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Hillslope response to oscillating forcing

Vincent Godard^{1,2} and Gregory Tucker^{3,4}

¹Aix-Marseille Université, OSU-Pythéas, CEREGE, Aix-en-Provence, France (godard@cerege.fr)

²Institut Universitaire de France (IUF), 75231, Paris, France

³Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO, USA

⁴Department of Geological Sciences, University of Colorado, Boulder, CO, USA

Assessing rivers' and hillslopes' sensitivity to external forcing is paramount to understand landscape evolution, in particular as a response to Quaternary climate changes. River networks are usually considered to be the main conveyors of environmental signals, such as changes in precipitation, temperature, or baselevel. Yet because hillslopes provide the source of sediment for river networks, their response to environmental change also modulate landscape dynamics. In order to characterize such behavior we analyse the response times of a transport-limited hillslope.

We use simple numerical models of denudation to study hillslope responses to oscillatory forcing and understand their filtering effects on environmental signals. Modifications in the frequency of climate oscillation, such as the change that occurred at the Mid-Pleistocene Transition, can significantly modulate hillslope sediment-flux response. We infer a wide range of hillslope responses, ranging from negligible change over the full range of climate-forcing frequencies, to a significant filtering of long-period signals.