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Exploring the role of sediment and wood transport during flash floods in the Darro River crossing the city of Granada (Spain)

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Mountain rivers can convey significant amounts of coarse sediment (gravel, cobble), and large wood pieces; both recruited from river margins and valley slopes. The erosion, transport, and deposition of this material may endanger human infrastructures, such as bridge piles, canals, or weirs, notably increasing flood hazards and potential damages. Therefore, sediment and large-wood dynamics should be considered in the flood hazard evaluation, particularly in mountain areas. However, traditional flood hazard assessment often relies solely on hydraulic models assuming non-movable riverbed and no sediment or wood supply. These assumptions neglect the important role that sediment-transport and geomorphic changes have on the evolution of water levels during floods, potentially leading to strong under- or over-estimations of related hazards.

In this work, we developed a methodological framework that incorporates sediment- and wood-transport to assess flood hazards in the Darro River (Andalusia, Southern Iberian Peninsula); a mountainous torrent turned into an urban river characterized by a flash-flood regime, and high sediment and wood supplies. We selected a river reach, 3 km in length, where the river Darro crosses the city of Granada. The monumental city of Granada is highly populated and welcomes >5 million visitors every year; so, the reliability of previous flood-hazard assessments, without considering sediment and wood transport, was questioned by river managers. The selected study reach includes an area of high urban pressure where the river flows under a vault. Thus, it is crucial to consider the sediment and wood transport, as they could potentially trigger a catastrophe (as already happened in 1951, when the vault partially collapsed).

We conducted a field survey to identify mobile-sediment patches and large-wood jams along the selected reach. Sediment patches were sampled following the Wolman method to characterize the grain-size distribution. Wood pieces were measured, and characterized in terms of size, position and susceptibility to be incorporated into flood flows. This information is being used to build a 2D hydraulic and morpho-sedimentary (assuming a mobile bed) numerical model (IBER software), coupled to a specific module (IBERwood) that simulates wood transport and deposition. A scenario-based approach is used to explore the effect of sediment and wood supplies on the flooded area, the flow depth and the velocities. This contribution will show preliminary results.

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