Geophysical Research Abstracts
Vol. 20, EGU2018-11806-3, 2018
EGU General Assembly 2018

Hillslope asymmetry from the coevolution of vegetation and landforms in semiarid landscapes

Nikul Kumari (1), Omer Yetemen (1), Ankur Srivastava (1), Kwok P. Chun (2), Jose F. Rodriguez (1), and Patricia M. Saco (1)

(1) University of Newcastle, Discipline of Civil Engineering, Callaghan, Australia, (2) Hong Kong Baptist University, Department of Geography, Kowloon Tong, Hong Kong

The emergence of aspect-controlled vegetation patterns as a result of solar insolation in semi-arid ecosystems leads to a differentiation in soil properties and vegetation characteristics on opposing hillslope aspects. In mid- to high-latitudes where available soil moisture is a limiting factor for vegetation growth, slopes with poleward-facing aspects tend to develop denser vegetation cover that provides more erosion protection than on the equatorward-facing aspects. Over long timescales, this difference in erodibility induced by the coevolution of vegetation and landforms is responsible for the emergence of hillslope asymmetry. The hillslope asymmetry index (HAI), which has been developed to measure the magnitude of this asymmetry, is obtained as the ratio of the median slope angles of opposite hillslopes. Although previous studies have documented hillslope asymmetry values for individual sites, there is no analysis that investigates the relationships of HAI with geographic, ecologic, and climatological variables at a global scale. Here, we investigate these relationships using DEM data (to compute HAI) and existing data on vegetation and climatology for 80 different catchments across the world, in which aspect-controlled vegetation has been reported in the literature. Additionally, we also perform similar analyses for a few hundred young cinder cones, with ages that have been radiometrically dated as less than ∼1.5 Ma, to understand how HAI vary with time after the formation of cinder cones. Preliminary results show that latitude and mean topographic gradient are the two leading factors controlling HAI in semi-arid catchments, possibly because of their key role on the modulation of incoming solar radiation and its effect on vegetation density. For cinder cones, geologic age appears as an important factor affecting the temporal variation of HAI magnitude. We find a period between ∼150 ka and ∼250 ka is long enough to generate steeper poleward-facing aspects in cinder cones. These results improve our understanding of the main factors contributing to hillslope asymmetry at the global scale and have important implications for the analysis and modelling of coevolving landscapes.