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Interaction Between Large Wood and Sediment Transport in an Alpine Torrent in the Dolomites

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Large wood (LW), defined as woody pieces exceeding 1 m in length and 10 cm in diameter, significantly shapes channel morphology and ecological habitats within Alpine torrents. Lower-order alpine torrents, with their smaller drainage areas and steeper gradients, are particularly sensitive to LW dynamics. The movement of LW greatly affects channel processes, altering flow patterns and sediment dynamics. LW can retain sediments and form log steps that may reduce bed erosion. Moreover, the accumulation of LW at bridge piers and filters or openings of retention check dams can exacerbate flood hazards, emphasizing the crucial need for its accurate quantification for more effective hazard assessments and protection measure design. Our investigation aims to assess changes in the LW budget in the Ru de Vallaccia catchment (covering 1.72 km^2, Melton number 0.97, mean channel slope 45%) in the province of Belluno, Veneto, Italy. Specifically, we explore variations in LW volume before and after a heavy rainstorm event with a return period between 2 and 5 years that occurred between the 30th of October and the 2nd of November 2023. Furthermore, this study examines the correlation between segments of the channel affected by sediment erosion and deposition and changes in both the spatial distribution and volume of LW within the channel. Field surveys coupled with high-resolution topography (HRT) assessments conducted before and after the rainstorm event (July and November 2023) allow for a comprehensive evaluation of sediment and LW budgets. Our methodology involves direct field measurements of LW and photointerpretation using GIS software on orthophotomosaics resulting from HRT surveys. Additionally, we utilize the Digital Elevation Model (DEM) obtained from HRT surveys to analyze channel geomorphological changes through the DEM of Differences (DoD) technique, enabling precise quantification and visualization of sediment alterations related to erosion and deposition phenomena. Preliminary findings reveal pronounced sediment mobility, significant alterations in channel morphology, and notable changes in both the spatial distribution and volume of LW. The results of the study highlight the close link between patterns of erosional or depositional sediment dynamics and alterations in the LW budget, elucidating the intricate interaction between geomorphic processes and the presence and evolution of LW during subsequent flood events in steep mountain basins. In addition, these insights have substantial implications for addressing or guiding periodic monitoring of LW and thereby improving our hazard mitigation strategies against those sediment transport events (bedload, debris flood, and debris flow) capable of encompassing significant amounts of LW.