Combining Terrestrial Laser Scanning and dendrogeomorphological data for flash flood magnitude reconstruction

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The study of processes such as flash floods in ungauged mountain basins often requires the combination of different techniques enabling numerical models to be developed in order to understand the processes. In this study, we have focused on the use of detailed topography obtained with Terrestrial Laser Scanner (TLS) and dendrogeomorphological evidences to calibrate hydraulic models which allow the magnitude reconstruction of an extraordinary event that took place on December 18th 1997, in the stream Arroyo Cabrera (Gredos Mountain Range, Spanish Central System). The methodology was carried out on a river reach characterized for presenting a hydraulic jump on stable bed-rock and numerous scarred trees on the banks caused by the impact of rocks and woody debris during the event. Along a 500 m stretch, a high-resolution Digital Elevation Model (DEM) was built with an average precision of 5 mm based on more than 4 million points taken using a TLS. At the same time, classical stream cross sections and morphometric measurement data from trees and scarred evidences were collected with a Total Station. Subsequently, both topographic and dendrogeomorphological data were included in one-dimensional and bidimensional hydraulic models. The results obtained from the methodology developed allow the magnitude of the event studied concerning the transported flow, the flooded area and the pattern of the flow velocity to be reconstructed. Additionally, the use of different hydraulic models and topographic data enabled the differences in the results obtained to be observed. Knowing the advantages and disadvantages derived from each case provides useful information for producing future flash flood hazard maps in ungauged catchments, with exposed goods of great vulnerability. Keywords: Terrestrial Laser Scan, Dendrogeomorphology, Digital Elevation Model, ungauged basins, Spanish Central System.