



Geomorphometric approach for a preliminary debris-flow characterization at the regional scale

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Debris flows are widespread phenomena in mountain catchments causing major damage when they intersect transport routes or urban areas. The assessment of areas affected by debris flows and their spatial characterization is thus a major issue in the framework of watershed management.

This work presents a simple and fast semi-automated procedure developed for a regional-scale identification of debris-flow prone channels and related downstream alluvial fans. The main aim is to develop a low data-demanding method for a preliminary mapping of potentially debris-flow affected areas at the regional scale to enable priority ranking of channels and alluvial fans at risk by debris flows.

The methodology is based on a geomorphometric approach that involves the analysis of morphometric parameters derived from Digital Elevation Models (DEMs) for the identification of debris-flow triggering areas and their kinematic along the channel. Potential initiation sites of debris flows are identified as those exceeding a threshold identified on a plot of local slope versus contributing area whereas channel reaches corresponding to debris flows deposition, deceleration and halting conditions are derived from thresholds of local slope. An empirical method, which considers the traveled distance and the local slope along the channel profile, is used for the computation of the debris-flow runout. The presence of hydraulic control works (i.e. check dams) along with information on erosion-resistant bedrock channels and sediment availability are taken into account within the procedure. This approach has been validated by means of field checks and through its extensive application in the eastern Italian Alps.

The developed methodology has been implemented in a set of freely-available software tools (<https://github.com/HydrogeomorphologyTools>) in order to facilitate its application and further validation in different environments. Potential and limitations of the method will be also presented.