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Sediment tracing from small torrential channels to gravel-bed rivers using pit tags method. A case study from the upper Guil catchment.

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In mountainous areas, especially in large catchments with torrential tributaries, the production and sediment transport significantly increase flood impacts in the valley bottoms. The quantification and characterisation of sedimentary transfers are therefore major challenges to provide better flood risk management. As a part of SAMCO (ANR 12 SENV-0004 SAMCO) project, for mountain hazard assessment in a context of global changes, we tried to improve the knowledge of these hydromorphological systems at both spatial and temporal scales, by identifying sediment supply and sediment dynamics from torrential tributaries to the main channel. A sediment budget was used as a tool for quantifying erosion, transport and deposition processes.

This research is focused on the upper Guil catchment (Queyras, Southern French Alps – 317 km2) entrenched in “schistes lustrés” and ophiolitic bedrock. This catchment is prone to catastrophic summer floods [June 1957 (>R.I. 100 yr), June 2000 (R.I. 30 yr)] characterised by huge sediment transport from tributaries to downvalley, very much facilitated by strong hillslope-channel connectivity (about 12,000 m3 volume of sediment aggraded in the Peyronnelle fan during the June 2000 RI-30 year flood event).

We intend to highlight sediment dynamics on small torrential channels and its connection with gravel-bed streams. Four study sites characterised by avalanche and debris flow-dominated channels located in the upper Guil catchment were investigated. In order to better assess sediment movement, we used the pit-tags technique. In total, 560 pit-tags (pt) have been implemented in four catchments: Peyronnelle (320pt), Combe Morel (40pt), Bouchouse (120pt), and Maloqueste (80pt). Distances and trajectories of gravels sediments have been monitored since two years during summer periods.

We specifically describe results obtained along the Peyronnelle channel affected by a large debris-flow during august 2015. Data are used to discuss lag time, processes and thresholds needed to observe significant sediments fluxes. Results highlight the pulsating character of sediment fluxes associated with high magnitude and low frequency events and indicate the strongest functionality of debris flow-dominated channels. We intend to continue this monitoring long enough to observe sediment connection with gravel-bed streams.