



Tree-ring reconstruction of snow avalanches: an evaluation of the dendrogeomorphic approach by comparison with historical archives on an accurately documented path (Chamonix, French Alps).

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Knowledge of snow-avalanche regimes is crucial for human safety in mountain regions. In snow-rich areas, snow avalanches endanger settlements and cause heavy damage to infrastructure or transportation route. In wooded avalanche paths, early dendrogeomorphic studies date back to the late 1960s and the method has been used extensively in the United States and in Canada ever since. The use of tree rings was demonstrated to greatly help documentation of past events and may allow

reconstruction of chronologies of major avalanche activity over considerable periods of the past. However, its accuracy has to be investigated, with regard to methodological issues. In that respect, we started a research on snow avalanches in the Chamonix valley (France), with many efforts devoted to the comparison between dendrogeomorphic reconstruction and historical archives. In this study, we compared the historic record of natural avalanches in one avalanche path with tree-ring evidence of avalanches from trees sampled in the same path. As the history of the avalanches in the studied path was accurately documented between A.D. 1779 and A.D. 2010, it constitutes an uncommon record of natural avalanches and presents a unique opportunity to examine the accuracy of tree-ring reconstruction. Our dendrogeomorphic approach was based on the process-event-response and on the computation of an avalanche activity index (percentage of responses in relation to the number of trees alive for a given year). This study confirms the reliability of the dendrogeomorphic method to reconstruct high-magnitude avalanches, especially wet snow-avalanches, whatever the threshold used for the avalanche activity index. On the other hand, 20% to 80% of dry-snow and smaller avalanche events were deciphered depending on the threshold value.