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Different regimes of critical rainfalls for debris flows initiations by channel-bed failure of the Dolomites

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The most common processes of initiation of debris flows in natural channel of high mountainous areas is the channel bed failure. The initiation of debris flow by channel bed failure occurs in very steep natural channels where the concentration of runoff is able to mobilize the debris deposit laying at the bottom. In this case the runoff becomes the most important controlling factor of the occurrence of debris flow. The estimates of the critical values of runoff can be indirectly approached by the precipitations that generated them. Aim of present study is the analyses of the critical rainfalls for the initiation of debris flow by channel bed failure.

Historical and rainfall data on twenty six debris flow events occurred in five watersheds of Dolomites (North-Eastern Italian Alps) were collected from different sources.

Field investigations in the five sites, together with the hydrologic response to the rainfalls that triggered the events, were performed to obtain a realistic scenario of the formation of the debris flows there occurred.

The rainfalls up to the time of occurrence of debris flows are scanned and a conventional way to identify them is proposed by the help of a SCS based kinematic distributed hydrological response model.

The critical rainfalls show two different patterns: the former with the presence of rainfall bursts, the latter without any significative variation of rainfall intensity. The hydrological response of most of the checked and isolated bursts is greater than the critical runoff for the initiation of sediment transport at high slopes and nearly half of the cases than the critical runoff for the debris flow initiation by channel-bed failure.

The identified precipitation intensities are then plotted versus time and a threshold

curve for the triggering of the debris flow by channel bed-failure in the Dolomite environment is obtained. The threshold curve is compared with other eleven threshold curves for to the triggering of debris flow phenomena given by other authors and with the intensity-duration-frequency curves obtained by statistical analyses of the recorded precipitations in three gauges stations next to the five sites. The comparison with the literature threshold curves do not led to significative results. The comparison with the intensity-duration-frequency curves lead to the identification of two different regimes of the precipitation that triggers a debris flow by channel bed failure. The former regime is the one with the bursts, the latter regime is the one without bursts and any significative variation in rainfall intensity.