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Reconstructing snow-avalanche activity with tree rings in Maramureş Mountains (Eastern Carpathians, Romania)

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Snow avalanches represent a common phenomenon in Maramureş Mountains (Eastern Carpathians, Romania) where they occur frequently on higher steep slopes and reach in the runout zones the valley bottoms below 1000 m a.s.l. The presence of particular topo-climatic conditions influences the patterns of avalanche activity in terms of past frequency and spatial extent along the slope valleys. As the past snow-avalanche activity is not documented by written reports in the area, reliable information about avalanche history is missing. However, the slopes are forested, trees repeatedly disturbed by snow avalanches record evidence of past events. For this study we reconstructed the avalanche activity using tree rings as a source of proxy data. To date the snow-avalanche history, dendrochronological investigations have been carried out in two avalanche paths, along which living trees showed clear external signs of past disturbances related to mechanical impacts produced by snow avalanches. In each investigated path, a total number of 52 and respectively 118 trees have been sampled and their spatial position recorded with a GPS device. Tree-growth anomalies (e.g. scars, callus tissues, the onset sequences of tangential rows of traumatic resin ducts, compression wood, growth suppression and release sequences) related to snow avalanche disturbance identified within tree rings served to reconstruct past events with an annual resolution. The results indicate that, apart the 2005 major event witnessed and also confirmed by tree-ring dating, multiple other events have been reconstructed since the beginning of 20th century. Despite some inherent limitations of tree-ring methods in reconstructing past avalanche events, these dendrochronological investigations confirm their utility in deciphering the patterns of avalanche activity in Maramureş Mountains. Tree-ring studies contribute to a better understanding of the role of topographical and climatic factors which influence the spatio-temporal occurrence of snow avalanches.

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