Geophysical Research Abstracts, Vol. 5, 03462, 2003

ROCK INSTABILITY HAZARD ASSESSMENT BASED ON DETAILED TOPOGRAPHIC ANALYSIS

M. Jaboyedoff (1,2), F. Baillifard (1,3), J.-D. Rouiller (1)

(1) CREALP (Research Center on Alpine Environment), (2) Quanterra, Lausanne, (3) Institute of Geology and Paleontology, University of Lausanne

Assuming that rock instabilities are generated by the conjunction of particular structural and morphological settings, analysis of the topographic relief using DTMs (digital elevation model) provides essential results for the hazard assessment of rock instability. The accuracy of the results is dependent on the mesh size of the DTM.
Residuals obtained by the subtraction of a DTM and a smoothed topography allows the detection of either convex or concave morphologies. Depending on the smoothing parameters used, convex relief can correspond to potentially unstable spurs, and concave relief can correspond to thalwegs indicative of local areas affected by higher erosion rates. The combination of these two features and the use of different smoothing parameters allows the detection of unstable spurs in local areas prone to high erosion.
Three-dimensional topographic analysis is performed by using the orientation of each single cell of the DTM, and provides a 3D shaded relief. This analysis allows the identification of the main structures that shape the landscape, especially from a tectonic perspective. This leads to the identification of the main potential rock slope failure mechanisms produced by discontinuities. Using these results, the area where potential plane or wedge sliding may occur can be detected, as well as the density of dangerous structures.
Combining residual analysis and structural analysis allows rock hazard instability assessment. This method can be refined by using other instability factors such as proximity to observed regional faults, observed scree slopes, or poor geomechanical properties. Depending on the data available, these instability factors must be classified.
This method provides a useful tool for a primary rock instability hazard assessment as a first approach for large areas without a detailed field survey.