Geophysical Research Abstracts, Vol. 7, 03902, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03902


# Response times in a mountain-piedmont system. Results of a numerical model

S. Carretier (1) and F. Lucazeau (2)

(1) IRD, LMTG, Toulouse, France (carretie@lmtg.obs-mip.fr), (2) IPGP, Paris, France (lucazeau@ipgp.jussieu.fr)

We evaluate the response times of mountain catchments systems disrupted by uplift and/or climate variations. Boundary conditions at their outlets are determined by alluvial piedmonts which evolve themselves according to catchments output. Evaluating response times in such a coupled system is interesting because 1- mountain-piedmont systems are common in most active intracontinental settings, 2- whether transient landscapes record tectonics or climate variations depends on their corresponding response times, 3- response times of geomorphic systems depend on boundary conditions. To explore catchment response times we use a Landscape Evolution Model (APERO) applied to a 25km uplifting bloc surrounded by alluvial piedmonts. In mountain catchments, transport limited and detatchment limited conditions compete each other. On alluvial fans, either the steepest descent or multiple flow routine is used to model channelized-flow and sheet-flow transports, respectively. Results show that transfer times accross piedmonts determine the times span needed by catchments to adapt their erosion rate to an increased uplift rate. This means that the whole denudation rate of catchments is not limited by the speed of regressive erosion in rivers. Compare to catchments with pinned outlets, catchments response times are increased by a factor ranging between 1.5 and 10 for channelized transport and sheet-flow transport in the piedmont, respectively. Analytical development of these results enlightens that the piedmont length is a crucial parameter controlling the response time of the whole system. It can be shown that sediment transfer controls mountain catchment response times if the piedmont length is greater than 0.7 km (for channelized-flow) and 3.5 km (for sheet-flow). On the contrary, mountain rivers control response times of catchments when climate varies cyclically. Indeed, piedmont responds more quickely than rivers in this case. However it imposes large oscillations at mountain rivers

outlets. This leads to time delays in catchment responses. Thus, rivers adaptation to climate change is not instantaneous. This is different to what is predicted for rivers with pinned outlets.