Geophysical Research Abstracts
Vol. 19, EGU2017-9023, 2017
EGU General Assembly 2017

Outbursts and Gradualism: Megaflood erosion consistent with long-term landscape evolution

Daniel Garcia-Castellanos (1) and Jim O'Connor (2)

(1) CSIC, ICTJA - Inst. Ciencias de la Tierra Jaume Almera, Barcelona, Spain (danielgc@ictja.csic.es), (2) OWSC-USGS Portland, Oregon, USA

Existing models for the development of topography and relief over geological timescales are fundamentally based on semi-empirical laws of the erosion and sediment transport performed by rivers. The prediction power of these laws is hindered by limitations in measuring river incision and by the scant knowledge of the past hydrological conditions, specifically average water flow and its variability. Consequently, models adopt 'gradualistic' (time-averaged) assumptions and the erodability values derived from modelling long-term erosion rates in rivers remain ambiguously tied not only to the lithology and nature of the bedrock but also to uncertainties in the quantification of past climate. This prevents the use of those erodabilities to predict the landscape evolution in different scenarios. Here, we apply the fundamentals of river erosion models to outburst floods triggered by overtopping lakes, for which the hydrograph is intrinsically known from the geomorphological record or from direct measures. We obtain the outlet erodability from the peak water discharge and lake area observed in 86 floods that span over 16 orders of magnitude in water volume. The obtained erodability-lithology correlation is consistent with that seen in 22 previous long-term river incision quantifications, showing that outburst floods can be used to estimate erodability values that remain valid for a wide range of hydrological regimes and for erosion timescales spanning from hours-long outburst floods to million-year-scale landscape evolution. The results constrain the conditions leading to the runaway erosion responsible for outburst floods triggered by overtopping lakes. They also call for the explicit incorporation of climate episodicity to the landscape evolution models. [Funded by CGL2014-59516].