Geophysical Research Abstracts, Vol. 7, 08813, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08813

Landslide hazard in Val di Fassa (Trentino, Italy): a multi-process approach

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In the Alpine region risk management frequently forces administrators and policy makers to deal with hazards derived from different kinds of processes. In order to provide end-users with a decision support tool, for the Val di Fassa area (nearly 300 km2 in size, Trentino, Eastern Alps) we developed a multi-process susceptibility map that incorporates within a single framework different sources of hazard. Four kinds of instability processes were considered: rock-falls, debris-flows, deep-seated slide/complex landslides, and alluvial fan processes. To assess rock-fall susceptibility, we applied a grid-based, numerical model (HY-STONE) that allows for simulating the propagation of blocks along a 3D topography with a distributed approach. The model result consists in a hazard Index map that incorporates information on the frequency and energy of blocks crossing each cell, and the height of the trajectories. For the other processes we developed multivariate statistical models. For the debris-flows, we used as a dependent variable the presence of source areas within morphologically-sound slope-units of small size. For slides and complex landslides we used a coarser subdivision of the area into larger slope-units. Lastly, for the alluvial fans, we used as dependent variable the activity of the fan as resulting from both field/laboratory observations and historical data. To assess the different processes we used different approaches (statistical and physically-based) that involved different terrain-units (pixels, slope-units, alluvial fans) at different scales. Hence, we needed to harmonise the resulting susceptibility maps in order to build a single management-oriented synthetic map. For that purpose, we classified the results of each map into binary classes, and we aggregated the different maps into a single multiple-process map.