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Reconstruction of the debris-flow history of a small alpine torrent by dendrogeomorphology

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Debris-flow risk analysis in mountainous terrains requires a better characterization of the frequency and the propagation area of debris-flow events. This characterization is generally based on the analysis of historical records, which are more or less incomplete and sometimes inexistent for small pristine catchments. To complete and enhance the historical record analysis, the dendrogeomorphological survey of alluvial fans has proved to be an efficient and attractive tool. The objectives of the study conducted on a small torrent of the Northern French Prealps (Manival Torrent, drainage area: 7 km^2) are : (1) to map the geomorphic evidences of debris-flow events by means of a high resolution DEM obtained from an airborne LiDAR survey, (2) to date the debris-flow events from dendrogeomorphological evidences on the wooded alluvial fan, and (3) to analyze the evolution of debris-flow activity through time from the historical record completed with dendrogeomorphological surveys. From the study of the growth disturbances of 250 Pinus sylvestris located in abandoned channels and associated banks we reconstructed the geomorphic activity of old debris-flow channels of the Manival. Ten events were identified by dendrogeomorphological survey. Only 3 of them were previously known from historical records.