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On the efficiency of an open retention check dam against a debris flow

Vincenzo D'Agostino, Gabriele Bertoldi, and Francesco Bettella
(vincenzo.dagostino@unipd.it)

The high-intensity rainfalls occurred on the 4th of August 2015 triggered different debris flows in the torrent Boite valley (Belluno, Italy). Three people died and considerable damages to villages and infrastructures were caused. The research investigates on the debris-flow event occurred in the rio Rudan catchment (south facing slope of the Antelao peak, Dolomites; tributary of the Boite torrent) and particularly on the interaction of the debris-flow front with a retention open check dam placed at the fan apex. The rainfall intensity of the rainstorm reached a value of 38 mm in 0.5 h (precipitation measured by the raingauge installed on the Antelao massif by the Regional Agency for Environmental Prevention and Protection of Veneto Region, ARPAV). This rainfall triggered a debris flow, which deposited 25000 cubic meters of solid material in the terminal reach of the channel and in the storage basin of the retention check dam.
The research is voted to: i) conduct the back analysis of the debris-flow event estimating the peak discharge upstream and downstream of the check dam; ii) evaluate the influence of the structure on the reduction of the maximum debris-flow surge; iii) estimate the impact force of the flow on the structure.
The back analysis was carried out through the application of different methodologies supported by field surveys (significant cross sections in different channel reaches, Close Range Photogrammetry of the fan area, measurement of the sizes of the biggest boulders entrained by the flow). The different methods used for the reconstruction of the maximum discharge of the debris flow provided converging values, allowing to conclude that the structure was capable to halve the peak discharge and to efficiently protect the neighboring village. Finally, the back calculation of the impact force of the flow against the check dam was conducted through the analysis of structure damages and indicated some design criteria for the most exposed parts of the work.