Learning from the 30 M m^3 Randa rockslide (Switzerland) for rockfall hazard assessment

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The increasing availability of numerical documents improves rock instability detection and hazard assessment. By analyzing documents such as Digital Elevation Model (DEM), topographic vectorized map, aerial pictures, etc… and using Geographical Information System (GIS).

In 1991 about 30 million cubic meters of rocks fell from a rock face near the village of Randa (10 km north of Zermatt) in two main stages: the first one on April 18, and the second one on Mai 9. No fatalities were reported except for a few horses, cows and sheep. 31 chalets were buried. Both events caused the deposit of 10 to 40 cm of dust in a radius of approximately 1 km from the rockslide area.

Using the Randa rockfall area as a benchmark region indicates that the developed methods are relevant to detect rockfall. Several descriptors can be extracted from digital documents. Starting from the analysis of slope angle, slope orientation, kinematics tests and relief analysis it is possible to obtain several parameters that can be used as indictor of instability. A simple counting of unfavorable parameters leads to a rating that corresponds to a relative hazard scale. Using aerial photographs or fields survey permits to greatly improve the above analysis.

In the case of Randa, it has been demonstrated that several indicators of instability are present. The Randa rockfall scar is located in higher cliff of the glacial valley of Zermatt, the Randa cliff had a large erodible volume, joints and faults have unfavorable orientations, previous instabilities and recent rockfall activity demonstrated the movement affecting the slope. Presence of all those parameters demonstrates the predisposition of the Randa cliff for rockfall.

The application of the same principle with different parameters linear objects such as roads has demonstrated the efficiency of such simple methods. The developed methods have predicted the location of three new rockfalls since its development in 2002 (location present a rating greater or equal to 3 in a scale counting 5 classes).