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Simulation of debris flow deposition areas using a single flow routing algorithm

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A new modelling technique to forecast the spatial distribution of debris flows is introduced. A combination of empirical relationships and flow routing algorithms is used to estimate the depositional area of debris flows. This information may then be used to derive hazard maps.

Adapting a method to delineate hazard zones of lahar inundated areas, the runout area of a debris flow is simulated. A semi-empirical predictive equation is developed which relates the debris flow volume to the planimetric deposition area. The equation is derived from data on deposition volumes and inundated areas of debris events in Austria, Switzerland and Northern Italy. The predictive equation is implemented in a GIS based simulation program and combined with a simple flow routing algorithm, in order to determine a potential deposition area. For a given volume and starting point of the deposition, a Monte-Carlo simulation is used to produce trajectories that include the spreading effect of a debris flow. In a further simulation step, the known debris flow volume is distributed over the predicted area using a mean deposition height. The simulation code uses the ARC-Objects environment of ESRI© and is adapted to run with high resolution (2.5m) elevation models, generated from LiDAR data. The simulation program is tested with debris flow events of August 2005 in Switzerland for areas where LiDAR generated elevation models are available.