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Regional landslides susceptibility classification based on LiDAR-DEM hillshade, 3D visualization and geological maps

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Susceptibility to landsliding is a useful classification tool for land planning. Nowadays, the availability of airborne LiDAR digital elevation model (LiDAR-DEM) can account for landscape details at regional scale as well. The GIS enables to build up methods that take advantage of the relatively fine-scale topographical attributes and pattern of instabilities to point out landslides.

Using a cross-analysis of the LiDAR-DEM hillshade and its 3D visualization, a map of the classified potential landslide areas was obtained for all the canton of Vaud (3200 km^2), Switzerland. The identification of potential landslide zones were visually analysed according to a systematic approach based on morphological features: slope failures, scars, deposits, sagging and all kinds of topographical irregularities as well as slope statistics were taken as evidence to delineate current and ancient landslides prone areas. Moreover, this approach was associated with the analysis of the 1:25'000 geological maps (www.swisstopo.ch), using the sensitivity of lithologies to landsliding, structural elements, such as faults system and tectonic lines. The slopes at rivers edges were also inspected because of the effect of enhanced erosion in such a context. Distortion of watercourses, occurrence of natural dams, etc. were used as criterion to detect landslide activity. The landslide susceptibility could be then subdivided in four categories, from proved landslides (clear geomorphologic signatures) to zones that possess one or more criterions susceptible to contain landslides, but without any clear features.

In the same way, a terrain stability modelling using SINMAP was performed in order to assess shallow landslide hazard map. Calibration was operated according to observation describes above.

All those information were stored in a GIS database and constitute a landslides susceptibility map all over the canton of Vaud. Besides, this elaborate visual terrain analysis is an interesting example of how a detailed inspection can be used for slope instabilities susceptibility classification by taking advantage of the new LiDAR DEM, which enables a detailed analysis that was not possible before, even by field analysis.