



The altitude effect on the climatic factors controlling debris flows activation: the Marderello Torrent case study

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The left Cenischia valley includes some of the best known alpine basins prone to debris flow in Northwestern Italian Alps. In particular, in the Marderello catchment (6,6 km²), a left tributary of the Cenischia river, 31 important debris flood/flow events occurred during the last one hundred years. According to the chronicles of the last three centuries, events with significant volumes are on the average liable to take place every 3-4 years, whereas minor events may occur even twice per year.

Due to the high frequency of activations, the site is of relevant interest for monitoring purposes. Since the early nineties, the CNR IRPI equipped the Marderello basin with meteorological monitoring devices. The rainfall monitoring network consists of four rain gauges, placed at different elevations, between 800 m a.s.l. and 2854 m a.s.l. Other meteorological data (air moisture and temperature, atmospheric pressure, wind speed and direction) are provided by three stations located at 3150, 2150 and 830 m a.s.l. The main objective of the monitoring is the investigation of the triggering conditions for debris flows initiation. In the scientific literature the prediction of debris flows is often tackled by the use of empirical methods, based on the analysis of past activation and related rainfall triggering conditions. The effectiveness of these methods strictly depends on the representativeness of the meteorological monitoring stations used to collect the data. In complex orography sites, as the Alpine catchments are, the remarkable elevation gaps between the source areas of debris flows and the rain gauges position make it difficult to identify the triggering rainfall. To attain more reliable results, the elevation effect must be considered. In fact, elevation influences the precipitation in terms of cumulative values and, as a result of the temperature gradient, it controls the nature of the precipitation (rain/snow).

In the present study we use the rainfall and temperature monitoring data collected in the Marderello basin to investigate the effect of the elevation on the recorded precipitation. The capability to find a correlation between elevation and rainfall can be useful to have a better comprehension of triggering mechanisms, to identify the source areas and to produce reliable event predictions.