Upstream versus downstream forcing: the response of the Golo River system, Corsica, to late Quaternary climatic and eustatic oscillations

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The Golo River system, Corsica, France, is an natural laboratory to study the impact of external forcing on fluvial landscapes and stratigraphy. We have investigated the geomorphological evolution of the Golo catchment and coastal plain during the Late Quaternary adopting an integrated stratigraphic, geomorphological, and modeling approach. First, we built a 4D geomorphological and stratigraphic model of the Golo coastal plain by acquiring and interpreting new geophysical, boreholes, luminescence and radiocarbon ages, and geomorphological data. Then, we compared the 4D model to the output of PaCMod (Forzoni et al., 2013), a spatially-lumped numerical model, which calculates sediment storage and reworking in a catchment, and sediment flux from the catchment outlet.

Our results indicate two distinct stages of alluvial fan development on the Golo coastal plain during MIS4 and middle MIS3, respectively. Such accumulation of coarse sediments was induced by high sediment supply and low water discharges, induced by dry-cold climatic conditions and low vegetation cover. Incision and terrace formation occurred in the Early MIS3, as a result of increased water discharges, and in MIS2, when sea level dropped below the shelf edge. During the Late Glacial transgression and Holocene sea level high stand, fluvial and shallow marine sediments progressively filled in the MIS2 valley in the Golo coastal plain, while the high discharges-transport capacity caused further incision in the upper reaches of the catchment. PaCMod simulations showed that high sediment flux pulses were generated in the catchment during deglaciation, at the transition from cold-dry stadials to warm-wet interstadials, as a result of catchment geomorphological memory.

Our results suggest that the geomorphological evolution of the Golo coastal plain was a complex combination of (i) fluvial-alluvial fan dynamics and (ii) eustatic sea level. The first mainly influenced the catchment and the upper coastal plain, whereas the latter predominantly affected the lower coastal plain and the shelf. Hence, different parts of the fluvial system preserve the record of different forcing mechanism. Finally, PaCMod simulations showed a non-linear relation between climatic changes and fluvial system response on a secular-millennial timescale, and evidenced how such response is importantly affected by the wavelength of climatic oscillations.

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downstream sediment flux propagation within a fluvial catchment. Geomorphology 193, 65-80