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Modeling the debris flow expansion on alluvial fan areas - A comparison of different modeling approaches

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Debris flows are a major threat to settlements and infrastructures in mountainous regions. The threat due to natural hazards, including also debris flows, can be reduced by integrating their aspects into the land use management and urban planning at the municipality level. Numerical models represent a commonly used tool to delineate hazard areas affected by debris flow activity. There are several modeling approaches documented in the literature, their applicability depends largely on various factors, such as e.g. the debris flow rheology and alluvial fan topography.

We applied two different numerical models to simulate the well documented debris flow event of the Rossiga Valley (Italian Southern Alps) of November 2002. The event mobilized about 90'000 mˆ3 of material and spread it over the alluvial fan, damaging 3 buildings and killing some livestock.

The models are both two-dimensional, but differ largely in their approaches, how the debris flow expansion is modelled. The first model is the rather simple, empirical model dfwalk, based on a multiple flow direction algorithm for the flow routing and a two-parameter approach for the debris flow velocity [1]. The second model, Flo2D, is physically based, and simulates the expansion of a non-Newtonian single phase flow based on a given inflow hydrograph [2].

The two models were applied to the Rossiga Valley debris flow event, and their outputs were compared to evaluate the predicted run-out distances and velocities based on field analyses and to cross-check and compare the general applicability and validity of these models that have completely different approaches. In a final conclusion the advantages and disadvantages of the two models are summarized in the prospective to

be used as a tool for the hazard mapping for debris flows on alluvial fan areas.

References

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