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Analysis of natural hazards along infrastructure networks using a GIS-tool for risk assessment in mountain regions. An exploratory study on an hypothetical event: the Val Canaria flood.

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Several percent of the Canton Ticino (Southern Switzerland) is prone to slope instability. The climate of southern Switzerland favors slope failure. In particular, landslides and accelerated creep are commonly triggered by major storms associated with warm humid air flowing from southwest towards the Alps.
These storms can be particularly severe in the Ticino region. The storms of 1993 and 2000, characterized respectively by up to 2200 mm in 26 days, and 500 mm in 5 days, caused extensive flooding, triggered debris flows and landslides, and induced higher rates of creep in some existing large landslides (Seno and Thüring, 2006).
Some of these landslides (Val Canaria landslides) are located near Airolo in the upper Leventina valley. The Val Canaria landslides consist of failed rock masses on both sides of the valley with a total volume of about 80 million m3.
The area is historically known for its instability. Despite of the average long-term displacements that are of the order of a few centimetres per year, the snow melt in the spring of 1992 caused total slope displacements of 2 to 7 m. The landslide masses blocked the stream creating a natural dam, which disappeared after a few days, without causing flooding or debris flows (Seno and Thüring, 2006).

In fact, the channel of the Canaria stream at the slope's toe is filled with unvegetated landslide debris. A natural dam could form again after a landslide event with a possible subsequent disastrous failure and destructive consequences on the important traffic lines passing in the Leventina valley.

This scenario, although characterized by a very low probability of occurrence, is nevertheless possible and could have effects that would certainly be devastating for a big part of the Swiss economic system. A damaged infrastructure would cause serious material damage that would require extraordinary repairs or restorations. The services inactivity, as a result of a malfunction, would generate important financial losses and problems in essential services supply in the region (Maggi R. et al, 2009). All these elements justify a risk analysis of this region.

With a Geographical Information System adapted to run with a tool developed to manage risk analysis, it is possible to survey the data in time and space, obtaining an important system for managing natural risks (Frigerio and van Westen, 2010). The aim is to join and organize the various data currently available to carry out a qualitative and semi-quantitative analysis giving an overview of the risk (BUWAL, 1999).

The tool is developed in ESRI ArcObjects and runs in ArcGIS. The topic of ArcObjects usually emerges when users realize that programming ArcObjects can actually reduce the amount of repetitive work, streamline the workflow, and even produce functionalities that are not easily available in ArcGIS. We have adopted Visual Basic for Applications (VBA) for programming ArcObjects. Because VBA is already embedded within ArcMap and ArcCatalog, it is convenient for ArcGIS users to program ArcObjects in VBA.

The outcomes can provide an answer to the questions: "what can happen?" and "how achieve maximum safety with a minimum of effort?" or, depending on the desired depth, they can represent also input to start an increasing order of analytical analysis (i.e a cost-benefit analysis or so on).

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