Geophysical Research Abstracts
Vol. 20, EGU2018-8768, 2018
EGU General Assembly 2018

Coupled increase in sediment flux and grain size export during transient response to tectonics

Duna Roda-Boluda (1), Sam Brooke (2), Mitch D'Arcy (3), Alexander Whittaker (2), and John Armitage (4)

(1) GFZ German Research Centre for Geosciences, Telegrafenberg, 14473 Potsdam, Germany. (roda@gfz-potsdam.de), (2) Department of Earth Science & Engineering, Imperial College London Royal School of Mines, Prince Consort Road, SW7 2BP London, (3) University of Potsdam, Institute of Earth and Environmental Science, Karl-Liebknecht-Str. 24-25, 14476 Potsdam Golm, Germany, (4) Institut de Physque du Globe de Paris, 75238 Paris, France

The rates and grain sizes of sediment fluxes modulate the dynamics and timing of landscape response to tectonics, and dictate the depositional patterns of sediment in basins. Over the last decades, we have gained a good quantitative understanding on how sediment flux and grain size may affect incision and basin stratigraphy. However, we comparably still have limited empirical data on how these variables change with varying tectonic rates, and degree of landscape adjustment to these rates. To address this question, we have studied 152 catchments along 8 normal fault-bounded ranges in southern Italy, which are affected by varying fault slip rates and experiencing a transient response to tectonics. Using a data set of 38 new and published ^{10}Be erosion rates, we calibrate a sediment flux predictive equation (BQART), in order to estimate catchment sediment fluxes. We demonstrate that long-term sediment flux is governed by fault slip rates and the tectonically-controlled transient incision, and that sediment flux estimates from the BQART, steady-state assumptions, and incised volumes are highly correlated. This is supported by our ^{10}Be erosion rates, which are controlled by fault slip and incision rates, and the associated landsliding. Based on a new landslide inventory, we show that erosion rate differences are likely due to differences in incision-related landslide activity across these catchments, and that landslides are a major component of sediment fluxes. From a data set of $>$13000 grain size counts on hillslope grain size supply and fluvial sediment at catchment outlets, we observe that landslides deliver material $\sim$20-200% coarser than other sediment sources, and that this coarse supply has an impact on the grain size distributions being exported from the catchments. Combining our sediment flux and grain size data sets, we are able to show that for our catchments, and potentially also for any areas that respond to changes in climate or tectonics via enhanced landsliding, sediment flux and grain size export increase concomitantly and scale non-linearly. Finally, we explore the consequences that this coupled sediment flux and grain size increase may have on basin stratigraphy, and we show that it has a significant effect on generating or amplifying gravel front progradation, leaving a depositional record of the transient response to tectonics.