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Torrential activity facing global change in Southern French Alps

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Geomorphic activity in a torrential catchment may be highly sporadic, erratic, especially because it depends on the sediment transfers. For a better flood risk management in large river catchments, where torrential tributaries provide significant sediment supply, it is essential to assess the amount of sediment transfers and deposition of such tributaries so that hazard assessment can be apprehended globally. This is one major issue of the SAMCO project (ANR 12 SENV-0004 SAMCO), which was designed for mountain hazard mitigation in a context of Global Change. Here, our objective is to understand how sediment cascades are coupled (or not) with climatic parameters.

Here we focus on the Guil River catchment (Queyras, Southern French Alps - 317 km^2). This catchment is prone to devastating summer floods (19 events since 1918: June 1957 (> R.I. 100 yr), June 2000 (R.I. 30 yr)...) characterized by considerable sediment transport from tributaries down to the Guil valley, highly facilitated by strong hillslope-channel coupling (≈ 12,000 m3 volume of sediment aggraded during the June 2000 flood event). During the last flood events several infrastructures and buildings were seriously damaged because the Guil River was carrying a large volume of sediments. For risk mitigation some protection equipments were built after the 1957 flood event, but most of them are now poorly maintained and might be not very effective in case of forthcoming flood events, especially if tributaries provide large volumes of sediment.

Geomorphic data acquired through fieldwork and archives investigations were carried out to formalize the overall functioning of the sediment cascade. The initial phase of our study consists in identifying sediment sources and storage grounded on geomorphological analysis and mapping. The volumes of the sediment stores were then estimated and sedimentary transfers assessed using Terrestrial Laser Scanning survey (fine grained sediment inputs in the cascade), and the implementation of 560 pit-tag tracers (coarse grained sediment). Coupling patterns between sediment stores within the sediment cascade were documented through simulation software: sedimentary signals through time were thus reconstructed. The results suggest a complex response of the system, which does not seem to react directly to climate change but to occasional, meteorological forcing only.