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Three-year sediment transport in a highly erodible catchment: The River Isabena (Ebro Basin, Southern Pyrenees)

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Quantifying suspended sediment load is important in catchments containing highly erodible materials, especially in those that drain into reservoirs since high suspended yields generates and exacerbates reservoirs siltation. Suspended sediment records are also essential for the calibration and validation of numerical models that aim to reproduce past soil erosion and sediment dynamics and to generate reliable data for management purposes. The River Isabena is a mesoscale (445 km^2) mountainous catchment located in the Southern Central Pyrenees in the Iberian Peninsula. The river experiences frequent floods, a characteristic that, together with the high connectivity between its network and the sediment sources, keeps sediment transport rates relatively high; instantaneous suspended sediment concentration occasionally attains 300 g l^{-1}. The main sources of fine sediment are badland areas on marls (occupying less than 1% of the catchment area). The river flows into the Barasona Reservoir that experiences historical siltation problems.

In order to quantify the suspended sediment transport in the Isabena basin, water and suspended sediment were monitored during the period 2005-2007. Discharge was sampled at the downstream end of the catchment. Suspended sediment transport was measured continuously at the same section by combining high-range turbidimeter readings and water samples (obtained regularly using and automatic sampler and manually -DH54 sampler- during floods). A total of 80 floods have been sampled during the study period. Total sediment yield has been estimated at 552,760 tones, representing an annual average of 184,253 t yr^{-1}, and an averaged specific sediment yield (hereafter SSY) of 414 t km^{-2} yr^{-1}. Most studies that showed a similar range of SSY are restricted to small mountainous catchments (<1 km^2), where sediment eroded off the slopes is readily available to be transported and exported out of the catchment during floods. Such high SSY ranges are not typically for basins with comparable (or larger) sizes to the Isabena. The sediment dynamics were also studied for individual floods through the analysis of hysteretic loops, with a clear dominance of counterclockwise loops, that related to temporarily in-channel sediment storage. The channel controls the sediment transfer between the sources and the outlet, acting sometimes as the main source of sediment and others as sink. The River Isabena represents one-third of the catchment area of the Barasona Reservoir, with the total load transported by the Isabena to the reservoir during the three study years can be estimated at around 0.36 hm^3, a value that represents more than 0.4% of the original reservoir capacity.