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Seasonality of debris-flow events in the mining area of Călimani Mountains (Eastern Carpathians, Romania) inferred from tree rings

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During the second half of 20th century, in the central part of the Călimani Mountains (Eastern Carpathians, Romania), the mining activities for sulfur-rich ore extraction and processing resulted in significant morphological changes. Hydrogeomorphic processes, i.e., debris flows originating in the spoil heap area produced in the last decades an increasing volume of sediments transferred along the stream channels. In this mining area, very limited information exist about the frequency and spatial extent of debris flow activity. To bridge the gap between the increasing need of information regarding debris flow patterns and the data provided by the costly field monitoring methods, dendrogeomorphic methods allow to document the spatial extent and temporal frequency of debris-flow activity in forested areas. Dendrogeomorphic approach rely on the identification of growth anomalies recorded by the annual rings of trees disturbed by debris flows. This method proven to be a viable tool for reconstruction of past natural debris flows occurring mountainous areas, but recently few dendrogeomorphic studies have focused also on reconstructing anthropogenically-induced debris flows. The main aim of this study is to apply dendrogeomorphic methods to reconstruct debris flow chronology in mining area of C□limani Mts. Trees living along debris-flow channels below the spoil heaps, which exhibited clear external signs of disturbances (stem wounding) caused by the mechanical impact of past debris-flows were sampled. The growth anomalies, e.g., scars identified within the annual rings of the disturbed trees served to date the occurrence of debris-flows events with a seasonal resolution. In the study area, tree-ring analyses allowed the reconstruction of the past debris-flow events, spanning the period 1970–2021. Reconstructed debris flow frequencies and return periods indicate an increase of debris flow activity over the last two decades. Further studies will attempt to link the seasonality of reconstructed events and the analysis of meteorological patterns characterizing debris flow triggering rainfall events in the study area.