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# Temporal structure of debris-flow triggering rainfall derived from high-resolution weather radar estimates

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Due to the scarce representativeness of rain gauges in convective and mountainous environments, typical situations for debris flows occurrence, the magnitude and temporal dynamics of debris-flow triggering rainfall are largely unknown, except for a limited number of cases occurred in well instrumented catchments. Despite this, the common risk management and research practices rely on rain gauge data. Recent studies shed light on the impact of spatial rainfall patterns on rain gauge based early warning systems, however, only poor information is yet available on the temporal structure of the triggering rainfall. We use high-resolution (5 min) corrected and gauge-adjusted weather radar estimates for 11 storm events occurred in the Eastern Italian Alps, which triggered a total of 99 debris flows, to (i) quantify the severity of the triggering rainfall on different duration scales, (ii) analyze the fine-scale temporal structure of the triggering rainfall, and (iii) gain insights on the temporal resolution required to adequately measure such events. Results from this study show that durations between 30 min to 3 hours are characterized by longer return periods, with the 1-hour highest burst often contributing >70% of the total rain depth. Moreover, the amount of rainfall preceding the strongest bursts is often larger than the amount following it. The temporal autocorrelation of the triggering rainfall decreases sharply, with time-decorrelation distances between 15 and 45 min and rarely exceeding 1 hour. This suggests that at least 15-minute temporal resolutions should be desired to adequately represent the development of the events.