Badland dynamics and its role in runoff and sediment response in a small Mediterranean mountain basin (Vallcebre, eastern Pyrenees)

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Badland landscapes are the main sediment sources in the upper Llobregat basin and particularly in the Vallcebre research basins (Eastern Pyrenees). The dynamics of these badlands is dominated by physical weathering (mainly frost heaving) during winter and by water erosion during summer when intense rainstorms occur. 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.

As a summary, the regolith is prepared during winter, eroded from the hillslopes but deposited in the stream channels during late spring and summer, and finally resuspended and transported away during large runoff events in autumn or early winter. Nevertheless, the diversity of local characteristics of badlands in terms of bedrock, slope gradient and aspect and vegetation cover means a large spatial variability of processes on badland hillslopes, whereas the sediment stores in the channels seem to play a major role in the regulation of long-term sediment transport exports at the basin scale. Finally, in spite of the relatively wet climate, the dynamics of these badland systems seems to be limited by the transport capacity of the streams.