Application of Rock Engineering System (RES) for debris flow susceptibility mapping in Alpine basins (Western Alps)

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Keywords: landslide susceptibility mapping, rock engineering system, OpenGeodata, debris flows.

Hazard mapping and risk assessments are fundamental tools for local authorities to support the development of protection plans and the design of appropriate risk mitigation measures. The spatial probability of landslide occurrence in a given area (Brabb, 1984) is expressed by susceptibility map, which identifies sectors prone to triggering. In mathematical terms, susceptibility can be defined as the spatial probability of occurrence of landslide, given a set of geo-environmental conditions (Guzzetti et al., 2005; Reichenbach et al., 2018).

In the alpine environment, debris flows are one of the most dangerous natural events with a high potential of destruction due to high kinetic energy and velocity. The scope of this study is to propose a quantitative, rapid and low-cost methodology for mapping debris flow susceptibility at the regional scale using available open-access data and geodatabases.

Bedrock lithology, quaternary deposits, slope, hydrological network, degree of fracturing, landslide activity, land use and curvature were selected as predisposing factors. Their mutual interactions were described and quantified using the Rock Engineering System (RES) methodology (Hudson, 1992). The method is based on a matrix approach capable to qualitatively coding the mutual interactions between the parameters and returning a "Debris flows susceptibility index (DfSI)".

The illustrated approach can represent a useful standardized tool, universally applicable as it is independent of the type and characteristics of the basin.

The prosed methodology has been applied to produce a susceptibility map of the Upper Susa Valley (Torino, Western Alps), where a number of debris flow events were recorded.

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