



Analysing sediment production and transfer in a small Mediterranean mountain basin using a 15-year data period

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Badland landscapes are known to be the main sediment sources in the upper Llobregat basin and particularly in the small Vallcebre research basins (Eastern Pyrenees). The dynamics of these badlands is dominated by physical weathering during winter and by water erosion during intense rainstorms in summer. Nevertheless, as these landscapes represent a small fraction of the basin area, their role as runoff source is only relevant when the basin is dry, but it becomes less important during major rainfall events under wet conditions. Thus, there is a temporal uncoupling between runoff and sediment supply that results in events with a large variety of sediment concentration - discharge relationships at the gauging stations, as well as sediment deposition and erosion phases in the stream channels.

The main aim of this work is to analyse the relevance and renewal times of the sediment stored in the stream channels in the Ca l'Isard sub-basin (1.32 km²). Information on stream discharge and suspended sediment loads was taken from a 15-year record at the gauging station, whereas badland erosion for the same period was simulated using the soil erosion model KINEROS2. The model was calibrated and validated using 3-year sediment yield data obtained using containers provided with slot divisors in a 1,240 m² elementary badland catchment. Other qualitative observations were also used for validation.

The results demonstrated that there was a low correlation between badland erosion volumes and stream sediment loads at the event scale; the first were well correlated with rainfall intensities whereas the latter were better correlated with total event precipitations and stream discharges. Badland erosion was simulated as null for some events with large stream sediment loads because the model did not simulate any runoff on the hillslopes.

Stream sediment transport was more compulsive than badland erosion, as 90% of the sediment exported from the basin was produced by only 21% of the events, whereas the same fraction of badland erosion needed 44% of the events. Finally, although other sources of sediments than badlands were not assessed, the results suggest that beyond the occurrence of minor erosion and deposition phases every year, the stream channels underwent a progressive aggradation during most of the time, interrupted only by severe erosion crises during major stream runoff events that occurred a few times during the 15-year analysed period.