IAG Webinar NORTH AMERICA

Date: 1 March 2022 at 12:00 – 16:00 ET

Coordinators: Marisa Palucis (Dartmouth College) and Allan James (University of South Carolina)

INTERNATIONAL GEOMORPHOLOGY WEEK 2022

12:05 – 12:25

Into the abyss: Stratigraphy reveals optimal seascape evolution models

Charles Schobe, West Virginia University, USA

Quantitatively reading the stratigraphic record using coupled landscape and seascape evolution models is a promising approach to extracting information about landscape history. Yet there is no consensus about the optimal seascape model due to a lack of tests against observed stratigraphy. Using data from the Southern African Margin, we test common approaches to determine how best to model seascape evolution over geologic time. Results suggest that processes of sediment bypass and long-distance transport are required to model realistic passive margin stratigraphy, and therefore to accurately invert stratigraphy for past perturbations to source regions.

12:25 – 12:45

Do deltaic deposits on Mars record an ancient northern ocean?

Frances Rivera-Hernandez, Georgia Tech, USA

Martian deltaic deposits have been cited as one of the strongest lines of evidence in support of an ancient northern ocean on the Red Planet. However, updated imagery and topographic data have revealed that the elevations of these deltas vary greatly, calling into question whether they were all deposited into the same body of water. This talk will investigate this hypothesis by presenting mapping and geophysical modeling results for a large number of lowland deltas in the vicinity of Gale crater, home to the Curiosity rover.

12:45 – 13:05

Relating nearshore bar morphology and wave events to the beach-dune system

Mayra Roman-Rivera, University of Tennessee, USA

This study investigated three morphologically, hydrodynamically, and geographically distinct locations to understand how bar morphology influences beach-dune characteristics. An OBIA classification was conducted of imagery acquired before and after significant wave events produced by different weather systems. Results demonstrated concrete process-based linkages that bar morphology directly impacts how the beach-dune system responds to these significant wave events. We propose a conceptual model that demonstrates how the different bar morphologies determine the response of the dune-beach complex to incoming wave energy that applies to intermediate and dissipative beach systems.

13:05 – 13:25

Logjam patterns, wood recruitment, and salmon habitat in a sub-arctic boreal river system

Katherine Lininger, University of Colorado - Boulder, USA

Large wood accumulations (jams) in river systems influence both geomorphic and ecological processes. However, the distribution and abundance of logjams and the mechanisms of jam formation along boreal drainage basins are poorly understood. We present a unique dataset of the abundance and distribution of jams in the Chena River basin in interior Alaska, from the headwaters to the basin outlet. We link jam characteristics with fish counts of juvenile salmon. We find that jam frequency and wood recruitment declined downstream and the portion of the river affected by a dam has the least trapping potential for jams, influencing fish habitat.

13:25 – 13:45

Riverine floods in the late Holocene: Insights from muds & models

Samuel Munoz, Northeastern University, USA

Riverine floods rank among the costliest and most frequently occurring natural disasters in the United States, with large uncertainties in near- and long-term projections of flood hazard. In this talk, I will describe a series of projects that integrate instrumental datasets, sedimentary records, climate reanalysis, and model output to examine the response of river systems to climate variability and change over the last 2,000 years.

13:45 – 14:05

Insights on the growth and mobility of debris flows from repeat high-resolution lidar

Corey Scheip, BGC Engineering, USA

Submeter lidar bracketing a debris flow event in Polk County, North Carolina illustrates the volumetric growth and decay of 54 rainfall-triggered debris flows that occurred on May 18, 2018. The debris flow cycle is characterized by three phases: 1) initiating debris slide; 2) supply-limited entrainment phase; and 3) transport-limited deposition phase. Rate of debris flow growth is highest during the first phase, nearly linear during the second, and negative during the third phase. Cumulative volume per distance decays according to the power-law $E = aX^b$ ($r2 \geq 0.97$). This new power law relationship has far reaching implications for understanding debris flow processes.

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14:20 – 14:40

Landscape scale patterns of bedrock weathering and their relationship to water and carbon cycling

Daniella Rempe, UT Austin, USA

Bedrock weathering profiles, and their relationship with topography, can impact contemporary fluxes of water and carbon within a landscape. For example, weathered bedrock can be a vital water supply to vegetation and deep roots can enhance bedrock weathering. Relative to the overlying soils and underlying groundwater, the hydrologic and geochemical dynamics of weathered bedrock are challenging to observe and consequently poorly understood. In this presentation, I will review recent advances in understanding the relationship between topography and weathering as well as results of intensive efforts to directly quantify the complex fluid pathways in weathered bedrock.

14:40 – 15:00

The Pacific in the Puzzle: Exploring global leads and lags in millennial-scale climate oscillations

Mo Walczak, Oregon State University, USA

Offshore drill core records from International Ocean Discovery Program Expedition 341 offer new insights into the timing of episodes of millennial-scale instability of the Cordilleran Ice Sheet, as well as associated changes in Pacific Ocean circulation. Radiocarbon and sedimentological results from the Gulf of Alaska document recurrent episodes of reorganized Pacific Ocean ventilation synchronous with rapid discharge from the Cordilleran Ice Sheet. We explore the apparent cascade of global climate perturbations supported by the best available chronologies for these records, as well as the implications for potential drivers of ice sheet instability in both the Pacific and Atlantic.

15:00 – 15:20

Paleoecological insights into drivers of landscape change in Dhofar, Oman

Kaitlyn Horisk, Penn State University, USA

Earth's arid places are especially at risk from climate and land use change. However, the interactions between climate, human activity, and vegetation in these regions are poorly understood. Dhofar, Oman is an ideal study area to investigate the mechanisms driving vegetation change. Dhofar is arid and highly biodiverse, and nomadic pastoralism has been practiced here for the last ~7,000 years. Rock hyrax (*Procavia capensis*) middens host paleoenvironmental indicators that can be used to reconstruct changes in past climate and plant communities. This information can be linked with archaeological data to understand the roles of climate and humans in shaping landscapes.

15:20 – 15:40

A 30 Million Year History of Subduction Zone Dynamics Revealed by Tectonic Geomorphology

Sean Gallen, Colorado State University, USA

Mountain building above subduction zones results from crustal, mantle, and surface processes, yet it remains challenging to isolate the specific process(es) responsible for topographic change along these plate boundaries. Here we conduct a data-driven inversion of tectonic geomorphology measurements (i.e., low-temperature thermochronology, cosmogenic radionuclides, and digital topography) to reveal a 30 Myr history of rock uplift in the Calabrian subduction forearc in southern Italy. Combining these results with records of the retreat history shows a transition from crustal- to mantle-dominated orogenesis in the middle Miocene, which has broad implications for understanding drivers of topographic change here and other subduction margins.

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