

DENUCHANGE Webinar



Date: 13 October 2021 at 14:30 – 18:00 CEST

Organisers: A.A. Beylich and K. Laute

14:30 – 14:40 INTRODUCTION: The IAG Working Group on Denudation and Environmental Changes in Different Morphoclimatic Zones (DENUCHANGE)

What controls sediment fluxes in glacierised Alpine catchments? First results and ongoing monitoring in the Italian Alps within “DENUCHANGE”

F. Comiti, I. Bollati, B. Aldighieri, A. Andreoli, V. Coviello, M. Pelfini, S. Savi, B. Testa, G. Tronti

Large volumes of water and sediments entering rivers due to rapid glacier melting are influencing downstream sediment regime and channel morphodynamics, posing new management challenges to society. In the presentation, preliminary suspended sediment transport data collected during summer 2021 in the Aurna River (Piedmont Region, 29 km²) will be illustrated, along with an overview of the different sediment cascades in its catchment. Later, bedload fluxes in the larger Sulden River (South Tyrol, 110 km²) – where an experimental station has been operating from 2014 to 2020 (project AQUASED, www.aquased.net) – will be presented and their potential controlling factors discussed.

Sediment transfer and relief development in the proglacial zone of the Greater Caucasus: initial results of the monitoring in the Djankuat catchment

V. Golosov, S. Kharchenko, A. Tsyplenkov, A. Kedich, M. Uspensky

Initial results of the quantitative evaluation of mass movement and erosion processes rates in the high mountain catchment of the Djankuat River (A= 9.1 km²) are presented. The catchment is located in the Russian part of the Northern Caucasus. The outlet of the study catchment is a hydrological gauging station (N43°12'31.71", E42°44'05.93", altitude: 2635 m a.s.l.). The catchment includes a valley glacier (called the Djankuat glacier), with a surface area of 2.42 km². Different methods and techniques, including terrestrial laser scanning, UAV survey, comparison of the digital elevation models, water discharge and turbidity measurements, pin methods, etc., are using for the assessment of sediment redistribution and relief transformation.

Glacier melting runoff control on suspended and bedload sediment transport in the Estero Morales (Andes, Chile)

L. Mao, R. Carrillo

Sediment transport dynamics on rivers draining glacierized basins depend on runoff generation processes and sediment availability and connectivity at the basin scale. Here we present the dynamics of bedload transport in the Estero Morales, a glacier-fed basin in the Chilean Andes where sediment transport have been continuously monitored during two ablation seasons. Results indicate that bedload availability and yield depend on the origin of runoff, and considerable differences between the two ablation seasons are evident, and likely related with the dynamics of coupling of the proglacial area during the snowmelt period. Here we stress the importance of studying bedload dynamics in retreating glaciers, that are likely producing less sediments after the “peak flow”, with long-term consequences on the ecology and geomorphology of rivers downstream.

Wildfires as a denudation agent

N. Shtober-Zisu, L. Wittenberg

Whereas most of the scientific effort regarding wildfires has predominantly focused on fire effects on vegetation and soils, the role of fire as an essential denudation agent has been largely overlooked. This study aims to evaluate rock decay processes during wildfires, in relation to ground temperatures and rock morphologies. While a detailed description of the bedrock exfoliation was previously reported, here we conduct an experimental open fire to determine temperatures responsible for boulder shattering. Our findings reveal that fire related rock-breakdown, if accounted to the long run, can be responsible for a high proportion of the total denudation rate.

16:00 – 16:15 BREAK

Landscape evolution and development of inselbergs in southern Africa

J. Knight

Inselbergs and similar bedrock morphological forms (bornhardts, buttes, nubbins) are reported throughout semiarid southern Africa but their morphodynamic development has not been examined in detail. This study considers this topic in the wider context of regional landscape evolution, linking the development of specific weathering and erosion processes to geology and to regional climate change during the Cenozoic. Over long (10⁵-10⁸ yr) time scales, epeirogenic uplift caused by mantle swells resulted in areal denudation and exhumation of bedrock edifices. Cenozoic climate change was instrumental in weathering and debris removal, resulting in exposure of bare bedrock surface, formation of spalled and gnamma surfaces, and transport of debris to form footslope fans. Cosmogenic dating studies show consistent regional inselberg denudation rates of around 3-5 m/Ma, similar to rates of soil formation. These relatively subdued rates can help account for the apparent preservation of old land surfaces across southern Africa.

Natural and human drivers in the recent environmental evolution of Northern Iberian watersheds

J. Remondo, M. Morellón, J. Bonachea, V. Rivas, J.L. Cavallotto, L.M. Forte, J.E. Gómez-Arozamena, V. Villasante, I. Hernández-Almeida, M. Leira, C. Morales-Molino, V. Bruschi, C. Sierra-Fernández, A. Cendrero

The reconstruction of the geo-environmental evolution during the last decades-centuries is useful for better understanding its causes and, on that basis, improving our predictions on possible future changes driven by increasing human pressure. This research initiative (the GECANT project), currently under development, aims at understanding how recent (19th to 21st centuries) natural and anthropic changes have affected the geomorphological dynamics of Cantabrian watersheds (northern Spain), which have experienced an intense human activity during the last centuries. For this purpose, a multi-file and multi-site approach are being used, integrating data from lakes and estuaries representative of a wide range of environmental conditions, particularly climate and land use, and covering the whole Cantabrian region. To disentangle the natural and human causes of environmental changes, we use a multidisciplinary strategy, including geomorphological analyses, instrumental climate records, limnological studies, and multiproxy analysis of sediment cores (sedimentology, geochemistry, and palaeoecology), as well as socioeconomic data. The data obtained so far indicate an increase in sedimentation rates in lakes and estuaries since the middle of the 20th century, coinciding with the Great Acceleration. It is expected this research will contribute to improve our understanding of the synergistic effects of natural and human drivers at the basin scale, and help to better design global change mitigation and adaptation policies.

Accounting for the particle size distribution of sediment and tracers in sediment fingerprinting technique

L. Gaspar, W.H. Blake, I. Lizaga, B. Latorre, A. Navas

The key assumption of sediment fingerprinting approach is that physical properties of the source materials don't change during erosion, delivery and transport processes allowing for a direct comparison between source and sediment. Many of the properties used as fingerprints are sensitive to the particle size distribution as the sediment is generally enriched in fine-grained material compared to the sources. This research contributes to gain knowledge of the effects of particle size on sediment source signatures by using experimental samples fractionated in the lab with a known proportion of source contributions. Our findings confirm that source apportionment results are sensitive to differences in particle sizes.

Sediment tracing: Moving forward to new informative tracer selection methods

I. Lizaga, B. Latorre, L. Gaspar, A. Navas

Sediment fingerprinting is widely used for identifying sediment sources. However, traditional tracer selection methods as range test, Kruskal–Wallis, discriminant function analysis and mixing polygon are under discussion because introduce as suitable erroneous and dissenting tracers leading models to unpredictable outcomes. Recently, the Consensus method (Lizaga et al., 2020) and the Consistent Tracer Selection (Latorre et al., 2021) have demonstrated capability for identifying non-conservative tracers and extract the multiple discriminants and consistent solutions inside fingerprinting datasets beyond the capability of currently used selection methods. This research highlights the need to move forward to standardise the technique and promote its reproducibility.

Contemporary trends in river flow, suspended sediment load, and soil/gully erosion in the south of the boreal forest zone of European Russia: The Vyatka River Basin

A.V. Gusarov, A.G. Sharifullin, A.A. Beylich

Draining an area of 129,000 km², the Vyatka River is among the largest rivers in the boreal forest zone of European Russia. The results of state long-term hydrometeorological monitoring and information on land use/cover made it possible to reveal contemporary (since the 1960s) hydrological and erosion-intensity trends and their drivers within the river basin. There has been a statistically insignificant increase in water discharge in the Vyatka River basin during recent decades due to increased precipitation. In contrast to this, the total annual suspended sediment load of the river and, consequently, soil/gully erosion intensity have experienced a significant decrease. Land-use/-cover changes following the collapse of the Soviet Union in 1991 are considered the main reasons for this detected decrease.

17:55 – 18:00 FINAL REMARKS



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