Influence of a piedmont on the morphological dynamics of a range: insights from numerical modelling

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A piedmont consists of a region where a mountain range interacts with its foreland basin. It is influenced both by local tectonic activity and climatic context. It represents a temporary reservoir for sediments that are evacuated from the range towards the adjacent basin.

We investigate how the piedmont interacts with range catchments with the help of CIDRE (Computation of the Intensive Dynamics of Relief Evolution), a landscape evolution model. CIDRE takes into account the following processes: sediment production by bedrock weathering, alluvial transport and bedrock incision in rivers, non-linear diffusive transport on hillslopes, kinematic surface displacement for tectonics and lake evolution. The model has been developed for modelling the interaction of tectonics and erosion at spatial scale of tens of kilometres and at a time scale ranging from 10^4 to 10^6 years.

We simulate the growth of a mountain range as an uplifting block bordered by a more or less wide zone. We show that this piedmont zone plays a very important role on relief dynamics. The response time of the system to uplift varies according to the piedmont length and to the fluvial dominant process (transport or detachment). Though the final relief of the range remains constant, absolute elevations of the range and the apex of piedmont alluvial cones increase with piedmont length towards asymptotic values. Erosion processes in the piedmont correspond to a diffusive system.