Sediment budget monitoring of a debris-flow torrent (French Prealps)

/ The Manival near Grenoble (French Prealps) is a very active debris-flow torrent equipped with a large sediment trap (25000 m3) protecting an urbanized alluvial fan from debris-flows. We began monitoring the sediment budget of the catchment controlled by the trap in Spring 2009. Terrestrial laser scanner is used for monitoring topographic changes in a small gully, the main channel, and the sediment trap. In the main channel, 39 cross-sections are surveyed after every event. Three periods of intense geomorphic activity are documented here. The first was induced by a convective storm in August 2009 which triggered a debris-flow that deposited ~18000 m3 of sediment in the trap. The debris-flow originated in the upper reach of the main channel and our observations showed that sediment outputs were entirely supplied by channel scouring. Hillslope debris-flows were initiated on talus slopes, as revealed by terrestrial LiDAR resurveys; however they were disconnected to the main channel. The second and third periods of geomorphic activity were induced by long duration and low intensity rainfall events in September and October 2009 which generate small flow events with intense bedload transport. These events contribute to recharge the debris-flow channel with sediments by depositing important gravel dune propagating from headwaters. The total recharge in the torrent subsequent to bedload transport events was estimated at 34% of the sediment erosion induced by the August debris-flow.

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