



Debris flow frequency and their relation with precipitation. A case study in the central Alps, Italy

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Debris flows are one of the most common and important type of mass movements, and constitute a noticeable element of the geomorphological hazard. The aim of this research is to study debris flows in the alpine environment by using dendrogeomorphological dating techniques, to verify the modifications of the frequency and intensity of the events, and to outline relations with precipitation. The study area is upper Valle del Gallo (upper Valtellina, Northern Italy). It is a high mountain environment dominated by processes of slope degradation, whose valley-bottom is occupied by many debris flow fans. The dendrogeomorphological researches were made on 12 fans and two channels along the slopes. The employed techniques are based on the dating of damages and growth alterations to the trees caused by debris flows (corrasion scars, compression wood and abrupt growth changes). On the basis of the analysis of 757 trees, from 2 to 39 debris flows were recognized and dated for each fan or channel, for a total of 239 events occurring between 1875 and 2003. The evolution of the debris flow frequency in the time shows a trend of gradual increase, although the maximum value seems to have occurred in the period 1974-1983. This tendency agrees with the historical recurrence of the flood events in Northern Italy obtained from bibliography. The analysis of the relations between debris flows dated in the study area and the precipitations recorded by the Cancano meteorological station indicates that the debris flows can be triggered by 30-40 mm of rain, concentrated in few hours.