CONVENERS
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INTRODUCTION AND CONFERENCE DETAILS
Although tectonic forces are known to be a strong primary control on the generation of sediment, this conference assessed the dynamic role of global and regional climate in controlling the production, transport, and deposition of sediments over millennial to million-year time scales. However, study of climate and earth-surface process relationships is fundamentally problematic because many of these processes act both independently of and as a consequence of tectonic forcing. This conference sought to discuss how climatic forcing is translated to the sedimentary record and under what conditions the respective erosional signals can be observed and interpreted unambiguously in terms of paleoenvironmental and paleoclimatic change. This transdisciplinary meeting brought together researchers across a number of sub-fields to showcase the current state of research, demonstrate contemporary evidence and methods from studies worldwide, and summarize the research concerns remaining in our communities.

Hosted in Juneau, Alaska, USA, from 4–10 August 2019, CLAST2019 brought together 49 scientists from Australia, Brazil, Canada, France, Germany, Hong Kong, Israel, Italy, Switzerland, the U.K., and the U.S. The conference kicked off with an ice-breaker, was punctuated by a mid-week field trip and sunset dinner on Eagle Beach delta, and ended in Tracy Arm Fjord in the post-meeting field trip. Women scientists accounted for 46% of participants, and 23 of the participants were early career researchers (student and untenured researchers). Early career researchers presented one third of invited talks. Formalized one-on-one and informal peer mentoring was achieved throughout the week among researchers and across the wide range of disciplines.

Presentations were grouped into seven broad climate-erosion themes: (1) from source to sink: tracing erosional signals; (2) beyond the mainstream: continental deposition and erosion outside fluvial systems; (3) cycles, thresholds, and feedbacks: the evolving atmosphere and biosphere; (4) from ice to the ocean; (5) closing the gap: emergent tools and techniques for integrating earth-surface processes and solid Earth datasets across time scales; (6) moving forward: innovations in data sharing, visualization, and modelling to understand landscapes and climate; and (7) history matters: reconciling tectonic, climate, and erosion histories.

PRESENTATIONS AND DISCUSSION
The major aims of the talks and focused group discussions were to (1) identify new and persistent knowledge gaps within our communities; (2) define major challenges in addressing these gaps; and (3) initiate conversations on the resources needed both within, between, and outside of our communities to effectively address these over the next five to ten years. Over the course of the week, participants identified three key areas:

Weather Erodes, Not Climate
Understanding the relative importance of event-scale and extreme events in controlling the sedimentary record has come to the forefront of several communities. What is the relative importance of extreme events over steady-state erosion processes? Are extreme events (mass-wasting, cyclones, wildfires, earthquakes, [flash-]floods) controlling the sedimentary record, or are these events the “noise”? At what scales are events detectable and at what scales do they matter?

To understand the immediate and lasting effects of seasonality and variability, efforts need to be made in not only obtaining measurements of totals but also in constraining rates and durations. This includes identifying records for environmental boundary conditions in the rock record (elevation, temperature, precipitation, wind speed, aridity, and seasonality) and improving our ability to measure them using novel (bio)geochemical markers, such as clumped isotopes.

Scale Matters, So Mind the Gap
The issue of comparing observations at varying temporal and spatial scales was identified as a key challenge. We have disparate proxies relevant at different spatiotemporal scales and are especially data limited at time scales that might matter. Improvement in geochronological techniques has in part addressed this data gap, but continued effort is needed. Future approaches looking to quantify transience or disequilibrium will need to allow for a holistic interpretation of disparate proxies and include development of proxies that are truly compatible with the scale of observation.
Following on the key area above, the community highlighted the necessity for the development of possible, plausible, and probable models that can be appropriately upscaled from numerical and analog frameworks to test at the field scale. This includes developing coupled chemical and physical models that can be better applied when translating chemical fluxes (i.e., nutrients, carbon) along with records of physical erosion.

Landscape Connectivity (Buffers, Barriers, and Blankets)

The impact of landscape connectivity on source-to-sink dynamics has been an incredibly popular topic across geoscience fields for the past two decades and so consequently pervaded many discussions at the conference. Significant improvements have been made in understanding the role of signal shredding as a result of poorly connected landscapes, in how this process often biases sedimentary records, and over which spatiotemporal scales this process may inhibit accurate interpretation. Yet there are still issues in translating nonlinear behavior from erosional records, especially when non-unique responses are observed in both source and sink signals. Instead of viewing sedimentary systems as separate hillslope or fluvial systems, a nested perspective has proven useful for understanding landscape response and in identifying directionality of critical threshold behaviors. Recent work with community models has yielded interesting results and may continue to offer time- and energy-efficient ways in which to test hypotheses underpinned by empirical evidence from the field. Lastly, we recognized that necessary improvements are needed to identity the impact landscape legacy effects and how best to quantify “landscape memory” processes and rates.

ACKNOWLEDGMENTS

Financial support from joint sponsors enabled the high-level participation of 15 young scientists, international scientists, and the support of three women keynote scientists. Joint sponsorship was provided by The Geological Society of America Foundation and several programs within the National Science Foundation (NSF): the Geomorphology and Land-Use Dynamics Program, EPSCoR Program, Sedimentary Geology and Paleobiology Program, the Tectonics Program, and the Paleoperspectives on Climate Change Program. Supplementary sponsorship was provided by the International Association of Sedimentologists and the British Sedimentology Research Group of the Geological Society of London. We thank program directors Justin Lawrence and Marguerite Toscano at the conference for NSF representation and input, and we sincerely thank GSA meeting manager Becky Sundeen for organizational and administrative support. Considerable logistical support was provided by the University of Alaska Juneau and Forest Service staff of the Tongass National Forest.

Abstracts of presentations are available at www.geosociety.org/penrose (click the “archive” tab).

FIELD TRIPS AND GUIDES

An informal field-trip guide for the two field trips was compiled by the meeting conveners using text and figures compiled by UAS field trip leaders: Cathy Connor, Eran Hood, and Sonia Nagorski. This field trip guide is freely available at www.geosociety.org/penrose (click the “archive” tab).

Participants

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