Geophysical Research Abstracts
Vol. 18, EGU2016-16052, 2016
EGU General Assembly 2016

Erosion and Sediment Transport Across and Along Pronounced Topographic and Climatic Gradients: Examples from the Central Andes and Himalaya

Bodo Bookhagen (2), Manfred Strecker (2), and Stephanie Olen (2)

(1) UC Santa Barbara, Geography Department, United States (bodo@eri.ucsb.edu), (2) Institut f. Erd- und Umweltwissenschaften, University of Potsdam, Germany

Moisture impinging on high topographic barriers results in effective orographic barriers. For example, the interaction of the Indian Monsoon with the southern Himalaya and the South American Monsoon System with the eastern central Andes result in some of the most efficient orographic barriers on Earth. The steep topographic gradients, the impact of focused rainfall along the southern and eastern flanks of the range, and the northward and westward shifts of rainfall during frequent intensified storm systems are responsible for an efficient erosional regime, with some of the highest known erosion rates. The spatiotemporal correlation between various topographic, tectonic, climatic, and exhumational phenomena in these regions has resulted in the formulation of models of possible long-term erosional and tectonic feedback processes that drive the lateral expansion and vertical growth of mountain belts. However, despite an increase in thermochronologic, cosmogenic radionuclide, and sedimentological datasets that help explain some underlying mechanisms, the true nature of these relationships is still unclear and controversies particularly exist concerning the importance of the different forcing factors that drive sediment transport on different time scales.

Here, we synthesize and assess these controversies with observations from studies conducted perpendicular to and along strike of the orogens, and combine them with new basin-wide erosion-rate data from the Sutlej Valley in the NW Himalaya and from the southern central Andean Plateau (Puna) in NW Argentina. At first order and across strike, erosion rates based on cosmogenic nuclide inventories on river sands suggest a correlation with rainfall rates. But along-strike rainfall gradients in the Himalaya indicate additional moderating factors, such as vegetation. Leeward of the orographic barrier, fluvial erosion variability increases and erosion processes become more stochastic. Further leeward in the high-elevation and internally-drained part of the central Andean Plateau, we observe that aelion transport can exceed fluvial transport.

Taken together, the multitude of erosional processes controlling sediment transport on the Earth's surface results in spatially distinct transport processes that vary in time. The spatiotemporal interplay of these result in a highly transient landscapes.