



Zonal characterization of hillslope erosion processes in a semi-arid high mountain catchment

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Mediterranean and semi-arid catchments, generally suffer heterogeneous erosive processes at different spatio-temporal scales which produce, in a synergistic manner, a large amount of sediment supply. In mountainous catchments, the influence of pluvio-nival hydrological regime leads to a clear subdivision into homogeneous zones regarding the nature of hillslope processes. Here, a distinction could be addressed with 1) subsurface erosion due to saturated soil by intense snowmelt pulses and 2) steepest mid-mountain soil loss with rill/interrill, small-scale landslides and ephemeral or permanent gullying. Furthermore, the associated channels in these areas are formed by wide alluvial floodplains with important bedload contributions. This complexity conditions the evaluation of erosion and monitoring at catchment scale with elevated costs in time, devices and staff. The catchment of the Guadalfeo river encloses 1200 km², with important presence of snow in the summits height on its right margin, and semiarid low range hills with very erodible soils on its left margin. Gully erosion, landslides and stream bed-load processes, extremely active in this area, are responsible of a real problem of soil loss and desertification with a high associated cost.

This work suggests a methodology for the zonal assessment of different erosive processes taking into account the described heterogeneity and the reduction of research costs. To do this, high resolution bathymetric and topographic surveys supported in a reservoir (110 hm³) allowed the differentiation of bedload and suspended sediments as both are deposited in different locations and hence the validation of the hillslope sediment yield. In parallel, measurements in homogeneous areas were selected in order to obtain zonal results to achieve the representative processes involved. The use of portable samplers allows the remote changing of sampling routines, and thus to capture the temporal scale of the processes and the associated forcing agents. The obtained results validate the proposed methodology with adjustments/fitting between measured suspended sediment regarding the increase of volume registered at the dam. Furthermore, the measures obtained reveal a clear zonal differentiation in sediment yield which represents the heterogeneous dynamic of the processes involved.