movement of fine particles. Overall sediment flux remains low (~0.1 tons/day), indicating a predominantly storage-dominated fluvial system.

Floodplain cores further reveal that contamination is largely confined to a narrow meander belt and to shallow depths (<0.5 m), implying limited overbank dispersal. These findings highlight the interplay between geomorphic controls and legacy contamination, offering insight into sediment management and remediation planning across similarly affected TSMD watersheds.

CMORPH – An Open-Source Application for Coastal Morphology Detection and Analysis

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01H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring, Conway 3, February 2, 2026, 11:40 AM - 1:10 PM

CMORPH is an open-source application for automated coastal morphology analysis and visualization based on Python scripts. Designed for both researchers and practitioners, it offers a modular pipeline and an intuitive web-based interface built with Streamlit. The tool enables the detection of key coastal features such as shoreline, dune or cliff base and top, and supports statistical analysis of changes using standardized metrics (SCE, NSM, LRR, EPR). CMORPH improves reproducibility, reduces manual work, and facilitates large-scale comparative studies. It is fully compatible with GIS tools and includes advanced visualizations in Jupyter Notebook, promoting scalable and transparent coastal monitoring workflows.

Do lake sediments at Lorinna, Tasmania indicate a glacial lake outburst flood (GLOF) during the MIS6 / MIS5e transition?

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The Forth River valley in northern Tasmania runs from south to north and displays several glacial features including moraines and erratics but prior to this study no deposits have been accurately dated.

A recently exposed road cutting at Lorinna in the Forth River valley, has revealed a section of silty fine sands and silts stratified at a millimetre scale. The varve-like layering of the deposit indicates its lacustrine origin. The deposit is located at approximately 360 m a.s.l., 140 m above the present artificial Lake Cethana and about 240 m above the now-drowned Forth River channel.
LIDAR imagery reveals strong evidence of landslides on the valley slopes, both north and south of the lake deposits. We propose that landslides may have dammed the Forth Valley downstream of the lake deposits, trapping glacial meltwater and associated deposits behind a natural dam. Subsequently sediment in suspension (fine sands and silts; 99% <250 µm; 20% <50 µm) settled out to form the layered deposits we see today.

The sediments were dated c. 137±13 ka by OSL techniques, indicating that were deposited in late MIS 6, probably by melting of a glacier which previously filled the valley upstream and melted and released sediments during the MIS 6 / MIS5e transition. This glacier may have formed the prominent Forth River valley moraine at 390–410 m a.s.l., 30 km south of the lake deposits.

After deposition the natural dam must have been breached, releasing a huge quantity of impounded water down the Cethana Gorge to the northern Tasmania lowlands and the sea, 35 km north of Cethana. Such a large glacial outburst flood (GLOF) could explain at least some of the erratics and glacial deposits noted in the lower Forth Valley.

Geoconservation sites in Northwest Tasmania – the “endangered species” threatened by development

Dr Adrian Slee[1]
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07I: Geomorphology for geoconservation, Conway 4, February 3, 2026, 5:00 PM - 6:30 PM

Northwest Tasmania has a complex geomorphic history with anthropogenic, coastal, aeolian, karst, fluvial, volcanic and tectonic imprints on the landscape. In the region historic agricultural practices since European arrival have heavily impacted and modified geoheritage values over much of the region, resulting in several significant potential geoconservation sites being damaged or lost.

These include the removal of a cave and the draining of swamps that were shown to have contained important megafauna bone deposits; removal of vegetation and significant hydrologic disturbance around large karst mound springs; and stock damage to caves and the alteration of natural stream channels, sinkholes and aeolian landforms by canalisation and hump-and-hollow farming. These impacts are still occurring with recent disturbance of a potentially significant lagoon and lunette system, the burning and loss of thick organic peat soils and the disturbance of a significant avian bone deposit during construction of a golf course.

While extensive areas of northwest Tasmania have been heavily modified; hilly country and the more isolated upper reaches of the flat coastal draining valleys still have thick forest cover. This land has a mixed tenure of State Forest and private forest blocks and semi-formal conservation areas. Planning for forestry activities from time to time has located significant geomorphic landforms and with the advent of widespread lidar coverage remote landform analysis in this otherwise densely vegetated terrain can be used to help identify features for ground truthing prior to any disturbance.

The impacts on the region’s geomorphic landforms by agricultural activities has resulted in a significant decline in natural values. Consequently, the intact landforms within managed forestry estate have increased significance as potentially valuable geoconservation sites; some of these have been or will be likely to be formally recognised in Tasmania’s Geoconservation Database.

Tracking Solifluction Response to Temperature and Precipitation Using InSAR Deformation and seNorge Climate Data in Norway

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02G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 2:00 PM - 3:30 PM

Solifluction and related forms of shallow ground deformation occur widely on permafrost-affected hillslopes, with movement driven by seasonal freeze-thaw processes. In this study, we examine the relationship between ground deformation and climate across selected sites in Norway with documented solifluction or slope failure features. Surface motion is tracked using time series derived from InSAR, capturing both seasonal and interannual patterns of vertical displacement. Daily temperature and precipitation records are obtained from the SeNorge gridded dataset produced by MET Norway. These data are used to evaluate whether patterns in deformation correspond with thermal and hydrological conditions across multiple years. Displacement signals are extracted from hillslope sites and compared with local weather trends to determine periods of uplift and subsidence and their timing relative to climatic forcing.

Previous fieldwork shows a consistent pattern of thaw-related subsidence observed during spring and summer, reaching peak values several weeks after the seasonal temperature maximum. Periods of increased precipitation also could correspond with enhanced displacement in some locations, suggesting an added hydrological control on movement. Uplift occurs more gradually during fall and winter as the active layer refreezes. We hypothesize that the magnitude and timing of deformation should vary by site and be influenced by slope, elevation, and sediment type. This study aims to quantitatively assess how solifluction-related motion aligns with climate variables across hillslopes in cold-region Norway using InSAR data. Combining multi-year deformation records with high-resolution weather data will identify key seasonal signals in permafrost hillslope dynamics and describe their variability across different geomorphic settings, offering new insight into how temperature and precipitation drive surface change in permafrost terrain.

Catastrophic jökulhlaups along the Jökulsá á Fjöllum during the Little Ice Age

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12D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 9:35 AM - 11:05 AM

Volcanic activity beneath glaciers can rapidly generate subglacial reservoirs that may abruptly drain during catastrophic glacial lake outburst floods (GLOFs), so-called jökulhlaups. The Vatnajökull ice cap, situated atop multiple active calderas within Iceland’s main volcanic rift zone, is a hotspot for such glacio-volcanic floods. Historically, most of these floods have flowed northward along the Jökulsá á Fjöllum (JF), Iceland's largest proglacial river (Waitt, 2009). Although there is substantial geological evidence for large Holocene floods along the JF, large uncertainties remain regarding the frequency and magnitude of these events (Carrivick et al., 2013). This study tackles this research gap by utilizing slackwater sediments deposited in a threshold lake to reconstruct the magnitude of catastrophic floods (Baker, 2008) during the Little Ice Age. Our research focuses on sediments deposited in Lake Vestaraland (88 m a.s.l.), a 5-m deep endorheic lake at the end of an abandoned flood channel. The channel, oriented at an approximately 70° angle relative to the JF, provides close-to ideal conditions for the deposition of slackwater sediments (Kochel, 1980; Baker, 1987). Using a combination of methods including Computed Tomography, elemental geochemistry (X-Ray Fluorescence), granulometry and radiocarbon (14C) dating along with tephrochronology, we demonstrate that glacial sediment-laden flood waters inundated Lake Vestaraland in 1450, 1550, and 1630 CE. Based on historical witness accounts (Carrivick et al., 2013) a potential source of these floods are eruptions from the Barðabunga-, Kverkfjöll and/or Dyngjujökull calderas. Preliminary estimates for the minimum peak discharge of these events, based on simulations from the Icelandic hazards service (Vedur, 2017), suggest values of around 120,000 m^3/s.

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Virtual Field Trips for geoheritage outreach and geotourism promotion

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The understanding of landscape geomorphological features and evolution is typically achieved through physical exploration and the appreciation of specific locations. Recent technological advances, including the growing use of Virtual Reality (VR), are offering additional tools for visiting sites of geological and geomorphological interest thanks to Virtual Field Trips (VFT) which are based on 360-degree images and videos and interactive digital content. In recent years, VFT have proven to be effective tools for promoting awareness of geological heritage. VFT are emerging as an increasingly valid alternative to traditional field visits, as they not only enable immersive experiences of remote or difficult-to-access sites and overcome physical, logistic and economic limitations, but also offer experiences that would otherwise be unattainable in situ, such as a bird's-eye view or the ability to analyse the evolution of a location through virtual time travel. They can also serve as effective tools for science communication, presenting information in an engaging way, fostering a deeper understanding of the scientific significance of geological heritage features and the importance of their conservation.

In this context, the study explores diverse applications of VFT in geoheritage and geotourism enhancement in the Maltese Islands, a territory distinguished by scenic geomorphological landscapes, rich natural heritage, remarkable geodiversity and iconic landforms that are recognised as cultural and natural landmarks. A series of VFT were developed to integrate some itineraries from a geological field guidebook produced by the Continental Shelf Department of Malta, which displays thematic geological walks in areas characterised by valuable geological, geomorphological and cultural features. These virtual and immersive experiences favour a meaningful understanding of the scientific value of each site, beyond its sole aesthetic appreciation. This initiative aligns with the principles of sustainable development by emphasising the importance of geoscientific literacy in fostering resilient communities.

Investigation of slope stability and mass transport deposits in the Palliser basin with high resolution 3D P-Cable seismic reflection data

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Slope stability analysis of canyon flanks is a critical step in assessing hazards related to failures in submarine canyons. Various geophysical methods provide valuable data for the integrated interpretation and modeling of surface and subsurface structures and strata. Among these methods, high-resolution 3D P-Cable reflection seismic data offers significantly better subsurface imaging compared to conventional seismic reflection techniques, making it well-suited for detailed seismic stratigraphic and structural analysis. To evaluate slope stability in the Palliser Bank and Palliser Canyon, located in the Cook Strait, high-resolution data was acquired in early 2025. This dataset was complemented by numerous high-resolution 2D seismic profiles, sub-bottom profiler, ocean-bottom seismometer records, and coring, which are not addressed in this study. The 3D seismic dataset underwent a conventional processing workflow, including geometry and amplitude corrections, noise reduction, signal enhancement, velocity analysis, stacking, and time migration. The resulting migrated cube was then subjected to detailed stratigraphic and structural interpretation. In this context, mass transport deposits (MTDs) were identified based on their morphology and characteristic seismic patterns, which often appear chaotic due to the heterogeneity of the transported material during downslope movement. In addition to the MTDs, stratified sedimentary units were also interpreted. These show diverse geometries and seismic characteristics across the study area—from well-stratified, laterally continuous reflectors with low amplitude variation atop the MTDs and the Palliser Bank, to wavy sediments in deeper sections, and faulted, fractured reflectors with higher lateral amplitude variation beneath the MTDs. The seismic stratigraphic and structural interpretation of subsurface geological layers in the Palliser Canyon and Palliser Bank enhanced our understanding of past slope instability events in the region and supported the assessment of potential future mass movements. However, open questions remain, such as whether gas migration pathways and subsurface gas accumulations influence slope stability along the canyon flanks.

Investigating the characteristics and timing of the most recent glaciation in the upper Hurunui Valley, North Canterbury, New Zealand.

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

New Zealand's glaciers are among the most climate-sensitive worldwide. The Last Glacial Maximum (LGM) is well-documented within glacial records from the southern and central Southern Alps. A critical gap remains in understanding the LGM and subsequent deglaciation in the northern Southern Alps, limiting accuracy of glacier-climate models and broader interpretations about regional and global climate drivers. This study addresses this by investigating the characteristics and timing of the LGM and associated deglaciation in the upper Hurunui Valley, North Canterbury, using an integrated geomorphological and sedimentological approach. It focuses on the distributary valleys of the former Hurunui Glacier containing Loch Katrine, Lake Taylor and Lake Sheppard. A four-stage conceptual model of deglaciation has been developed. Stages 1 and 2 (dynamic ice) are characterised by climatically driven glacier fluctuations, forming terrace-margin style moraines. While rare globally, these moraines are common in the South Island and exist in the nearby Rakaia and Waimakariri valleys. Stage 3 (semi-active ice) represents partial decoupling of ice in sub-parallel distributary valleys from climate, due to down-wasting of the main glacier trunk and containment of the glacier behind a reverse slope. Local topography, lithology and glacial lake processes influence ice dynamics at this stage, resulting in complex, hillside-margin moraines aligned with drainage routes. Stage 4 (stagnant, debris-covered ice) is characterised by hummocky moraine formed through melt-out from continued down-wasting of the main trunk, leading to full ice starvation in the distributary valleys. Paraglacial features in the valley also indicate significant post-glacial landscape evolution, including an ~6% (34m) decrease in Lake Sumner's surface elevation since the LGM. This study highlights that while temperature is the primary driver of glacier behaviour, geomorphic and topographic settings can play important roles. This is especially true during deglaciation, as ice dynamics in distributary valleys become decoupled from the main glacial flow.

Evolution of channel capacity and its effect on flooding of the Hutt River, Wellington.

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Flooding is a frequent and costly disaster, often leading to civil defence emergencies. This study explores how geomorphic changes influence flood frequency, addressing gaps in current flood models that assume constant channel capacity, which is often inaccurate in geomorphically active rivers.

Using the Hutt River as a case study, this research investigates relationships between channel capacity changes and flood frequency and severity. With a history of major floods, the Hutt River flows through urban and industrial areas before reaching Wellington Harbour. By analysing channel capacity changes and trends, this research contributes to limited local research.

Using daily flow data from nine gauging sites, this research compares historical stage and discharge data to explore trends in channel capacity over time. Over half of the sites showed a positive trend in estimated channel capacity, while the other four showed stable or negative trends.

These findings contribute to local flood research, informing management strategies and discussions around the influences of flood protection schemes. Given New Zealand's diverse landscapes, site-specific studies like this are essential for improving flood resilience and understanding regional geomorphic processes.

Fluvial-Lacustrine and Aeolian Sedimentary Evolution of the Weihe Basin Since 3.7 Ma and Its Geomorphological Implications

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The formation and evolution of the Weihe Basin, along with the integration of the Yellow River, are key scientific issues for understanding the geomorphological development of the Loess Plateau. This study reconstructs the sedimentary environmental history of the southern Weihe Basin since 3.7 Ma, based on a 200-meter loess–lacustrine sediment core (GT3), using paleomagnetic dating, grain-size analysis, and magnetic susceptibility measurements. The results indicate that between ~3.7 and 2.6 Ma, the region was dominated by shallow lacustrine deposition, characterized by low magnetic susceptibility and fine grain size, reflecting relatively humid and stable paleoclimatic conditions, and coinciding with the maximum expansion of the Sanmen Paleo-Lake. From 2.6 to 1.8 Ma, the environment shifted to fluvial facies, with a strong correlation between magnetic susceptibility and grain size, indicating enhanced hydrodynamic conditions. This transition aligns with sedimentary phase changes in the Weihe, Linfen, and Yuncheng sub-basins during the Pliocene–Quaternary transition, suggesting progressive lake shrinkage. Between 1.8 and 1.3 Ma, alternating fluvial and aeolian processes dominated, with sediments showing loess-like or floodplain grain-size characteristics, indicative of depositional instability and the initial appearance of aeolian deposits. Since ~1.3 Ma, the basin has entered an irreversible aridification phase, marked by the development of typical aeolian loess–paleosol sequences. This environmental evolution was primarily driven by neotectonic activity related to the uplift of the Tibetan Plateau—including the Qingzang Movement (Phases B and C) and the Kunlun–Yellow River Movement—while variations in East Asian summer monsoon intensity further modulated sedimentary processes. This study provides direct evidence supporting the hypothesis that the middle reaches of the Yellow River were largely established by the late Early Pleistocene and offers new insights into regional geomorphological evolution under tectonic–climatic coupling mechanisms.

The biogenic elements retention in reservoirs of the Yangtze River basin and effect on the nutrient flux into the sea

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The Yangtze River catchment is among the most human-impacted basins globally, with a population of approximately 590 million and over 60,000 dams constructed by 2020. While the effect of reservoir dams on runoff and sediment has been extensively studied, assessing the impact of biogenic element retention in reservoirs on nutrient flux into the sea remains a challenge. This study analyzed the total organic carbon (TOC), total organic nitrogen (TN), biogenic silica (BSi), grain size, and 210Pb chronology of sediment cores collected from typical reservoirs in the catchment. The analysis was combined with the database of annual reservoir area and nutrient flux into the sea of the Yangtze River. The results showed that the average annual sedimentary retention of TOC, TN, and BSi in the reservoirs increased by 16%, 18%, and 26% after dam construction and rapid eutrophication. The total water area of large reservoirs increased from 30 to 132,000 km2 between 1960 and 2016, resulting in total accumulated retention increments of TOC, dissolved inorganic nitrogen (DIN), dissolved inorganic phosphate (DIP), and dissolved silicon (DSi) in reservoirs reaching 27, 3.5, 0.1, and 27.2 million tons, respectively. The retention increments accounted for 20.6%, 7.0%, 8.8%, and 12.1% of the total flux of TOC, DIN, DIP, and DSi into the sea during the same period, respectively. The retention of TOC and DSi in reservoirs led to a decrease in their annual flux into the sea by 67.2% and 61.4% in 2016 compared to 1960. However, the retention of DIN and DIP increased their annual flux by 6.4-fold and 4.2-fold in 2016 compared to 1960, which was attributed to the substantial emission of fertilizer and sewage in the downstream catchment area of dams. These findings provide valuable insights into biogenic element retention in reservoir catchments and their impact on nutrient flux into the sea.

Spatio-temporal fluvial changes in the western Amazon during the Pleistocene and their implications

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02B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 2:00 PM - 3:30 PM

Recent findings show a dynamic landscape in central and western Amazon during the Pleistocene, with major shifts over relatively short time scales (10^3-10^5 years). Most data feeding this geomorphological model are from sedimentary deposits along the Solimões, Madeira, and Branco rivers, lacking data from systems draining exclusively central lowlands in Amazon (e.g., Juruá and Purus rivers). Here, we provide spatio-temporal data on the geomorphological changes along the middle Juruá River over the late Quaternary using geomorphological mapping, optically stimulated luminescence (OSL) dating, and provenance analysis based on luminescence sensitivity. We identified four terrace levels (T1 to T4) and the floodplain level (FP) elevated in relation the river base level: 55-70 m (T1), 49-57 m (T2), 36-48 m (T3), 28-35 m (T4), and 5-27 m (FP). OSL ages indicate that terrace formation occurred during broad periods of fluvial incision: before 120 ka (T1 and T2), between 120 and 85 ka (T3), between 80 and 70 ka (T4), and between 8 and 5 ka (FP). T3 age allows bracketing to 120-85 ka the period when the large channel belt avulsion near Carauari city, a key feature to the evolution of biodiversity in the region, occurred. Mean values of quartz OSL relative sensitivity ranged from 35 to 45%, resembling the values previously reported for Negro and Madeira rivers deposits, which are composed by a mixture of Andean and cratonic sediments. Our study reinforces the emerging understanding that important fluvial changes, capable of transforming the landscape and thus affecting regional biotic diversification, occurred within relatively short periods in the Pleistocene in the Amazon. The mechanisms driving these shifts between the stages of fluvial aggradation and incision may be related to base-level fall, possibly triggered by discharge variation, as previously suggested for similar settings in the Solimões River and western Amazon. FAPESP 2021/14022-2 and 2022/03007-5.

Navigating the chasms and pitfalls of using Multi-Temporal lidar data to detect and quantify geomorphic change of river channels.

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Prioritisation of river management actions within a catchment that are aimed towards achieving the greatest impact for stream health for the lowest cost requires an understanding of fluvial geomorphic processes and upstream and downstream connectivity.

Multi-temporal lidar data, the availability of which is significantly increasing, can be analysed to yield data which quantifies recent erosion/deposition within a river channel. To produce information of any value to river management, any analysis of the geomorphic change between two lidar dataset, must consider the errors within the lidar datasets being analysed.

Lidar datasets are of varying quality and resolution. In general, older lidar acquisitions have lower resolution. The lowest quality data of two datasets involved in an analysis, dictates the resolution of change that can be detected.

In areas with dense vegetation, such as rainforest or dense riparian vegetation the penetration of lidar laser pulses through vegetation to the ground surface can be very poor, resulting in very low ground point density. Ground point density per square metre is the ultimate determinant of meaningful results from analyses pertaining to the ground surface.

Using examples from a current study being undertaken in the Richmond River, Northern NSW, we demonstrate how geomorphic change analyses done without any consideration of low ground point density or the errors inherent in lidar derive topographic data can produce wildly inaccurate erosion and deposition data. Inaccurate erosion and deposition information misleads river management decisions and actions.

We also demonstrate the methods being used in the Richmond catchment. These methods aim to maximise the amount of information extracted from geomorphic change analysis without introducing erroneous and misleading information. This involves restricting the analysis to areas with adequate ground point density. A consequence of this restriction is results that are conservative estimates of erosion and deposition with a high degree of confidence.

Gone with the Wind: Late Quaternary Climate Sensitivity of Aeolian Landscapes in the Argentine Pampas.

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The Argentine pampas are a productive sector in southern South America where a large part of the grains consumed worldwide are produced. In the Utracan-Argentino Valley, this production occurs on sand dunes fixed by vegetation, affected by fluctuating dry spells. Its recent history has shown that the combination of poor soil management and droughts can trigger the remobilization of these dunes and the loss of the superficial – and most fertile – layer of the soil profile. This work combines the quantification of the variations in the rain and wind in the area for the last seventy years, and the study of the processes forming the valley's aeolian landforms. The dunes were active in at least two periods during the late Quaternary: 5–4 ka and 2–0.8 ka because of changes in regional atmospheric circulation, lower precipitation, and reduced vegetation cover. Shifts in wind direction and dune morphology reflect changes in the Southern Hemisphere Westerlies, while vegetation loss combines with wind thresholds to drive aeolian transport. These results strengthen the knowledge of the geomorphological evolution of this productive region, the sensitivity of the dunes and the factors that cause it.

Built Up and Cut Down: Terrace aggradation and incision in a distal arid piedmont of the Southern Andes.

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02B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 2:00 PM - 3:30 PM

Distributary fluvial systems in arid environments are key archives of past environmental changes. Their deposits record shifts in hydrology and sediment supply. Understanding their long-term dynamics is necessary for reconstructing paleoenvironments and anticipating the geomorphological response of dryland river systems to future climate scenarios. Yet, many of these systems, particularly in the South American Andean piedmont, remain poorly dated and understudied. The Atuel–Diamante distributary fluvial system (AD-DFS) is a prominent late Quaternary landform located in the distal arid piedmont of the central Argentine Andes. The Atuel River is the main source of irrigation for agriculture and livestock in that region. However, its geomorphological evolution remains largely undetermined. This study presents the first optically stimulated luminescence (OSL) dating of the AD-DFS, focused on fluvial terraces and paleochannels of the Atuel and Diamante rivers. Along with the OSL chronology, geomorphological mapping and sedimentological analysis were conducted to characterize the stratigraphic context of the dated units. The oldest fluvial terrace, with sediments dated to ~11.5 ka, records a phase of continued sediment accumulation, succeeded by incision and terrace formation occurring between 5.5 and 5 ka, highlighting a long-term response of the system to postglacial meltwater availability and climatic fluctuations. By placing the AD-DFS within a broader glacial–interglacial framework, this work contributes to understanding the climatic controls on distributary fluvial dynamics in the dryland Andean piedmonts. The results offer a pivotal baseline for understanding how arid and semi-arid river systems may respond to ongoing and future climate change.

From Snow to Rain: A Cluster-Based Approach to Streamflow Forecasting in Transitional Mountain Basins

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07G: Cryosphere Processes and Mountain Hydrology, Conway 2, February 3, 2026, 5:00 PM - 6:30 PM

As mountain climates warm and the proportion of winter precipitation falling as rain increases, traditional regression-based streamflow forecast methods—reliant on snow water equivalent (SWE) as a primary predictor—are becoming less reliable. To address this, we evaluate whether pre-clustering water years and basins by hydroclimatic characteristics can improve regression-based streamflow forecasts across snow-affected watersheds.

We conduct two experiments. In the first, we use unsupervised k-means clustering to group individual water years within representative basins in the Western US based on precipitation-weighted temperature and snow fraction, computed from PRISM data across six elevation bands in each basin. This intra-basin clustering captures year-to-year variability in precipitation phase and melt conditions. In the second experiment, we apply the same framework to the CAMELS dataset to cluster 100 basins in the Western US using topographic and hydrometeorological metrics, grouping basins with similar phase-transition dynamics and runoff behavior.

For each individual cluster, we develop a multiple linear regression model to predict April-July streamflow using April 1 SWE, cold-season precipitation, and mean temperature. Model performance is evaluated using RMSE, NSE, and adjusted R2, and compared to traditional operational regression models applied across all years or basins without pre-clustering.

Results indicate that cluster-specific models consistently outperform traditional regressions, particularly in years with rain-on-snow events or phase-transition-driven midwinter runoff. These finding suggest that clustering improves the physical realism of regression-based forecast models by accounting for interannual and spatial variability in phase partitioning and melt dynamics. This work enhances our understanding of how geomorphic thresholds—such as snowline elevation and basin hypsometry—interact with shifting hydroclimatic regimes to control runoff generation. It also offers a computationally efficient and operationally feasible strategy for adapting streamflow forecasting frameworks to changing mountain climates.

Morphological modelling of the Waiho-Tatare Avulsion (New Zealand's West Coast)

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13B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 11:35 AM - 1:05 PM

For decades the risk of flooding from the braided gravel-bed Waiho River (New Zealand’s West Coast) has been worsening due to sediment deposition causing bed levels to increase by 10–20 cm/year. The river threatens the important tourist town of Franz Joseph. Waiho floods destroyed a hotel in 2016 and the main highway bridge in 2019.

The Waiho River is now developing an avulsion into the Tatare Stream, a smaller waterway on its true right. Flood spills started in about 2010 and a defined avulsion channel started forming in early 2023. Due to a significant lateral slope advantage, the avulsion is happening rapidly and potentially irreversibly.

The Avulsion Channel is evolving through lateral erosion, downcutting and headward erosion in its upper part, and the formation of a fan at the confluence with the Tatare that protrudes downstream into and past the Tatare Gorge. Risks include erosion of land and assets, including the sewage ponds that are located on the Waiho’s true right; and increased flooding of the Tartare associated with fan formation and backwater effects.

We present the results of two-dimensional morphological modelling that aims to forecast the future evolution of the Waiho-Tatare avulsion. The model was calibrated by reproducing observed changes between LiDAR scans and run into the future through to 2029.

Our results show that the present changes will be exacerbated with continued bed level increase in the Waiho, erosion in the Avulsion Channel, and deposition in the Tatare fan. The model indicates that the avulsion is naturally irreversible, as the Avulsion Channel and Tatare Stream will permanently become the main pathway for the floods of the Waiho River.

Modelling of shoreline displacement and deformation of the Polish Baltic coastline on the basis of geospatial transformations and satellite data

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01H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring, Conway 3, February 2, 2026, 11:40 AM - 1:10 PM

Changes in the shoreline position along the Polish Baltic coast result from complex environmental processes, including wave action, coastal currents, westerly winds, and bathymetric changes. The goal of this research is to develop an iterative approach for modeling shoreline displacements based on geodetic and satellite data.

The study analyzes Sentinel-2 satellite imagery and geodetic measurements to identify shoreline positions over sequential time intervals. Characteristic points along selected shoreline segments are identified, allowing the application of spatial transformation models—from linear to higher-order transformations.

The model is developed iteratively: each subsequent phase considers new points fitting well to higher-order transformations. This creates a hierarchical model describing progressive deformations and shifts of the shoreline. Additionally, alternative approaches, including machine learning methods and computational algorithms derived from Newton's method, are evaluated.

The research has exploratory and comparative characteristics, assessing the efficiency of various computational methods against control data and their predictive utility. The outcomes can improve understanding of coastal change mechanisms and support the development of tools for coastal area management, particularly in response to storm events.

A spatio-temporally dynamic landslide susceptibility analysis for Lower Austria and strategies to account for climate change

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09J: Responses of geomorphic processes and earth surface systems to extreme weather and climate events, Conway 5, February 5, 2026, 11:35 AM - 1:05 PM

In the context of climate change, it is assumed that altered precipitation patterns and more intense rainfall events will affect the slope stability and will increase their susceptibility to landslides in many regions worldwide. One recent event strongly supporting this assumption, is Storm Boris (Anett), that occurred in September 2024 in Lower Austria. This region received a total precipitation of up to 450 mm within 5 days only, resulting in hundreds of landslides and serious floods. Already existing landslides were reinitiated, and new landslides were triggered. This increase in landslide hazard not only puts critical infrastructures such as roads and railways at risk, but also buildings and, in the worst case, threatens human lives. To minimize or even prevent potential future losses and take appropriate and timely measures, it is essential to identify where landslides might be triggered in the future under different climate change scenarios.

For this analysis, we developed a dynamic spatio-temporal landslide susceptibility model for Lower Austria. The model is based on static local environmental conditions such as topography, geology, soils and land cover, as well as on dynamic parameters like precipitation patterns, including both antecedent and triggering rainfall. It was validated using a sub-set of landslides that occurred during the heavy precipitation event in September 2024 in Lower Austria. We make our first attempt to develop a methodical framework for accounting climate change effects on landslide susceptibility analysis. By integrating climate change considerations into spatial landslide susceptibility analysis and consequent maps, this approach supports a long-term perspective in informed decision-making, promotes early warning strategies, and contributes to an effective loss reduction in potentially affected areas.

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Mechanical properties of sediments involved in retrogressive submarine landslides at Palliser Canyon (New Zealand)

Mrs Fiene Stoepke[1], Gitta Ann von Rönn[2], Oded Katz[3], Joshu Mountjoy[4], Mehrdad Soleimani Monfared[1], Christian Berndt[1,2], Sebastian Krastel[2], Morelia Urlaub[1,2], Jörg Bialas[1]
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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Submarine canyons spread all along offshore New Zealand's coast and exist on active and passive continental margins worldwide. Submarine canyons are dynamic settings and turbidity currents and mass wasting are dominant processes forming the canyon topography. Often, flank failures observed at submarine canyons are retrogressive forming retrogressive terraces. Those flank failures can pose a hazard to the population living in the surrounding coastal areas as tsunamis can form if the flank failure is sufficiently large. But even smaller flank failures can pose a hazard to e.g., submarine installations. To better assess this hazard, understanding the conditions under which retrogressive failure occurs is crucial. One key factor to investigate are the mechanical properties of the sediments. During the MAWACAAP cruise (SO310) on the German research vessel SONNE that took place in February/March 2025, gravity cores were taken in Palliser Canyon (Cook Strait, New Zealand) along a profile over retrogressive terraces resulting from slope failure. Shear vane tests and triaxial experiments were carried out on the samples taken from the gravity cores. The experiments give insight into the shear strength and the state of consolidation of the sediments. They allow us to infer the role of the sediments on flank instability and to identify possible weak layers on which slope failure could occur. The results will be implemented into a numerical mechanical model to further test the influence of mechanical properties on flank instabilities and retrogressive failure at Palliser Canyon.

The role of excess topography and peak ground acceleration on earthquake preconditioning of landslides

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Landslides are a pervasive geophysical hazard occurring in all countries and causing almost 20% of all fatalities resulting from natural hazards globally. Therefore, the ability to manage and mitigate landslide risk is an imperative, especially in high relief and earthquake-prone mountainous regions worldwide. Yet despite decades of progress, landslide research including susceptibility models and landslide forecasts still suffer from significant problems and fundamental limitations. A key limitation is the commonly held assumption that the rate of landsliding through time is constant for a given region and trigger mechanism (i.e., time-independence). Yet research has demonstrated that this is untrue for many regions and that climatic, seismic and anthropogenic events can all perturb rates of landsliding above a background rate over periods of years to decades – a process that has been termed pre-conditioning.

Here, we address the role of earthquake preconditioning of landscapes through:

- a new six-year multi-temporal landslide dataset for Papua New Guinea, spanning 2016-2022, bracketing the 2018 Mw 7.5 Porgera co-seismic inventory. False colour composites derived from high resolution PlanetLabs imagery cover the 14,000 Km2 study area, delineated by the 0.4g PGA contour. Multivariate analysis of influential factors and magnitude-frequency results will directly contribute to a susceptibility assessment of the region.

- the development of an innovative new landscape evolution model that can predict the distribution of seismically triggered landslides in earthquake-prone locations around the world. The model has been validated using the mapped data from Papua New Guinea, and other published co-seismic inventories.

Ultimately, this project will transform our ability to forecast rates and patterns of landslides before and after major earthquakes and mitigate against cascading and subsequent hazards in earthquake prone areas.

Geomorphological controls on landsliding triggered by a rare Mw 6.8 intraplate earthquake in a dryland mountain landscape (Morocco, 2023)

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05C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 11:35 AM - 1:20 PM

A large (Mw6.8) and exceptionally rare intraplate earthquake struck the Moroccan High Atlas Mountains on 8 September 2023, causing severe ground shaking, landsliding, and moderate to heavy structural damage. The disaster resulted in over 3,000 fatalities and an estimated $7 billion in economic losses. Due to the region's steep terrain, high elevations (3–4 km), and significant relief (1–2 km), USGS models predicted extensive landsliding. In response, an international Earthquake Engineering Field Investigation Team (EEFIT) conducted remote sensing and field assessments of landslides and structural damage.

Using 30 cm/pixel Maxar satellite imagery from their open data program, the team analysed a 2,800 km² area around the epicentre, focusing on zones of high peak ground acceleration (PGA) and Modified Mercalli Intensity (MMI). The resulting inventory documented ~2,500 landslides, predominantly involving rock that failed as falls, slides, or avalanches. Landslide styles were lithologically controlled, comprising slides and avalanches in Paleozoic metasediments, and rockfalls in Mesozoic sandstone-limestone units. Soil landslides were limited and mainly linked to hillslope colluvium, river terraces, and roadcut fill.

Geomorphologically, most failures initiated along ridgelines and mid- to lower-valley slopes. These slope-break initiations were influenced by variations in bedrock strength, structure and long-term hillslope evolution. While landslides occurred throughout the study area, they were concentrated in a 10 km-wide NE–SW zone, approximately 20 km southeast of the epicentre in the Oued n'Fis valley, one of the region's largest, high-order catchments. Topographic analysis suggests catchment size and relief play key roles in landslide distribution. The number of landslides recorded was notably lower than expected for such a large event, possibly due to the arid climate near the Sahara Desert, which may reduce landslide susceptibility in this low-seismicity mountain region.

Landslide Dams Triggered by Extreme Rainfall Events: A Tairāwhiti Gisborne Case Study

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03J: Landscape conditioning for cascading sediment hazards in Pacific steepland catchments, Conway 5, February 2, 2026, 4:00 PM - 5:30 PM

Landslide dams, formed when landslide debris blocks a river, occur across Aotearoa New Zealand. These events pose serious hazards to downstream areas, as sudden breaches can result in unexpected flooding and debris flows. They are also important components of complex cascading slope-river systems. Despite their contribution to sediment cascades and potential impact, they remain under-researched. Understanding the processes that control landslide dam evolution and the most effective approaches for modelling them is crucial for hazard management planning.
The Tairāwhiti Gisborne region on the East Coast of New Zealand is particularly prone to landslides and subsequent dams, due to its steep slopes, susceptible lithology, and exposure to tropical storms from the east. Despite this vulnerability, very little is known about the material properties and behaviour of landslide dams in this area, and the effectiveness of existing models have not been tested with data from dams in this region.

We investigated the Tiniroto and Waiorongomai landslide dams in this region in detail, focussing on three elements of analysis. 1) We characterised the geomechanical properties of each dam (commonly lacking in landslide dam inventories), including the grainsize distribution, liquid and plastic limits, and geometric parameters. 2) Using LiDAR and aerial imagery in ArcGIS Pro, we documented the short-term evolution of each dam through a series of engineering geomorphic maps. 3) We mapped landslide source and deposit polygons on the slopes surrounding each dam, from 1939 to 2023, as imagery was available. We compared this mapping to the outputs of national landslide susceptibility and runout models to validate the models (as part of the Sliding Lands Endeavour programme). These high-resolution landslide inventories also aided in understanding sediment contributions to the local rivers.

This research provides insight into the geomechanics of landslide dams and their evolution, and the link between slope and river cascading processes.

Quantifying source-to-sink sediment fluxes from Cyclone Gabrielle using multitemporal lidar

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09J: Responses of geomorphic processes and earth surface systems to extreme weather and climate events, Conway 5, February 5, 2026, 11:35 AM - 1:05 PM

The routing of sediment from source to sink is often described as a jerky conveyor belt. With the increasing availability of multitemporal, high-resolution lidar, we are now able to develop topographic sediment budgets that improve our understanding of sediment transport processes. However, the role of extreme flood events in sediment routing through the landscape remains poorly understood.

In February 2023, Cyclone Gabrielle caused catastrophic flooding along the eastern coast of the North Island of Aotearoa New Zealand. Repeat lidar surveys were conducted in the affected areas immediately after the floodwaters receded, allowing us to quantify the impacts and develop catchment-scale sediment budgets for the event.

Here, we report on the topographic sediment budget for the Aropauanui Basin. In this catchment, a combination of intense landsliding and the reactivation and transport of previously stored sediment deposits led to damaging floodplain deposition and the destruction of major infrastructure. The presence of an on-channel lake allowed us to attempt closure of the sediment budget for the upper catchment and estimate the volume of sediment ultimately delivered to the coast.

Our sediment budget reveals high sediment delivery ratios during this event, driven by increased connectivity of sediment transport pathways from source to sink. With the expected rise in frequency and severity of similar extreme events, our results suggest a growing efficiency in sediment transfer to receiving environments—including distant, urbanized floodplains and sensitive marine ecosystems.

The Influence of the Shotover River on Lake Wakatipu Flood Hazard

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01I: Living with geomorphic change, Conway 4, February 2, 2026, 11:40 AM - 1:10 PM

In November 1999 Lake Wakatipu (Whakatipu Waimāori) rose to its highest ever recorded level, inundating the lower-lying communities located around the margins of the lake, including parts of central Queenstown. Following that event the Otago Regional Council drove a ten-year programme of technical work that considered how to best mitigate those impacts, both directly and indirectly. Direct mitigation had a range of significant engineering and aesthetic challenges for a place that is New Zealand's best known tourist destination; the focus for much of the work centred on the capacity of the outlet for the lake, the Kawarau River.

The Kawarau River as the outlet for the lake is a relatively (in a geological context) recent phenomena borne out of a very active landscape. That landscape is characterised by high seismicity, weak lithologies, mountainous terrain and orographic effects associated with proximity to 'the main divide' (the Southern Alps). A range of evidence suggests that the major tributary, the Shotover River (Kimiākau) located a short distance downstream of the lake outlet, obstructs the flow of the Kawarau River, particularly under flood conditions.

There are two components to that obstruction - the hydraulic interaction between the two rivers and the high sediment load in the Shotover River (the choking effect that sediment load has on the relatively confined and gradually sloping Kawarau River). The culmination of this work was the construction of a training line to limit unfavourable river alignments and to actively improve the sediment buffering characteristics of the Shotover delta, located at the confluence of the two rivers. That technical work has recently been reviewed and updated to evaluate both the effectiveness of those river management measures and the data collected over the last 15 years since the previous programme of technical work was completed.

Paraglacial coasts exposed by retreating marine-terminating glaciers of Northern Hemisphere - processes, landforms and landscapes

Professor Matt Strzelecki[1], Ms Małgorzata Szczypinska[1], Mr Oskar Kostrzewa[1], Dr Krzysztof Senderak[1], Dr Jan Kavan[2]
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11G: The role of paraglacial processes in the evolution of glacial landscapes, Conway 2, February 5, 2026, 5:00 PM - 6:30 PM

The majority of marine-terminating glaciers in the Northern Hemisphere have undergone significant retreat since the post-LIA period, a phenomenon attributable to accelerated climate warming. The present-day predominant form of ice mass loss is the calving of glacier fronts, which is a significant contributing factor to global sea-level rise. Although glacier retreat and changes in mass balance are the focus of much global research, the impacts of deglaciation on adjacent coastal geomorphology are frequently overlooked. The evolution of recently exposed paraglacial coastal environments is governed by a combination of nearshore marine, coastal and terrestrial geomorphic processes. These processes involve the reworking of glacial-derived sediments, resulting in the formation of novel coastal paraglacial systems. In this study, we present a state-of-the-art review of paraglacial processes, landforms and landscapes that have developed in front of the fastest retreating glaciers in the Northern Hemisphere. We focus particularly on juvenile beaches, deltas and lagoons. Furthermore, the significance of extreme waves, including landslide-triggered tsunamis, calving waves, and iceberg roll waves, in the reshaping of young coastlines recently abandoned by glaciers is assessed. The present review will be devoted exclusively to Svalbard and Greenland, with selected examples from Iceland, Alaska and the Canadian Arctic Archipelago also being considered. The characterisation of juvenile coasts will be undertaken on the basis of rock type, recent climatic conditions and location, with particular reference to the permafrost zone. These environmental factors have a significant impact on recently initiated paraglacial coastal evolution, and enable the identification of regions of particular interest in terms of expected geomorphological coastal dynamics.

The research is supported by the National Science Centre in Poland (project: 'GLAVE- transformation of paraglacial coasts by tsunamis - past, present and warmer future' No. UMO-2020/38/E/ST10/00042).

Societal Engagement in Conserving Mudstone Region of Taiwan - How Geomorphology Turns Communities On

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09F: Engaging the relational work of geomorphology, Conway 1, February 5, 2026, 11:35 AM - 1:05 PM

Geomorphology, a subject integral to Taiwan's high school geography curriculum and environmental hazard awareness, provides a foundational understanding of the island's dynamic landscapes. In promoting geoparks, particularly in regions characterized by mudstone formations, the interplay between human communities and the land, referred to as the man-land relationship, emerges as a critical focus.

This study employed a mixed-methods approach to explore community engagement in the conservation of Taiwan's mudstone regions: (1) Qualitative Methods, semi-structured interviews and focus group discussions with local residents, educators, and stakeholders to gather insights into their perceptions and interactions with the mudstone landscape. (2) Participatory Workshops: organized a series of lectures and workshops covering topics such as mudstone geology, sustainable land use, local agriculture (with an emphasis on guava and other local produce cultivation), and environmental ethics. These sessions aimed to foster a deeper connection between participants and environment. (3) Citizen Science Initiatives: engaged community members in observation, data collection and monitoring activities related to soil erosion, land stability, and agricultural productivity, thereby promoting active stewardship and scientific literacy.

The integration of geomorphological education with community-based activities yielded several positive outcomes: (1) Enhanced Environmental Awareness: Participants developed a more profound understanding of mudstone geomorphology and its implications for local agriculture and hazard mitigation. (2) Strengthened Community Engagement: The participatory approach empowered residents to take an active role in environmental conservation, leading to increased stewardship and sustainable land management practices. (3) Promotion of Sustainable Agriculture: Insights gained from citizen science projects informed better agricultural practices by aligning farming methods with the unique properties of mudstone soils.

This study demonstrates that coupling geomorphological knowledge with community engagement strategies can effectively promote environmental stewardship and sustainable development in geopark regions. The findings underscore the importance of integrating scientific education with participatory approaches to foster resilient and informed communities.

Glacial Geomorphological and Geological Constraints on Ice Sheet Mass Loss in Dronning Maud Land, East Antarctica Since the LGM

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04G: Antarctic Geomorphology, Conway 2, February 3, 2026, 9:35 AM - 11:05 AM

The rapid loss of ice mass from the Antarctic Ice Sheet (AIS) and the subsequent rise in sea levels pose a significant threat to global climate stability. However, the mechanisms that drove significant past ice loss events, which are crucial for improving future projections, remain poorly understood. To address these uncertainties, we conducted multiple field expeditions across central to eastern Dronning Maud Land in East Antarctica — one of the least well-understood areas of the East Antarctic Ice Sheet — in order to reconstruct ice mass loss since the Last Glacial Maximum (LGM). Using detailed geomorphological and geological surveys, surface exposure dating, and high-resolution, large-scale ice sheet and glacial isostatic adjustment modelling, we have reconstructed a significant ice mass loss event in the Holocene across the Dronning Maud Land (Suganuma et al., 2022). In addition to these inland studies, newly obtained sediment cores near the present ice front from Lützow-Holm Bay, reveal an ice shelf collapse event in the Holocene, likely driven by local sea-level rise and the inflow of warm Circumpolar Deep Water. Ocean modelling suggests potential triggers and feedback mechanisms involved in these ice shelf collapses and subsequent ice mass loss (Suganuma et al., in review). In this presentation, I will summarize these recent findings and discuss their implications for the future evolution of the Antarctic ice sheet and sea-level projections.

A Review of Sediment Carbon Content Mapping Approaches for Seagrass Habitats

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09C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 11:35 AM - 1:05 PM

Seagrass ecosystems are vital for coastal carbon storage and geomorphic stability, yet literature on mapping and sediment carbon analysis remains fragmented and methodologically diverse. Current approaches to analyse the literature typically adopt either narrative or in systematic formats, with the latter often deriving quantitative bibliometrics to discern contemporary trends within the science. However, these studies derive generic information with broad terms that do not sufficiently capture diverse array of techniques deployed within these studies. Here, we present a quantitative systematic literature review that uses regular expressions (regexs) and citation network analysis to extract key techniques used in seagrass habitat mapping and sediment carbon quantification. Approximately 200 full-text peer-reviewed articles from Scopus, Web of Science, and ResearchGate were analysed. Regex patterns were developed from publicly available datasets to extract information on classification models, data collection platforms, individual satellite names, geographic study regions beyond author affiliation, and species observed. Each technique is weighted using an importance score (e.g., PageRank, betweenness centrality), allowing more influential studies to have greater analytical impact. This method improves on traditional keyword-based reviews by targeting explicit methodological details within full-text PDFs, enabling a more precise synthesis of the literature. The resulting database provides valuable insight into methodological patterns, regional research gaps, particularly in tropical contexts, and the consistency of techniques across seagrass species and climates.

High-Resolution Seabed Mapping in Coastal Megacities: Marine Geomorphology and Hazard Mitigation in the Singapore Strait

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03C: Marine and lacustrine geomorphology - mapping and applications, Dobson 2, February 2, 2026, 4:00 PM - 5:30 PM

We present a high-resolution marine geomorphological and subsurface mapping effort conducted within one of the world's busiest commercial seaways—the Singapore Strait—completed in under two weeks. Utilizing a Norbit multibeam echo sounder, we mapped seabed features such as sedimentary bedforms and structural lineaments, while single-channel "boomer" sub-bottom profiling was employed to image sedimentary layers and fault structures buried beneath the seabed. This integrated approach enables (1) stratigraphic interpretation of the late Quaternary sequence in the Singapore Strait, (2) three-dimensional reconstruction of its paleogeographic evolution, and (3) mapping of previously undocumented offshore faults. Our findings reveal how the strait's geomorphology has been shaped primarily by relative sea-level fluctuations over the past ~140 ka, alongside relict tectonic activity. Although most faults in Singapore are considered inactive since the Neogene, our results highlight the need to reassess regional structural frameworks.
Our findings highlight the critical value of marine geomorphology in informing hazard assessment and supporting sustainable management of coastal and marine environments. The newly collected data and our insights directly inform the critical needs of adaptive strategies for natural disaster risk reduction and future environmental changes.

The glacial landsystem of former mountain icefield outlet glaciers between the Whataroa and Waiho river systems, South Island, New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Glacial landform assemblages enable identification of distinct landsystems that are diagnostic of palaeo-glaciological conditions. We undertook detailed geomorphological mapping from 1 m Digital Elevation Models (DEMs), derived from the national survey campaign of airborne LiDAR by Land Information New Zealand (LINZ), to characterise the nature and behaviour of outlet glaciers of the Southern Alps icefield. We showcase the exceptionally well-preserved evidence of extensive and repeated glaciations surrounding Lake Mapourika, between the Whataroa and Waiho rivers on the west coast, documenting a variety of ice-marginal, subglacial, supraglacial, and glaciofluvial landform assemblages. Spectacular latero-frontal moraine ridges and associated breach lobe geomorphology have been developed in this region as glacier lobes have partially overridden ice-contact fans and ramps. Active recession from major latero-frontal moraines is documented by complex sequences of fluted till surfaces with low-relief ridges that lie transverse to the dominant streamlined patterns, interpreted as series of minor recessional push moraines. This landsystem is typical of active temperature glaciers and records the behaviour of ice-marginal oscillations that reflect long-term quai-stationary ice lobes. We identify considerable complexity, and hence variability of glacier dynamics, including recognisable Waiho Loop type moraine construction associated with slugs of rock slope failure material transported from the Southern Alps mountain front over time. Overall, the glacial landsystem surrounding Lake Mapourika between the Whataroa and Waiho rivers is typical of active temperate glacial erosion and variable glacier flow speeds, reflecting the high-volume supraglacial debris loads located over tectonically active terrain.

Glacial Landsystems of the Southern Alps Outlet Glaciers, New Zealand

Dr Jenna Sutherland[1], Professor David Evans[2], Professor Jonathan Carrivick Carrivick[3]
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05G: Cryogenic Landsystems of Southern Hemisphere Alpine Environments, Conway 2, February 3, 2026, 11:35 AM - 1:20 PM

Landform assemblages enable identification of distinct sediment-landform associations that are diagnostic of palaeo-glaciological conditions. The availability of high-resolution topography generated from the national survey campaign of airborne LiDAR by Land Information New Zealand (LINZ) reveals a spectacular landform record that has remained undetected beneath dense forest canopies across South Island. We undertook detailed geomorphological mapping from 1m Digital Elevation Models (DEMs) derived from this LiDAR data to characterise the nature and behaviour of outlet glacier lobes of the Southern Alps icefield. We showcase the well-preserved evidence of outlet glacier oscillations and active recession during the last glaciation of the Southern Alps, documented by a variety of ice-marginal, subglacial, supraglacial, glaciofluvial and glaciolacustrine landform assemblages. Nested latero-frontal moraine ridges and associated outwash plains dominate at icefield outlets on the west coast (Hokitika). Sloping piedmont forelands on the eastern side of the Main Divide comprise fluted till surfaces with low-relief ridges that lie transverse to the dominant streamlined patterns, interpreted as series of minor recessional push moraines. Extensive phases of valley glaciation are also evidenced on the west coast (near Mapourika), with preservation of older moraines and discontinuously preserved remnants of subdued moraines indicative of overriding by regional ice advances. Localised crosscutting and breach lobe geomorphology indicate the overprinting of parts of these landsystem signatures. Within individual sites we identify considerable complexity and hence variability of glacier dynamics; for example, corridors of smoothed topography and attenuated mega-lineations near Te Anau that are superimposed and inset within occasional meltwater channels, suggest intermittent fast glacier flow. At Lake Heron, hummocky valley floor drift occurs in arcuate zones and includes thrust block moraines that were likely constructed during readvances or surges; further palaeo-surge evidence occurs at Lake Tekapo. Overall, the landsystems reflect the high debris transfer of a mountain icefield located over tectonically active terrain.

Japan's official high-resolution active fault map based on tectonic geomorphology and its potential contribution to earthquake risk reduction

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09D: Engineering Geomorphology AND Advanced technologies for natural hazard monitoring and data integration with social vulnerability for risk reduction strategies, Dobson 3, February 5, 2026, 11:35 AM - 1:05 PM

After the 1995 Great Kobe Earthquake, the Geospatial Information Authority of Japan (GSI) created 1:25,000 active-fault maps using tectonic geomorphological methods. Since then, approximately 20 university geomorphologists have been in charge each year, and three of them, including myself, have served as committee chairs. The purpose is to reduce the risk of earthquakes; therefore, accurate active-fault identification and high location precision are required. The achievements of Japanese geomorphologists since the 1970s have shown that tectonic geomorphology is most effective for this purpose.

Geomorphological identification methods significantly differ from engineering lineament surveys (Watanabe and Suzuki, 1999). It considers the geomorphological development and focuses on the uniqueness of the landform, which can only be formed by fault movements. The theory of origin and not simply morphological features are important.

Since 1995, earthquakes have demonstrated the effectiveness of active-fault maps. The active fault lines shown on the maps coincide with the locations of the surface earthquake faults during the 1995, 2004, 2014, and 2016 earthquakes. During the 2016 Kumamoto earthquake, a strong ground motion occurred within 100 m of the fault, causing severe damage to buildings (Suzuki et al., 2022). The 1995 Kobe earthquake caused severe damage to areas where no active faults were thought to exist. However, recent maps have demonstrated the existence of active faults there (Suzuki et al., 2024).

The 2024 Noto Peninsula earthquake was caused by the activity of an active submarine fault off the northern coast; however, its existence was not fully considered before the earthquake. Behind this lies the social problem of failing to prioritize active faults. The map to be published by the GSI in 2025 indicates the existence of previously unknown active faults around the nuclear power plant.

Ground Penetrating Radar studies of tropical beach ridge stratigraphy as a proxy for reconstructing late-Holocene regional coastal evolution.

Professor Adam Switzer[1,2]
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05H: Providing 2D & 3D Subsurface Imagery of Geomorphic Environments: Ground Penetrating Radar and Near-Surface Geophysics, Conway 3, February 3, 2026, 11:35 AM - 1:20 PM

Sea-level histories spanning the Late-Holocene are crucial for linking sea-level change to climate change, yet such studies are rare. This link is proxy dependant, and most proxies only provide decadal to centennial scale resolution of both sea level and climate. Here, we examine topographically corrected Ground Penetrating Radar (GPR) profiles along with Optically Stimulated Luminescence (OSL) and Radiocarbon ages for geochronology. The efficiency of using this method to examine beach ridge stratigraphy as a proxy for reconstructing regional sea-level histories in the tropics has recently been demonstrated by Kumar et al., (2024). This approach can be a highly efficient and effective means for reconstructing regional sea-level trends in beach ridges settings. Here, we present Late-Holocene sea level histories from beach ridges in Indonesia and Thailand that were reconstructed by identifying downlap points that mark the boundary between the foreshore and shoreface and use this as a past low-tide marker. We also identify notable erosional boundaries likely related to extreme events such as tsunamis. The datasets allow us to compare and contrast the sea level history of the two coasts and link the evolution to late Holocene sea level and climate variability.

Kumar, R., Switzer, A.D., Gouramanis, C., Bristow, C.S., Shaw, T.A., Jankaew, K., Li, T. and Brill, D., 2024. Late-Holocene sea-level markers preserved in a beach ridge system on Phra Thong Island, Thailand. Geomorphology, 465, p.109405.

Sandur glacial flood-origin kettle holes as an archive of aeolian accumulation during the climate warming (Skeiðarársandur, S Iceland)

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06H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 2:30 PM - 4:00 PM

The Icelandic climate has been warming since the end of the Little Ice Age. It is reflected in the glacier front retreat, its surface lowering, and the release of new areas becoming vast deserts as Skeiðarársandur – an outwash plain. Fieldwork research conducted in the 2021/22–2023/24 seasons focused on kettle holes remaining in the wind shadow, constituting important sediment traps for wind-borne material. They are formed after the melting of ice blocks detached from the glacier front during the glacier outburst flood (jökulhlaup). Sedimentary material was collected on plates installed at ~80 depression bottoms. Average aeolian accumulation ranged from 5,000 to 7,400 g/m/yr (4.6 to 6.8 mm/yr) within the unvegetated/sparsely vegetated kettle holes of the younger outwash plain (1996 jökulhlaup), entirely located within the plume area – a pathway of the glacier meltwater from Skeiðarárjökull. The sediments were dominated by coarse-grained, poorly sorted sand, deposited mainly by saltation (50–70%). In turn, at the older level (after the 1892–1938 floods), almost entirely covered by plants, accumulation averaged from 170 to 830 g/m/yr (0.2–1.4 mm/yr). This level is a "vegetation island" surrounded by plume areas. The accumulated material was composed mainly of organic parts, while the mineral parts were dominated by medium- and fine-grained, poorly and moderately sorted sand, the dominant mode of transport of which was suspension. The processes observed in Iceland, under conditions of a warming climate, may constitute a model for reconstructing the age and processes of the end of the Pleistocene, e.g. in the European Lowlands, where there are also kettle holes of glacial flood genesis. They contain a sedimentological record for aeolian facies, documenting the period between the melting of buried ice, the permafrost thawing, and the encroachment of stable vegetation cover.

Self-Organization in Solution Pipe Patterns: A Comparative Study from Australia, Bermuda, and the Mediterranean

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05B: Karst geomorphology, Dobson 1, February 3, 2026, 11:35 AM - 1:20 PM

Solution pipes—vertical cylindrical voids in karst terrains—are enigmatic geomorphic features whose formation mechanisms remain poorly understood. Their spatial distributions suggest the involvement of self-organization processes. To test this hypothesis, we analyzed spatial arrangements of solution pipes from Australia, Bermuda, and the Mediterranean region. Spatial patterns were quantified using metrics such as radial correlation functions, distributions of distances between neighboring pipes, and Voronoi tessellation statistics. The results revealed non-random distributions consistent with self-organization driven by feedback mechanisms involving dissolution dynamics and localized groundwater flow. These findings confirm that self-organization significantly influences solution pipe formation, providing new insights into global-scale processes shaping karst landscapes.

Structural, Tectonic and Erosional Controls Governing the Evolution of Sandstone Mesas: Insights from Central European Landscapes

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05J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 11:35 AM - 1:20 PM

The formation and evolution of sandstone table mountains (i.e. mesas and buttes) result from a combination of geological and geomorphological processes. Key factors include: (i) structural predispositions – such as lithology, stratigraphy, and bedrock architecture (e.g. bedding planes) – which govern the initial shaping of sandstone bedrock into mesa forms; (ii) tectonic activity inducing rock mass fracturing along faults or fault zones; (iii) weathering, which weakens the rock and facilitates disintegration; and (iv) erosional processes removing fractured and weathered material through outflow channels and fluvial transport. While structural, tectonic, and erosional factors establish the predisposition and govern the long-term evolution of sandstone mesas, current landscape dynamics at most sites are predominantly driven by gravitational slope processes, which destabilise the rock mass and initiate collapse mechanisms including toppling, block subsidence, rockslides, and rockfalls. To investigate these dynamics, we applied a multidisciplinary approach combining: (I) geomorphological analyses based on LiDAR-derived DEMs and field mapping; (II) structural measurements revealing both gravitational displacements (e.g. tilting, rotation) of rock blocks under investigation and tectonic fracturing patterns predisposing the rock mass to breakdown; (III) electrical resistivity surveying, clarifying (a) thickness of resistant caprock sandstones, (b) extent and course of fault structures, (c) evidence of block subsidence, and (d) washing out of sandy material (eluvium and colluvium) by flowing water from the mesas, notably from features such as the "Zlomová rokle" gorge (literally "Fault Gorge") dividing the Hejda mesa into two halves; and (IV) displacement monitoring using TM-71 crack gauges, confirming gravitational movements of observed rock blocks and indicating ongoing gravitational collapse of the studied mesas. Our findings from Central European sandstone landscapes support the hypothesis that the combined action of structural, tectonic, weathering, erosional, and gravitational processes is key to the disintegration and long-term morphological evolution of sandstone mesas.

A satellite-driven analysis of riparian vegetation dynamics under extreme climatic events: the case study of the Po River (Italy)

Mx Elia Taffetani[1], PhD Martina Cecchetto[1], Mr Naim Gault[2], Ms Elisa Matteligh[1], Ms Elisa Bozzolan[1], PhD Andrea Brenna[3], Professor Nicola Surian[1], PhD Walter Bertoldi[4], PhD Simone Bizzi[1]
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02K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 2:00 PM - 3:30 PM

Satellite imagery enables detailed analysis of fluvial vegetation dynamics and landscape evolution, though the sheer data volume presents significant challenges for processing and interpretation. In this study, we integrate machine learning algorithms with Sentinel-2 imagery at a 10-meter resolution to assess riparian vegetation evolution along the Po River (Italy).

A convolutional neural network model was used to delineate the yearly river active channel (the area occupied by water and exposed sediment). Within the envelope of the active channels spanning 2017-2024, a Random Forest model was then employed to classify macro-geomorphic units of water, sediment, and vegetation on a monthly basis. Vegetation patches were classified based on their yearly persistence – medium-frequency (present 50–80% of the year) and high-frequency (>80%) – and further differentiated with respect to their lateral connectivity to the active channel boundaries, distinguishing those connected to outer surfaces such as floodplains from those composing in-channel vegetation.

The results revealed differences in vegetation behaviour across different river morphologies. Compared to single-thread morphologies, transitional ones had a higher proportion of medium-frequency vegetation relative to high-frequency vegetation. Correlations were also found between hydrological conditions and vegetation dynamics. During the years 2021–2022 the river experienced an exceptional dry period. Vegetation encroachment intensified, particularly within transitional morphologies, leading to the expansion of in-channel vegetation and its connectivity with vegetation colonizing secondary channels. This tendency was reversed in 2024 when various floods occurred. Based on morphology, 2021 LiDAR topography, and artificial confinement, we analysed the persistence and removal of drought-induced vegetation patches, identifying those that were eroded by reactivation of active channel zones and those that remained stable.

The proposed frequency-based river mapping is transferable to any medium-to-large river globally and can improve our understanding of the complex feedback between river morphology and vegetation dynamics, ultimately supporting river management in a rapidly changing climate.

Satellite-based automated monitoring for quantifying the evolution of river active channel changes

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02H: Novel geospatial and remote sensing methods for geomorphological feature mapping and monitoring AND Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 2, 2026, 2:00 PM - 3:30 PM

Short-time monitoring using spaceborne images has increasingly been accepted as crucial for understanding river mobility, yet most methods focus on wetted channel shifts and centreline migration as proxies for geomorphic dynamics. Limited attention has been given to mapping the planimetric changes of the active channel—the area encompassing both flowing water and adjacent exposed, unvegetated sediment—across different river types and spatial scales. We present an automated, globally applicable framework to detect planimetric changes with respect to the active channel classified from Sentinel-2 via a convolutional neural network. Progressively gained, or lost, areas are automatically defined as activated, or deactivated, zones based on the temporal persistence of changes. By generating a continuous, updatable time series, we obtained a robust assessment of evolutionary trajectory, such as the onset of erosion zones or areas with progressive vegetation colonization. Applied to the Po River (Italy), the method effectively tracks all morphologies evolutionary trajectory, distinguishing lateral mobility from channel widening or narrowing. Results identified the exposed sediment-to-water ratio as a key indicator of river sensitivity, with reaches containing more exposed sediment relative to water showing greater responsiveness to hydrological changes. The proposed approach offers quantifiable insights for monitoring and predicting geomorphic trajectories of medium-to-large rivers, supporting the assessment of their sensitivity to climatic changes, restoration efforts, and risk mitigation strategies.

Detection of Active Landslides in the Southern Japanese Alps Using DInSAR and SAR Pixel Offset

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04C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 9:35 AM - 11:05 AM

Landslides cause significant damage to society, especially in mountainous countries. The landslide hazard is increasing due to climate change and urbanization. In Japan, many landslides occur due to monsoonal climate, steep terrain, complex geology, volcanic activity, and human influence. Monitoring landslide activity is essential for hazard mitigation. However, the field monitoring of all mountain hillslopes is difficult due to the large cost and labor. Differential Interferometric SAR (DInSAR) is an effective remote sensing technique that detects ground surface displacement using phase differences between radar images. It enables wide-area monitoring, even in inaccessible mountainous areas. However, the advantages of L-band SAR for tracking landslide dynamics remain understudied. In this research, we aim to identify the spatial distribution and activity of landslides in the Southern Japanese Alps using L-band DInSAR.

The DInSAR analysis successfully detected known active landslides and revealed previously unrecognized active landslides. We identified the pre-failure movement at the Morokozawa landslide site in the study area, which collapsed in 2023. The slope displacement was observed nearly seven years before the large-scale failure. These results suggest that DInSAR analysis using L-band is an effective tool for detecting active landslides and understanding landslide activity before the large-scale failure. Future studies should focus on quantifying geomorphic characteristics of the active landslides using LiDAR DEM and expanding the analysis to wider regions to assess correlations with rainfall and vegetation.

Formation of blocked-valley lakes and toe-cut terraces through the trunk river aggradation in the middle Sagami River, central Japan

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Fluvial processes in mid-latitude humid regions respond to long-term climate change by forming fill terraces in the upper and middle reaches of rivers through alternating phases of aggradation and incision driven by glacial cycles. Quantifying these responses to Quaternary climate change is critical for understanding long-term sediment-routing systems. However, the formation sequences of fill terraces in upper reaches, especially those shaped by interactions between trunk rivers and tributaries, remain poorly understood. We investigated fill terraces along the middle Sagami River and reconstructed their development with a focus on trunk river aggradation and changes in (dis)connectivity between the trunk and its tributaries. The Late Pleistocene fill terrace in the middle Sagami River consists of a rounded gravel bed and the finer deposits (mainly sand and mud) containing angular gravel. Optically stimulated luminescence (OSL) dating of the rounded gravel bed suggests rapid aggradation of the trunk Sagami River occurred between 120–100 ka, followed by a slower rate between 80–60 ka. Tephra layers and diatom assemblages in the finer deposits indicate that tributary riverbed slopes decreased between 100–87 ka, and lentic environments developed in tributary valleys around 87 ka. This evidence suggests that blocked-valley lakes developed in tributaries with low sediment supply during rapid trunk river aggradation, and that diverse facies of fill terrace deposits can form through a single valley-filling cycle. The fact that the finer deposits are overlain by angular gravel bed forming gently sloped toe-cut terraces implies that sediment connectivity between tributaries and the trunk river was temporarily lost during the phase of rapid aggradation but was reestablished as the aggradation rate of trunk river declined.

Rapid upstream migration of the knickpoint according to the co-seismic uplift of 2024 Noto Peninsula Earthquake, Japan

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08A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 9:35 AM - 11:05 AM

Understanding fluvial responses to co-seismic uplift is a key topic in geomorphology. While knickpoint migration associated with surface ruptures has been documented after events such as the 1999 Chi-Chi and 2008 Wenchuan earthquakes, cases linked to co-seismic coastal uplift remain rare. Following the 2024 Noto Peninsula Earthquake, we monitored the migration of knickpoints near river mouths using UAV-based surveys, focusing on river incision and fluvial terrace formation. A knickpoint that formed at the mouth of the Hakka River migrated approximately 700 m upstream within 10 days of the earthquake. During a flood triggered by heavy rainfall on 21 September 2024, the knickpoint advanced an additional 300 m upstream, accompanied by ~2 m of vertical incision. After the flood, outcrops of unconsolidated deposits intercalating with the Kikai-Akahoya tephra (K-Ah; 7.3 ka) were exposed on the riverbed with the elevation of around +3 m above sea level. In total, the knickpoint migrated ~1 km upstream within one year of the earthquake, stepwise incising both the alluvium “hardpan” and anthropogenic fluvial deposits. Our findings suggest that fluvial terraces can develop rapidly (even in the order of a year) following co-seismic coastal uplift, shortly after marine terrace formation within lowland alluvial plains. Currently, the river profile in the incised segment downstream of the knickpoint appears stable and may have reached an equilibrium state, as the bed is now armored with coarse gravel. We infer that this riverbed armoring caused by incision and sediment sorting has been temporarily inhibiting further incision.

Uncertainty in Rock Glacier Extent: Evaluating Spatial Consistency Between Manual Delineation and Deep Learning-based Mapping

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12G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 9:35 AM - 11:05 AM

Rock glaciers, permafrost landforms found in glacial, periglacial and paraglacial environments, play a crucial role in shaping high mountain geomorphology and influencing hydrology, ecology and geohazards. Accurate and consistent mapping of their extent is essential for advancing cryosphere research and informing practical applications. However, two key challenges complicate rock glacier boundary delineation: their spectral similarity to adjacent landforms and the inherent ambiguity of their shifting boundaries due to topographic and climatic changes. Manual digitisation through visual interpretation of geomorphological features remains the predominant approach however, it is inherently subjective and time-consuming. In response, recent studies explored a deep learning approach for automated and scalable mapping. Despite promising developments, studies remain limited in number and geographic scope, with minimal attention to evaluating discrepancies or uncertainties in mapped extents. In this study, we address these gaps by using deep learning models, specifically U-Net and DeepLabV3+, on a multi-regional dataset encompassing the Andes, the European Alps, and New Zealand's Southern Alps. The training data are derived from a multi-operator consensus-based rock glacier boundary mapped following the 2023 International Permafrost Association Rock Glacier Inventories and Kinematics guidelines. We assess model performance using a range of Earth observation inputs, including optical imagery, DEM, and SAR coherence, to identify the most effective combination for robust delineation. We also quantify the spatial consistency between deep learning derived outputs and manually mapped consensus boundaries to evaluate uncertainty and identify potential biases. By integrating automated methods with uncertainty assessment, this work aims not only to contribute to the evolving practice of rock glacier mapping but also to highlight the importance of validating the deep learning derived mapping outputs. Quantifying such uncertainties is vital for ensuring the reliability of mapping results and subsequent applications that depend on precise spatial delineation of landforms with dynamic boundaries.

Sedimentology and mass balance analysis of a co-seismic landslide dam-break sequence

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13D: Sediment-rich flows as extreme events: Triggers, dynamics, and environmental impacts, Dobson 3, February 6, 2026, 11:35 AM - 1:05 PM

Breaching of large landslide dams releases significant volumes of sediment that aggrade mountain valleys, leading to profound changes in channel geometry and planform. However, the stratigraphic facies assemblages that result from the associated high-energy sediment transport processes are not well characterised. This case study links evidence from recently deposited stratigraphic layers to dynamic cycling of materials, analysing changing mass balance over the course of ~4.5 years following a landslide dam formation and failure. The landslide, in the headwaters of the Hāpuku River, New Zealand, was triggered by the 2016 Mw 7.6 Kaikōura Earthquake. Partial breaching of the dam during storm events within a span of a few months contributed to sediment overloading along 6 km of the mainstem channel downstream. Over time, differential transport processes reworked the dam-breach deposits. The evolution of the valley debris train was monitored using a sequence of airborne LiDAR surveys, capturing the emplacement, reworking and exhumation of stratigraphy. Paired with field surveys, we document the contemporary evolution of this mountain valley stratigraphic sequence. Progressive enrichment of finer fractions further downstream was accompanied by development of a relatively coarse-grained, boulder cascade system in the winnowed upper reaches. The episodic aggradation and subsequent channel reworking varied over time, eroding only ~17.2% of the total deposited volume. Episodic cycles of aggradation and reworking form distinctive facies of debris flow, hyperconcentrated flow, sheetflood and reworked fluvial layers. Recurring disturbance and the continuing transit of legacy materials create ongoing disequilibrium conditions in such steep mountain channels.

Geomorphological mapping of Jökuldalur (northern Iceland): a complex landforms derived from the interplay of rock avalanches and glacial processes

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Jökuldalur Valley (dalur meaning valley and Jökull glacier in Icelandic) is located within the Dyrfjöll Mountains in northeastern Iceland (65°30′44.70″ N, 13°56′45.85″ W). The Dyrfjöll Mountains represent the eroded remnants of a Neogene volcanic caldera, composed of basal ignimbrites overlain by thick sequences of basaltic hyaloclastites and capped by basaltic lava flows. The massif is transected by the Dyr Pass (856 m a.s.l.; dyr mean door in Icelandic), which lies between the two highest peaks, Súla (1,127 m a.s.l.) to the north and Stöpull (1,074 m a.s.l.) to the south. The pass was formed by a large rock avalanche that, on its eastern side, overrode a glacier.

The aim of this study is to produce a high-resolution geomorphological map of Jökuldalur, capturing its complex landform assemblage. Geomorphological mapping was carried out through the integration of detailed fieldwork (August 2023) and photointerpretation of aerial photographs acquired on 14 August 2003, using a mirror stereoscope and Structure-from-Motion (SfM) photogrammetry. All identified landforms were delineated and digitized on a 23 July 2017 orthophoto within a GIS/CAD environment. A 2 m resolution Digital Elevation Model (DEM) was used as the base layer to enhance landform recognition and spatial differentiation.

The resulting geomorphological map reveals a high degree of complexity within Jökuldalur. Immediately below the Dyr Pass, a ~200 m high headwall hosts two small glaciers. Down-valley from the glaciers, six sets of push moraines are aligned along the central axis of the valley. The four outermost moraine ridges display a hummocky morphology, characterized by irregular relief and abundant closed depressions. At the valley outlet, a large rock avalanche deposit is present, exhibiting a distinctive pattern of alternating mounds (megablocks) and enclosed depressions. In addition, the valley slopes are affected by multiple landslides of varying size and by extensive areas of active solifluction.

Application of terrestrial “structure-from-motion (SfM)” photogrammetry to archaeological site “C2 valley” (Deir el-Bahari, Luxor, Egipt) for geomorphological mapping

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11F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 5:00 PM - 6:30 PM

The archaeological site called “C2 valley” (25º 44' N and 32º 36' E) is located on the west bank of the Nile River, opposite the city of Luxor, in the necropolis of Thebes (Egypt). This site forms a small amphitheatre-headed valley, surrounded by vertical limestone walls. The archaeological importance of the site of “Valley C2” lies mainly in the discovery of the tomb TT320 in 1881, where forty royal mummies were found.

This work aims to elaborate the detailed geomorphological mapping of the “C2 Valley”, that allows to differentiate processes and landforms of natural origin, from those that may have been altered by human action. For this purpose, the “SfM” (Structure from Motion) photogrammetry technique has been applied from a collection of terrestrial photographs. Methodological phases include: i) Capture of the photographs: they were taken in two field campaigns (411 photographs in February 2023 and 997 in December 2023) with a compact digital camera (Canon PowerShot G9X, 20 megapixels) and with the camera installed on a GPS device (Garmin Monterra, 8 megapixels). ii) Processing of photographs, with Bentley iTwin Capture Modeler software: the photographs taken with the GPS camera were processed to obtain a georeferenced-3D model; which later served as support for processing the photographs taken with the compact camera, and thus also obtain higher resolution and quality model.

As a final result, a 3D model of the archaeological site has been produced, which makes it possible to have a virtual recreation, and even to visually explore some of the most inaccessible sectors. In addition, a high spatial resolution orthophoto and DSM (2.3 cm), and a stereo-orthophoto have been produced. From this cartographic materials, the different natural and anthropogenic landforms have been delimited through photo-interpretation and digitalization, for mapping geomorphology.

Coastal zones vulnerability evaluation in the southern Baltic Sea: Shoreline dynamics and land use/land cover changes over five decades

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01E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 11:40 AM - 1:10 PM

Over the past century, coastal zones have experienced significant population growth and rapid development, often conflicting with these environments' dynamic and sensitive nature. The present study investigated five decades (1972–2023) of shoreline dynamics and land-use/land-cover (LULC) transformations along three study sectors located on a 47 km stretch of the Southern Baltic coastline. The research employed eleven multispectral Landsat MSS/TM/OLI images within a geographic information system (GIS) framework to analyze coastline variations and LULC patterns. Results showed significant accretion in Sector I (Usedom), while Sectors II and III (Wolin) experienced marked erosion. Over the entire study period, 29.59 % (3.21 km), 39.90 % (4.51 km), and 67.54 % (9.45 km) of the shorelines in Sector-I, Sector-II, and Sector-III experienced erosion. The distance correlation showed that hydrometeorological variables associated with wind-wave dynamics, exerted a stronger influence on shoreline changes. The LULC change analysis highlighted a decline in forest cover (−846.86 ha) and increased built-up areas (+1137.86) across all sectors. These results enabled the identification of four coastal vulnerability zones—one in Usedom and three in Wolin—characterized by pronounced erosion, forest degradation, and urban expansion. These findings can inform coastal management strategies by identifying high-risk zones, guiding sustainable development practices, and prioritizing areas for conservation and intervention.

Seasonal Dynamics of Soft Cliffs on the Romanian Black Sea Coast Revealed by TLS and Drone Surveys

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01F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 11:40 AM - 1:10 PM

Soft rock coastlines are highly dynamic environments, particularly susceptible to erosion from both marine and subaerial processes. This study presents the results of a recently started monitoring program focused on soft cliffs (loess) dynamics along a representative section of the Romanian Black Sea coast (2 Mai). We employed a combination of high-resolution topographic surveys, including TLS and UAV photogrammetry, to quantify seasonal variability in cliff retreat, slope instability, and volumetric sediment transfers and changes between February 2024 and May 2025, complemented by hydrometeorological measurements (air temperature, humidity and precipitation) and wave data. Our findings reveal distinct seasonal patterns of erosion and accretion on varying exposures to marine and subaerial processes. The winter months are dominated by marine erosion at the cliff toe, driven by increased storm frequency and higher wave energy. In contrast, the summer period is characterized by lower wave energy and the development of a protective beach berm, which reduces marine erosion. However, during this season, subaerial processes such as desiccation cracking and minor slumping become more prevalent, especially on SE and E exposed cliff faces, due to high thermal stress and episodic heavy rain events.

The high-resolution 3D point clouds allowed for a detailed analysis of these processes at an unprecedented spatial and temporal scale. By comparing seasonal DEMs, we were able to precisely quantify the volumetric changes and identify the primary drivers of erosion. For example, on an area of 754 sqm, 870 cbm of material was eroded between February 2024 and February 2025, 75% being lost during the energetic season (October - April) and only 25% during the calm season.

Our approach offers valuable lessons for the broader field of rock coast geomorphology, demonstrating the utility of multi-sensor approaches for capturing the full spectrum of erosional processes.

Cultural Resilience in a Changing Landscape: a Hapū-Centred Approach to Landslides in Whareponga

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The Whareponga Valley in Te Tairāwhiti, Aotearoa New Zealand, is both geomorphically dynamic and culturally rich—home to the descendants of Materoa and Porourangi, the community whakapapa to the whenua and maintain enduring ties to place.

Recent storm events, including Cyclone Gabrielle, have triggered numerous landslides across the region, including a major slip less than 100 metres from Whareponga Marae, the heart of the valley and people. Such events not only threaten lives and infrastructure but raise urgent concerns about the vulnerability of culturally significant sites and the resilience of communities who derive their identity and essence from the land itself.

This research explores the intersection of geomorphic hazard and cultural identity by investigating the nature and extent of landslide activity in the Whareponga Valley, and by examining how adaptation strategies can honour and sustain whakapapa-based relationships with place. Using a combination of geospatial analysis and applying a Māori lens to research methods, this study seeks to understand both the physical landscape changes and the cultural responses to those changes. Ultimately, this work advocates for hazard management approaches that are not just technically robust, but culturally grounded—supporting haukāinga to lead conversations about resilience, relocation, and future planning on their own terms.

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Quantifying proglacial soil carbon stocks and fluxes

Professor Arnaud Temme[1], Dr. Sigrid van Grinsven[2], MSc. Collin van Rooij[3]
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08C: Earth Surface Processes and Carbon Dynamics, Dobson 2, February 5, 2026, 9:35 AM - 11:05 AM

Although they are the mountain posterchildren of the negative impact of global warming, recently deglaciated proglacial areas also represent a carbon sink of currently unknown magnitude, as well as opportunities for ecosystem expansion. The intense interactions between geomorphic processes in unstable moraines on the one hand and stabilizing soil development on the other hand, present the dynamic template in which organic carbon is stored and cycled. A paucity of direct observations, as well as sometimes challenging field conditions, so far have been in the way of larger-scale estimates of the size of the proglacial carbon sink.

We present a set of new findings from global and particularly european-alpine studies into carbon fluxes and carbon stocks from proglacial soils in their geomorphic context. In these studies, a conditioned latin hypercube sampling scheme was adopted to ensure that not only the time since glacial retreat but also the variation in geomorphic settings was captured. Gaseous carbon fluxes were measured using Senseair CO2-sensors in transparent static chambers with a 0.2 m2 footprint, soil carbon stocks were quantified using loss-on-ignition methods and with structure-for-motion photogrammetry to determine sample volumes. Statistical and geostatistical approaches were then used to estimate per-valley fluxes and stocks, as well as larger-scale values.

Soft cliff response to cascading extreme storms

Assoc. Prof. Pawel Terefenko[1], dr Andrzej Giza[1], Jakub Śledziowski[1], Kamran Tanwari[1]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Coastal soft cliffs are subject to changes related to both marine and subaerial processes. The ability to realize measurements in coastal, hard to access, cliff areas on demand with a possibility to capture data below cloud cover with finer sub centimeter spatial resolution emerge Unmanned Aerial Vehicles (UAVs) as an important tool in coastal monitoring. Establishing a methodology for describing cliff morphology using various indicators derived from UAV LiDAR measurements enabled to bridge the existing knowledge gap by elucidating the intricate relationship between changes in cliff system morphology and the driving forces behind these changes, all within the context of ongoing climate change.

Therefore in this study, we employed various quantitative numerical methods to investigate the factors influencing coastal cliffs and the adjacent beaches. We implemented an automatic methodology using the Coastal Cliffs Morphology Analysis Toolbox (CCMORPH) to describe cliff morphology, which were then used to assess how cliffs respond to extreme weather events. We explored the roles of specific factors, such as wave characteristics, beach morphology, rainfall, and storm energy, in shaping cliff morphology. Detailed analysis of short-term cliff responses using various data mining techniques, revealed intricate mechanisms that govern beach and cliff changes. This comprehensive analysis has enabled the development of a classification system for soft cliff dynamics. Our statistical analysis highlights that the study area exhibits a unique conditional dependency between erosion processes and hydrometeorological conditions, both during and between storm events. Furthermore, our findings underscore the vulnerability of cliff coastlines to extreme water levels and episodes of intense precipitation.

Rock glacier hydrology in the semi-arid northern Rocky Mountains of the United States

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03G: Open session on rock glaciers dynamics, Conway 2, February 2, 2026, 4:00 PM - 5:30 PM

We have conducted rock glacier stream monitoring in North American semi-arid mountains, coupled with inSAR analysis of rock glacier motion. We monitored discharge and temperature of seven rock glacier streams and two snow-fed streams in 2023, with continuing single-stream discharge, temperature, and electrical conductivity monitoring at one stream.

Rock glacier streams exhibit consistent hydrologic behavior differing markedly from snow-only streams. Rock glacier streams reach baseflow ca. July 1 when snow cover is <10%. Baseflow and temperature of <4^{o} C are maintained through early autumn in contrast with declining and warming snow-fed streams. Electrical conductivity rises through summer, indicating outflow water with longer water-rock contact, possibly from basal water flow. Consistent discharge is maintained through winter and early spring.

InSAR analysis suggests correlation between discharge/temperature and velocity of rock glacier surface motion. Motion varies 2-10 cm, with more active rock glaciers generally yielding colder, persistent discharge through the summer months.

Summer rainstorms in 2023 and 2024 (20-100 mm) inform our understanding of water flow paths. All rock glacier streams display peaks of colder, low-EC water ca. 24 hours after rainfall onset. While water flow beneath the rock glaciers may increase proportionately through summer months, the storm discharge is dominated by fresh water stored in contact with ice.

We propose a conceptual aquifer-based model for rock glacier outflow. Large rainstorms during snowmelt produce rapid, muted stream responses, suggesting that rain and meltwater flow through talus above a seasonally frozen active layer. Cold and consistent summer water flow is maintained by increased intergranular and fracture flow within the evolving ice body, coupled with higher-EC basal flow through inferred sub-ice rock debris. Late summer storm outflows suggest that rainwater infiltrates an ice body storing snowmelt and ice melt in evolving intergranular spaces and fractures. Rapid infiltration of rainwater raises hydraulic head, driving rapid outflow.

Ice-marginal evolution and dynamics of the Évettes, Grand Méan and Vallonnet glaciers since the Little Ice Age (Western Alps, France)

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01G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 11:40 AM - 1:10 PM

The Little Ice Age (LIA) was a period of climatic cooling between the 13th and 19th centuries that primarily affected the Northern Hemisphere and favored the expansion and advance of glaciers. Its end resulted in a non-linear glacial retreat trend characterized by phases of re-advance or stillstand, leaving significant or in some cases subtle morphosedimentary records in the landscape. Recent technological developments allowing the acquisition of high-resolution topographic data and imagery in alpine environments have enabled the identification and mapping of previously undocumented sediment-landform assemblages. The unprecedented level of detail provided by these techniques significantly improved our ability to reconstruct past glaciological and geomorphological processes influenced by climatic and topographic forcings.

Here, we examine the evolution and dynamics of three alpine glaciers since the LIA (Évettes, Grand Méan, and Vallonnet) located in the Haute-Maurienne region of the French Alps. Our integrated approach combines geomorphological mapping and geohistorical analysis, including high-resolution geospatial (LiDAR and UAV), geochronological, and iconographic datasets. The analysis reveals distinct ice-marginal dynamics in these three adjacent glacial systems. The Évettes system exhibits an extensive and complex record, with five distinct morainic systems, subglacial lineations, and glaciofluvial deposits suggesting a surge-like behavior. The Grand Méan system is retreating at an accelerated rate due to calving in a recently formed proglacial lake. The Vallonnet system comprises two components: a disconnected ice mass and a mass fed by dry calving and avalanche inputs. These insights improve our understanding of glacier-specific responses to climatic and topographic controls since the LIA. They demonstrate how the complex morphosedimentary assemblages left by this period provide critical information to improve our capacity to anticipate the effects of future climate changes on alpine glaciers.

Modelling Longitudinal River Response to Cessation of Mine-Waste Discharge, Kawerong-Jaba Rivers, Bougainville Island, Papua New Guinea

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05I: Human Footprint in River Basins AND Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 11:35 AM - 1:20 PM

Construction and operation of the Panguna mine between 1968 and 1989 supplied approximately 812 million tonnes (MT) of mine waste into the Kawerong River, a tributary to the Jaba River that flows into the Solomon Sea. In 1989, when mining ceased, approximately 242 MT of primarily sand-sized tailings were longitudinally distributed down 32 km of river between the mine and the head of the delta. Comparison of 1989 surveyed cross sections and 2023 LiDAR-based topography confirmed a downstream-progressing geomorphic response trajectory that had resulted in upstream coarsening of the bed material, erosion of 65 MT from the Upper River and deposition of 60 MT in the Middle River that caused the Jaba River to avulse into the 500 ha Konaviru Wetland in 2017, thereby abandoning 3.7 km of channel and 20 MT of tailings, and interrupting sediment delivery to the Lower River that initiated degradation in both the Lower River and delta. A 2-D fixed-boundary HEC-RAS model of the system, with limited calibration, was developed to: (1) predict the extent of current mine-related flooding for a range of recurrence interval floods, (2) evaluate river crossing hazards using Engineers Australia (2010) criteria and (3) perform sediment transport analysis to predict erosion and deposition of tailings and future changes in channel morphology and flooding.

The sediment-transport analysis was performed using the reached averaged 2-D hydraulic output and reach-appropriate sediment transport equations based on the measured bed-material gradations (Wilcock-Crowe, 2003; Wu, Wang and Jia, 2000). The analysis was performed for both individual flood events (2- through 100-year recurrence intervals) and for average annual sediment loads based on integration of the flow-duration curves. The findings confirmed the geomorphic response model and provided temporal and spatial predictions for future tailings-related sedimentation.

More-than-human Geomorphology

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09F: Engaging the relational work of geomorphology, Conway 1, February 5, 2026, 11:35 AM - 1:05 PM

More-than-human (MTH) geomorphology is proposed as a method for undertaking socially situated geographical and holistic landscape science. As early as 1867 John Muir called for the consideration of respect for 'the rights of all creation'. Yet, due to the fact that certain portions of society benefit from nature's 'lack of rights', little headway has been made in this matter. Here, the history of geomorphology, the study of the development and resultant forms of nature, is revisited from its geologic origins to its modern geographic framings. Throughout much of this history historical and process geomorphology have been separated. However, process philosophy combined the two enabling a broader deliberation of landscapes as socially produced entities (socio-geomorphology). Ethnogeomorphology further advanced this by acknowledging cultural processes and challenging the value-neutrality of science. MTH geomorphology is put forward as a logical extension to this history through its consideration of non-human agency, embracing of indigenous perspectives and global applicability. Such a suggestion is grounded through the use of a New Zealand case study that overviews changing approaches to landscape analysis and how MTH geomorphology expands this. The way in which MTH geomorphology is conducted in practice, both in the process of research and the resultant products, is discussed. The place-based and holistic nature of the method allows for the best use of the best knowledge in the correct situation. This geographic holism reduces the limitations placed on the questions able to be asked and in turn the understandings produced. Thus, a move is made beyond 'who speaks for nature' to allowing nature to speak for itself through more attentive practices that listen and understand landscapes.

Goat Cave, an Innocuous Name for an Enigmatic Scientific Repository

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06B: Karst geomorphology, Dobson 1, February 3, 2026, 2:30 PM - 4:00 PM

A small doline leads into the huge entrance chamber at Goat Cave, on the Western Australian side of the Nullarbor in Australia. Like many Nullarbor caves, Goat Cave "breathes" air in and out according to differential pressures. This alludes to a large cave system beyond the entrance chamber. Efforts to find more passages in the 1990s did not extend the cave far.

Persistent efforts in 2023 resulted in a breakthrough to astonishing, speleothem-filled passages about 70 metres below surface. Some of the passages contain what are probably the longest halite straws in the world. These passages were also found to contain multiple corpses of possums, a snake, a bat, and a western quoll, and corpses of thousands of spiders, plus centipedes, cockroaches and other insects, all likely preserved due to the dry, salty environment in the cave. Exploration over the following two years has extended the cave system to over 1.5 km lateral extent and nearly 10 km of passage length.

Shallower caves within 5 km of an ancient cliff-line, now referred to as the Hampton Scarp, display classic flank margin cave formation features, with very large chambers and interlinked chambers, all at the same horizon. By comparison, Goat Cave lies 23 km from the Hampton Scarp and shows different features.

Passages in Goat Cave are strongly oriented ENE-WSW, similar to the nearby Thampanna Cave. This orientation may reflect a predominant joint direction in the limestone. Goat Cave's passages extend through three limestone formations to over 80 metres from surface, but do not reach the present water table. The lowermost passage appears to have a different morphology to the other passages.

This paper considers the likely methods of formation of Goat Cave and other similar caves on the Nullarbor.

A 30-year investment and implementation strategy for 18,000 km2 of drinking water catchments in southeast Queensland, Australia

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07A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 5:00 PM - 6:30 PM

Traditionally, water storage dams and water treatment plants have been the focus of investment for community drinking water security and safety while catchment investment has been piecemeal and reactive to site-scale symptoms. International best practice for drinking water safety and the updated Australian Drinking water Guidelines says a multi-barrier approach with catchments being the first barrier is required. Seqwater, the bulk water supplier to ~ 3.4 million people in southeast Queensland, has recently completed long-term planning for investment needs for water security and safety through to 2052. Catchment investment primarily targeting river corridors has been included for the first time.

This case study firstly describes a multi-tiered investment strategy to manage catchments and their river corridors with respect to degrading land-uses and warming climate influences on river system processes. The approach largely aims to work with landholders to facilitate reach-scale riparian zone condition to enable on-going ecosystem services such as riparian zone alluvium resistance to fluvial entrainment and bank mass failure, structural complexity to provide roughness to flood flows, filtering of overland runoff constituents. Secondly, a business partnerships program to implement interventions at scale across the region is outlined. Thirdly, a modelling approach to demonstrate future challenges to water treatment plants under reduced or business as usual investment in catchment management is presented.

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Have we matured? An analysis of 100 years of river restoration

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01I: Living with geomorphic change, Conway 4, February 2, 2026, 11:40 AM - 1:10 PM

Re-establishing physical structures, normative rates and magnitudes of physical, chemical and biological processes are the focus of many river and floodplain management strategies. Despite legal mandates, increasing budgets, and the growth of the restoration industry, river ecosystems continue to decline. River restoration projects have increased exponentially over the last two decades with an expenditure >$1 billion a year. As the practise of river and floodplain restoration continues to grow, the need to develop sound scientific principles is important especially given the number of organisations active in restoring rivers and policy initiatives focused on the topic. Disparities in stakeholder interests, scientific knowledge, scale of activities, and system constraints all contribute to uncertainties in river restoration. Using a data base of >1200 river restoration activities undertaken between 1920 and 2024, in the Driftless Area of the midwestern USA, we examine changes in river restoration strategies. A maturity model framework is used to assess advances in river restoration. Three questions are asked: 1). Has river restoration changed over time and in space? (2) Have river restoration projects between co-developed and co-designed by river scientists and river communities? (3) What has been learned in relation to the science of restoration in the Driftless Area?

Role of the Himalayan mountain on glacier retreat and lake evolution in the Bhutanese Himalaya over the recent decades

Mr Thongley Thongley[1], Andrew Mackintosh[1,2], Levan Tielidze[2], Weilin Yang[1,2], Andrew Gunn[1]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The Bhutanese Himalaya (BH) is home to thousands of glaciers, which in recent decades have been retreating, causing mountain hazards and changes to river flows. The emergence and enlargement of glacial lakes is a critical aspect of this change due to the risk of glacier lake outburst floods (GLOF). Despite this risk, little is known about how Bhutanese glaciers are changing and why. This study examines the behaviour of Bhutanese glaciers and lakes over recent decades, and relates this to the climatological, topographic factors responsible, including the role of the Himalayan mountain range in the BH between the 1970s and 2024. For this study, the BH is divided into north and south-facing slopes by the Himalayan mountain peaks. The north slopes face Tibet Autonomous Region while the south face Bhutan. Glacier extents for both periods were manually delineated using Landsat and Sentinel-2 images. Glacial lake data were extracted from published datasets. Results show that glaciers on south-facing slopes retreated faster (17.54 km^2/year) than those on north-facing slopes (15.01 km^2/year). Both lake-terminating glaciers and land-terminating glaciers retreated more rapidly on the south-facing slope, with little to no change on the debris-covered glacier termini on both sides of the BH. Glaciers retreated more at lower elevations, with minimal influence from slope gradient. Glacial lake area on south-facing slopes increased 1.7 times more than the north-facing slopes between 1970s and 2024. An analysis of ERA5-Land reanalysis data indicates that glacier retreat and lake expansion correlate with higher average summer temperatures, with south-facing slopes of the BH warming at a faster rate than the north-facing slopes. Higher glacier retreat and lake growth on south-facing slopes suggest increased risks to water resources and greater potential for GLOFs in Bhutan.

Examining Patterns of Discharge Variability in Australia's Largest Rivers: Insights into Fluvial Responses to Quaternary Forcing

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01A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 11:40 AM - 1:10 PM

The Central Murray Valley (CMV), located below the confluence of Australia's two largest rivers, the Murray and Darling Rivers, preserves a variety of aeolian/fluvial landforms adjacent to the current River Murray channel that provide insight into past fluvial activity in the Murray-Darling Basin (MDB). These include fluvial terraces, lunettes (lake marginal dunes), channel source boarding dunes and palaeochannels tracers with varying channel widths, depths, meander amplitudes and sinuosities. Using geomorphic mapping, combined with statistical analysis, we classify the palaeochannel traces into channel networks, representative of changing discharge regimes in the MDB. We then applied modern channel morphology-discharge relationships to the palaeochannel networks to estimate palaeo-discharge. Optically Stimulated Luminescence (OSL) dating of the palaeochannel networks and other geomorphic features in the CMV illustrates that the oldest features preserved on terraces at the CMV margins date from the previous interglacial/end of the penultimate glacial. Preserved channel traces indicate that the average palaeo-discharge was approximately from 2 to 7 times that of the modern Murray River. There is little preservation of information through much of the Upper Pleistocene before the Last Glacial Maximum (LGM), although discrete pulses of fluvial activity are likely recorded via lunette accretion. Around the LGM, there is a major fluvial regime change, with large, possibly bedload-dominated rivers re-shaping the modern floodplain of the CMV. These channels exhibit that the maximum palaeo-discharge was up to 15 times modern and were coupled with dune/lunette accretion, indicating high rates of sediment transport during a potentially highly seasonal snowmelt-dominated fluvial regime. Following the LGM, there is a succession of Holocene-aged channels all supporting higher discharge (by approximately 2 times), with the modern discharge regime establishing from the mid-Holocene. Overall, these results attest to the sensitivity of the MDB rivers to Quaternary forcing of precipitation and runoff.

Inconsistent Periodicities of Extreme Discharges in Greece: Potential Impacts on the Morphology of Greek Rivers

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

In recent years, Greece has experienced extreme, often unprecedented rainfall events that triggered damaging floods and reshaped river channels from headwaters to mouths. How increasing frequency and intensity of such extremes might affect the hydromorphological state of river corridors over short timescales remains unclear. Understanding historical flood dynamics and shifts in the periodicity of extreme rainfall is essential to assess whether climate change is driving river systems toward a more chaotic rather than equilibrium state. We analysed daily discharge data from HERA, a high-resolution pan-European hydrological reanalysis dataset (1951–2020), for 12 major Greek rivers (>100 km). Data were aggregated seasonally and annually to evaluate long-term trends. Results reveal a marked negative trend in discharges, particularly during winter, with regional differences shaped by climate, topography, and land cover. Extreme discharge events (z-score > 2.0) were examined using Fast Fourier and Wavelet Transforms to detect periodicity shifts. A dominant 7–10-year periodicity was found across most rivers. Initially, a 3–10-year cycle prevailed (1950–1970), evolving into a longer 10–20-year cycle, then losing clear periodicity in recent decades. A partial reappearance of the 3–10-year pattern has emerged in the last 20 years. Despite inherent data uncertainties, findings suggest a shift from predictable, possibly NAO- or ENSO-influenced discharge extremes to more irregular and chaotic flood regimes. This transition, along with riparian vegetation changes and growing anthropogenic pressures, may accelerate river morphology shifts and heighten flood risks in vulnerable areas. In many local rivers, reduced high flows have enabled riparian vegetation encroachment and channel narrowing, disrupting the balance where floods historically limited vegetation growth and promoted long-term channel widening.

Large scale (1:32,000) Geomorphological Map of Heard Island, Australian External Territory

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Heard Island, a World Heritage listed, and remote sub-Antarctic territory of Australia located in the southern Indian Ocean has a unique landscape shaped by active volcanism, glaciation, and climate processes. Our large-scale (1:32,000) geomorphological map builds on recent efforts to map the geology of the island , and it integrates high-resolution satellite imagery and digital elevation models to classify and delineate volcanic, glacial, periglacial, coastal, and fluvial landforms. Key geomorphic elements such as the Big Ben massif, lava flows, moraines, and rapidly evolving proglacial and paraglacial environments are captured in detail. The dynamic nature of the landscape resulting from glacier retreat is a point of interest in the mapping, but also present a challenge, given the incomplete satellite and aerial photo records in setting where cloud-free images are rare. Other challenges include differentiating between glacial and volcanic landforms in some locations, noting that the island has been seldom visited and field verification is lacking in many cases. Despite these limitations, the map provides a critical tool for understanding landscape evolution in one of the world's most remote and least disturbed volcanic-glacial systems. The island's rapidly changing environment, driven by glacial retreat and climate change , makes it a natural laboratory for investigating interactions between volcanism, glaciology, and climate change. Our new large-scale map enhances capacity to monitor changes over time, identifies hazard-prone areas, and supports studies of the island's ecosystem.

Glacial and Periglacial Geomorphology of the Drang Drung, Haskira, and Pensilungpa glaciers, Trans Himalayan Ladakh, India

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Glacial geomorphological mapping is vital for understanding the role of glaciers in shaping landscapes and glacier response to climate change. In this context, we present a high-resolution glacial geomorphological map of the Drang Drung, Haskira, and Pensilungpa glaciers in Trans Himalayan Ladakh, India. The mapping was conducted using a combination of high-resolution satellite imagery (Pléiades, SPOT, Planet) supplemented with Google Earth Pro and a 2 m resolution Pléiades Digital Surface Model (DSM) in Geographical Information Systems (GIS) software. Our map provides a detailed inventory of glaciers and glacial geomorphological landforms with over 12,000 features extending over an area of ~290 km². These prominent features include landforms such as moraines (terminal, lateral, and hummocky), alluvial fans, flutes, rock glaciers, crevasses, and debris cones. The map has been validated by carrying out extensive field surveys in 2023 and 2024. The main map is projected at a 1:33,000 scale, and shall also serve as the baseline for cutting edge science related to glacial geomorphology, glacier evolution, paleoglacier and paleoclimatic reconstruction in Trans Himalayan Ladakh.

Quaternary landscape evolution of a Carpathian limestone massif (NW Romania) reconstructed from karst geomorphology and cave deposits

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Caves are one of the best continental environments to preserve climatically-relevant records. They acted as natural traps, preserving a broad range of sedimentary archives, sometimes in very good conditions when compared to those at surface. In isolated karst massifs, the topmost caves or cave levels are of particular interest since they could preserve the oldest geomorphological evidence on the regional landscape evolution. In this study we focus on Bisericuța („Little Church”), a short fossil cave located in the Apuseni Mountains, Carpathian Range (Romania) at ~1220 m a.s.l. Uvalas and dolines spread over an uplifted limestone plateau are the characteristic surface karst landforms. The cave has two levels: a subhorizontal upper level (the main passage), and a lower chamber that functioned as a sediment trap in the past. Preliminary research revealed the existence of a rich deposit of MIS 3 faunistic assemblage (e.g., Ursus spelaeus, Panthera spelaea, Canis lupus) with the internal texture suggesting at least three distinct accumulative events, separated either by calcite deposition or disconformities. Based on the geomorphological and sedimentological evidence, we distinguished four evolutionary stages of Bisericuța Cave and the surrounding karst plateau: 1) Development of the upper cave level during the pre-Quaternary times, as a meandering subterranean tributary of the local river; 2) At a later stage, it appears to have functioned as a drainage pipe of the uvala, probably synchronous to the development of the lower cave level; 3) Infilling with sediments and accumulation of the fossil assemblage during the MIS 3-2; 4) Formation of the semi-active ponors and the lowermost drainage pathways during the Holocene until present. The cave deposit is surprisingly rich in fossil remains considering its altitude and location, encouraging further excavation works in search of more evidence on the paleoenvironmental changes during the turbulent MIS 3-2 period.

Examining Normalized Channel Steepness within the Basin and Range, Colorado Plateau, and Transition Zone Physiographic Provinces of Utah, USA.

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07D: Tectonic Geomorphology for Mountainous Terrain, Dobson 3, February 3, 2026, 5:00 PM - 6:30 PM

Channel steepness, normalized for drainage area and discharge (Ksn-q), records information about variations in tectonic uplift, rock strength, and responses to base level change over timescales of 10^4 – 10^7 years. Our investigation uses 30m ALOS DSM, Topotoolbox/MATLAB, and GIS to examine variations in Ksn-q across upland areas of the Basin and Range, Colorado Plateau and Transition Zone physiographic provinces of Utah. In the Basin and Range, the steepest channels are located along the seismically active Wasatch fault zone (WFZ) which has Quaternary uplift rates exceeding 0.5 mm/a. Along the various segments of the Wasatch, Ksn-q clearly discerns between the fault segments known to have high fault activity and those with lower activity. Ksn-q also differentiates between channels on the actively uplifting side of the WFZ and those that are passively responding to uplift on the Wasatch back. Other ranges across the province have lower uplift rates ranging between 0.05-0.4 mm/a and their mean Ksn-q values (~40-100) are significantly lower than the central segments of the WFZ (~100-130) but are similar to the less active WFZ segments (~60-70). Within the Transition Zone, Ksn-q highlights areas of active faulting from areas of passive incision. Here, we identify a mapped Tertiary fault associated with high Ksn-q values and lidar terrain visualizations confirm there is evidence of Holocene activity. Within the canyons incised into the Colorado Plateau and the Uinta Mountains, we observe Ksn-q values that are similar to those of actively uplifting ranges in the Basin and Range. This reflects the youth of incision along many channels cutting into this epeirogenic uplifted region and the recency of some drainage integrations within the Plateau. We aim to further normalize our comparisons by rock strength and provide a statewide map of channel steepness for both visualization and classification of active uplift and incision.

Modelling surface water flow along recreational trails using high-resolution UAV-collected elevation data

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Recreational trails are essential infrastructure in protected natural areas (PNAs), facilitating visitor access and enabling activities such as hiking, biking, and horse riding. However, intensive trail use often leads to degradation, which negatively impacts both the environment and visitor safety and comfort.

In mountainous and hilly terrain, recreational trails frequently act as temporary stream channels. Surface runoff along these trails can lead to accelerated erosion, while areas where water accumulates may encourage visitors to step off-trail, resulting in trampling, trail widening, and further environmental degradation. Therefore, modelling water flow along trail networks can support sustainable trail planning and design by identifying high-risk segments for erosion and waterlogging.

This study explores the use of high-resolution (centimetre-scale) digital elevation models (DEMs), derived from UAV surveys, to simulate surface water flow along trail surfaces. Flow modelling was conducted using the HEC-RAS hydrodynamic software.

The modelling results allowed identification of trail segments prone to concentrated surface runoff and, consequently, increased erosion potential. In contrast, sections exhibiting low transport capacity were pinpointed as potential depositional areas, where water stagnation and muddy conditions are likely to occur. These results offer practical value for trail management, enabling planners to reroute trails away from erosion-prone areas or to prioritise the installation of appropriate drainage infrastructure in problematic segments. Overall, this study demonstrates that UAV-derived topographic data combined with hydrological modelling provides a valuable tool for assessing geomorphic risks associated with trail use and informing more sustainable trail network design in sensitive mountain environments.

This study was supported by National Science Centre in Poland (2021/43/B/ST10/00950)

Annual dynamics of alluvial and colluvial fans developed on a lateral moraine, SE Iceland

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12G: Permafrost, periglacial and paraglacial geomorphology, Conway 2, February 6, 2026, 9:35 AM - 11:05 AM

Fan-shaped landforms typically develop at the mouths of mountain catchments, where steep slopes transition into flatter terrain. Positioned at the interface of the lithosphere, hydrosphere, and atmosphere, fans are important archives of long-term environmental change. Their short-term (annual) morphological evolution also offers valuable insights into high-magnitude, low-frequency events such as debris flows, avalanches, and rockfalls—processes that pose risks to infrastructure, cultural heritage, and human life.

This study investigates the annual dynamics of several small alluvial and colluvial fans that have developed within the last ~100 years in a recently deglaciated zone of the lateral moraine of Breiðamerkurjökull, SE Iceland. These fans are shaped not only by material delivered from their catchments but also by the reworking of sediments previously deposited by the glacier, making them an example of periglacial landscape response to glacier retreat and climate change.

High-resolution (centimetre-scale) digital elevation models were generated from UAV surveys conducted annually and biannually between 2016 and 2025. While most of the fan surfaces remained relatively stable, the data revealed clear signatures of morphological change driven by episodic, high-intensity processes. Our results show that:

(1) fan surfaces experienced notable morphological change within short timescales;
(2) changes were spatially and temporally variable;
(3) the most significant transformations were caused by debris flows, avalanches, and rockfalls;
(4) the proportion of fan area with elevation change exceeding the minimum detection threshold (0.10 m) varied annually from 0.5% to ~10%;
(5) fan response was influenced by multiple factors, including morphometry, surface composition, timing of events, and process diversity.

These findings highlight the value of UAV-based monitoring for understanding the short-term geomorphological evolution of dynamic fan systems in deglaciating environments.

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Five years of InletTracker: New developments and insights for monitoring bar-built estuaries

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04F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 9:35 AM - 11:05 AM

InletTracker is an earth observation tool which utilises over 40 years of satellite imagery data to assess and analyse the entrance conditions of bar-built estuaries. It provides insights into bar formation and the subsequent connectivity between an estuary and the ocean. The tool also addresses key challenges regarding data collection for bar-built estuaries, particularly for remote and regional locations where long-term datasets are often lacking. Since its release five years ago, InletTracker has been implemented at a range of sites around the world to enhance our understanding of the geomorphology and dynamics of bar-built systems.

To evaluate the impact of InletTracker since its development, we conducted a review of its applications over the past five years. This involved the analysis of peer reviewed and grey literature to understand how the tool has been utilised. Particular attention was given to identifying features of the tool that have been most useful for studying bar-built estuaries. Based on this investigation, InletTracker was further developed to enhance its accuracy and usability, and to incorporate recent advancements in earth observation science.

The updated InletTracker is now being applied on a global sample of bar-built estuaries. This analysis is returning a range of meaningful insights into inlet dynamics and is demonstrating the improved capabilities of InletTracker. This global-scale analysis highlights the value of InletTracker in advancing our scientific understanding of the entrance processes of bar-built estuaries. This is particularly relevant given the dynamic nature of these estuaries and their increased vulnerability due to climate change.

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Stream Power as a Predictor of Geomorphic Change: A Study of Auckland Floods

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

A series of intense storms across Auckland in 2023 caused rapid geomorphic adjustments across the region's drainage networks, offering a critical opportunity to evaluate stream power metrics for erosion prediction. Rapid bank erosion and channel adjustment pose significant risks to adjacent land and infrastructure. This study applies a GIS-based analytical framework drawing on works by Yochum et al. (2017) and the SPIN (Stream Power in Networks) model of Ghunowa et al. (2021) to quantify spatial patterns of stream power, boundary shear stress, sinuosity and other predictors of erosion potential.

LiDAR-derived digital elevation models enable extraction of drainage network form and reach-scale channel gradient metrics. We integrate this data with temporally discrete channel-change measurements to calibrate model parameters derived via differencing pre- and post-storm LiDAR surfaces. Additional spatial layers—including land use/land cover, soil texture classes and geologic substrate maps—are incorporated through a weighted overlay approach to refine erosion susceptibility scores, accounting for local variability.

Our workflow involves (1) automated drainage network delineation and network topology construction; (2) reach-scale computation of hydraulic and morphological indices (stream power); (3) calibration of erosion predictors against observed LiDAR-measured banks and channel changes; and (4) synthesis of erosion-potential indices with environmental variables to produce composite hotspot maps.

The resulting geospatial products offer planners and asset managers a prioritized roadmap for targeted monitoring, riparian stabilization and land-use policy adjustments. By linking process-based modelling with remote sensing calibration, this approach delivers a rapid, region-wide assessment tool adaptable to changing climate regimes and variable storm frequencies. Council stakeholders may leverage these findings to guide resilient infrastructure siting and develop strategic mitigation plans anticipating future flood and erosion hazards.

References:

Ghunowa, K., et al. (2021). Stream power index for networks (SPIN) toolbox. Environmental Modelling & Software. https://doi.org/10.1016/j.envsoft.2021.105185

Yochum, S.E., et al. (2017). Stream power framework for geomorphic change. Geomorphology. https://doi.org/10.1016/j.geomorph.2017.03.004

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Disturbance Legacies and Sediment Storage in Tairāwhiti: How Storm Sequencing Shapes Fluvial Response

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10A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 2:30 PM - 4:00 PM

The rivers of Tairāwhiti rank among the most sediment-rich systems in Aotearoa New Zealand, with catchment yields driven by steep terrain and a regime of intense hillslope mass wasting. Large alluvial stores develop on floodplains and braided reaches, priming these systems to rapidly transfer sediment during high-magnitude storm events.

Climate-driven increases in storm intensity and frequency across a warming Pacific raise questions about river recovery between disturbances. Recovery hinges on the balance between hillslope sediment supply and the river network’s capacity to transfer material—processes that typically unfold over decadal timescales in key catchments such as the Waiapu, Uawa, and Waipaoa. When storm recurrence outpaces system re-equilibration, rivers exhibit hysteresis: their present state reflects the legacy of previous storage, channel form, and hydrologic history. This study examines decadal-scale hysteresis using historic records of channel surveys and repeat LiDAR surveys bracketing major flood events in 2023. We quantify changes in floodplain and braidplain storage volumes, channel geometry, and sediment fluxes to assess how valley-scale boundary conditions—valley confinement, upstream supply, and storage capacity—influence post-storm recovery trajectories.

Results reveal that extensive floodplains and broad braided reaches can act as sediment sinks, delaying export and amplifying responses to subsequent floods. In contrast, confined valleys with limited storage flush supply quickly but are prone to rapid channel incision under successive events. These findings underscore the importance of storage-transport relationships for predicting future channel adjustment and managing flood risk in sediment-rich river systems under changing climatic regimes.

Reducing uncertainty in landslide age-roughness modelling through roughness analysis of coseismic landslides from the 2016 Mw 7.8 Kaikoura earthquake

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Landslide inventories, which accurately record the spatial distribution of landslides across wide regions, normally lack a temporal dimension. Although geomorphic relationships provide insight into the relative timing of landslides, pinpointing precise ages is limited to traditional landslide dating techniques. Studies have demonstrated that landslide deposit surface roughness can serve as a proxy for landslide age when calibrated against landslides with numerically constrained ages. However, due to natural variability in initial surface roughness and uncertainty in traditional landslide dating techniques used to calibrate landslide age-roughness models, the uncertainty of age estimates is high.

In addition to age, initial landslide deposit surface roughness may reflect differences in lithology, slope steepness, slope direction, failure style, and climate. We investigated non-age-related controls on roughness using 107 medium to large coseismic landslides from the 2016 Mw 7.8 Kaikōura earthquake. For each landslide, we calculated mean deposit surface roughness using 10, 15, and 20m Richter wavelets, assigned geologic information from pre-existing maps, and derived additional attributes including slope steepness, slope direction, and failure style. Using the data, we plan to first apply Random Forest regression to assess the relative influence of lithology, slope steepness, slope direction, and failure style on initial deposit surface roughness. We will then fit an interpretable regression model to derive correction coefficients, enabling normalization of roughness values and improving the precision of landslide age estimations.

Age-roughness modelling offers a promising approach to address the lack of age information in landslide inventories, but the methodology remains in its early stages. By adjusting for initial conditions, we aim to isolate the influence of post-failure landscape evolution on surface roughness, minimizing the confounding effects of geologic and geomorphic variability. This is especially important in seismically active regions, where improving the precision of landslide age estimates across diverse terrain can enhance paleoseismic studies.

Adding landslide ages to the paleoseismic puzzle: Refining earthquake chronologies in the southeastern North Island, New Zealand

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05D: Advances, challenges and future directions in Tectonic Geomorphology AND Seismic Related Cascading Hazards: How Can They Contribute to Improve Paleoseismic Studies?, Dobson 3, February 3, 2026, 11:35 AM - 1:20 PM

The paleoseismic record for the Hikurangi Subduction Zone (HSZ), New Zealand, has been approximated using various geologic and geomorphic proxies including paleo-tsunami deposits, uplift and/or subsidence, marine terraces, and turbidites. Collectively, these records point to four events on the southern Hikurangi margin in the past 2000 years, while similar proxies provide evidence for additional earthquakes on nearby upper plate faults (e.g. Palliser-Kaiwhata, Wairarapa). Landslides, which are often a direct result of ground motions for earthquakes larger than Mw 4, may provide an avenue to better understand the paleoseismic record and ground motions from paleoearthquakes. The Wairarapa region, in the south-eastern part of New Zealand's North Island, hosts tens of thousands of landslides preserved in the landscape and is the site of large (Mw>6.5) historical earthquakes and forecasted very large (Mw>8) earthquakes. Here, we use the timing and locations of landslides in the Wairarapa as proxies for large paleoearthquakes on the HSZ and related upper plate faults in the region.

In an effort to build an age-roughness model to date landslides across the wider Wairarapa, we obtained numeric ages of 12 paleo landslides using radiocarbon dating. Results from these 12 landslides indicate hillslope movements span the Holocene, with an abundance of activity in the most recent ~2000 years along the Wairarapa coast. New landslide ages overlap with pre-existing proxies supporting the occurrence of three of the four HSZ earthquakes (2145-1837, 1505-1283, and 881-795 cal. Yrs BP) and two suspected Palliser-Kaiwhata earthquakes (2256-1869 and 1261-965 cal. Yrs BP).

Landslide ages, especially at regional scales, can improve the resolution of the paleoseismic record where existing proxies are inconclusive or span a wide age range. Furthermore, unlike other proxies, landslides allow us to better understand the spatial extent of ground shaking related to paleoseismic events to better prepare for future events.

Marine Geomorphology of Fiordland Fjords: Decoding Paleoglacial Signatures from Seafloor and High-Resolution Seismic Datasets

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03C: Marine and lacustrine geomorphology - mapping and applications, Dobson 2, February 2, 2026, 4:00 PM - 5:30 PM

Fiordland, located along the tectonically active southwestern coast of New Zealand, contains a network of 16 fjords that preserve a glacially sculpted landscape characteristic of temperate coastal environments. This study presents a regional-scale investigation of fjord evolution based on newly acquired multibeam echosounder bathymetry and high-resolution seismic reflection data. By integrating seafloor and subseafloor datasets with mapped regional fault structures, bedrock lithology, and catchment area estimates, the spatial configuration and geomorphic architecture of the Fiordland fjords are assessed in detail.

The analysis identifies the distribution, depth, and morphology of overdeepened basins, their sedimentary infill, bedrock sills, and submerged deltas. These features are key to reconstructing the retreat dynamics of former ice masses. Quantitative geomorphometric analysis highlights the influence of structural inheritance, lithological boundaries, and catchment characteristics on basin development and sediment accumulation. Results demonstrate how fjord geometry was shaped by glacial advances and, in turn, influenced retreat behaviour. Wider fjord mouths promoted enhanced melting and buoyancy-driven retreat, while the location of main basins indicates zones of focused glacial erosion. Bedrock geology and mapped faults play critical roles in controlling fjord orientation and limiting their along-trend extent, reflecting strong tectonic influence on glacial confinement. This integrated framework enables the evaluation of spatial patterns in erosion, sediment accommodation, and glacial occupation across the region. Synthesising geomorphic, structural, and stratigraphic observations supports a proposed set of glacial retreat dynamics for Fiordland, contributing to a broader understanding of paleoglaciation in tectonically active temperate environments and offering a foundation for interpreting glacial histories in this understudied part of New Zealand. The study underscores the value of integrated seafloor and subseafloor datasets in marine geomorphology and highlights the role of high-resolution acoustic mapping in reconstructing fjord evolution and postglacial landscape transformation.

Development of an intracontinental plate boundary transfer zone, Marlborough, Aotearoa New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The 2016 Mw 7.8 Kaikōura earthquake highlighted the complex three-dimensional intracontinental plate boundary transfer zone between subduction and oblique continental collision in central Aotearoa New Zealand. The 3-D architecture of the transfer zone and associated Marlborough Fault System between the Hikurangi subduction margin and the Alpine Fault is not as well understood as the plate boundary segments it joins. We review existing geological and geophysical data and including additional new thermochronological data to understand the spatial and temporal controls on the evolution of the transfer zone. Three distinct domains comprise the transfer zone. (1) The Eastern domain, where faults formed during Cretaceous continental breakup still play a dominant role in controlling the evolution of the region. At depth, plate motion is localized into a mid-crustal ductile shear which separates the transfer zone from the underlying Pacific slab. (2) The Central domain, where deformation is taken up on two cross-cutting fault sets, reflects a shift from oblique continental collision to a strike-slip plate boundary over the past 10 Ma. To the southeast, the Chatham Rise impinges on the Marlborough transfer zone, reducing the space available for mid-crustal shear. We suggest its influence will increase in the future. (3) The Western domain, an older and advected segment of the central transfer zone, now abuts and is structurally above the Alpine Fault having migrated through the main divide. We posit that the development of the Marlborough intracontinental transfer zone through these three domains is controlled by structures inherited from Cretaceous deformation and breakup of Gondwana and its current tectonic setting as a segment of the evolving Pacific-Australian plate boundary.

Understanding dynamic source-to-sink sediment contributions across contrasting rainfall events in the Ōreti river, Southland, New Zealand.

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02J: Mountain sediment cascades and landscape response to changing climate, Conway 5, February 2, 2026, 2:00 PM - 3:30 PM

Understanding how sediment moves through the sediment cascade from mountainous headwaters to downstream receiving environments is critical for managing erosion-prone landscapes and mitigating future impacts from climate change. In this study, we applied sediment fingerprinting using geochemical tracers, combined with nested measurements of suspended sediment and flow, to investigate sediment loads and source contributions during three contrasting storm events in the Ōreti River catchment (2,200 km²), a mixed alpine–hill country catchment in Southland, New Zealand.

The catchment is predominantly underlain by greywacke, with ancient volcanic lithologies in the steep headwaters, transitioning downstream through loess-covered hills and sandstone to lowland alluvium. Composite source samples were collected across the major geologies to represent key erosion processes, including surface soils, channel banks, and subsoil materials associated with mass movement erosion (e.g. gullies and landslides). Suspended sediment was sampled during three storm events in February 2020 (major flood), September 2020, and July 2022 at four nested gauging sites (Lumsden, Benmore, Wallacetown, Taramoa). Between 4-6 samples were collected per site during each event, allowing assessment of both spatial and intra-event temporal variations in sediment provenance. All samples underwent particle size and geochemical analysis (XRF and LA-ICP-MS). Tracers exhibiting non-conservative behavior were excluded, and statistical methods used to optimise tracer selection. A Bayesian unmixing model was used to estimate proportional source contributions, which were then combined with event suspended sediment loads to quantify mass-apportioned source contributions.

Results provide insights into both intra-event and event-specific variability in erosion source dynamics, influenced by rainfall patterns, geomorphic setting, and catchment connectivity. This integrated approach shows how sediment source contributions change during and between contrasting storm events, providing a basis to evaluate future catchment responses under changing climate.

Geohistory of anthropogenic forcing: insights into the temporal trajectory of the natural artefact of the Danube delta (Romania)

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The Danube delta is Europe's least densely populated area and the second largest wetland. Inventories of flora and fauna have revealed remarkable biodiversity, and the area was classified as a Biosphere Reserve by UNESCO in 1990.

But the Danube Delta is also a cultural hot spot, and this aspect is often overlooked. The 'Archaeology of the Danube Delta' mission (https://archeologie-danube.hypotheses.org/) has shown that this vast wetland area has been occupied by man for thousands of years. What's more, the archives and various ancient documents available enable us to draw up a geohistory of anthropogenic forcing over the last 400 years. The abundance of ancient sources is conducive to the reconstruction of a temporal trajectory of artificialisation showing the gradual construction of the Danube delta landscape. From the 16th century until 1856, this refuge area was characterised by a traditional society of fishermen and hunters, where adaptation to the environment was paramount through the establishment of a subsistence economy. From the second half of the 19th century until the 1940s, the Danube delta, which had been nothing more than an 'aquatic desert', saw the intervention of Western powers in favour of capitalist ideology. The latter was based on two ideas: to promote international trade via river navigation (work of the European Danube Commission) and to develop the delta's land (thoughts and actions of Grigore Antipa). The Communist period between 1945 and 1989, meanwhile, was based on a vast project to develop the delta.

Today, the Danube delta conveys an image of 'unspoilt nature'. However, the geohistorical approach allows us to demonstrate, on the contrary, that the Danube delta is the result of anthropic forcings gradually put in place over the last 400 years.

Urban streams in the Garonne valley (France).

Geohistorical trajectory of the making of urban river landscapes

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11I: Urban Streams: From Long Trajectories to Restoration Issues and Hazard Management, Conway 4, February 5, 2026, 5:00 PM - 6:30 PM

As a general rule, work on the city/river relationship focuses on the example of one urban site. Our aim is to study urban river landscapes on the scale of the entire Garonne valley (south-west France) using a geohistorical approach on different, overlapping spatio-temporal scales.

From its source to its mouth, sixty-five towns with more than 2,000 inhabitants have developed in the Garonne valley. Several types of urban settlement can be distinguished, and the location of these sites offers great diversity. Some towns are now far from the river and outside the flood zone, as the Garonne has changed over time. In the end, only 23% of Garonne towns were originally located in flood-prone areas. Among these towns, the examples of Toulouse and Agen show that urban river landscapes are strongly linked to different policies to combat flooding of the river. Here, the extent and frequency of flooding of the Garonne plays a fundamental role in shaping urban river landscapes. Sustainable hydromorphological management of watercourses is not taken into account. The schemes put in place are designed to contain and reduce floodwater by simplifying river forms (reducing the number of islands).

While the development of the dykes has had a particular impact on the trajectories of the Garonne's urban river landscapes, a number of initiatives aimed at enhancing river resources are also playing a role. Several towns in the Garonne region have developed policies aimed at reconnecting with the river, through the redevelopment of river frontages. The Garonne then becomes a source of landscape amenities. Numerous leisure and cultural activities are being developed everywhere, and nowadays, urban regeneration on the river is extending to a wider scale (metropolis), with many new initiatives springing up.

Identifying and conserving natural abiotic states in bar-built estuaries enables effective application of environmental flow. assessments and management interventions.

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04F: Bar-Built Estuaries: Dynamics, Disturbances, and Future Challenges, Conway 1, February 3, 2026, 9:35 AM - 11:05 AM

Bar-built estuaries cycle through a wide range of abiotic conditions in both their open and closed states. These abiotic states are typically associated with changes in salinity, often spanning fresh to marine conditions. However, it is during the closed states that complexity amplifies, where extended mouth closures can result in the development of either extended fresh or hypersaline conditions. Closed states also induce extreme water level variations, well below or above average tidal ranges, resulting in the modification of available estuarine habitat over a range of temporal scales from daily to decadal. These complexities are largely driven by the interplay of regional climate and wave conditions interacting with local estuary geomorphology, the latter being a good predictor of the range of possible abiotic states that can develop in an estuary. Typical abiotic conditions, in turn, drive characteristic biotic responses.

In South Africa, ‘archetypal’ conceptual models identified seven open states and more than eight closed states evident across nearly 300 estuaries. The country’s Environmental Flow (EFlow) methods adopted these conceptual models to ensure that natural processes are protected. These methods also emphasise the preservation of natural variability in abiotic states typical of an estuary. Additionally, this approach highlights the importance of NOT intervening during naturally occurring extreme states (e.g., hypersalinity), unless linked to anthropogenic drivers of change (e.g., flow reduction). This is often counterintuitive to the need to manage all estuaries with similar operational rules. However, conserving natural stressors is necessary to ensure evolutionary processes and future climate resilience.

Reconstructing the Last Glacial Maximum landscape of the Malta Plateau from seismic data: Insights into the ancient Malta-Sicily land-bridge

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Since the Last Glacial Maximum (LGM), significant sea-level fluctuations have controlled the long-term geomorphological evolution of the Maltese Islands, located in the south-western part of the Malta Plateau, in the central Mediterranean Sea. It is well established that a land-bridge connected the Maltese Islands to Sicily at that time. However, direct geomorphological evidence from current offshore regions remains scarce, primarily due to the limited availability of high-resolution bathymetric and seismic datasets, as well as potential tectonic influences. This study aims at bridging this gap by reconstructing the LGM palaeocoastline of the Malta Plateau through the analysis of 2D multichannel seismic profiles acquired during offshore oil exploration surveys and EMODnet bathymetry data.

Seismic stratigraphic interpretation revealed two main acoustic facies: (i) a lower unit, interpreted as corresponding to the pre-Plio-Quaternary (pre-PQ) sequence widely outcropping in the Maltese Islands; (ii) an overlying unit attributed to the Plio-Quaternary (PQ) deposits onlapping on an erosional surface marking the top of the pre-PQ sequence, interpreted as the Messinian unconformity. The integration of seismic and bathymetric data enabled the identification and mapping of the western palaeocoastline of the land-bridge connecting the Maltese Islands and Sicily during the LGM, at depths ranging between 119 and 131 m below present sea level. This palaeolandscape was progressively submerged during post-LGM transgression, with key features being preserved beneath a thin sediment cover. A coastal palaeolagoon system, bounded offshore by a structural high, was also identified.

Although the eastern sector of the Malta Plateau remains poorly resolved due to limited seismic coverage and continuous reshaping caused by mass transport processes, the western reconstruction refines previous palaeogeographic models and provides robust geomorphological constraints on LGM sea-level dynamics in the tectonically complex Mediterranean area.

Using vegetation-based spectral indices as indicators of slope sensitivity to rainfall: a case study from the Northern Apennines, Italy

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Landscape sensitivity is a key concept to understand the spatial and temporal variability of slope instability under conditions of landscape and climate change. Mountain environments are intrinsically sensitive landscapes where even small variations in external factors, such as intense precipitation, temperature excursions, snowmelt or human-induced land use changes, can trigger significant geomorphological responses. In line with this framework, this study evaluates whether variations in vegetation spectral indices can act as indicators of landslide occurrence or reactivation in response to intense rainfall events in a pilot area of the Modena Apennines (Northern Italy). The study area corresponds to the Scoltenna catchment which features a remarkable number of active and dormant landslides of different types and sizes. The most frequent are slow-moving earth slides and earth flows affecting clayey terrains which are proved to be sensitive to either intense or prolonged rainfall.

The research analyzes the Normalized Difference Vegetation Index (NDVI), Green NDVI (GNDVI), and other spectral indices derived from PlanetScope and RapidEye imagery to detect post-failure vegetation changes and identify landslide events. The research investigates the capacity of these indices as potential tool for detection and monitoring of landslide activity as well as the identification of potential new landslides or newly reactivated landslides not yet mapped. Additionally, the research is supported by RGB imagery analysis for visual interpretation and semi-automated detection of landscape changes. To validate the spectral-based landslide identification, the results are compared with the national Inventory of Landslide Phenomena in Italy (IFFI) and displacement data derived from Synthetic Aperture Radar (SAR) imagery and the available landslide susceptibility map. Correlations with meteorological records are also examined to explore triggering conditions. By integrating optical and radar data, this study proposes a multi-sensor approach to assessing slope sensitivity to rainfall, improving the understanding of landslide sensitivity in mountain areas.

An integrated approach to understand landslide dynamics under climate change: a case study from the Emilia Apennines (Northern Italy)

Dr Vittoria Vandelli[1,2], Sofia Costanzini[3], Francesca Grassi[2,3], Francesco Lelli[1], Luca Lombroso[3], Francesco Mancini[2,3], Carlotta Parenti[1,2], Paolo Rossi[2,3], Mauro Soldati[1,2]
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07C: The geomorphological impacts of landslides and their associated hazards, Dobson 2, February 3, 2026, 5:00 PM - 6:30 PM

Landslide activity can be significantly enhanced by extreme rainfall events, which are becoming more frequent due to the ongoing climate change. The Emilia-Romagna region (Northern Italy) has been severely affected by such events in recent years, including in May 2023 and October 2024.

In this context, this study focuses on the Gaiato historical landslide, in the Emilia Apennines, an intermittent slow-moving landslide primarily controlled by a complex structural setting characterized by lithologies with contrasting geomechanical behaviours: fractured sandstone cliffs, subject to rock falls and block slides, and underlying clayey terrains, prone to earth and debris flows. Slope instability is also favoured by springs’ activity at the contact between sandstones and clays, and the limited surface drainage. As a consequence, the Gaiato landslide can be subject to reactivation, particularly in response to intense and/or prolonged precipitation, making it a key study site for understanding slope sensitivity to climate change.

An integrated approach has been applied to study the recent dynamics of the Gaiato landslide. High-resolution geomorphological mapping has been conducted using UAV-based LiDAR-derived DEM, complemented by InSAR. Site-specific meteo-climatic data have been also collected and analysed from an on-site weather station.

In April 2025, a significant reactivation of the upper part of the landslide was observed, likely triggered by prolonged and exceptionally high rainfall inputs occurred in the previous months. Landslide reactivation lagged behind peak rainfall, probably due to delayed rainwater infiltration reaching deep rupture surfaces. Similar lag effects have been documented in other landslides in the Emilia Apennines.

This integrated approach not only proved to be helpful in identifying the landslide sectors involved in the reactivation but it is also expected to contribute to the understanding of slope evolution in the region under evolving climatic conditions which is a crucial aspect for supporting targeted risk mitigation strategies.

Shifting Grounds: Modeling the Interplay Between Soil Depth and Landslides

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12C: Spatio-temporal landslide assessments – new challenges in mapping, modelling, validation and scenario building, Dobson 2, February 6, 2026, 9:35 AM - 11:05 AM

Many different models exist for landslide prediction. Possibly the parameter with the highest uncertainty in these models is soil depth. While most studies acknowledge its importance, few studies include the spatial variability of soil depth in the predictions. In addition, in mountainous areas, landslides are one of the main processes shaping the relief and therefore have a significant impact on the spatial distribution of soils. In this study, we model the interaction between long-term soil formation and landsliding. Soil formation from bedrock is modeled by a depth-dependent soil production function. Soil is then redistributed in the landscapes by water erosion processes and landslides. The factor of safety is calculated at each time step by using the dynamic soil thickness and rainfall. First, the model is evaluated by comparison of the modeled soil depth with published field measurements (Iida et al., 1999). The relation between soil depth and topographical attributes, such as slope, curvature, or compound topographic index, shows how including landsliding processes generates patterns of soil depth that reflect the observations much better than a simple model that only includes soil formation and water erosion. Finally, the model is applied to a study area in the Akaishi Mountains to model the occurrence of landslides there. Landslides were mapped by remote sensing between 1992 and 2002. It is shown that by taking into account the modeled soil depths, the prediction of landslide occurrence is improved over a model with spatially constant soil depth.

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Understanding Spatio-Temporal Dynamics and Processes in Landslide Geomorphology through Integrated InSAR and UAS: Observations from "Amynteo Mining Site" Mega-landslide, Greece

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01C: State-of-the-art and new perspectives in long-term monitoring and analysis of landslide dynamics, Dobson 2, February 2, 2026, 11:40 AM - 1:10 PM

The Amynteo mega-landslide in northern Greece represents one of the most significant mass-wasting events in southeastern Europe in recent decades, with substantial geomorphological, geotechnical, and socio-economic impacts, causing the relocation of an entire village (Anargiri). Understanding such large-scale slope failure requires a multi-scale and multitemporal approach that captures both the surface dynamics and underlying controlling processes. This study investigates pre- and post-failure surface motion associated with the event by integrating Earth Observation (EO) data and Unmanned Aerial System (UAS) surveys. Surface motion gradients extending from the mine toward the nearby village of Anargyri were assessed using multi-temporal SAR interferometry (MT-InSAR) and offset tracking techniques, together with high-resolution UAS-derived Digital Surface Models (DSMs) and orthophotos. We examined the limits of each technique in measuring surface motion and exploited their complementarities across multiple spatial and temporal scales. Multi-sensor SAR datasets, including Copernicus Sentinel-1 and TerraSAR-X, were processed using MT-InSAR, supported by Copernicus EGMS products and the SNAPPING online service. Offset tracking contributed insights in areas with high displacement gradients where phase decorrelation limited interferometric methods. Repeated UAS campaigns further enhanced spatial interpretation and deformation quantification. Our analysis indicated persistent ground deformation in the pre-failure phase, spatial variability in displacement rates, and post-failure reactivation zones. The integration of InSAR and UAS photogrammetry links geomorphic process domains, such as headscarp retreat, lateral spreading, and toe bulging, with slope kinematics. We also investigate how hydrological forcing, mining-related disturbances, and lithological controls contribute to the triggering of the landslide. The study highlights the spatial and temporal dynamics of the Amynteo landslide and demonstrates the value of integrating diverse EO and UAS techniques for advancing landslide geomorphology and hazard assessment in complex slope systems. This multi-scale, multitemporal monitoring approach enhances the early detection of instability and supports the development of early warning strategies in mining environments.

BAD2BED Project: Tracking 70 years of sediment dynamics in Italian badlands

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Italian badlands offer a unique opportunity to explore how geomorphic systems respond to long-term climatic and anthropogenic pressures. The BAD2BED PRIN2022 project, titled “BADland morphodynamics assessment and hillslope-channel BED coupling in the context of global change”, focuses on three key sites capturing the north–south gradient of the Italian temperate zone, which is increasingly affected by prolonged dry seasons.

Rather than treating these areas as isolated case studies, the project frames them as interconnected “open-air laboratories” for understanding landscape evolution processes.

The research adopts a multi-scalar, diachronic approach, integrating historical aerial photo interpretation, geomorphological mapping, and land use analysis over the past 70 years. Standardized criteria were established for identifying hillslope landforms and sediment source areas, enabling consistent multitemporal comparison across sites.

Attention was also given to river corridors, where changes in planform morphology were mapped to evaluate (dis)connectivity between hillslopes and channels, with particular focus on indicators of human modification such as channel stabilization and land abandonment. Concurrently, land cover changes were assessed at catchment scale, revealing how human interventions—both direct and indirect—have shaped sediment dynamics and altered fluvial systems.

These badland environments, though showing signs of activity decline, remain highly sensitive to external forcing, making them ideal for evaluating erosion risk and landscape transformation in the context of global change.

By coupling hillslope and channel analyses within a unified methodological framework, BAD2BED contributes to a broader understanding of Mediterranean morphodynamics in rural areas. The project not only offers insights into recent geomorphic trends but also supports the development of informed land management strategies at the catchment scale.

Testing the tsunami hypothesis versus storm deposition in the Voidokilia–Gialova coastal system (Peloponnese, Greece): Barrier evolution and lagoon infill reconstruction

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

In recent years, the eastern Mediterranean has been the subject of an intensifying debate regarding the sedimentary imprint of extreme marine events, particularly between tsunami and high-energy storm processes. While several studies have proposed a widespread Holocene tsunami record across the Ionian and Aegean margins (e.g., Vött et al., 2019), others argue that many such interpretations may in fact reflect episodes of enhanced storminess linked to climate variability (e.g., Marriner et al., 2021). Our study contributes new data from the Voidokilia bay - Gialova lagoon (Pylos region, SW Peloponnese), a semi-enclosed coastal system with high potential for preserving evidence of past marine flooding.

Preliminary analyses of two sediment cores (from the outer and inner/seaward margins of the lagoon) reveal at least three coarse, poorly sorted high-energy layers dated between ~5000–3000 cal BP, interpreted as candidate tsunami deposits based on stratigraphic, sedimentological, and micropalaeontological proxies. In contrast, the upper 3000 years of the sequence do not display clear tsunami signatures. This absence may not indicate a true quiescence, but rather reflect a reduced preservation potential due to the progressive widening (via progradation) and heightening of the Voidokilia barrier. The development of extensive transgressive dune systems during the late Holocene likely prevented direct overwash into the lagoon.

Ongoing work includes palaeogeographic reconstruction of the barrier–lagoon system and the use of multiproxy data (e.g., pollen, marine microfauna, macrocharcoal, GPR, OSL) to refine the geomorphological and chronostratigraphic framework. Additional cores, including one from the lagoon center, are planned to assess lateral continuity and event extent. These results underscore the importance of considering local coastal evolution when interpreting extreme wave deposits and provide valuable insights for hazard reconstructions in the Mediterranean.

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Paleogeographic evidence for flood memory and settlement strategies in prehistoric communities of the Lower Danube Plain and Dobrogea coastal region

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11F: Geoarchaeology: Interactions between people and the environment, Conway 1, February 5, 2026, 5:00 PM - 6:30 PM

This study examines how prehistoric communities in the lowlands of SE Romania adapted their settlement choices in response to hydro-morphological constraints and flood-related risks. Focusing on the Chalcolithic period (5300–3900 BCE), we integrate geomorphological, sedimentological, paleoecological, and archaeological data to analyze human–environment interactions in two complementary regions: the Eastern Lower Danube Plain and the coastal uplands of the Dobrogea region (adjacent to the Black Sea). Our results reveal a clear preference for settlement along small, low-energy rivers and interfluves during the Chalcolithic, with systematic avoidance of the deeply incised valleys and dynamic floodplains of major tributaries. In the Lower Danube Plain, Chalcolithic communities settled on slightly elevated features (such as terrace margins, river-remnant islands, and alluvial fans) or even within the floodplain zones of small rivers that lacked major flooding activity. This pattern reflects a deliberate landscape strategy that ensured water access while minimizing exposure to flood hazards from large river systems.

Importantly, our spatial analysis suggests that this avoidance of large rivers was not merely pragmatic but may reflect a deep-seated, perhaps inherited, cultural memory of catastrophic flooding: an archetypal fear that strongly shaped settlement behavior during the Neolithic and Chalcolithic. By contrast, from the Bronze Age onward, settlement patterns show increasing proximity to major rivers, suggesting a shift toward greater risk tolerance or a changing cultural perception of fluvial landscapes.

Preliminary results from the Dobrogea region support this interpretation: diachronic analysis of settlement altitudes over the past 7500 years reveals a pronounced vertical trend, with Neolithic and Chalcolithic sites significantly higher than those from Medieval and Modern times. This integrated geoarchaeological perspective contributes to broader debates on landscape memory, resilience, and the cultural mediation of environmental risk in dynamic alluvial and coastal zones.

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Tectonic Origin of Tafoni: A Morphostructural Reinterpretation

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12H: Quaternary Geomorphology and Landscape Evolution, Conway 3, February 6, 2026, 9:35 AM - 11:05 AM

Tafoni are rounded natural cavities commonly interpreted as exogenous landforms resulting from differential weathering. However, this study proposes a novel endogenous interpretation based on tectonic processes, supported by morphostructural evidence and historical references. A two-stage formation model is presented: the first occurs during the emplacement of plutonic bodies or the folding of stratified rocks, where stress concentration along pre-existing discontinuities generates lacunar spaces through localized elastic deformation. In the second stage, erosion combined with positive isostatic rebound exposes these weakened zones, triggering spontaneous and progressive disaggregation of the rock. This reinterpretation, supported by recent studies (Lee et al., 2024) and classical works (Vidal Romaní, 1984), explains both the internal and external morphology of tafoni, regardless of lithology. A historical and typological review is also provided, from early descriptions in the 19th century to modern morphogenetic classifications. The results challenge the traditionally accepted exogenous genesis of tafoni and open new perspectives for their interpretation as indicators of hidden tectonic processes.

Geomorphology rules: How the evolution of riverbank monitoring has fundamentally changed river operation rules

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07A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 5:00 PM - 6:30 PM

River streamflow rules that define operations, including irrigation transfers and environmental flows, have been fundamentally modified due to geomorphic monitoring in a number of rivers in the Murray Darling Basin. Much of this can be linked to geomorphic investigations in the Goulburn River almost two decades ago, with an evolution that has moved from casual observations, to erosion pins, to lidar, to drone-based photogrammetric 3D change detection and consideration of machine learning. We outline this evolution in riverbank monitoring and the extent to which it has influenced the science and river operations throughout Australia, including the Murray, Campaspe, Broken, and the Edward Kolety Wakool Rivers. The evolution of techniques applied is an indication of the pace of change in environmental monitoring, leading to dramatically increased understanding of patterns at a range of scale, and greatly increased resolution of cause-and-effect relationships, including explicit linkages between geomorphic processes, hydraulics and streamflow patterns. We interrogate the role of human geomorphologists in the digital age, and look at opportunities (and gaps) for advancement from here. A key message is that even with the rate of historical evolution of geomorphic monitoring, future evolution needs to be more thoughtful to keep up with analysis techniques (e.g. AI) and changing needs like increasing climate variability.

Paleoseismic studies inform past complex interactions between fault rupture and volcanic eruption in the Taupō Rift, New Zealand

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05D: Advances, challenges and future directions in Tectonic Geomorphology AND Seismic Related Cascading Hazards: How Can They Contribute to Improve Paleoseismic Studies?, Dobson 3, February 3, 2026, 11:35 AM - 1:20 PM

Paleoseismic studies in the rhyolite-dominant section of the Taupō Volcanic Zone and Rift, in the central North Island of New Zealand, have shown close temporal associations between surface fault rupture (indicating earthquakes of M>6) and volcanic eruptions. These associations include ruptures recorded in fault exposures that occurred immediately pre-, during, or immediately post-eruption (~40% of the cases), as well as ruptures not linked to eruptions (~ 60%). These observations have important implications for how we assess volcanic and seismic hazards, and for emergency response during complex cascading hazard events. In the Taupō Rift excellent surface expression of faults and well-dated volcanic strata enable robust and extensive quantification of incremental fault displacement and activity rates. At appropriate distances from the active volcanic centres, paleoseismic excavations display well-dated eruption products with thickness values that are large enough to enable observations of temporal associations between volcanic eruptions and large earthquakes to be resolved. In this dynamic environment, large and sudden processes, such as ignimbrite-forming eruptions, can overwhelm the landscape and bury important information, but can also provide well-dated geomorphic surfaces that are subsequently displaced by faulting.

Temporal linkages between fault rupture and volcanic eruption provide the basis for physical and numerical modelling of causal relationships between tectonism and volcanism, and the trajectory of compounding and cascading hazards. Globally, while extensional faulting occurs within volcanic arcs at some plate boundaries, the high rates of faulting and large-volume rhyolite eruptions in the Taupō Rift makes this an ideal setting for understanding interacting crustal processes.

We present examples of the rich prehistoric record of interactions between fault rupture and volcanic eruption from the Ōkataina and Taupō volcanic centres in the central Taupō Rift and illustrate our progress to date on the circumstances under which large earthquakes promote volcanic eruptions and vice-versa.

Comprehensive Assessment of Snow Avalanche Activity in the Bucegi Mountains, Southern Carpathians, Romanian Carpathians

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The study of snow avalanches in mountains with inherited or current glacial forms and significant active periglacial processes is essential for understanding avalanche hazards and their geomorphological impact. Snow avalanches cause considerable damage to transportation routes, tourism infrastructure, and forests, and often result in numerous human casualties.

Our study was conducted in the Bucegi Mountains, Southern Carpathians, Romanian Carpathians, an area known for both a high incidence of snow avalanches and very active winter tourism. Therefore, both natural or spontaneous snow avalanches and those triggered by tourists occur here. We selected two areas with a significant record of avalanche events. One is the northern sector of the mountains, with elevations exceeding 2500 m a.s.l. and prominent glacial landforms. The other is the Sinaia ski area, located in the southern half of the Bucegi Mountains, where altitudes exceed 2000 m a.s.l.

To evaluate avalanche activity, we primarily considered the controlling factors of avalanches. Morphometric parameters (valley orientation, slope angle, length of avalanche corridors, and the elevation of starting and runout zones) were extracted from a Digital Elevation Model. Climatic variables (snowfall amounts, temperature variations, and wind speed, direction, and frequency) were processed using data provided by the Sinaia weather station (1500 m a.s.l., 45°36′ N, 24°37′ E; observation period: 1979–2024) and the Omu Peak station (2505 m a.s.l., 45°27′ N, 25°27′ E; observation period: 1961–2024). On the other hand, to obtain dendrogeomorphological information on the frequency and magnitude of avalanches, we extracted data from tree-ring growth patterns and used avalanche event statistics from the archives of the Mountain Rescue Public Service in the Bucegi Mountains.

Our study can contribute to better land-use planning, the safe development of winter tourism, and more effective management of mountain traffic.

Comparative analysis of 1D and 2D hydraulic approach for fluvial flood inundation mapping

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Fluvial flooding is demonstrated by water overflowing the banks and affecting the adjacent floodplain. The traditional approach for fluvial flood modeling is the physically-based hydrologic-hydraulic approach, where the hydrologic part is used to define design discharges with specific return periods while the hydraulic part is used for modeling the water flow though the channel and floodplain based on the estimated design discharges. In this study, we aimed at comparing and assessing 1D and 2D hydraulic models using MIKE+ model and geographic information systems. For instance, we focused on deriving flood extents and flow depths based on the officially estimated design discharges (Q_{10}, Q_{100}, Q_{1000}) by the Slovak Hydrometeorological Institute. We applied the two hydraulic approaches on a short section of the Gidra River (3.1 km) and assessed their accuracy using also benchmark official flood maps created under the EU Floods Directive (2007). The 1D and 2D models were cross-evaluated against each other as well as against the benchmark official flood maps using six metrics. The results showed that 1D model significantly underestimated the flood extents of 2D model for all design discharges. Similarly, 1D model significantly underestimated the flood extents in official flood maps for Q_{100} and Q_{10} while for Q_{1000}, the underestimation was not so high. The 2D model slightly overestimated flood extent in Q_{1000} official flood map, slightly underestimated the Q_{100} official flood map while higher underestimation was for Q_{10}. As a result, we can state that 1D model was not able to derive comparable flood extents and flow depths to 2D model as well as to benchmark flood maps. Therefore, 1D models are not suitable for fluvial flood inundation mapping and 2D models should be chosen instead. Acknowledgment: Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project No. 09I03-03-V03-00085.

Management implications of highly variable flow regimes in Australian drylands rivers

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

In the Australian drylands, fluvial systems experience highly variable water input and throughput, from widely ranging conditions of runoff, transmission, evapotranspiration, and rainfall. Consequently, drylands rivers have highly variable flow regimes. Rivers are usually dry* but commonly experience transient flow events; in-channel flows and widespread inundation are within their expected range of behaviours. “Channel forming discharge” is spatially and temporally complex, and this has a profound effect on the fluvial architecture of semi-confined and alluvial reaches. Channels are commonly discontinuous on sub- reach to multi-reach scales (depending on the river). Flow continuity from upper to lower catchment depends on active floodplain-level flow as well as channels. Thus, drylands river flow paths are geomorphically complex. Channel character may be anastomosing, anabranching, complex macrochannels, or various subsidiary forms (distributaries, flood runners, reticulated swamps). Floodplain-level flow is marked by a range of diffuse or well-defined flow paths, scours and other forms. During a flow event in-channel flow in one reach often depends on floodplain-level flow elsewhere: floodplain-level flow is an integral part of the fluvial process.
The management implications extend deeply into basic ways that land and catchment managers interact with rivers. The main channel is not the creek: the creek system is all the channels and connected floodplain. On digital datasets or automated machine learning, the named “main channel” line will not realistically represent the creek: inundation footprints are a better guide. Functional Process Zones won’t reflect fluvial process unless they consider the total flow path. Discharge isn’t meaningfully measured by in-channel stage height: during flooding, records wouldbe improved by recording floodplain-wide volume and velocity. Culvert and bridge designs should scale to whole-floodplain water volumes: if only scaled to the channel, during flooding they will concentrate flow and become a point-source of erosion.
*excepting parts of the exogenous Murray Darling Basin

In-situ 14C exposure ages in western Dronning Maud Land indicate rapid post-Last Glacial Maximum ice-sheet thinning and potential Holocene re-thickening

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

We present the first cosmogenic in situ 14C exposure ages from nunataks flanking Veststraumen, the largest ice stream feeding the Riiser-Larsen Ice Shelf of western Dronning Maud Land, East Antarctica. By collecting samples along elevation transects from nunatak summits to the present-day ice-sheet surface, we constrain ice sheet thinning histories since the Last Glacial Maximum (LGM) and reveal potential subsequent Holocene re-thickening of the East Antarctic Ice Sheet (EAIS).

Samples from Mannefallknausane (n=6), a group of nunataks bordering the left flank of Veststraumen, show rapid exhumation at c. 10 ka down to the present-day ice sheet surface. Further upstream, the EAIS flows across the Heimefrontfjella escarpment. Samples from Vardeklettane (n=10) instead show rapid exhumation from c. 14 to 13 ka down to the present-day ice surface, while its summit remained ice free throughout the LGM. These clustered exposure ages indicate rapid ice thinning at two sites in the Veststraumen catchment area. We thus formulate a testable hypothesis that Veststraumen continued to thin below present-day elevations through parts of the Late Glacial/Holocene and subsequently re-thickened to current ice levels.

Such ice-sheet thinning and thickening histories, when fully explored, provide key validation constraints for ice sheet models intended to simulate the future response of the EAIS to global climate changes. Furthermore, collecting additional samples from below the present-day ice sheet at Mannefallknausane and Vardeklettane is key to assess the timing of the potential ice-level reversal, the magnitude of thinning before re-thickening, and average ice-surface elevations during previous global warm periods using longer-lived cosmogenic nuclides.

Ireland's Coastal Exposure Index: Quantifying Vulnerability and Protection from Climate Hazards by Natural Habitats

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01E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 11:40 AM - 1:10 PM

The latest IPCC Synthesis Report (2023) projects global sea level rise of up to 1.1 m by 2100 under high-emission scenarios, with impacts further intensified by a likely increase in storm frequency and severity. In Ireland, these effects will be highly variable, with diverse coastal landscapes – including rocky cliffs, salt meadows, and sandy beaches – experiencing different degrees of exposure to climate hazards. With 40% of Ireland's population residing within 5 km of the coast (CSO, 2016), understanding and quantifying coastal vulnerability is critical for informed risk management and adaptation planning.

This study presents a national-scale Coastal Exposure Index (CEI) for Ireland, developed using the Coastal Vulnerability model from the open-source InVEST® software suite. Building on the Coastal Vulnerability Index by Gornitz (1991), the CEI integrates multiple physical, climatic, and socio-economic variables – including geomorphology, habitat presence, wave dynamics, elevation, and population density – to assess relative shoreline exposure to climate-driven hazards.

Ireland’s west coast, facing the full force of North Atlantic storm systems, is especially influenced by wave energy. To improve the spatial accuracy of exposure assessments, this study incorporates high-resolution, multi-year hindcast wave data from the Copernicus 'Atlantic-European North West Shelf – Wave Physics Reanalysis'. Regional projections of sea-level rise are also included to account for non-uniform trends across the island.

The resulting vulnerability assessment identifies coastal "hotspots" most at risk of flooding and erosion. A comparison of exposure scores with and without coastal habitats highlights the important protective function these ecosystems provide. The findings offer strong evidence for promoting nature-based solutions as part of climate adaptation efforts.

Ultimately, this research aims to provide novel, actionable insights to support policymakers and coastal managers in developing targeted, evidence-based resilience and adaptation measures in response to the accelerating impacts of climate change on Ireland’s coastlines.

Integrating Vertical Datums to Improve Flood Susceptibility Assessment in Dynamic Coastal Environments

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Coastal areas are some of the most dynamic and vulnerable regions on Earth, where changes in terrain and tides can greatly influence the risk of flooding. To manage these risks effectively, it's essential to have accurate and well-integrated coastal monitoring data. One of the main challenges in Taiwan is the mismatch between the vertical reference systems used for land and sea measurements—land elevations are typically based on the geoid (mean sea level), while marine depths are often measured from the Lowest Astronomical Tide (LAT). This inconsistency makes it difficult to produce continuous coastal elevation models, which in turn affects the reliability of flood risk assessments. This study tackles the problem by proposing a unified vertical reference framework that aligns both terrestrial and marine data to the geoid. By comparing Digital Elevation Models (DEMs) and bathymetric data referenced to different vertical datums, we examine how these differences play out spatially and assess their impact on flood modeling. The goal is to improve the accuracy of coastal topography representations and provide a more solid foundation for hazard analysis and coastal management. Bringing consistency to vertical datums across the land-sea boundary helps create more dependable flood risk assessments, especially in areas where coastal landscapes are constantly shifting. This research highlights the value of datum unification as a key step toward better understanding and managing risks in coastal geomorphology.

Estimating Carbon Stock Changes Induced by a Landslide: Multi-Temporal Assessment of the 2016 Hongye Debris Flow, Taiwan

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The 2016 Hongye debris flow in Taitung County, Taiwan, originated from the landslide with an area about 4.8 ha and triggered by Typhoon Meranti, serves as a representative case for investigating the dynamic processes of landslides and their cascading impacts on ecosystem carbon cycling. This study contributes a multi-disciplinary monitoring framework that integrates geospatial modeling, in-situ sampling, and simulation to assess landslide-induced environmental change. Specifically, multi-temporal field surveys, remote sensing data, and spatial modeling techniques were used to quantify the changes in carbon stocks, mainly soil organic carbon and transported litter carbon, before, during, and after the landslide event. We applied regression kriging using 60 soil samples and environmental covariates (e.g., NDVI, DEM-derived indices, and climatic variables) to generate high-resolution spatial maps of soil organic carbon (C_soil). Results indicated that the regional average of C_soil declined significantly, from 70.1 to 19.7 tC/ha, following the event. By coupling debris flow simulations with pre-event soil parameters, we estimated sediment-associated carbon transport (C_litter). The simulations revealed that C_litter peaked at over 1,500 tC during the most active stage of the flow, with an average of 883.7 tC transported throughout the event. This study provides a quantitative assessment of terrestrial carbon loss from soils and surface litter, delivering a detailed carbon budget associated with slope failure and sediment transport. Future research will focus on evaluating vegetation carbon stocks (C_tree and C_underplant) using Net Primary Productivity (NPP) and spectral indices to monitor long-term vegetation succession and carbon recovery following disturbance. Overall, this research demonstrates a transferable methodology for assessing the environmental consequences of rapid landslide events. It supports risk reduction and ecosystem restoration planning by improving our understanding of disturbance-driven carbon stock changes.

Thresholds and Cascades: Quantifying 5000 Years of Human-Induced Fluvial Transformation in China's Loess Plateau

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

This study evaluates both direct and indirect anthropogenic impacts on fluvial processes in the Wei River catchment of the Chinese Loess Plateau over the past five millennia. By integrating an advanced Landlab modeling framework with evapotranspiration modules, we quantified how human activities transformed river dynamics through multiple pathways. Our findings reveal three distinct mechanisms of anthropogenic influence. First, land cover modification—primarily agricultural expansion beyond 50% coverage around 1000 BCE—directly increased sediment yields by 40–60% and amplified flood magnitudes due to reduced infiltration capacity. Second, deforestation enhanced the catchment’s sensitivity to precipitation variability, making discharge fluctuations 2–3 times more responsive to equivalent climate forcing after the agricultural threshold was crossed. Third, anthropogenic sediment pulses triggered channel instability waves that propagated downstream over centuries, reshaping flood hotspots 120–150 km downstream through altered channel geometries and floodplain connectivity. Temporal analysis indicates a shift in dominant controls: while climate accounted for 70–80% of flood variability before 3000 BP, land use impacts became predominant thereafter, contributing 55–65% to flood generation. Notably, accelerated siltation between 3400 and 2800 BP increased overbank flooding frequency by 30–40% independent of climatic conditions. These findings provide a mechanistic framework for understanding human-river couplings, demonstrating how direct land use changes can trigger cascading effects that permanently alter fluvial behavior. The study offers critical insights for managing modern river systems facing similar anthropogenic pressures globally.

Geomorphical effects of outburst floods in the Yarlung Zangbo Grand Canyon, Eastern Himalayas

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

River systems in orogenic belts evolve toward dynamic equilibrium, periodically disrupted by catastrophic outburst floods that drive rapid geomorphic change. We investigate these processes in the Yarlung Tsangpo Gorge (erosion rates: 5-10 mm/yr) through integrated field measurements, remote sensing, and 2D HEC-RAS modeling. Analysis of two contrasting events - the Gega megaflood (~10^6 m^3/s) and 2000 Yigong flood (~1.2×10^5 m^3/s) - reveals magnitude-dependent erosional mechanisms. The Yigong event caused 10 m of average erosion along 80 km of the gorge, tripling valley width through lateral scour and triggering landslides, while delivering 10^3 times more sediment than millennial fluvial budgets. Boulder-bar deposition ($\tau c > 2$ kPa) stabilized knickpoints, demonstrating flood-induced landscape stabilization. Flow structure varies systematically: megafloods generate wall-parallel vortices (>5 m/s) enabling plucking, while superfloods develop divergent (~30°), spindle-shaped flows favoring abrasion. KDE analysis of nine post-LGM floods shows medium-magnitude events (2-3×10^6 m^3/s) dominate sediment transport, contributing 64% of 13 km^3 deposits along 500 km of river. These findings establish outburst floods as primary drivers of landscape evolution in high-relief settings, with important implications for both hazard assessment and long-term incision models.

Land Use Change Effects on Soil Organic Carbon and Carbon Fluxes in the Jhuoshuei River Basin in Central Taiwan

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Land use change plays a crucial role in shaping soil organic carbon (SOC) dynamics and carbon fluxes, particularly in regions undergoing agricultural and ecological transformation. This study evaluates the impacts of land use transitions on SOC stocks and associated carbon fluxes in the Jhuoshuei River Basin in Central Taiwan, from 2007 to 2021. Land use maps from 2007, 2014, and 2021 were analyzed to identify major transitions among paddy field, cropland, forest, and grassland. The RothC (Rothamsted Carbon) model and Biome-BGC was employed to simulate SOC changes under these transitions, incorporating regional climate data and soil characteristics. By quantifying SOC variations over time, this study further explores how different land use types and their intensities affect carbon fluxes. Carbon fluxes resulting from land use transitions were estimated by evaluating SOC stock changes across different land cover types. Conversions from forest to paddy fields resulted in an average carbon loss of 84.25 tC/ha, while transitions from grassland to paddy fields led to a decrease of 22.14 tC/ha. In contrast, cropland to forest conversions contributed to a carbon gain of 78.47 tC/ha. Land use change also serves as an indicator of carbon flux variations within distinct terrestrial ecosystems. By defining constraints for specific land use transitions, this study seeks to identify optimized pathways for future land use planning. The findings underscore the importance of strategic land management in sustaining soil carbon sinks and offer insights into geomorphological carbon dynamics within highly managed catchments. Moreover, this study underscores the influence of human activities, particularly agriculture, on carbon fluxes within ecosystems and geomorphic landscapes. Building on the current findings, future research will simulate and evaluate the potential impacts of projected 2028 land use patterns on SOC stocks in the Jhuoshuei River Basin, contributing to forward-looking strategies for carbon budgeting and sustainable land planning.

Effects of cyclic freezing and thawing on mechanical properties of Qinghai–Tibet clay

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

A fine-grained clay was compacted in the laboratory and was thereafter exposed to a maximum of 21 closed-system freezing and thawing cycles. The sample height, water content, stress–strain behavior, failure strength, elastic modulus, cohesion and friction angle were measured in initial unfrozen soil as well as in subsequent thawed soil. The results show that the physical mechanical characteristic of investigated soils changed after it was subjected to freeze–thaw cycles. The height of sample increased and water content decreased before the sample exposed to 7–10th cycle of freeze–thaw, but both the height and water content remained constant after the 7th freeze–thaw. The shape of the stress–strain behavior curves were not affected by the freeze–thaw process, but the resilient modulus and the failure strength were heavily influenced by the number of freeze–thaw cycles. The minimal values for both the resilient modulus and the failure strength were frequently achieved after the specimen was exposed to about 3–7 freeze–thaw cycles, therefore, the resilient modulus and the failure strength of soils experienced seven freeze–thaw cycles could be applied to the process of cold region engineering design. For the soil investigated, the cohesion decreased with the increasing number of freeze–thaw cycles, and the friction angle exhibit an increasing trend.

The response of the Yarlung Tsangpo Gorge drainage evolution to tectonics, climate, and erosion on the southeastern of Tibetan Plateau

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

The Yarlung Tsangpo Gorge is the largest and deepest gorge in the world. Its formation and evolution are closely linked to various geological dynamics, including differential uplift of the plateau margin blocks and the development of maritime glaciers on the edge of the Tibetan Plateau. Additionally, the deeply incised canyon restricts the formation of V-shaped valleys in its tributaries and the transmission of river channels into the interior of the plateau. We conducted systematic sedimentological, geomorphological, and chronological studies on the fluvial deposits in the region, identifying a series of river-lake transition events and preliminarily establishing an overall chronological framework for the valley deposition sequence within the watershed. By integrating our findings with previous thermochronological data and analyses of watershed geomorphological characteristics in the area, we reconstructed the evolutionary process of the Yarlung Tsangpo Gorge 's drainage system during the Quaternary and explored its responses to tectonic, climatic, and erosional influences. This work will contribute to an in-depth exploration of scientific issues such as the development mechanisms of major rivers on the Tibetan Plateau, the interactions between glaciers, rivers, and surface erosion under complex tectonic backgrounds, extreme climatic and environmental events, and the catastrophic impacts of human activities on river system.

Climatic forcing controls the evolutionary pattern of Holocene C4 vegetation on the southern Tibetan Plateau

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13H: Quaternary Geomorphology and Landscape Evolution, Conway 3, February 6, 2026, 11:35 AM - 1:05 PM

The soil organic carbon isotopes (δ13Corg) serve as a valuable proxy for reconstructing the history of vegetation change, as they reflect the relative abundance of C3/C4 plants under different climatic conditions. However, on the Tibetan Plateau (TP), the world's highest and largest plateau, the paleovegetation history inferred from δ13Corg and its relationship with climate change remain poorly understood. In this study, we selected three Holocene aeolian sections, SGX, HZ and MR respectively, from west to east in the Yarlung Zangbo River Basin (YZRB) on the southern TP, where is notable for its extensive aeolian deposits. The first in-depth investigation of δ13Corg variations in aeolian deposits and the estimated relative abundances of C3/C4 plants were conducted. Our findings revealed that the western SGX section exhibited highest δ13Corg values, while the HZ and MR sections were characterized by lower values, largely owing to the climatic conditions. After correcting δ13Corg for minimal altitudinal effects, quantified C4 abundances suggested the spatially increasing temperature and precipitation generally favored C4 plants expansion, but excessive precipitation limited the growth. Temporally, C4 plants expanded during the early-middle Holocene in response to a warming trend, indicating that temperature exerted a key controlling role. However, after 6.0 ka, precipitation emerged as the dominant climatic driver with C4 plants declined in HZ and MR sections while increased slightly in SGX section. This pattern reveals that in regions primarily influenced by Indian Summer Monsoon (ISM), variations in C4 abundances corresponded to a drying trend associated with weakened ISM intensity. In contrast, in regions affected by the interaction between ISM and Mid-latitude Westerlies (MLW), C4 plant dynamics aligned with the strengthening of MLW intensity. Our results indicate the presence of C4 plants in the high-altitude areas and demonstrate that their evolutionary patterns offer a novel perspective for understanding carbon dynamics under climate change.

Temporal stability of soil moisture in an arid desert area, NW China

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01A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 11:40 AM - 1:10 PM

Temporal stability analysis is a statistical approach for describing the persistence of spatial patterns and characteristic behavior of soil moisture. Using temporal stability method, we aimed to identify statistically stable locations to estimate mean soil moisture content and examine the feasibility of confirming temporally stable locations by using other properties that were themselves relatively temporally stable. The temporal stability of soil moisture was investigated at three depths at the hillslope scale in an arid desert area, northwestern China. Results indicated that strong temporal persistence existed at three depths, and the temporal stability was more pronounced at deep soil layer than at soil surface. The temporal stability characteristics were relatively lack in a state of transition from wet to dry. Identified statistically stable locations at three depths represented well for the mean soil moisture content. The representative site for 0-6 cm soil layer can serve as a good indicator of soil moisture at other depths. The mean soil moisture contents at different depths can be predicted by other topographic and edaphic factors. This study is expected to be useful in characterizing mean soil moisture content in soil profiles on a hillslope scale.

Subaqueous delta evolution of mid-mountainous river in anthropocene: A case study of Minjiang River estuary, Southeastern China

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07F: Tropical coral reefs and reef-lined coasts AND Delta Geomorphology Observed from the Past to the Present: Interactions of Natural Processes and Anthropogenic Influences, Conway 1, February 3, 2026, 5:00 PM - 6:30 PM

The river delta is a sensitive area of land-ocean interaction and also the area with the most intensive human activities. With further economic and social development, the estuaries have become a key area for development and utilization of resources. This study takes the Minjiang River Estuary in China as the research object, and analyzes the characteristics of erosion and accretion processes of the Minjiang River estuary subaqueous delta over the past 40 years by comparing the water depth data of different periods extracting from nautical charts. The research results indicate that the subaqueous delta of the Minjiang River estuary experiences erosion first, accretion later, and then erosion again since 1983. In terms of spatial scale, overall, nearshore areas exhibit accretion, which gradually transforms into erosion as the distance from the coast increases. In recent years, due to intensive human activities, the sediment flux discharged into the sea by the Minjiang River has gradually decreased, leading to erosion in the subaqueous delta of the Minjiang River. The extraction of marine sand in the estuary area has further intensified the erosion of the subaqueous delta. However, the construction of dyke has led to accretion near the dyke.

Spatiotemporal Shoreline dynamics and Geomorphic Change Detection for Coastal Vulnerability Assessment of Pakistan

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02E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 2, 2026, 2:00 PM - 3:30 PM

Anthropogenic activities coupled with climate change, intensify the metocean factors that increase hazards for coastal communities globally. Specifically, accelerated sea-level rise poses a considerable threat to 10% of the world's total population living in low-lying coastal zones and their economic assets. For this reason, accurate identification, extraction and analysis of shoreline dynamics has become more crucial for coastal vulnerability assessment and geomorphic change detection. In the present study, the historical satellite remote sensing archives (1970-2025), along with topographic and socio-economic data was used to analyze 1050 km long coastline of Pakistan. Open-source satellite derived shoreline analysis tools were employed to automatically detect and extract the shoreline positions from moderate-resolution Landsat sensors including Thematic Mapper (TM), Enhanced Thematic Mapper Plus (ETM+), Operational Land Imager (OLI) as well as high-resolution Sentinel-2 images. Shoreline change analysis was carried out by employing a transect based approach to calculate rates of shoreline retreat and advance along the coast. Spatial-temporal geomorphic classification of coastal landforms such as sandy beaches, barrier islands, mangroves, built-up areas and mud flats was carried out and was compared with shoreline dynamics to establish locations of greatest vulnerability. In addition, topographic analyses were performed by utilizing DEM within a 1 km buffer zone along the shoreline, to identify the areas where low-lying land is adjacent to the shoreline. The results demonstrated varying levels of coastal susceptibility, mainly highlighting unprotected vulnerable hotspot areas along the coastline impacted by natural forces and human activities. By integrating shoreline change rates with geomorphic classification and terrain analysis, this framework can provide critical insights for coastal risk assessment, sustainable planning and management.

Distal Cirque Contribution to the Northern Cordilleran Ice Sheet, Yukon, Canada

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Yukon has been repeatedly affected by the northern Cordilleran Ice Sheet (NCIS). It has a complex history, with quasi-independent lobes originating from mountainous areas around the border of Yukon. This ice complex produced irregular, digitate horseshoe-shaped glacial limits largely controlled by precipitation. The growth model of the NCIS is contingent on ice from numerous cirques and ice fields in the source areas eventually amalgamating into these large, coalescent ice lobes. What is unclear is the contribution of cirque and valley glaciers from the few mountainous areas near the limits of glaciation.

Central Ruby Range is in southwest Yukon and was affected by the Saint Elias lobe. It encompasses the limits of MIS 2, 4 and 6 glaciations. During early MIS 2, local valley glaciers advance to the edge of the range but had retreated before inundation by the St. Elias lobe, likely due to local precipitation reduction. These alpine ice centres hosted significant re-advances during the Older Dryas, despite their location in the rain shadow of the St. Elias Mountains and during rapid retreat of the St. Elias Lobe. The MIS 4 limit is slightly more extensive than the MIS 6 limit, likely because local ice contributed to this portion of the St. Elias Lobe.

Granite Creek is in the Gustavus Range, central Yukon at the MIS 2 limit of the Selwyn lobe. During MIS 2 a tongue of the Selwyn lobe occupied the lower portion of Granite Creek, overrunning cirque glaciers near the margin and forming a lake. Cirque glaciers terminating in the lake advanced due to floating ice margins, but these maximum limits are not reflected in the geomorphic record; their well-defined moraines are recessional from this maximum. Stratigraphic studies indicate extensive MIS 4 cirque glaciation but provide no evidence of a proximal Selwyn lobe.

Evolution and Timing of the 2019 Koidern River Landslide, Yukon, Canada: another thawing permafrost related landslide?

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06J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 2:30 PM - 4:00 PM

A ~1.5 M m3 rock avalanche with significant mobility and abundant molards occurred at 5:17 PM on Dec. 19, 2019 in SW Yukon, within the traditional territories of the Kluane First Nation and the White River First Nation. High resolution drone-based lidar and photogrammetry data were used to map the landslide. It is ~2.3 km long with 540m elevation drop. It is a wedge failure in faulted and fractured mafic and felsic intrusives with the release surfaces being an eastward dipping weathered fault and southward dipping fracture planes.

The landslide moved in three phases. It initially crossed a small tributary valley, running up and banking downslope toward the Koidern River, before spreading out on a mid-slope bench. Material deposited in the tributary valley then remobilized as a more fluid flow, which crossed and blocked the Koidern River forming a small lake. This remobilization caused depletion of thick material deposited directly below the initiation zone. Finally, a smaller failure from the headscarp occurred. The remobilization of the slide debris was likely caused by frictional melting of snow and seasonal ice.

The landslide is characterized by abundant molards suggesting that blocks of frozen material were rafted on the surface of the landslide. They preserve stratigraphy in unconsolidated materials, including peat, and many are capped by 1250 BP White River Tephra. Some molards reactivated and slid along organic rich soil into the remobilization depletion zone.

Two well-recorded and long-duration, 90 s and 30 s pulses, recorded by seismographs to distances of just over 500 km are likely the seismic signals from this landslide. These data suggest initial failure was at 5:17 PM on Dec 19, with a second smaller failure approximately 2 minutes later. The landslide was likely conditioned by thawing permafrost caused by anthropogenic global warming but the trigger is unknown.

Hidden patterns: Spatio-temporal pockmark development linked to Plio-Pleistocene sea-level rise on the Chatham Rise, Aotearoa New Zealand

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Pockmarks are geomorphological depressions found on the seafloor in various environmental settings. Ranging from small (10s of meters) to giant depressions (several km), pockmarks can appear isolated, clustered, or in strings, exhibiting shapes from simple, elliptical to complex, irregular morphologies. Pockmarks are commonly linked to fluid release from the subsurface; however, the processes involved, fluid types, and the relative timing of their formation often remain enigmatic. We investigate the spatio-temporal evolution of an extensive pockmark field on the southwestern Chatham Rise, offshore Aotearoa New Zealand that features several formation episodes. We integrate high-resolution bathymetry and novel pseudo-3D subbottom volumes to characterize and quantitively analyse pockmark morphology and spatial distribution. Pockmark formation in the study area is temporally constrained to distinct subsurface horizons with clusters of individual features surrounded by exclusion zones where pockmarks are absent. Across different horizons, these features can be genetically linked and form distinctive spatio-temporal clusters of nested, stacked, or main and satellite pockmarks. Pockmark horizons occur consistently above high-amplitude reflections that are interpreted to represent sea-level lowstands during glacial maxima. Therefore, pockmark onset in the study area appears to be linked to sea-level rise, in contrast with the commonly proposed hypothesis relating pockmark formation to sea-level fall. After their initiation, vigorous bottom currents erode and modify pockmark morphologies, resulting in elongated and complex, amalgamated structures. Linking these processes to a temporal pattern of recurring pockmarks, we developed a conceptual model of spatial-temporal pockmark development in our study area. These findings highlight the benefits of 3D imaging for shallow subsurface analysis and offer new insights into the timing of episodic pockmark formation, with implications for understanding similar features globally.

Coastal karst development during sea level fluctuations and tectonic uplift - Glenelg River karst, Southeastern Australia

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05B: Karst geomorphology, Dobson 1, February 3, 2026, 11:35 AM - 1:20 PM

The Glenelg River karst area lies along the incised gorge of the Glenelg River in southeastern Australia, located within the relatively flat coastal plains of the Gambier Karst Province. It is a low relief karst hosted in high porosity/high permeability Miocene limestones, which are overlain by Pleistocene strandline dunes deposited by sea level fluctuations. Slow tectonic uplift has resulted in incision of the Glenelg River through the karst, forming a gorge 70-100 m wide and 20-30 m high in its downstream tidal section.

More than 70 caves are concentrated along the Glenelg River; they are predominantly single conduit caves comprising narrow, high, relatively straight rifts with near vertical walls, and have been modified by entrenchment. Many have entrances that open into the Glenelg River gorge. Passage orientations and spacing are dominated by the regional joint pattern. There is little collapse. The caves occur at two different levels, either within 1 m of the level of the present river (these often contain seasonally flowing water), or 10-15 m above present river level with entrances in the cliffs. The caves have significantly different morphologies to the dominantly flank margin caves in the same Miocene limestone 120 km to the north at Naracoorte.

Understanding the cave development of the Glenelg River karst requires untangling the relative influences of Pleistocene sea-level fluctuations and tectonism. The Pleistocene strandline dunes date past sea level high stands and can be used to calculate the rate of uplift, which was generally slow (0.04-0.06 mm/yr). Around 500 ka there was a period of more rapid uplift (0.3-0.5 mm/yr) that elevated the existing dunes to the southwest by 25-50 m, decreasing southeasterly to ~20 m at the Glenelg River gorge. Fault activity around this time may have uplifted the coastal Bulley Range and diverted the Glenelg River westward.

Evaluating Rock Glaciers as Essential Climate Variables: Rock Glacier Velocity (RGV) Investigations in the Alpine Regions of Western Canada

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03G: Open session on rock glaciers dynamics, Conway 2, February 2, 2026, 4:00 PM - 5:30 PM

Investigated within this research are the distribution, characterisation, and dynamics of rock glaciers, as well as features of interest within the alpine periglacial environments of Alberta and British Columbia, Western Canada. With Rock Glacier Velocity (RGV) recognised as an Essential Climate Variable (ECV) with Global Climate Observing System (GCOS), this research also marks the first deployment of Differential Interferometric Synthetic Aperture Radar (DInSAR) in the investigation of rock glaciers in Canada. Features of interest inclusive in this initiative are debris-covered glaciers, relict rock glaciers still containing ice, solifluction lobes, protalus ramparts, and potential embryonic rock glaciers, which were only inventoried. Canada is a unique region as the current status of rock glacier conditions is sparse, the resolution and accuracy of previous investigations are low, and recent studies completed are limited, filling a significant gap in regional and global permafrost research. This inventory utilised free, high-resolution optical imagery available within base layers in QGIS, with supplementary datasets from Planet Labs and the National Air Photo Library in absence of clear images. With characterising the rock glaciers, the Rock Glacier Inventories and Kinematics (RGIK) guidelines were partially utilised, along with a separate method for delineation. To reduce subjectivity of upper boundary delineation of rock glacier complexes and units, as well as reduce mapper bias, a Flow Initiation Line (FIL) was implemented. Methodology for this research also includes the framework for systematic characterisation and monitoring of rock glaciers from the RGIK RGV guidelines, which assisted in the detection of ground deformations and surface velocities of the rock glaciers. The focus of this work is rock glaciers, although cataloguing their distribution with the features of interest further enhances the suitability of this dataset for hazard mapping efforts and hydrological studies, as well as degradation and slope instability in these regions.

Issues and challenges related to the development of a community-based flood and debris flow early warning system in Southern California

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Destructive floods and debris flows in many areas of Southern California often occur with little advance warning after major storm events. The extremely short lead times (often less than one hour) associated with such occurrences presents unique challenges for efforts to provide adequate warnings for road closures, the mobilization, positioning and deployment of emergency response units, and the issuance of evacuation warnings and evacuation orders. In response to a long history of such relatively frequent and often localized flood/debris flow events, some 16 over the period between 1937 – 2010, the City of Laguna Beach undertook the development of a local watershed specific monitoring and warning system for properties adjacent to the local stream channel and areas where the channel flows through the central portion of the City. The system, consisting of: 1) a network of shallow groundwater water level monitoring sensors; 2) a channel camera flow monitoring system; 3) a local watershed specific rain gauge network nested within a wider regional rain gauge network; 4) local and regional radar feeds; and 5) a dedicated data collection, integration and analysis computer system that provides centralized, real time multi-level output of conditions at a emergency response command center. Based on a review of the history of prior events, a five-level emergency response plan was also developed designating escalating levels of response once the monitoring system indicates specific event thresholds are reached. The real time data collected by the system, in consort with the established response thresholds, can provide decision makers critical information to guide the need and timing of actions such as the mobilization of emergency response units, the issuance of reverse 911 alerts and evacuation orders based on the risk levels reached.

River morphodynamic response in watersheds affected by megafires (Deadman River, British Columbia, Canada)

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09A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 11:35 AM - 1:05 PM

Wildfires can have profound impacts on the movement of water and sediment on hillslopes and along watersheds, due primarily to changes in the mechanical and hydrologic properties of vegetation and soil. Previous studies have documented the damaging but local post-wildfire landslides, debris floods, and debris flows, though little attention has been paid to the large watershed-scale fluvial response to wildfire. To address this knowledge gap, this study focuses on the Deadman River watershed, which was severely affected by the Elephant Hill and Sparks Lake fires of, respectively, 2017 and 2021 in the southern interior of British Columbia, Canada. We included results from field-data collection, multispectral remote sensing, and timelapse photogrammetry, to examine how fire-related changes in water and sediment flux following the fires have influenced meander migration and channel morphology. The timelapse imagery analysis indicates a broad, watershed wide increase in channel width and migration rate over the observed timespan (2002–2023), with a sharp increase in these metrics (up to 100% and 540%, respectively) in the aftermath of the 2021 fire. Integration of sub-catchment-scale burn severity analysis reveals that regions that burned more severely drained into meandering reaches that migrated at faster rates. We observed a dependency of channel migration rate on integration timescale that was primarily attributed to channel-migration reversals and chute-cutoffs. We conducted a normalization of migration rate to demonstrate that the observed post-fire morphodynamic changes are not an artifact of integration timescale – a conclusion corroborated by the relationships with channel width, which is not sensitive to integration timescale. Our results provide a quantification of the degree to which wildfires can alter the morphodynamics of meandering-river catchments. We anticipate our study to inform natural hazard mitigation efforts as well as longer-term ecosystem restoration and recovery efforts in area affected by megafires.

Peaks, plateaus and glaciers: designations and categories in the mountain domain

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

This poster outlines notions of recognition and classification of landforms and their interpretation, specifically in the ‘mountain domain’. Human visual cognition of landforms and remotely sensed classification procedures both present difficulties, especially if identification is vague and ‘ground truth’ lacking. Provision of decimal latitude-longitude values, [dLL], help rectify imprecision and improve recording. Google Earth (GE) provides a way of obtaining [dLL] data retrospectively and GE images tagged with [dLL] can be used to provide a mapping function, particularly via transects. GE-mapped areas can also be tagged with two-letter, ‘digraph’, labels to identify landforms. This information schema can be used in various ways and to record data within databases. Inventories, particularly of rock glaciers, have been compiled in various ways over the years by visual, aerial and satellite photography or by automated methods. Making inventories and mapping has also been applied to landslides and glaciers in the mountain domain but without consistent geolocation. The paper shows how Euler diagrams, category and information theoretical approaches can be used to help solve some of these problems. Classification and landform monitoring are particularly significant as they relate to the uses of ‘big data’, in tracking environmental changes and the long-term development of digital twins. The Lyngen Peninsula, with plateaus at about 1300–1600m asl, has slopes descending to fjords a few km away and can be compared to Øksfordsjøkelen, 90 km to the northeast, with larger plateaus but at lower altitudes. Digital, [dLL], mapping and consistent classification procedures can be used to compare the two areas. Glaciers, valley, cirque and plateau, are currently in recession, although the highest plateaus have preserved most of their mass over the last 120 years, as determined from photographs. Geolocation mapping of landforms and data management can help produce information-rich catalogues of such landforms and their changes in landscapes.

Landsystem explorations in mountain domain connectivities

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11B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 5:00 PM - 6:30 PM

This paper presents on-going work developing ways to organise, display and map information contained in landforms/scapes. The techniques described are of general applicability, although specific 'mountain domain' examples are from New Zealand, Norway and with connectivity exemplified by zoonotic disease transfer, bird tracking and coastal planning as well as geomorphic materials. The use of the FAIR data principles is part of the approach; findable, accessible, interoperable, reusable as part of 'open data'. Domains are collections of geolocated landforms but can also be viewed in 'domain' and 'category' theory to help analyse landform development, movement and flux of materials. This approach requires digital georeferencing in the field, on maps and in the literature and is achieved by a decimal latitude-longitude, [dLL], schema. Thus [dLL] located points and collection of associated data can be assembled and recorded as points, locations of landforms or gauging stations as well as 'geomorphic information tensors'; [dLL]{information about the location}). Geolocated points can be linked to dates/times/other data such that database rows can be given meaningful [dLL] locations rather than lab/sample numbers using category theory to help organise and analyse information and connectivity. In general, landsystems and geolocated landforms provide ways of tracking information together with materials involved and assessment of biota in the 'critical zone'. Environmental changes, especially climatic or meteorologically induced, such as rainfall, winds and soil piezometric values can be considered as classical fields with scalar, vector or tensor values at geolocated points. Lagrangian mechanics applied to geolocated point behaviour within fields can also be utilised with these information schemas. The widest, and long-term, view of landsystem approaches to geomorphic domains is developing tools for the production of 'digital twins'. However, past events and present observations are required to build such systems but [dLL] identification can help build the information bases.

Unblocking the potential: Geomorphology's role in reinstating environmental water beyond the Gwydir Raft, NSW Australia

Ms Nicole Wheeler[1,4,5], Dr Geoff Vietz[2], Dr Christine Lauchlan Arrowsmith[2], Ms Kira Woods[2], Dr Paul Hanley[2], Ms Pearl Elgindy[2], Ms Alisha Matheson[2], Dr Mark Southwell[3], Dr Lindsey Frost[3]
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05A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 11:35 AM - 1:20 PM

Some of the greatest complexity in geomorphic processes can be in the flattest of landscapes. In these settings geomorphic insights are critical to the evolving practice of river rehabilitation, particularly where legacy land-use changes and water management have altered natural processes. This geomorphic-led assessment and options analysis addresses flow disruption to a Ramsar-listed wetland and localised flooding. The 1.5 km long woody debris "Raft" on the Gingham Watercourse, on the Gwydir River system, New South Wales, Australia, includes sediment and woody debris accumulations that reduce flow capacity, leading to critical ecological concerns.

Through a multidisciplinary approach, incorporating field geomorphic and ecological assessments, hydraulic modelling, and stakeholder engagement with NSW (DCCEEW) Government and Commonwealth, and landholders; the project evaluated eight management options ranging from full mechanical removal of the Raft to bypass channels. Through multi-criteria analysis of environmental impacts, feasibility, approvals and costing, the analysis revealed that a bypass channel or mechanical removal options were of similar viability as long-term interventions, balancing geomorphic stability, cost, and environmental outcomes. A staged approach was found to cater to legislative approvals whilst also increasing certainty on actions within a largely inaccessible site.

This case study illustrates the shift from traditional river management toward process-based, place-specific interventions that work with geomorphic trajectories. It also underscores the importance of repeat terrain data, scenario modelling, and decision-support frameworks in bridging science into practical actionable outcomes. The findings contribute to a growing body of evidence that geomorphology can effectively inform water delivery strategies, particularly in complex distributary fan systems where ecological assets are at risk.

Integrating Geomorphic Dynamics into 2D Flood Modeling

Miss Alex White[1]
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13B: Advancing Theory and Modelling of River Systems, Dobson 1, February 6, 2026, 11:35 AM - 1:05 PM

The 'fixed bed assumption' in representing river bathymetry for model simulation of a flood event is one of many assumptions used to develop hydraulic models. Such models are often used to estimate peak flood levels, and are reliant on suitably accurate channel geometry that exists at the time of the peak. Hydraulic modelling often focuses on large flood events and does not take river bed deformation during the event into account. This assumption is well understood, and as a result river model calibration, when achieved, often does not converge on a unique solution. In river systems where a robust morphological modelling approach has been adopted, a 2D morphological modelling approach was the only reasonable way to achieve model calibration.

Representing changes to channel geometry during the passage of a flood in hydraulic models is possible, but often discounted due to lack of data available and the cost and effort associated with obtaining this data. However, technological advancements in modelling are making it much easier to include mobile bed processes in hydraulic models.

I will present a case study in which geomorphic processes are accounted for in a hydraulic model using a 2D morphological model. This case study proved that while detailed data was not available, the inclusion of geomorphic processes at a high level meant we were still able to learn valuable insights, such as;

- Potential changes in scour and deposition as a result of flood mitigation measures
- Understanding flood mechanisms while directly comparing them to geomorphic change during a flood event
- Better understanding of uncertainty in peak flood levels due to bed deformation during a flood event

The case study proved it was possible to narrow the gap of uncertainty in flood modelling of a complex river system, even with a coarse representation of geomorphic processes.

Glacial lakes outburst floods of Svalbard, A Case Study of Isfjord

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04J: Landscape and landform evolution under geohazard impulses, Conway 5, February 3, 2026, 9:35 AM - 11:05 AM

The Svalbard Archipelago, situated in the High Arctic and often dubbed the "Arctic Tropics," is experiencing a rate of warming approximately four times faster than the global average. One visible consequence of this rapid warming is the accelerated evolution of glacial lakes across the region, which in turn increases the likelihood of Glacial Lake Outburst Floods (GLOFs). While Svalbard's extremely low population density (approximately 0.044 people per square kilometer) means these events rarely pose a direct threat to local communities or infrastructure, the growing number of scientific expeditions and the surge in tourism highlight the need for a better understanding of the associated geohazards.

In recent years, the region has seen increased attention to risks stemming from natural hazards such as landslides and avalanches. However, glacial flood hazards have not been systematically assessed. The Isfjord catchment area, the most populated and frequently visited part of Svalbard, hosts numerous glacial lakes and is therefore a critical area for hazard assessment.

This study aims to develop a preliminary glacial flood risk map for the Isfjord region using available remote sensing data, field reports, and prior scientific research. The methodology integrates geomorphological mapping with satellite image analysis to identify glacial lakes with a potential for outburst floods. The findings reveal several key locations where GLOF events have already occurred and indicate areas that may be at risk in the near future.

This is the first study to systematically map past GLOF events in Svalbard and propose an approach for forecasting future ones. The results provide a foundation for better hazard preparedness and risk mitigation, particularly in areas with increasing human activity.

This research was supported by the Polish National Science Centre under project GLOWS [2023/49/N/ST10/01075].

HYDROLOGIC, ECOLOGIC AND ECONOMIC COST-BENEFITS FROM CHANGED RIVER WIDTH AND BED ELEVATION SCENARIOS

Dr Clare Wilkinson[1], Richard Measures[1], Jo Hoyle[1], Peter Tait[2], John Saunders[2], Scott Wilson[3]
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08B: Predicting and responding to geomorphic change: case studies from Aotearoa New Zealand, Dobson 1, February 5, 2026, 9:35 AM - 11:05 AM

Braided rivers are dynamic and complex natural systems. They provide unique habitat to rare species, supply natural resources, and provide groundwater recharge. However, they can also pose significant management challenges. Current management of braided rivers in Aotearoa-New Zealand largely focuses on flood protection as a critical service to communities. This approach – in addition to agricultural encroachment – has contributed to river narrowing across the country's braided river environments. Narrowing of braided rivers has resulted in ecological habitat loss, disrupted groundwater aquifer recharge and, in some cases, exacerbated the effects of flooding during extreme weather events.

Here, we explore the hydrologic, ecologic, and economic costs and benefits of changing river bed levels and widths. Theoretical width and bed level scenarios were developed for a river reach in two study rivers: the Ngaruroro River (Hawke's Bay) and the Wairau River (Marlborough). The scenarios were co-developed with local members of the community with professional roles in river management and/or guardianship. Following scenario co-development, we applied the Delphi method to gauge expert opinion on how ecological values might change in the study rivers under the proposed scenarios and modelled potential changes to groundwater recharge. We shared the scenarios and their possible ecologic, hydrologic and geomorphic benefits with the public via public surveys to gauge willingness-to-pay (WTP) for the benefits associated with the scenarios. Finally, we conducted an economic analysis of physical works and changes that would be required to achieve the scenarios.

Across both case studies, our results indicate that widening braided rivers has benefits for aquatic ecology and groundwater recharge, and can result in a net economic benefit to the regions over the longer term (e.g., 150-160 years into the future). Lowering bed levels (e.g., via intensified gravel extraction) could have costly impacts on ecology and groundwater that exceed potential economic benefits.

How much space do rivers need? Satellite big data analysis to inform a nature-based approach to Philippine river easement

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rivers need space to sustain key ecological and geomorphological functions, and to convey floodwater. However, river management efforts have often used structural engineering approaches to mitigate erosion hazards to land that has been developed for agricultural, industrial and urban land uses. In the Philippines, current easement regulations require a minimum 3 metre buffer along the bank of a river for urban areas and 20 metre buffer for agricultural lands. We use a two-decade long archive of Landsat satellite imagery, processed in Google Earth Engine, to investigate river mobility across eight rivers in the Philippines (Abra, Abulug, Amburayan, Cagayan, Chico, Ilog, Laoag, Pampanga), enabling us to quantify how mobile rivers are and the land use land covers (LULC) that are eroded due to river migration. Intersections between active channel edges and LULC maps revealed the types of land cover rivers interacted with over time, highlighting areas of encroachment and potential risk. The analysis of LULC distributions and observed river mobility provides insights into how easement regulations could be informed by observations of actual river mobility. We show that the eight case-study rivers are dynamic but not equally so. Whilst results show that agricultural land is often the land cover that is eroded, a high proportion of land that is generated through accretion is subsequently used for agriculture. Our findings are a demonstration of a nature-based solution to defining how much space rivers need, informed by big data. The findings have direct implications for Philippine easement laws, which mandate buffer zones along waterways to protect against flood and erosion risks, and environmental degradation; there is potential to re-evaluate static buffer zones and consider adaptive, risk-based approaches to easement enforcement.

Outdoor activities and digital technologies for geoheritage popularisation: Outcomes from IGCP 714

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07I: Geomorphology for geoconservation, Conway 4, February 3, 2026, 5:00 PM - 6:30 PM

The IGCP 714 project “3GEO – Geoclimbing & Geotrekking in Geoparks” has been sponsored by the International Geoscience Programme (IGCP) and supported by the International Union of Geological Sciences (IUGS). The aim was to develop a robust workflow to integrate digital technologies into geoscience communication, and to create Digital Outcrop Models (DOMs) of geosites and geodiversity sites used for recreational climbing and trekking. The first phase of the project identified the criteria most suitable for selecting geodiversity sites equipped for climbing (geoclimbing sites) or explored through trekking (geotrekking sites). More than 20 geoclimbing sites and 30 geotrekking sites were selected in UNESCO Global Geoparks, aspiring geoparks or geopark project areas across 14 countries, as well as in other protected areas featuring geoheritage sites. The scientific and other additional site values, along with their potential for use, were the key criteria for identifying suitable contexts to explore the link between outdoor activities and Geoscience education.

Using technologies such as UAVs, tablets, and smartphones equipped with LiDAR sensors, the workflow model identified in this project allows the acquisition and creation of DOMs that can be integrated into web-GIS applications and Virtual Reality experiences (https://arcg.is/00umX9), offering interactive educational content. The workflow is designed to support practitioners globally in selecting the right tool for data acquisition and to learn how to construct DOMs for public and student engagement. These DOMs can also be used for geoconservation through monitoring of dynamic sites based on the repeated acquisition of geospatial data. The collection of DOMs in the project members territories is available via a Sketchfab repository (https://sketchfab.com/3geo714/models) and using an ArcGIS Online web application (https://arcg.is/1SH8Hr1). The database includes geological and geomorphological descriptions, that in the future will be implemented on the DOMs in the form of annotations.

Does a river change in response to 25 years of rewilding? Morphodynamics of the braided River Feshie, Scotland

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09A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 11:35 AM - 1:05 PM

The vegetation that covers many of Scotland's upland riverscapes is being transformed by the adoption of "rewilding" principles in land management. Changes in presence of live and dead wood in river channels, riparian margins, and across floodplains has the potential to change interactions between flow, sediment transport and morphology, with subsequent feedbacks to ecology through the alteration of physical habitat. Over the last few decades, some of the largest-scale changes in vegetation have been observed in valleys where deer numbers have been radically reduced and existing seedbanks in the soil have enabled extensive regeneration of woodland vegetation. Here, we focus upon Glen Feshie, a valley in the northern Cairngorms, to investigate interactions between vegetation and morphological change along several kilometres of a reach with a braided planform. Over the last 25 years a variety of woody species, including Caledonian Pine, Silver Birch and Alder have reestablished on river islands, riparian margins and across the valley floor. Using a 25 year long dataset of high-resolution digital elevation models and aerial imagery, acquired using a range of geomatics technologies, we quantify sediment budgets and map vegetation change to investigate whether there is a fluvial response to rewilding.

Whole Management of Watersheds – Integrating geomorphology, hydrology and waterway management

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10A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 2:30 PM - 4:00 PM

A holistic management of river systems requires an understanding of the inter-connectedness of the water and land interaction processes of hydrology and geomorphology. There is a functional relationship between flood flows, sediment (and debris) transport, and channel form, and waterway interventions affect this integrated functionality.

Aotearoa New Zealand is a high-energy mountainous land, located on the Pacific 'Ring of Fire' and isolated in the South Pacific Ocean, where its climate is influenced by large, decadal circulations of the South Pacific and circum-Antarctic Southern Oceans. Its mountain backbone intersects both westerly and ex-tropical weather systems, resulting in distinct regional variations in the timing and intensity of flood events. River systems respond to longer-term variations in flood flows, with different channel forms and sediment delivery during quiescent versus intense flood periods. Large earthquakes also have major effects on watershed processes and sediment delivery, and can give rise to gross changes in channel form over relatively short time spans.

This landscape context must inform the determination of appropriate river corridors, channel management zones, and interventions. Examples are given for gravel-bed river reaches around the country, of the implications of climate variations and consequential geomorphic responses, on river management and hazard reduction.

The rugged, steep hill country of Aotearoa New Zealand has been largely deforested over the past century. This landscape change has significantly affected geomorphic processes, leading to widespread land slipping and increased fine sediment input to rivers during intense flood events. Simultaneously, introduced vegetation is congesting lowland waterways. The cumulative effects of these vegetative changes are a major challenge for river system management.

The presentation will explore the integrated dynamics of watershed processes through examples from river systems across the Aotearoa New Zealand landform.

Decadal-scale topographic monitoring of four river realignment schemes shows restoration increases and maintains geomorphic unit diversity

Mr Craig MacDonell[1,5], Prof Richard Williams[1,4], Dr Helen Reid[2], Dr Fiona Caithness[2], Miss Lucy Daniels[1], Dr Eric Gilles[3], Dr Hamish Moir[3,6]
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01I: Living with geomorphic change, Conway 4, February 2, 2026, 11:40 AM - 1:10 PM

River restoration is key to realising ambitions to improve the biodiversity of rivers and to contribute to natural flood risk management. However, a dearth of detailed, accurate and consistently acquired, long-term topographic monitoring constrains the available evidence base to evaluate the efficacy of different river restoration approaches. Upland gravel-bed river realignment schemes are emblematic of this challenge. Here, the results from monitoring four contemporary upland river restoration sites in Scotland and the North-West of England are presented. The topography of 7 km of restored reaches at Whit Beck, Swindale Beck, Allt Lorgy and the River Nairn was measured for a period of approximately one decade after each river realignment. The full extent of each scheme was surveyed every 1-3 years, with the frequency dependent on the geomorphic dynamism of the scheme. A variety of geomatics technologies were deployed to survey topography including, robotic total stations, RTK-GNSS, Structure-from-Motion photogrammetry, Terrestrial Laser Scanning and Unmanned Aerial Vehicle LiDAR. This unique dataset has enabled geomorphic change to be mapped and annual sediment fluxes to be quantified. Moreover, the high-resolution topographic datasets enable the geomorphic unit development of each scheme to be mapped using the Geomorphic Unit Toolbox (GUT). Together, this dataset enables three questions to be investigated: (i) what is the geomorphic unit composition of restored rivers?; (ii) how does geomorphic unit diversity develop post-restoration; and (iii) what geomorphic mechanisms are sustaining geomorphic unit diversity? We show that different restoration schemes have contrasting geomorphic unit assemblages, which are influenced by sediment supply, scheme constraints, in-channel and riparian wood and vegetation, and adaptive management. Whilst there is geomorphic change with time, geomorphic unit, and thus physical habitat, diversity increases or is maintained across all schemes. These findings provide strong evidence that should underpin efforts to scale up from demonstration sites to catchment-scale restoration efforts.

Distribution, evolution and record of karst in New Zealand

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05B: Karst geomorphology, Dobson 1, February 3, 2026, 11:35 AM - 1:20 PM

Karst in New Zealand is developed mainly on widely distributed carbonate rocks, although karren also occur on basalts in the warm humid north, as well as small lava caves. Polygonal karst is found on gently dipping patches of limestone along the west and east coasts. In western North Island, it has evolved on Oligocene limestones since the Plio-Pleistocene, following up-doming of central North Island. In southeast North Island, it developed on Pliocene limestones in the Quaternary, possibly the world's youngest polygonal karst. By contrast in northwest South Island, the country's oldest karst occurs on Ordovician marble (to 1 km thick), where it is found in a 90 km long discontinuous belt to 1867 m above sea level. The higher areas were glaciated in the Pleistocene, and meltwater drained through caves to 1.2 km in depth and 74 km in length. Cosmogenic burial ages on cave gravels at 1164 m indicate that caves were active 2.8 ±0.4 Ma ago, as the Southern Alps were developing. Cave stream incision rates averaging 0.2 m/ka are implied. The Ordovician marble contains the country's largest karst aquifer (2.85 km3 volume) and sustains the largest spring (average discharge 13.4 m3/s, mean flow through time 7.9 years). Caves contain important paleo-environmental records, including of seismicity. Some North Island caves were invaded by incandescent ignimbrite flows from central North Island eruptions of 1.4 and 1.0 Ma. In Fiordland, Aurora Cave acted as a dip-stick with respect to an adjacent glacier, and a mix of uranium series and cosmogenic dates shows that the last glaciation advance commenced abruptly from 33 ka ago, culminated 32-29 ka ago and terminated by 17 ka. Thus evidence from Aurora Cave shows that the LGM in New Zealand occurred at least 12,000 years before global ice volume had reached its maximum.

How River Form Controls Groundwater-Surface Water Exchange in Braided Rivers

Mr Scott Wilson[1], Dr Jo Hoyle[2], Dr Richard Measures[2]
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06A: Using geomorphology in river management: From science to action, Auditorium, February 3, 2026, 2:30 PM - 4:00 PM

We have recently completed a five-year programme to understand surface water-groundwater exchange in braided rivers. Previous concepts and definitions for understanding groundwater-surface water interaction have been inherited from passive river environments. For braided rivers, a re-assessment was required to understand exchange in a river environment with highly dynamic hydrology and bed morphology.

A conceptualisation of braided rivers has been developed (Wilson et al. 2024), based on surface and subsurface investigations carried out in the Ngaruroro, Selwyn, and Wairau rivers. Surface investigations consisted of lidar, bathymetry, concurrent flow gauging, and radon sampling. Subsurface investigations consisted of electrical resistivity tomography, nuclear magnetic resonance imaging, fibre optic sensing, sediment coring, porosity and grainsize analysis, and radon sampling. Time series of water level and temperature were also collected from the rivers and piezometers.

The new conceptualisation highlights that a braided river should be considered as a whole system. This “river system” comprises individual channels or braids, river bed gravels, and water held within those gravels which can freely exchange with channels (a braidplain aquifer or bed reservoir). Groundwater-surface water interaction can be considered to occur at two main scales:

1. local scale, parafluvial exchange between individual channels and the braidplain aquifer
2. regional scale exchange between the braidplain aquifer and regional aquifer

Our conceptualisation implies that low flows depend on flood flows due to the mobilisation of bed sediments during high flows. Bed sediment mobilisation controls both the bed reservoir geometry, and parafluvial and river-system aquifer exchange. Both of these aspects are influenced by river management practices which affect the elevation and morphology of the river bed.

Wilson, S.R., Hoyle, J., Measures, R., Di Ciacca, A., Morgan, L.K., Banks, E.W., Robb, L., Wöhling, T.: Conceptualising surface water-groundwater exchange in braided river systems. Hydrology and Earth System Sciences, 28, 2721-2743, 2024.

An Early Holocene climax in rock glacier formation and activity, Ben Ohau Range, Southern Alps/New Zealand, and its palaeoclimatic implications.

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Rock glaciers are common periglacial landforms in the drier mountain ranges east of the Main Divide of New Zealand's Southern Alps. However, only few studies on their chronological constraints have been carried out to date and their potential as palaeoclimatic archives remains largely unexplored. Schmidt-hammer exposure-age dating (SHD) was applied to selected rock glaciers in the Ben Ohau Range to obtain a regional chronological data set. SHD-sampling was additionally conducted on high-altitudinal moraines where independent published cosmogenic 10Be surface-exposure ages served as control points for establishing a regional SHD age-calibration equation. SHD age-estimates for a total of eight rock glaciers based on >16,000 sampled boulders were subsequently analysed in a chronological, morphodynamic, and palaeoclimatic context.

According to SHD-age estimates for their respective frontal ridges, initiation of rock glacier formation spread between 12.1 ± 1.6 and 7.2 ± 0.8 ka. With a cluster of four individual features dated between 9.3 and 8.6 ka those landforms are predominately of Early Holocene age. Activity at some rock glaciers must have commenced immediately following local deglaciation. All landforms are considerably older than previously anticipated, but methodological uncertainties have contributed to this underestimation. Successive transverse ridges dated on the rock glaciers reveal a clear general trend of increasing age with increasing distance from the rooting zone. This reflects conveyor-like transport of boulders in predominantly stable position on the surface.

The SHD-age estimates of transverse ridges are interpreted as morphological evidence for phases of strong morphodynamic activity in form of increased debris supply by climate-driven frost weathering. Consequently, they are interpreted as palaeoclimatic signals for cold period with low air temperatures. All rock glaciers investigated show a distinct climax of such activity during the Early Holocene. After c. 7.0 ka such activity phases became less frequent and subsequently rare during the Late Holocene.

Is geomorphology the key for understanding the Holocene glacier chronology in the Southern Alps/New Zealand?

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01G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 11:40 AM - 1:10 PM

As one of few mid-latitudinal mountain ranges on the Southern Hemisphere, the Southern Alps of New Zealand Alps offer excellent opportunities to investigate Holocene glacier chronologies. But even if a reasonable number of studies have been carried out, a detailed critical review reveals both considerable degrees of uncertainty and significant differences between individual chronologies. Some of it can be explained by methodological issues or lack of spatial differentiation, but what role plays geomorphology in this context?

A recent study on Holocene glacier chronologies in the Southern Alps utilised a multi-proxy approach of 10Be cosmogenic radionuclide and Schmidt-hammer exposure-age dating combined with rigorous geomorphological mapping and analysis. Highly individual configuration of glacier forelands and complex moraine morphologies both strongly influenced the chronological results obtained. In particular, excessive supraglacial debris input caused by large mass movement events could frequently be detected as impacting moraine formation (and possibly also glacier response). As a result, the palaeoclimatic significance of moraine sequences cannot automatically be taken as granted but need to be verified in detail. Currently strong paraglacial overprinting of glacial landforms related to very dynamic geomorphological process systems in the Southern Alps may, furthermore, indicate a high potential for "erosional censoring" of Holocene moraine sequences. But the non-existence of Early and Mid-Holocene moraines must not be interpreted as evidence for this and certainly does not justify common amalgamation of fragmental, incomplete glacier chronologies into a summarising complete regional record.

It will finally be argued that critical evaluation based on this new and existing studies can only lead to the conclusion that a reliable Holocene glacier chronology actually representative for the entire Southern Alps does not exist to date. A detailed and thorough geomorphological approach integrated with any future chronological investigations on Holocene glacier chronologies will, however, help to minimise any related uncertainties.

Tree rings as an early warning against catastrophic landslides (examples from Poland and Italy)

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01C: State-of-the-art and new perspectives in long-term monitoring and analysis of landslide dynamics, Dobson 2, February 2, 2026, 11:40 AM - 1:10 PM

We investigated three slopes in Poland (Western Carpathians and Sudetes) and three in Italy (Northern Apennines and Southern Apennines) that were already subject to catastrophic, sudden landslides or at risk of catastrophic reactivation. We reconstructed past landslide activity at the six sites. We analysed the eccentricity of tree rings in trees growing on slopes under study using a per cent eccentricity index method. We obtained data on year-by-year changes in eccentricity patterns of single specimens, as well as data on landslide events dated from the whole population of trees sampled on each slope. These data supplied proxy information on the temporal variability of landslide activity on study sites, revealing that all slopes were subject to frequent landslide activity in the past (recurrence intervals 2.0–7.1 years). The study also showed that in the case of four slopes, where catastrophes had already occurred, 3–7 years before catastrophic events, sampled trees started to record increasing ground instability, demonstrated as an uninterrupted, sudden increase in the eccentricity of single trees. Then, we tested this approach on the remaining two slopes to asses the potential of their catastrophic reactivation in the near future. Our results suggest that applying dendrochronological methods, that provide long-term data on landslide activity, can reveal slopes at an increased risk of catastrophic landsliding well in advance. The methods we applied show great promise for forecasting catastrophic landslides and assessing landslide hazards, slope stability, and the effectiveness of engineering works undertaken to stabilise landslides.

The study was funded by the Polish National Agency of Academic Exchange NAWA, Urgency Grants Programme, grant number: BPN/GIN/2024/1/00008.

The impact of climate change on small Arctic catchments – revealed using a remote sensing study

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Remote sensing data provide an invaluable record of the environment and unlock the secrets of the past. Before environmental satellite missions were developed, the environment was documented for cartographic and strategic purposes, such as through aerial photography. This practice also served military objectives, like the Key Hole mission, which began around the same time as the first Landsat. While these missions were not initially intended to study climate change, the data they collected can be used for environmental research purposes, such as measuring the extent of glaciers (including small ones), recording lake changes and mapping river channels. Recent studies have shown that 16 out of 97 (16.5%) of the small mountain glaciers on Wedel Jarlsberg Land (SW Svalbard, the High Arctic) have disappeared, while 47 (48.5%) have shrunk by over 50% in area between 1936 and 2020. These data are based on the 1936/38 orthophoto created by Geymann et al. (2022) and remote sensing analyses using Landsat (USGS) and Sentinel (ESA) satellites. We would now like to present our analysis of glacier extents in Wedel Jarlsberg Land in the 1960s. Our analysis is based on oblique aerial photographs taken by the Norwegian Polar Institute in 1960 and 1961. This study aims to address the lack of data between the end of the Little Ice Age on Svalbard, documented in the 1930s, and the beginning of regular satellite measurements in the late 1970s for this region. Additionally, the data from the Key Hole 9 mission in 1979 enables us to evaluate the error in determining the extent of the glaciers from Landsat data from the same time period.

The Changing Morphology of Braided Rivers in the South Island of New Zealand

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11A: River and catchment evolution, processes, and management, Auditorium, February 5, 2026, 5:00 PM - 6:30 PM

Braided rivers are a common river form draining the tectonically active mountain ranges in Aotearoa New Zealand. These river systems are maintained by a high-disturbance environment straddling a strike-slip plate boundary and orographic rainfall across the “Roaring 40s”. Consequently, mountain rivers have high sediment yields and extremes in discharge that can vary by two orders of magnitude. However, the asymmetry of the Southern Alps creates a hydrological and morphological distinction between the rivers draining either side of the Main Divide, with west draining rivers characterised by short, steep, catchments with a narrow coastal plain, and east draining rivers flowing across a wide braid plain to the ocean. Here we use remotely sensed imagery to map changes in the width and area of the active channel of 15 braided river systems of the South Island, New Zealand. Lower catchment morphology was mapped for three periods: 1960s, 1980s and 2020s. All mapped rivers showed a decrease in the active channel area between the 1960s and 2020s, with the greatest percentage reduction of active river channel observable on east-draining rivers. The areas of greatest change were usually associated with vegetation establishing on lateral bars, a general narrowing of the riparian corridor often exacerbated by changing land uses, and the incursion of invasive plant species into river beds. The near natural mountain rivers within conservation estate, however, showed only modest changes in river morphology during the observation period, and highlights that the main pressures on braid-form are from anthropological disturbance. Understanding past braided river responses is essential for determining their future vulnerability and capacity to adapt to near-future changes in climate that are expected to intensify extreme flows, and morphological mapping may be a useful tool for targeting remediation efforts to improve river conveyance in the future.

Managing high energy and complex river systems in a changing climate: An example from southeast Australia

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

Complex and high-energy river systems are a geomorphic challenge, but also highlight the importance of geomorphic investigation in light of a future of climatic extremes. Traditional approaches to waterway management are often failing in this new paradigm. An example of this is Livingstone Creek, in southeast Australia, a unique river system in a region otherwise dominated by meandering, low-energy, fine sediment streams. Livingstone Creek is a high-energy system that is often braided with an excess supply of cobble and boulder-sized sediments.

A history of catchment disturbance, floods and steep terrain drive dramatic changes in this system. Several floods affected the catchment in 2021 and 2022. Large scale erosion and deposition ensued, with historical management approaches tending to be reactive, ad-hoc and missing the broader geographic context. The project emerged from the need to align with a new vision for the system to which it contributes, building a catchment-scale understanding of geomorphic processes and stressors. By understanding the system, the opportunities for resilience and recovery in light of likely climatic extremes will be greater.

Data gaps have held back a robust understanding of this system. We developed an understanding of the catchment by linking geomorphic form to processes and likely trajectories of change, informing management strategies for each process zone. Recommendations were subsequently tested with the capture of new lidar data, allowing Digital Elevation Models (DEMs) of difference to validate, and refine the original recommendations.

Key recommendations included: working with the dynamic nature of the system; providing the river space to adjust; and recognizing and managing ongoing high sediment loads. These recommendations are informing channel resilience objectives of a ‘Flagship Project’ (for the Upper Mitta Mitta River) and the geomorphic principles for drawing upon the past to inform future trajectories and appropriate management should be incorporated more broadly into projects.

How geomorphology can tell a powerful story: the Waring/mid-Goulburn River

Miss Kira Woods[1], Dr Geoff Vietz[1]
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09F: Engaging the relational work of geomorphology, Conway 1, February 5, 2026, 11:35 AM - 1:05 PM

The river as a living entity is a cultural perspective of landscape that has significant links to the discipline of geomorphology and the potential to change the way we understand and manage waterways. This shift in perspective necessitates telling the story from the rivers' perspective, in a way that is consistent with cultural perspectives. It requires distilling complex information into a cohesive and easy to understand narrative. This project emerged in an effort to make the wealth of data and reporting for the Waring/mid-Goulburn River more accessible.

The project utilised and synthesized several data sources, including past geomorphic investigations, academic literature and historical survey, to tell the continuous story of change on the Waring from the distant, geologic past to the likely future trajectory of the system. Leveraging the power of visual imagery, informative mapping, diagrams and historical photographs, it takes the audience on a journey through time.

While the project is a seemingly straightforward one, the power of a story shouldn't be underestimated. For Taungarung, the Traditional Owners of the Waring, the project represents a possible piece of the puzzle, realizing cultural principles such as the 'river as a living entity' and translating this into a contemporary context. For the catchment management authority, it is also a step towards being able to more readily incorporate cultural perspectives in river management.

Importantly, this story is anticipated to improve communication with landholders and the community, focus investments for river health outcomes, understand how current pressures are influencing change, and helps explain the benefit of allowing the river 'room' to accommodate geomorphic processes, as have been occurring for thousands of years. Ultimately, the geomorphic perspective is a way in which we can weave together traditional knowledge with historical data and interpretation, developing a cohesive story to inform the broader community.

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Portable luminescence measurements correlate with the age, composition, and stability of aeolian sediments in the Northern Great Plains, western Canada

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Aeolian landforms are important archives of past climatic and environmental change. Traditionally, aeolian sediments are dated using optically-stimulated luminescence (OSL) or radiocarbon methods. Portable OSL (pOSL) readers now allow researchers to rapidly measure luminescence signals from sediments. In low-latitude arid landscapes, pOSL signals from dune sediments are closely correlated with known age, providing calibration models that could expedite dating campaigns at large spatial scales. Less attention has been paid to how pOSL methods translate to mid- and high-latitude, post-glacial dunefields, which provide age constraints on ice sheet retreat and information on palaeowind directions. In contrast to low-latitude dunefields, post-glacial dunefields have been recently deposited and tend to be compositionally heterogeneous across space. Here, we test the controls on pOSL signals obtained from samples of aeolian sand from across the grassland, parkland, and boreal regions of the Canadian Prairies, which have independent OSL ages. Strong correlations with known age are found at small spatial scales where sediments are compositionally similar. At larger spatial scales, pOSL signals are sensitive to sediment geochemical composition, showing strong correlations with silicate content, as well as underlying luminescence sensitivity, the efficiency with which mineral grains emit light during stimulation. Luminescence sensitivity is increased by cycles of sediment reworking. We find that dunes in drier, prairie grassland ecosystems have the greatest luminescence sensitivity, indicating that they have undergone more cycles of reworking due to disturbance, relative to those in more stable, boreal ecosystems. We conclude that pOSL measurements can provide information on the age, provenance and long-term stability of post-glacial sediments, as long as the underlying drivers of these signals are understood.

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Reconstructing post-glacial landscape evolution from river terraces in central British Columbia, Canada

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03B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 4:00 PM - 5:30 PM

Post-glacial river terraces preserve complex signals of long-term changes in aggradation and incision that relate to past changes in climate, base level and tectonic and glacioisostatic processes. Due to these competing controls, it can be difficult to untangle the dominant drivers of post-glacial landscape evolution. Central British Columbia, Canada, underwent deglaciation with the retreat of the Cordilleran Ice Sheet during the Late Pleistocene, but there have been few studies that employ absolute chronology to quantify the rates of landscape change and identify their drivers. We present the results from a multi-method dating study along the Thompson River, the largest tributary of the Fraser River, constraining the ages of terrace deposition and abandonment throughout the Holocene. These terraces not only archive fluvial processes, but also the activity of paraglacial alluvial fan deposition and post-abandonment aeolian units that cap terraces. Our results show that valley incision was initiated by ~10 ka, with a mean long-term incision rate of ~7 mm/yr. Incision rates increased to ~26 mm/yr during the mid-Holocene, from 7 – 4 ka, during a period of wetter climate than present. Our luminescence ages also show that paraglacial fans became widely stabilised by the mid-Holocene, decreasing sediment supply from valley sides into the main channel. Incision rates decreased with a shift towards drier conditions, similar to present, after 4 ka, with luminescence ages showing that aeolian sediments were extensively reworked during this period. Similar patterns of changing Holocene incision rates are also recorded for other rivers in the region, with consequent changes in aggradation rates recorded downstream in the Fraser River Delta. Given that glacioisostic rebound occurred very rapidly across central British Columbia, likely by 10 ka, we conclude that the main drivers of post-glacial fluvial evolution in the region are climatic forcing and base-level change.

Sediment source hysteresis during extreme flood events: the case of Tropical Cyclone Alfred on Eastern Australia's subtropical rivers.

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Eastern Australia's subtropical rivers are prone to extreme flooding due to the combination of climatic factors, shallow soils, and distinct topography. This natural vulnerability was compounded by two centuries of land use change and deforestation, increasing the runoff pulses and connectivity between land and river. Downstream propagation of sediment and associated pollutants reduces the water quality and increases the risk for harmful algal blooms, which has a profound negative impact on aquatic ecosystems, fisheries, recreation, and human health. Most of the soil erosion and downstream sediment transport happen during storm event flooding. However, little is known about the dominant source processes and hysteresis loops of fine sediment and phosphorus during these extreme events. Using grab and rising stage samplers we calculated hysteresis loops of suspended sediment and phosphorus concentrations throughout to the Cyclone Alfred flood event. The changes in source contributions were quantified using novel sediment geochemical fingerprinting techniques and mixing models. These results were integrated into a sediment budget that illustrates progressive activation and connection of distinct soil sources. These results can be used to target land, river, and riparian management actions to improve resilience against future extreme events.

Assessing Soil Erosion during Extreme Events in Tropical Savannas through the lens of variable Sediment Connectivity: from Monitoring to Modelling

Dr Maarten Wynants[1,2], Dr Nic Doriean[2], Mr John Spencer[2], Prof Will Bennett[2], Prof Pascal Boeckx[1], Prof Andrew Brooks[2]
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11B: (Dis)connectivity in geomorphology: From basic research to managing fluxes at source and at scale, Dobson 1, February 5, 2026, 5:00 PM - 6:30 PM

Soil resources in tropical savannas of the world are rapidly degrading, posing an imminent threat to food, water and livelihood security. Subsurface erosion on deep tropical soils has been shown to be the dominant source of sediment to the Great Barrier Reef. However, these soil loss processes tend to happen in stochastic burst during extreme flood events. Little is known about the impact of these rapid geomorphological changes on fine sediment and phosphorus connectivity in catchments. These caveats in our understanding of geomorphological and connectivity responses to extreme events are a major hindrance for attributing soil erosion and sediment flux dynamics to environmental drivers. These challenges are further compounded by a lack of suitable approaches for quantifying and modelling catchment geomorphological processes in these remote and unpredictable environments. Using an hierarchical catchment approach in the Bonnie Doon Creek of the lower Burdekin, Australia, this study assesses fine sediment and phosphorus transport during the 2024/2025 extreme flood season. We introduce a novel sediment tracing tool based on secondary weathered metal species that provides a new pathway for attributing the contribution of different subsurface layers in deep tropical soils. This novel tool is integrated within established techniques, resulting in a dynamic sediment budget to elucidate non-linear geomorphological responses to extreme events. Our results highlight the dominance of alluvial gullies to the sediment losses towards the Great Barrier Reef. We demonstrate shifting importance of source contributions and gully erosion processes throughout and between storm events. Moreover, we provide evidence for the positive feedbacks of gullies on land and water degradation through increased connectivity and the dissolution of P-holding carbonates. Finally, we introduce SWAT+-Gully that integrate open-access gully maps in the model sediment generation and routing routines, wherein gullies are both a direct source of sediment and a driver of changing sediment connectivity.

Integrated GNSS-Based Monitoring Framework for Landslide Early Warning in Mountainous Terrain

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Reliable monitoring of landslides using Global Navigation Satellite System (GNSS) in mountainous regions faces significant challenges due to environmental interferences like vegetation, terrain complexity, and atmospheric disturbances, causing noise, spikes, and gaps in data. These disruptions interfere with the accurate interpretation of displacement trends, hindering timely decision-making for early warning and risk reduction. To enhance disaster resilience and support civil protection initiatives, this study introduces a novel three-step GNSS data filtering and processing workflow using the open-source Generic Mapping Tools (GMT). The workflow encompasses: (1) interpolating missing GNSS data to create consistent and continuous time series; (2) optimizing filtering parameters (Gaussian, boxcar, cosine arch, Kalman filtering, and outlier thresholds) to remove noise while preserving displacement signals; and (3) validation and visualization through comparison with other geotechnical monitoring data, such as inclinometers and piezometers. Preliminary results indicate substantial improvements in noise reduction, data continuity, and accuracy in tracking surface movements. This integrated, accessible approach facilitates the development of reliable landslide early warning systems, supports multi-platform and multi-temporal data integration, and significantly contributes to risk reduction and management strategies within vulnerable mountainous communities.

Neogene–Quaternary channel evolution and provenance shift of the middle Yellow River

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The formation age of the middle Yellow River and the existence of a northwards-flowing river have been fiercely debated. Age distribution of detrital zircon varied spatiotemporally and produced contradictory provenance interpretations. The Jinshaan Gorge, the main part of the middle Yellow River and key to studying fluvial evolution and clarifying disputes, developed its topography during the late Cenozoic. In this study, we systematically review the Cenozoic tectonic evolution of the North China Craton, execute detrital zircon U–Pb dating in the Neogene?Quaternary sediments and investigate the topography along the Jinshaan Gorge, and the sedimentology and chronological framework of these sediments. We propose that the Gorge of the middle Yellow River could have developed since the Neogene, controlled by the tectono-geomorphologic evolution of the North China Craton in a dominantly extensional environment. No evidence supports a northward-flowing river during the Early Pleistocene or even earlier in the Jinshaan Gorge. We attribute the provenance variations of the Cenozoic sediments to detrital mixing of diverse geological units, local and distant, and especially highlight the systematic provenance shift between the Neogene and Quaternary sediments caused by bedrock downcutting and recycling aeolian sediments. The increased 1.5?0.33 Ga component of the lower Yellow River during the Early Pleistocene was likely caused by enhanced loess accumulation and should not be individually used as a proxy for the Yellow River formation. We emphasize the significance of comprehensive study on river evolution.

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Vegetation Recovery and Dune Stabilization under Climatic and Human Influences During the Past Four Decades in Northern China

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10H: Shaping Arid Landscapes: Unraveling the Complex Interactions Between Wind, Sediment, and Vegetation in a Changing Climate, Conway 3, February 5, 2026, 2:30 PM - 4:00 PM

Dryland aeolian landscapes are among the most vulnerable ecosystems under accelerating climate shift and land-use changes, where complex interactions between vegetation, soils, and landforms play a crucial role in maintaining ecosystem resilience and services. This study integrates remote sensing, field surveys, and numerical modeling to explore the coevolution of vegetation and aeolian landforms over the past four decades in East Asia's arid regions, with a particular focus on the feedback mechanisms driving landscape stability in the arid zones under climatic and human forcing. Analyses of aeolian landforms and climate systems in northern China reveal that declining wind speeds, associated with global terrestrial stilling, have significantly slowed dune migration rates over the past few decades, while widespread vegetation recovery has stabilized dune fields and mitigated desertification. Restoration practices, such as straw checkerboards, have accelerated vegetation recovery, increasing biodiversity and stabilizing soils, though soil fertility remains low compared to natural systems. Dust activity, an integral component of aeolian systems, have been suppressed in these areas, largely due to both climatic shifts and these large-scale restoration projects. Finally, high-resolution satellite images and field observations highlight how vegetation expansion modifies dune morphology through processes such as vegetation anchoring and sand transport alteration, leading to transitions from active to stabilized states. Conceptual models of vegetated dune morphodynamics provide insights into the role of vegetation-soil-landform feedbacks in shaping the arid landscapes.

By linking dune morphologies and vegetation dynamics to thresholds of stability and nonlinear responses to climatic and anthropogenic pressures, the findings contribute to a deeper understanding of how dryland ecosystems adapt and evolve. These insights support more effective strategies for soil conservation, landform stabilization, and the restoration of ecosystem functions in the face of ongoing climate and land-use changes.

Assessing Environmental Responses to Coastal Development in a Tropical Shallow Marine Setting Using Foraminifera and eDNA

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Singapore, home to one of the world's busiest ports, has undergone substantial urbanisation over the past few decades, with large-scale coastal projects continuing to this day. These developments inevitably impact the ecological health of coastal systems, and such effects are often preserved in the sedimentary record as shifts in sedimentological characteristics, microfossil composition, and/or community structure. However, our understanding of how these anthropogenic activities influence ecological and sedimentary processes over time remains limited. To assess the impacts of these developmental changes on coastal systems, bioindicators such as foraminifera are commonly used due to their sensitivity to various environmental parameters and good preservation potential. In addition, environmental DNA (eDNA) has also emerged as a powerful biomonitoring tool, providing a less labour-intensive and more time-efficient alternative for tracking ecological shifts. Here, we examine modern surface sediment samples from the Singapore Strait using a combination of traditional sedimentological and foraminiferal approaches, alongside multi-taxon eDNA metabarcoding, to establish current baseline environmental data. The same analyses are conducted on short sediment cores to determine if recent coastal development in Singapore has had any measurable impact on the nearshore marine environment. Preliminary results from a sediment core show a coarsening trend upcore accompanied with a shift in foraminiferal assemblages at about 16 cm depth, likely reflecting a shift in hydrodynamic or sedimentation conditions. This study provides valuable baseline data for interpreting environmental change in the Singapore Strait during the Anthropocene and aims to identify key indicators for coastal monitoring and paleoenvironmental reconstructions.

How “wet islands” form – A case study of the Qilian Mountains on the arid northern Tibetan Plateau

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Mountains in arid regions often act as “wet islands” by intercepting moisture and sustaining ecosystems distinct from their surrounding deserts. However, the timing and mechanisms of their formation remain uncertain. Here we investigate the Qilian Mountains on the northern Tibetan Plateau during the Middle Miocene (16–12 Ma), a period of significant global cooling and rapid plateau uplift. By integrating multiproxy climate records from the Westerlies, Asian monsoon, Plateau basin, and Qilian Mountains, we reveal contrasting hydroclimatic trends: widespread aridification in surrounding basins versus increasing humidity in the mountains. Pollen data indicate divergent vegetation evolution, with conifer forests expanding in the Qilian Mountains while xerophytic taxa dominated the basin. Quantitative precipitation reconstructions show that the mountain–basin precipitation gap widened from ~100 mm at 16–15 Ma to ~470 mm at 13–12 Ma. Regional climate modeling further demonstrates that uplift-induced orographic precipitation in the Qilian Mountains offset cooling-driven drying, in contrast to basin environments where cooling amplified aridification. These findings indicate that the Qilian Mountains “wet island” formed during the Middle Miocene Climatic Cooling (14–12 Ma) through the combined effects of global cooling and tectonic uplift. This study provides a process-based model for understanding mountain–basin climate differentiation in Asia’s arid interior and offers insights into ecosystem and hydrological resilience under future climate change.

Tectonic and climatic processes on mudstone badland evolution in southwestern Taiwan

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08H: New frontiers in the study of erosion processes and geomorphic dynamics in badlands, Conway 3, February 5, 2026, 9:35 AM - 11:05 AM

Badlands in southwestern Taiwan offer a unique natural laboratory for understanding rapid landscape responses to both natural and human-induced forces. Formed in highly erodible mudstone under conditions of rapid tectonic uplift (> 7 mm/year), these small-scale ridge-and-valley landscapes preserve geomorphic signatures that reflect short-term tectonic and climatic forcing. The dynamic response to individual events, such as slope steepening from earthquakes and gradient reduction from typhoon rainfall, mirrors processes in larger mountain systems but occurs at faster rates, enabling direct observation. Moreover, badlands serve as valuable archives for chemical weathering during typhoon events: during typhoons, rapid transitions from evaporite to silicate weathering coincide with high sediment concentrations and sodium-induced deflocculation. Human intervention modifies these systems—over 50 years of fluvial sediment show that embankment dams have significantly reduced sediment delivery (>90%) despite expanding badland areas and increased rainfall. The dams accelerate flat-bottomed valley formation, with siltation filling 87% of such valleys within five decades. Collectively, our findings highlight badlands as sensitive indicators of both natural forcing and anthropogenic impacts, offering crucial insights into transient landscape evolution and the importance of integrated sediment management in a rapidly eroding system.

Late Quaternary evolution of upper Dadu River, eastern Tibetan Plateau, and its impact on human activities

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06I: Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 2:30 PM - 4:00 PM

The Tibetan Plateau (TP), known as the "Asian water tower", hosts the headwaters of major Asian rivers and has a long history of human activity since middle Pleistocene. The Dadu River, an important fluvial system on the eastern TP, has supported human activity since at least the Neolithic period in the upper valley. However, the fluvial evolution process and the impacts on human activities remain unclear. In this study, a total of five fluvial terraces (T1-T5) were mapped in the upper Dadu River valley. Multi-method luminescence dating was applied to fluvial deposits from the terraces, aiming to reconstruct the landscape evolution during the late Quaternary and to evaluate its impacts on early populations. The results indicate that the fill terraces were formed during distinct periods: approximately 150-130 ka (T5), ~110 ka (T4), 60-40 ka (T3 and T2), and ~2 ka (T1). Tectonic activity and orbital climate variability are likely the primary drivers of river incision and terrace formation. Before the formation of T1, inhabitants of Konglongcun site occupied the T2 terrace at ~5.5-4.8 ka, and utilized the landscape and the associated ecological resources, highlighting the interaction between early human activities and fluvial landscape evolution.

Key words: Tibetan Plateau; Dadu River; Luminescence dating; Fluvial landscape change; early human activity.

The role of the Tarim River in shaping the Taklamakan Desert during the late Quaternary

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06H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 2:30 PM - 4:00 PM

The Taklamakan Desert, located in the Tarim Basin in northwestern China, is by far the largest sand sea in China. The Tarim River with the headwaters both in the Tianshan in the north and in the Kunlun Mountains in the southwest is the largest inland river in China. The Tarim River acts as the main agent bringing large portion of water and sediments from the mountains into the basin, providing fundamental sources of sediments for the sand sea and moisture for the flora and fauna. In the other sense, the northern margins of the sand sea offer the large space for the river to have formed extensive flooding plains and terraces where humans have found habitat for a long time. Here we present our current research about the spatial and late Quaternary changes of the sand dunes, river system and glaciers along the Tarim River from the lower catchment to the headwaters in the Tianshan Mountains. We dated the moraines and fluvial deposits via OSL, confirming occurrence of glaciers several hundred meters below the current snowline and river channels in the northern portion of the sand sea. We investigated changes of sedimentary facies in selected sections across the entire study area. Our preliminary results suggest that the runoff of the Tarim river, in response to the enlarging of the glaciers in the headwater areas during the Little Ice Age and the local Last Glacial Maximum, had increased simultaneously, causing the increase in the water level in the terminal lake in the east of the endorheic basin. Our new study of loess section in the catchment generally confirms the fluctuation of palaeoenvironments during the late Quaternary, but a detailed comparison between different achieves remains a challenging task due to the nature of geomorphic records.

Joint effect of aquaculture and land reclamation on sediment dynamics

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04E: Coastal dynamics and climate change: from the recent past to the near future, Dobson 4, February 3, 2026, 9:35 AM - 11:05 AM

The rapid development of global coastal aquaculture and land reclamation are significantly changing the offshore sediment dynamics system. Based on remote sensing, in-situ observation, digital elevation models and numerical simulation, the research surveyed and simulated changes in aquaculture and land reclamation areas, their effects on sediment dynamics, and the resulting bed erosion/deposition in Sansha Bay from 2005 to 2020. From 2005 to 2020, aquaculture and land reclamation areas increased from 6.2 km2 and 16.5 km2 to 154 km2 and 55.3 km2, respectively. In the subtidal area, the sharp increase in aquaculture area dominated the changes in sediment dynamics, altering the vertical velocity profile from a logarithmic to bow shape due to double boundary effect of top aquaculture and bottom bed. This effect shifted maximum velocity layer downward to 0.4-0.6H and the average bottom velocity increased by 10%, the bottom suspended sediment concentration (SSC) increased 26%, resulting in a 102% increase in bed erosion. While in intertidal flat, increased land reclamation dominated the changes in sediment dynamics and weakened the hydrodynamics due to dam reflection effect. This effect decreased bottom velocity by 15% and SSC by 22%, resulting in a 153% increase in bed deposition. This study provides a reference case for the impact of offshore aquaculture and land reclamation on sediment dynamics.

Cosmogenic 36Cl and 10Be Exposure Ages, Kinematics and Inventory of Rock Glaciers in the Eastern Black Sea Mountains, Türkiye

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03G: Open session on rock glaciers dynamics, Conway 2, February 2, 2026, 4:00 PM - 5:30 PM

Rock glaciers are significant indicators of the presence and boundaries of mountain permafrost, hold great potential for reconstructing past and current climatic variations, and play a critical role in mountain hydrology. However, studies on their distribution, mapping, classification, dating, activity, and hydrological potential in Türkiye remain sparse. Determining the timing of their formation and stabilization and high-resolution kinematic characteristics during their evolution are therefore essential for understanding how permafrost dynamics have responded to climate changes in the past and how they will respond to future climate changes. The Eastern Black Sea Mountains host Türkiye's most extensive glaciated and periglacial area, yet no regional rock glacier dataset currently exists. To address this, we compiled a comprehensive inventory of 1150 rock glaciers, quantified their kinematics, and dated their formation and stabilization periods by integrating remote sensing, geodetic surveys, unmanned aerial vehicle (UAV)–based photogrammetric mapping and monitoring, and surface exposure dating with cosmogenic ^{36}Cl and ^{10}Be isotopes. Our classification identified 259 active or inactive rock glaciers and 891 relict periglacial landforms, while morphological analysis showed that 80% are lobate and 20% are tongue shaped. The total mapped area is approximately 35 km^2, of which about 18 km^2 corresponds to active or inactive forms. The mean elevation of active rock glaciers is ca. 3100 m above sea level. Annual velocities of some monitored rock glaciers between 2023 and 2024 reached approximately 1 m/year, triggering tongue detachments. Established cosmogenic nuclide chronology reveal stabilization during the Lateglacial, Younger Dryas, and Early Holocene, influenced by varying topography and environmental conditions. Our results provide a critical baseline for future monitoring, numerical modelling, risk assessment, and adaptive management of mountain permafrost under projected climate change.

Aerodynamic ripples on Earth and Mars -new insights from wind tunnel experiments

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03D: Planetary Geomorphology, Dobson 3, February 2, 2026, 4:00 PM - 5:30 PM

Aeolian sand ripples formed due to the interaction between wind and loose sand and they are ubiquitous both on Earth and Mars. Terrestrial normal ripples forming in unimodal fine sand are quite small with wavelengths smaller than 30 cm and height in the order of 1 cm. Surprisingly, on Mars, these ripples are much larger with wavelengths of an order of 1-3 m and height of a few cm with smaller decimeter superimposed ripples. Since the discovery of these large martian ripples, there is an ongoing scientific debate about their formation.

According to a new theory, the large martian ripples are wind drag (fluid) ripples or aerodynamic ripples that are similar to subaqueous ripples. They form due to the large kinematic viscosity of the martian atmosphere. This hypothesis argues that these two ripple sizes have distinct size distributions and lack bedforms in the ∼20–80 cm range, indicating two different formative mechanisms that can overlap. According to the new model the large ripple form due to hydrodynamic instability with a subscale saturation length and their size scale with the thickness of the viscous sublayer.

Here we present detailed experimental studies focused on the formation of impact and hydrodynamic ripples in the boundary layer wind tunnel in Ben Gurion University and in the low-pressure wind tunnel in Aarhus University for different grain sizes of sand, nutshell granules, glass beads and very fine sand natural from the Taklimakan Desert. According to the experiments there is a range of wind velocities where both impact and hydrodynamic ripples are stable. For larger wind velocities the impact ripples disappear and the aerodynamic ripples become more sinuous like subaqueous ripples. The rate of the change in the sinuosity increases with wind velocity. These results can shed light on the formation of the large martian ripples.

Controls on small-scale geomorphic features in intertidal environments: the differing influence of patchy mangroves in muddy and sandy systems

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01K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 11:40 AM - 1:10 PM

Coastal vegetation, such as mangroves and salt marshes, plays a significant role in altering hydrodynamics by exerting drag and slowing large-scale flows, but generating turbulence on the stem-scale. Developing a detailed understanding of the impact of vegetation across multiple scales is therefore crucial for unravelling sediment resuspension and deposition, and thus also predicting longer-term geormorphic evolution in these environments. However, studies on the influence of patchy vegetation, a common feature in New Zealand’s mangrove forests, remain limited.

To address this knowledge gap, we undertook field measurements on an intertidal sand-flat, in which six artificial circular vegetation patches were created to mimic pneumatophores, the pencil-shaped areal roots of Avicennia marina mangrove stands. Pneumatophore density (projected area density of 0.6, 2.5, and 7.5 m-1) and height (0.1 and 0.2 m) were varied, and flow velocities and turbulence were measured within and behind the patches over several tidal cycles. The results demonstrated a substantial influence of pneumatophores in attenuating flow velocity and suppressing near-bed turbulent kinetic energy (TKE) inside the patch, characterizing them as depositional zones. However, high pneumatophore densities led to notably elevated TKE just behind the patch (~ 0.3 m from the edge) due to eddies created at the scale of patch height, indicating erosional zones. The corresponding measurements of acoustic backscatter also suggested enhanced resuspension behind the dense patch during times of greater TKE.

Results are compared to corresponding data collected from small patches of natural mangroves on an intertidal mudflat. In this case, diverse and complex spatial patterns of deposition and erosion patterns around the mangroves were visible. However, in contrast to the sandy environment, the influence of the small tree canopy and creation of wake zones appeared to dominate the small topographic variations rather than the pneumatophores.

The Scripps Oceanography coastal observation program

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08E: Coastal geomorphology: from monitoring techniques to littoral hazard analysis, Dobson 4, February 5, 2026, 9:35 AM - 11:05 AM

The Scripps Oceanography monitoring program for San Diego County is one of the most comprehensive shoreline observing systems in the world. This presentation will provide an overview of the monitoring program, how it has evolved over time, and applications of the datasets generated by the program. The monitoring program uses a comprehensive coastal system approach that includes offshore, nearshore, and onshore monitoring, designed to better understand feedbacks and interactions of the coastal system. Beaches, cliffs, and waves have been monitored at select sites since 2001, using a range of in-situ instruments, GPS equipped platforms, mobile and stationary LiDAR, video cameras, and photogrammetric unmanned aircraft systems. Data have been collected before, during, and after several important forcing events including energetic El Niño winters and beach nourishment activities. Observations include regional weekly and site specific near continuous topographic observations. These observations have led to a better understanding of long term and seasonal beach sand level changes, wave runup, coastal flooding, the fate of sand deposited during beach replenishment projects, coastal storm impacts, cobble movement, cliff erosion, and improvements in coastal wave forecasting. Recent work includes development of a real time coastal cliff failure warning system and autonomous coastal hazard monitoring stations.

Debris-flow fan development and geomorphic effects in alpine canyons under a changing climate

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01B: Alluvial fans and rivers: landform archives of long-term landscape development and environmental change, Dobson 1, February 2, 2026, 11:40 AM - 1:10 PM

Debris flows in alpine regions are increasingly frequent due to climate change, driven by rising temperatures and more intense precipitation events. These flows often generate fans at tributary outlets, which extend into the main river channel and mediate interactions between tributaries and rivers. Understanding the formation and evolution of these fans is essential for elucidating their geomorphological impacts on alpine river valleys. We investigate the Tianmo Gully, a tributary of the Parlung Tsangpo basin in Southeast Tibet, which has shifted from hazard-free to hazard-active over the past two decades due to recurrent debris flows. Integrating remote sensing, digital elevation models (DEMs), UAV imagery, RTK surveys, and field observations, we analyzed the Tianmo fan's development and morphology, focusing on the effects of four major debris flows. The fan's evolution reflects two distinct processes: episodic debris flows and perennial stream flows. Episodic debris flows, characterized by high-magnitude sediment transport, rapidly expand the fan through deposition, while perennial stream flows gradually reshape it between events via incision and channel migration. These dynamics have altered the Parlung Tsangpo River, shifting its morphology from a narrow, single-channel system to one with alternating wide and narrow reaches and a stepped longitudinal profile.

An effective approach by using proxy of deepwater depth to assess wave hazards and public safety on microtidal shore platforms

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03F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 4:00 PM - 5:30 PM

Rocky coasts in microtidal regions are hazardous environments due to their exposure to high wave energy and popularity for recreational activities. In Australia, rocky coasts contributed to 17% (n = 211) of total coastal drowning death between 2014 and 2024, with over half of these deaths (n = 113) associated with rock fishing on the edge of rocky ledges, termed shore platforms. A simple morphological method has been proposed to assess shore platform danger by using two landform elements: front depth (FD) and elevation. However, its application is often limited by the lack of high-quality nearshore topographic data and challenges in precisely identifying FD locations.

In this study, we substitute FD with a more accessible water depth value as proxy which is defined as the greatest depth within a certain offshore buffer zone (in width of 20, 50, 100 and 150 m, respectively). This proxy is used to assess the morphological exposure and drowning risk (by combining with nearshore wave height) on shore platforms along the entire coastline of Victoria, Australia (in length of 2515 km). Results show that the proxy water depth derived from 100 m buffer zone produces the most robust correlation with FD in both exposure and risk assessment while other proxy depths tend to underestimate the hazard ranking along the coast. This is probably because the 100 m buffer zone can best capture the greatest depth of the nearshore shelf. Additionally, the hazard ranking results are compared with known rocky coast drowning death locations in Victoria over past 10 years. There is no bias of the occurrence of drowning in more dangerous platform which suggests the complexity in human behaviour and risk perception on shore platforms.

Global Delta Topography using ICESat-2: Elevation Signatures, Forcing Controls, and Vulnerability Typologies

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

Quantifying global river delta vulnerability to relative sea-level rise (RSLR) has been fundamentally constrained by inadequate elevation data. This study addresses this critical gap by providing a high-accuracy reconstruction of delta topography for ~81 major river deltas, using ICESat-2 satellite altimetry data referenced to local mean sea level.

Our analysis reveals a global median delta elevation of just 1.65 m above Mean Sea Level (MSL), with 39% of global delta area already below Mean High Water Level (MHWL)—a figure projected to increase to 58% with 0.5 m of sea-level rise. We demonstrate that MHWL, not MSL, acts as the primary base level governing delta plain formation. Furthermore, extensive engineered landscapes below MSL correlate strongly with anthropogenic land use, highlighting the role of human-induced subsidence.

This study uses elevation probability density functions (PDFs), as unique topographic signatures reflecting millennial-scale adjustments to varied natural and human forcings. We identify four distinct global delta typologies, each with characteristic elevation distributions, geomorphic drivers, and human pressures, revealing significant inter-delta variability previously unrecognized.

These results challenge simplistic views of deltas as uniformly low-lying, correct biases in vulnerability assessments, and advance understanding of the complex interplay between natural processes and human impacts on delta evolution. This novel global dataset and typological framework provide a critical foundation for developing effective adaptation strategies.

Granite megaclasts and flatrocks in Lara village (Far North Cameroon): assets for geotourism implementation

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13H: Quaternary Geomorphology and Landscape Evolution, Conway 3, February 6, 2026, 11:35 AM - 1:05 PM

In Lara granites are the main rock bodies cropping out in plutons (inselbergs), megaclasts, and slabs of exceptional sizes and shapes. Even though inselbergs have been recently inventoried and studied for geotouristic purposes in Lara, megaclasts and flatrocks, mainly scattered in the Piedmont areas, are still under-investigated despite their alluring features. Thus, their inventory and study are of great importance in promoting them while scaling up Lara's geotouristic offer, as aimed at in this study. To achieve this goal, laboratory and field surveys were alternatively carried out, enabling the selection, description, and mapping of these landforms using GIS software. These geomorphosites were selected based on their aesthetic value and geological features. This study shows that Lara's piedmont is embellished with particular granite megaclasts and flatrocks. Megaclasts are isolated and clustered. They are 2 metres or more in size and have infrequent shapes, encompassing Mushroom, Recumbent Dog, Split Tuber, Spiral Ice-Cream, and Bowl-like. Some megaclasts are crosscut by slits networks and riddled with coarse-grained quartz xenocrysts. Moreover, others are punctured by various coalescent tafoni. All these features enhance the geoheritage value of Lara megaclasts. Flatrocks are mostly elongated and fairly elliptical in shape. They extend to 10 square metres and are mostly bored by tens of centimetric pits. Lara's flatrocks bearing pits have significant cultural value due to the long-term activities practiced there by the local population. Through these features, granite megaclasts and flatrocks endow relevant educational values that make them suitable tools for geotourism implementation.

LGM glaciers in the northern Dinaric Mountains of Slovenia, Europe

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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

The Dinaric Mountains (2694 m asl) are a mountain range stretching in a NW–SE direction from the Alps to Albanides–Hellenides, Europe. The highest parts were occupied by small ice fields and/or valley glaciers during the Quaternary cold periods, while even today some small glaciers still exist in topoclimatically favourable areas. The northernmost part of the Dinaric Mountains is called Trnovski gozd (1495 m asl). It is a high karst plateau characterised by conical hills, uvalas, solution dolines and numerous speleological objects. In addition to the karst, Trnovski gozd also has a palaeoglacial landscape above 1100 metres asl. Here we present the glacial history of Trnovski gozd, which was studied by geomorphological mapping, ^{36}Cl terrestrial cosmogenic nuclide dating and the Parallel Ice Sheet Model (PISM). The glacial evidence on the Trnovski gozd is very scattered and sparse. Based on geomorphological mapping, the ice area was estimated to be ~7 km^2. We took five samples from boulders located on the crest of the largest moraine in the area. The dating results are consistent with the global LGM age. PISM simulations confirmed the plausibility of the geomorphologically reconstructed glacial extent. The optimisation process identified optimal climatic parameters with a temperature offset of -7.5 °C and precipitation scaling factor ranging between 0.8 and 0.9 with respect to the modern values. The equilibrium line altitude (ELA) derived from the simulation results is 1205-1281 m, depending on the precipitation scaling factor. The ELA of Trnovski gozd is comparable to the LGM ELAs of some nearby isolated alpine glaciers. The temperature and precipitation offsets are also similar to those found over the Alps during the LGM. Isolated LGM glaciers close to the Alpine ice field allow for straightforward glacier reconstruction and are therefore ideal for ELA calculations and deciphering the impact of atmospheric circulation systems.

Soča glacier during the Last Glacial Maximum, SE European Alps

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01G: Glacial and Periglacial Processes in Mountain Regions: Past and Present, Conway 2, February 2, 2026, 11:40 AM - 1:10 PM

The European Alps were covered by a large ice field during the Last Glacial Maximum (LGM). While the timing and extent of quite a few palaeoglacier systems on the southern and northern sides of the European Alps have been studied in detail, comprehensive glacial studies along with glacial chronology are still scarce in the south-easternmost sector. It is important to fill this research gap to better understand the LGM climate patterns over the European Alps. Here we present the first glacier chronology from one of the major valley glaciers in Slovenia, south-eastern European Alps, i.e. the Soča glacier. The timing and extent of the Soča glacier during the LGM were reconstructed by geomorphological mapping, sedimentological logging and radiocarbon dating. We carried out detailed geomorphological mapping of the lower valley, where we logged 40 profiles of glacial, fluvio-glacial and lacustrine deposits and dated 49 samples using bulk radiocarbon dating method. Although bulk samples are considered lower quality than plant macrofossil samples, the large dataset and careful stratigraphic analysis allow for the following conclusions: 1) The landform – deposit – absolute age relationship confirms that the Soča glacier was nearly 60 km long during the LGM and terminated in the form of two snouts. 2) The ages indicate a good agreement of the Soča glacier advance with the available chronological data of other major glacier systems in the Alps, although the timing cannot be precisely determined due to the time lag between organism death and landform generation. These new findings provide important insights into the extent and timing of the south-eastern part of the Alpine ice sheet and may contribute to a better understanding of regional climate patterns at this time.

Oases as built landscapes: geomorphological formation, human maintenance and sustainability

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Poster Session 2, Exhibition & Poster Hall, February 3, 2026, 4:00 PM - 5:00 PM

The formation of oases is one of the major geomorphological processes that has taken place since the mid-Holocene. In the arid regions of North Africa, Arabia, and the Levant, these landscape units developed because of the progressive reduction in water availability, triggered by the retreat of the summer monsoon and ultimately driven by decreased insolation. While the pace and characteristics of this process vary slightly across regions, the outcome is the emergence of specific ecological niches capable of sustaining life through residual water resources. In addition to natural geomorphological dynamics, human activity has significantly contributed to the expansion and shaping of oases, playing a key role in their preservation over time. In some cases, however, the overexploitation of natural resources has led to their decline or disappearance. Cultural adaptations to increasing aridity include the shift to agriculture, the persistence of specialized pastoralism, continuous innovation in farming techniques, the introduction of new plant and animal species, and the development of complex tools for managing water resources and preserving fertile soils. Human agency in shaping oases throughout the Holocene, combined with cultural innovation, operated diachronically, with processes that varied widely in terms of their local to regional impacts and strategies for coping with aridity. A range of geoarchaeological evidence for the anthropogenic maintenance of oasis ecosystems across different physiographic units of arid lands are available, highlighting the diverse timing and nature of these processes and suggesting that present-day oases are not natural ecosystems but rather anthromes—landscapes profoundly shaped by centuries or millennia of human activity.

The geoarchaeology of the built landscape: long-term human impact and sustainability

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06I: Human impact on geomorphological processes: from the Quaternary record to the present, looking to future trends, Conway 4, February 3, 2026, 2:30 PM - 4:00 PM

For most of their time on Earth, humans had little impact on the environment. However, around 12,000 years ago, the first permanent modifications to natural ecosystems began to appear at a relatively local scale. Human influence on the planet became increasingly significant around 3,000 years ago, as progressively intensive land-use systems altered surface geomorphological processes and ecosystems. This led to the creation of anthropogenic landscape features designed to control or modify natural geomorphological dynamics, resulting—starting in prehistory—in cascading impacts on ecosystems and the formation of built landscapes. This contribution explores the geoarchaeological record of built landscapes, drawing on specific case studies from the Mediterranean region and arid lands, based on recent research projects, including the ERC-2024-COG TerraForm Project. Particular attention is given to the significance of landesque capital techniques and their role in the exploitation of natural resources, as well as their medium- to long-term effects on geomorphological processes. The role of anthropogenic landforms—representing a distinct aspect of the early Anthropocene—will be critically examined in relation to the resilience of ancient communities to environmental change. The analysis aims to assess the impacts of agricultural landesque capital strategies and the broader consequences of changing land use on both geomorphological processes and ecosystems.

Assessing Hydro-Geomorphological Risk under Climate Change Scenarios: A Multi-Hazard Framework Applied to the Lisbon and Tagus Valley Region

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13J: Landscape sensitivity and global change, Conway 5, February 6, 2026, 11:35 AM - 1:05 PM

Hydro-Geomorphological hazards such as landslides, riverine and flash floods, estuarine flooding, coastal flooding, and cliff erosion are increasingly influenced by climate change, particularly through the intensification of extreme weather events and sea level rise. This study presents a multi-hazard methodological framework designed to assess both current and future climate-induced risks associated with these five hazards in the Lisbon and Tagus Valley region (Portugal). The framework combines spatial analysis of hazard susceptibility, exposure of residential buildings and populations (based on 2021 data), and a social vulnerability index constructed from socio-demographic indicators.

Using civil parishes as the territorial unit, each hazard was modelled under present and projected climate scenarios (RCP 4.5, RCP 8.5) for the end of the 21st century, allowing for a spatialized and comparative analysis across 355 civil parishes. Susceptibility was evaluated through geomorphological, hydrological, and coastal process indicators, while exposure and vulnerability were integrated to quantify relative risk levels.

The results reveal differentiated risk profiles, with coastal flooding and cliff erosion posing increasing threats in low-lying and urbanized coastal sectors, while landslides and fluvial flooding remain dominant in inland areas with specific geomorphic conditions. The findings demonstrate the value of combining geomorphological knowledge with climate risk assessment tools, and underscore the need for place-based, hazard-specific risk reduction strategies.

This contribution illustrates the applicability of a multi-hazard, climate-informed approach to geomorphological risk in regional planning and adaptation policy.

Responses of main river in flow and sediment transport to abrupt sediment supply from tributary debris flow

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

With the increasing impact of global climate change on the Tibet Plateau, debris flows are prone to occur in steep tributaries along the main rivers. Debris flows normally provide high-intensity sediment supply to the main river and significantly affect flow and sediment transport processes in the main river. The abrupt sediment supply from debris flows may cause deposition at the confluence, narrowing the channel width and even blocking the main river. However, responses of main river to sediment supply regimes from debris flows have not been well understood and quantified due to the difficulties in monitoring and measurement in either field or laboratory. To address this issue, a theoretical model was established by reflecting all the physical processes during and after a debris flow entering the main river. The hydraulics, sediment transport and morphological variations were coupled at the confluence. The variations of length, width and area of the deposition fan in the Tianmo debris flow gully in the Southeast Tibet Plateau, China, obtained by remote-sensing images and field surveys were used to validate the newly developed model. Then the morphological evolution and sediment transport processes in the main river were simulated under various hydraulic and morphological settings of the tributary and main river. The results show that main river blockage is primarily influenced by the sediment transport ratio between debris flow and main river. The bedload transport rate in the main river significantly correlates with the slope of the main river channel and the momentum ratio between the main river and debris flow. The bedload transport rate shows two peaks in a debris flow event: one at the initial entry of the debris flow and another one with much lower magnitude when the debris flow stops and the scouring of the deposition intensifies.

Late Quaternary mega-lake formations in the central-southern Tibetan Plateau constrained by K-feldspar single-grain pIRIR dating of paleo-shorelines

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02A: Dryland hydrology: water processes and dynamics in arid and semiarid environments, Auditorium, February 2, 2026, 2:00 PM - 3:30 PM

Lake evolution in the Tibetan Plateau (TP) during the late Quaternary exhibits pronounced spatiotemporal complexity, manifested by mega-lake formations during MIS 5 in the northeastern TP (NETP) versus MIS 3 and early Holocene lake high-stands in the central-southern TP (CSTP). While quartz optically stimulated luminescence (OSL) remains the most widely used dating method for reconstructing paleolake levels across the TP, its reliability has recently been questioned, prompting a critical re-evaluation of paleolake chronologies. Here, we determined the ages of thirteen mega-lakes in the CSTP by dating the highest paleo-shorelines using both quartz single-aliquot OSL and K-feldspar single-grain (SG) post-infrared infrared stimulated luminescence (pIRIR) techniques. Dimensions and water storage changes of these mega-lakes were reconstructed. Our results indicate that quartz OSL signals exhibit thermal instability, resulting in age underestimations, particularly for samples older than ~40 ka, potentially explaining previous MIS 3-restricted paleolake chronologies. By contrast, K-feldspar SG-pIRIR dating provided robust age constraints, revealing that the mega-lakes primarily formed during the last deglaciation-early Holocene (17-15 ka and 12-9 ka), while a subset of lakes record MIS 5 mega-lake phases (106.7-97.6 ka and ~70 ka). We hypothesize that enhanced Indian summer monsoon intensity coupled with increased glacial meltwater drove mega-lake formations during MIS 5 and the early Holocene, whereas the last deglacial mega-lakes may reflect meltwater flux variations.

Hydrodynamics of stepped channels: insights from refractive index matching (RIM)-based flume experiments

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04H: Geospatial Innovations in Geomorphological Research: Integrating Remote Sensing and Advanced Technologies, Conway 3, February 3, 2026, 9:35 AM - 11:05 AM

Bed structures (e.g., step-pool, transverse rib, riffle-pool) normally form in high-gradient channels and many of them lay out transversely in the channel, leading to stepped features in the longitudinal profiles. The stepped channels show alternations from supercritical flows at the steps to subcritical flows downstream, which significantly influences geomorphological processes of the channels with regard to bed scour, air entrainment and sediment transport. However, the turbulent water surface in a stepped channel blocks most measurement of the hydrodynamics. Furthermore, the flow beneath the bed surface due to high porosity of the riverbed is usually neglected but influences the surface flow characteristics and fine sediment transport significantly.

To acquire detailed information of hydrodynamics for stepped channels, we conducted a series of experiments in a refractive index matching-based flume system (3 m long, 0.1 m wide, 0.25 m deep). Saturated sodium iodide solution was used as the fluid phase, showing the same refractive index with transparent borosilicate glass beads which simulated the bed grains. Scenarios with various conditions of slopes, grain sizes, discharges, step structures and spacing, and bed porosity were tested. The flow fields around each step were lighted up by a 1 mm-thick laser sheet and captured by a high-speed camera at a frequency > 1000 Hz. Both the flow field and particle movement in each measured longitudinal section were visualized by combining PIV (Particle Image Velocimetry), PTV (Particle Tracking Velocimetry) and CNN (convolutional neural network) methods. The results showed that the step structures strongly diverted the surface flow and fine sediment to beneath the bed surface, especially at low flows, based on the streamlines both above and beneath the bed surface for all the tested step structures. Our work highlights the great potential of RIM-based experiments in revealing complex properties of flow and sediment transport for mountain rivers.

Large-number detrital zircon U-Pb ages reveal global cooling caused the formation of the Chinese Loess Plateau during Late Miocene

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06H: Aeolian dynamics in context – links between wind and landscape processes, Conway 3, February 3, 2026, 2:30 PM - 4:00 PM

The erosion, transmission, and deposition of dust substances are controlled by multiple factors such as structure and climate, and have significant impacts on global temperature, precipitation, carbon cycle, and so on. The Chinese Loess Plateau is the geomorphic unit with the largest and longest accumulation history of dust on land. The study of the transmission process of dust on the Chinese Loess Plateau can provide key evidence for the generation, transmission, and driving mechanisms of dust globally. This study used the large sample method of detrital zircon U-Pb age tracing. Based on a thorough investigation of the material characteristics of detrital zircon U-Pb age spectra in potential source areas, more than 37000 age data from nearly 100 samples were statistically analyzed. Combined with source area classification and Monte Carlo simulation, a new model for quantitatively tracing different source areas was proposed. Based on this, quantitatively estimate the changes in the contribution of different source areas to dust on the Chinese Loess Plateau over the past 8 million years. Summarize the dust deposition flux data of the Chinese Loess Plateau over the past 8 million years, combined with published geochemical and mineral composition data, to comprehensively analyze the changes in material sources and regional weathering intensity on the Loess Plateau. Research has found that the northeast of the Qinghai-Tibet Plateau is the main source area of the Loess Plateau. The process of dust erosion and transmission in the source area of the Loess Plateau is mainly controlled by climate. Since the late Miocene, the world has gradually cooled down, exacerbating the glacial and periglacial processes in the northeast of the Qinghai Tibet Plateau and regional aridification, which has led to an increase in regional dust emissions.

Simulation of the spatio-temporal evolution of soil erosion on the Loess Plateau in future scenarios

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07J: Hillslope processes and landslides in a changing world, Conway 5, February 3, 2026, 5:00 PM - 6:30 PM

Soil erosion poses a significant threat to global soil functionality and represents one of the most prevalent forms of land degradation. Influenced by both natural factors and anthropogenic activities, mitigating soil erosion is crucial for maintaining ecosystem stability. As one of China's most erosion-prone regions, the Loess Plateau features complex natural conditions and intensive human activities, yet future soil erosion dynamics under changing scenarios remain underexplored. This study evaluates soil conservation value in the Loess Plateau from 2020 to 2050 by integrating PLUS-model simulated land-use data with downscaled CMIP6 climate projections under three scenarios (SSP126–EP, SSP245–NG, SSP585–EG), coupled with the Universal Soil Loss Equation. Key findings include: (1) Multi-model ensemble (MME) reliably projects precipitation trends, showing southwestward spatial shifts with southern dominance. SSP585 exhibits the highest rainfall increase, particularly in southwestern/southeastern areas, while SSP126 remains stable. Land-use patterns generally align with historical configurations but display localized variations. (2) Erosion distribution predominantly concentrates in central loess hilly-gully regions (northern Shaanxi), with SSP585–EG showing expanded severe erosion in southwestern areas. Average erosion rates follow SSP245–ND (17.64–22.46 $t \cdot ha^{-1} \cdot yr^{-1}$) < SSP126–EP (17.68–20.42 $t \cdot ha^{-1} \cdot yr^{-1}$) < SSP585–EG (20.23–22.46 $t \cdot ha^{-1} \cdot yr^{-1}$). SSP126–EP demonstrates V-shaped temporal fluctuations, while SSP245–ND and SSP585–EG show progressive increases. Severe erosion areas under SSP126–EP fluctuate between 90,467–108,887 km^2, contrasting with steady escalation in other scenarios. Results suggest aggravated erosion risks under SSP585–EG and SSP245–ND, particularly in southern regions, necessitating targeted conservation measures. This research provides theoretical and practical guidance for soil-water conservation policies and land-use planning in ecologically vulnerable areas.

Biogeomorphological niche of a landform: Machine learning approaches reveal controls on the geographical distribution of Nitraria tangutorum nebkhas

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10H: Shaping Arid Landscapes: Unraveling the Complex Interactions Between Wind, Sediment, and Vegetation in a Changing Climate, Conway 3, February 5, 2026, 2:30 PM - 4:00 PM

Nebkhas are a type of distinctive biogeomorphological landform formed by aeolian sand deposition within and around vegetation clumps. They exhibit a widespread distribution in global drylands and coastal zones, and play an essential role in maintaining ecosystem stability and supporting biodiversity. Existing studies have shown that the development of nebkhas is the result of complex nonlinear interactions between biotic and abiotic factors. However, how these environmental factors jointly and quantitatively influence the formation and development of nebkhas have not been fully explored. In this study, we focus on Nitraria tangutorum nebkhas—one of the most widespread nebkha types in northern China, to quantify their biogeomorphological niche and simulate their geographic distribution under present and future climate conditions. A total of over 300 nebkha occurrence records were compiled through field surveys, remote sensing imagery interpretation, and literature review across deserts and dune fields in north-central China. Using a suite of climatic, soil, and topographic predictors, we applied two machine learning models, Maximum Entropy (Maxent) and Random Forest (RF), to identify the dominant environmental drivers and simulate both current and future spatial distribution of nebkhas. The results demonstrate that while climatic variables primarily influence the growth and persistence of formative shrub species, the formation and distribution of nebkhas is jointly determined by the interplay of climate, soil, and geomorphological conditions, as well as their spatial configuration. Model projections under both medium (SSP2-4.5) and high (SSP5-8.5) greenhouse gas emission scenarios indicate a pronounced northward shift in the potential distribution of Nitraria nebkhas in northern China by the end of the 21st century, with a concurrent contraction in southern regions driven by rising temperatures. These anticipated changes highlight the vulnerability of nebkha-dominated ecosystems to climate change, underscoring the need for adaptive land-use and conservation strategies to safeguard their ecological functions and maintain dryland resilience.

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Systematic slowing of initially rapid retreat of new coasts formed by historical eruptions in volcanic islands

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01F: Lessons and future prospects for rock coast geomorphology, Conway 1, February 2, 2026, 11:40 AM - 1:10 PM

Volcanic island coasts are densely populated and newly formed land is often adopted for agriculture and other purposes. Better prediction of future coastal changes would be useful for planning coastal infrastructure, assessing risks and insurance decisions. Historical eruptions can create new coasts with volcanic materials that are friable. Retreat of such coastlines can be fast and more easily observed than for many older rocky coasts. Here we assemble coastline retreat distances and rates of 12 coasts formed by historical eruptions from literature sources and remote-sensing data. In the cases with observations at multiple time steps, post-eruptive coastline retreat was rapid initially and declined with time. We adapt an empirical equation found earlier to represent coastline retreat of a Surtseyan cone, finding that it represents the systematic variation in retreat distances with time well where coastal evolution is known in >5 time steps and in some cases less. Based on a detailed case study of Capelinhos, Azores, where multidisciplinary data are available, we interpret the slowing with time as arising from (1) increasing wave attenuation with abrasion platform widening, (2) exposure of progressively more resistant materials at cliffs, and (3) from increasingly taller cliffs, which lead to increasingly large volumes of debris from cliff collapses, temporarily protecting cliff bases. Coastline retreat rates also follow inverse power-law relationships with varied time intervals of measurement, hence they are affected by the episodicity of erosion. Comparisons with wave height and precipitation from ERA5 reanalysis outputs reveal surprisingly no strong co-variation with the retreat rates. We hypothesize that varied lithology, fracture density and other factors dominate retreat rates of these young volcanic coastlines.

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Physical and biogeochemical responses of Tibetan Plateau lakes to climate change

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07G: Cryosphere Processes and Mountain Hydrology, Conway 2, February 3, 2026, 5:00 PM - 6:30 PM

The lakes, rivers and glaciers of the Tibetan Plateau (TP) – a vital water resource for East Asia – are undergoing substantial environmental change. In this Review, we examine trends in the size, and physical and biogeochemical properties of TP lakes. Lake area and volume have consistently increased since 1995, with most rapid expansion in northern lakes. Between 1986 and 2022, the total area of lakes larger than 1 sq km increased from 37,109 sq km to 46,980 sq km, and water storage increased by 169.7 cube km, driven by warming and enhanced precipitation. In large lakes (≥10 sq km), average surface temperatures increased by 1.33℃, water transparency increased by 1m, and salinity decreased from 48.76 to 23.76 psu. Responses in lake biogeochemistry include enhanced microbial diversity and trophic status, despite minimal additional nutrient inputs and consistent rates of productivity. Although TP lakes appear to be a net source of carbon dioxide to the atmosphere (1.60, 6.87 and 1.16 Tg C per year in the 2000s, 2010s and the 2020s), long-term carbon dioxide source-sink dynamics remain uncertain. TP lake area is projected to increase by 9000 sq km by 2050 under SSP5-8.5 and will continue to influence and enhance regional precipitation. Improved prediction of TP lake hydrology and biogeochemistry will aid sustainable management of water resources across the TP.

Great transitions in Donaumoos land reclamation (Bavaria, Germany) since the late 18th century – a palaeohydrological and historical perspective

Professor Christoph Zielhofer[1], Marie Kaniecki[1], Dr Anne Köhler[1], Vera Seeburg[2], Arnela Rollo[3], Laura Bergmann[1], Dr Stefanie Berg[4], Dr Barbara Stammel[5], Dr Rita Gudermann[6], Prof William J. Fletcher[7], Dr Ulrike Werban[8], Prof Anja Linstädter[3], Prof Natascha Mehler[2]
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Poster Session 1, Exhibition & Poster Hall, February 2, 2026, 5:30 PM - 7:00 PM

Systematic human intervention in wetlands has been taking place in Central Europe for several centuries. The Donaumoos fen in Upper Bavaria, Germany, has been cultivated since 1788, resulting in the permanent loss of its natural state. The adjacent Danube River was straightened during the same period. This study presents a quantitative reconstruction over a 235-year-long timeframe of the development of the natural Donaumoos fen and Danube River into a human-dominated landscape (anthroposphere). The selected quantitative proxies for the change of the socio-ecological system are the Donaumoos drainage ditch lengths and changes in Danube surface water area traced through the analysis of old maps. A multi-temporal series of old maps from 1788 to 2023 are used to document land reclamation in the Donaumoos and hydro-engineering activities in the Danube floodplain. The comparison of the quantitative data on the development of drainage ditch lengths with the state of research from written sources leads to the discovery of potential great transitions in floodplain and peatland changes and associated human drivers as well as consequences for society in the region. One phase of great transition with far-reaching human interventions spanned 1788 to 1794 and a second phase ran from 1907 to 1959. However, the phases of substantial transitions with river straightening, land reclamation and colonization were embedded in multi-decadal intervals of setbacks and socio-ecological stagnation. Regarding the future, an updated economic and ecological understanding of resources is difficult to implement for the Donaumoos, because socio-ecological path dependencies present challenges for the sustainable development of the Donaumoos, in particular, the ongoing and self-reinforcing mechanism of peat subsidence in parallel with the ongoing pressure for drainage under continued agricultural use of the former fen.

Eco-morphological changes and potential Salmon habitat suitability since pre-industrial times at the Mulde River (Germany)

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03K: Biogeomorphology and Ecological Baselines: From Life–Landscape Interactions to Restoration, Bealey 3, February 2, 2026, 4:00 PM - 5:30 PM

Channel patterns and river connectivity are widely recognized to be representative parameters for the fluvial-geomorphological behaviour and eco-morphological properties of rivers. They are sensitively af-fected by climate and land-use changes and, in turn, can indicate the habitat suitability for the aquatic fauna, i.a. expressed by the diversity of channel width, flow velocity and depositional regimes. Both, habi-tat potential and the overall river connectivity are additionally influenced by barriers such as weirs and dams, at least since Medieval times. Here we present the results of a multi-temporal study investigating river morphology, river connectivity and floodplain land use in the Mulde River system (Germany). The study is motivated by the local extinction of the Atlantic Salmon (Salmo salar) within the last two centuries and low-success reintroduction endeavours. In order to test Salmon occurrence for a relation to water body structures, we make use of old maps to pinpoint (i) historical barriers and (ii) historical floodplain land use as a pollution proxy that may have affected migratory fish populations. Furthermore, we (iii) evaluate anthropogenic changes in channel patterns assuming that these also influence salmon habitat suitability. First results point to a negative relation between an increasing number of cumulative barriers, increased floodplain land use and the occurrence of salmon populations during the past. Sinuous and meandering channel patterns correspond with higher probabilities of salmon occurrence.

Subglacial Carbonates and 36Cl Dating Indicate Unprecedented Glacier Retreat in the Southeastern Alps

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08G: Glacial and periglacial landscapes in a changing climate, Conway 2, February 5, 2026, 9:35 AM - 11:05 AM

Subglacial carbonate crusts, formed between glacier ice and bedrock, can indicate the past presence of glacier ice. In the southeastern Alps, these deposits were recently uncovered by the retreat of the Triglav and Skuta glaciers, Slovenia. Uranium-thorium dating of the carbonates shows they formed during the Last Glacial Maximum, Younger Dryas, and also later, around 4,000 and 2,000 years ago. These ages suggest that glaciers persisted or reformed during colder phases throughout the Holocene. Cosmogenic 36Cl exposure dating supports this interpretation: rocks located only 300 m from today's glacier margins show exposure ages of about 3,500 years, while rocks directly under the ice show only short-term exposure signals. This suggests that the glaciers, although reduced in size, did not disappear entirely during the Holocene. To evaluate the hypothesis of long-term preservation, we tested the carbonates' resistance to frost weathering in a controlled freezing chamber. The results show that subglacial carbonates are susceptible to frost weathering and can deteriorate relatively quickly by natural freeze–thaw processes. Their present-day preservation strongly implies that glacier ice remained over these surfaces until recently. Together, the 36Cl exposure ages and frost weathering tests indicate that the current glacier retreat is more extensive than at any time in the Holocene, even during the warmer Holocene Climatic Optimum.

Geological Evidence for the Early Pleistocene Integration of the Upper Yellow River

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

River drainage systems are the product of the combined effects of regional tectonics and climate. Understanding their formation and evolutionary history is considered crucial for comprehending regional tectonic history, climate change, and the impacts of geological hazards. The upper Yellow River drains from the Tibetan Plateau, flow through the Zoige Basin, then take an "S"-shaped turn before exiting along the northeastern edge of the Tibetan Plateau. Its drainage evolution is closely linked to the uplift and expansion of the plateau.However, the timing incision for the Yellow River significantly lags behind the initiation of mountain uplift, resulting in ongoing debate regarding the timing and mechanisms of drainage integration in the upper Yellow River. Here we show new geomorphological, sedimentological, and chronological data along the upper Yellow River, enabling the reconstruction of the timing, processes, and patterns of river incision. These results indicate that the upper Yellow River had integrated and stabilized since the late Early Pleistocene. This conclusion is supported by the widespread occurrence of coeval fluvial sediments, dated to ~1.5Ma, along several hundred kilometers of the river, suggesting a new model for drainage integration.. Our suggests that drainage system evolution may possess a more ancient and complex history, characterized by cyclical disintegration and reorganization driven by climate change. This perspective provides new insights for resolving the widespread controversies regarding the timing of river formation.

A Geomorphometric Twin-Approach to Landform Geodiversity Assessment at Local and National Perspectives

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Poster Session 3, Exhibition & Poster Hall, February 5, 2026, 4:00 PM - 5:00 PM

This presentation introduces a comprehensive methodology for assessing the morphological geodiversity of 23 national parks in Poland, analysed both as individual units and collectively across the entire country. The assessment relies on selected geomorphometric parameters derived from high-resolution DEMs, ensuring precise and consistent terrain characterization. The primary goal is to develop a robust five-level Likert scale for terrain morphological variability, designed to be applicable at both local and national spatial scales. The analysis focuses on five key morphometric indicators that capture various aspects of terrain complexity and environmental conditions: relief energy, geomorphons, TRI, TWI, and solar radiation index. Each of these parameters is classified using two complementary approaches: (1) Self-referenced classification, where geodiversity values are interpreted relative to the internal variability and distribution within each individual park, highlighting local geomorphological distinctiveness; (2) Nationally referenced classification, where geodiversity values are evaluated concerning their position in the overall distribution across all 23 national parks, facilitating inter-park comparisons and identifying nationally significant morphological features. The proposed decision-making framework integrates these classification modes into a composite morphological diversity index for each park. This index supports meaningful cross-park comparisons, allowing identification of areas with the most heterogeneous, unique, or valuable landforms from a geodiversity perspective. The fully automated workflow employs advanced statistical techniques, including Fisher–Jenks Optimal Classification with min/max range extensions, threshold-based reclassification, logical rule application, and final aggregation into five ordinal geodiversity classes. This methodology contributes significantly to the fields of geodiversity assessment by offering a scalable, objective, data-driven approach grounded in publicly available DEM data. The resulting classification outputs are expected to aid in conservation planning and effective communication of geomorphological values to stakeholders, policymakers, and the general public. It will also highlight how the dual referencing approach enhances interpretability and decision-making at different spatial scales, ultimately supporting sustainable landscape management.

Climate- and Human-Induced Denudation Trends: The Case of the Upper Parsęta Catchment, Poland (1994–2024)

Professor Zbigniew Zwoliński[1], Prof. Józef Szpikowski[1], Dr. Grażyna Szpikowska[1], Prof. Małgorzata Mazurek[1], Professor Andrzej Kostrzewski[1]
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01J: Denudational Dynamics and Hazards in a Changing Environment, Conway 5, February 2, 2026, 11:40 AM - 1:10 PM

This presentation aims to identify the trends and rates of change in denudation processes in the lowland catchment from 1994 to 2024. The catchment, located in the young-glacial landscape of Pomerania, is characterized by diverse landforms, varied lithology, a mosaic of land use, and a significant influence of climatic conditions. The dynamics of chemical and mechanical denudation in the catchment result from a complex interaction of natural and anthropogenic factors. A systematic increase in the rate of chemical denudation was observed, rising from approximately 45 t/km²/year in the mid-1990s to over 55 t/km²/year after 2020. The main drivers of this trend include the rise in mean annual air temperatures, more frequent periods of drought and low discharges, increased CO_2 concentration in soils, and intensification of chemical weathering. Chemical denudation has proven to be a persistent and steadily intensifying process, responsible for a significant portion of material removal from the catchment in dissolved form. In contrast, mechanical denudation remained at a much lower and more variable level, averaging 1.4–1.7 t/km²/year, with a tendency toward episodic increases during years of intense rainfall or snowmelt. The greatest variability was recorded in the second half of the study period, when extreme weather events intensified, and soils became increasingly vulnerable to erosion due to more frequent droughts. Despite a slight rise in average values, mechanical denudation remains irregular and highly dependent on weather conditions and local land use practices. It can be concluded that chemical denudation exhibits a clear, long-term upward trend, while mechanical denudation increases slowly but with growing episodic variability, reflecting the impact of modern climate change on geomorphological processes in lowland catchments. Among these natural denudation processes, anthropogenic denudation (ranging from intensive agriculture to land abandonment and afforestation) is also important, especially in the context of the Anthropocene, dated from 1950 onward.

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