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Bérangé Moussirou and Stéphane Bonnet
stephane.bonnet@get.omp.eu

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The way landscapes respond to variations of climate over long time scales is very difficult to document in nature and is still largely unknown today. We investigate here how rainfall variations impact the erosion and dynamics of laboratory-scale landscapes (Bonnet and Crave, 2003). Our final objective will be to better constrain how landscape respond to cyclic variations in the amplitude and periodicity of precipitations as already investigated numerically and analytically by Godard et al (2013) and Braun et al. (2015) using Stream Power Law models. Before to consider experiments forced by full oscillations of rainfall we present here some preliminary results that investigate how landscape respond to an elementary precipitation variation. We consider the impact of a fall in precipitation on the dynamics of an initially steady-state landscape, and by considering different time-scale of precipitation fall (thereafter called τp) with regard to the response time of the landscape to such a change (called $\tau 2$). For this purpose we used an upgraded version of the experimental facility initially developed at the University of Rennes (France; e.g. Bonnet and Crave, 2003) and now set up at University of Toulouse (GET laboratory).

We performed experiments with an initial homogeneous and constant uplift and rainfall (e.g. Bonnet and Crave, 2003). Under such conditions, landscapes evolve a steady-state between erosion and uplift with a characteristic time, $\tau 1$ that is inversely correlated to uplift and rainfall rates. Starting from such a steady-state landscape, a subsequent instantaneous reduction of rainfall induced a decrease in erosion rates, which drives a surface uplift of the experiment that then evolves toward a new steady-state characterized by higher elevations, with a characteristic time ($\tau 2$) whose dependency with uplift does not longer stand. We will consider a second set of experiments where the reduction of rainfall is not instantaneous but occurred with a time-scale (τp) that is lower or higher than $\tau 2$. This difference drives two contrasting behaviors of the landscape response to the rainfall decrease. It is noticeable that in the case where $\tau p > \tau 2$, erosion rate of the landscape remains always very close to the steady-state value because landscape adjusts continuously to the incremental amount of rainfall decrease without any significant response time. In such a situation the time-scale of landscape adjustment to rainfall variation is imposed by $\tau p$and no imprint of rainfall on erosion rates is decipherable.