Geophysical Research Abstracts, Vol. 5, 03556, 2003

UPLIFTS, SEISMIC ZONES AND LANDSLIDES: THE EXAMPLE OF SWITZERLAND

M. Jaboyedoff (1,2), F. Baillifard (1,3), Derron, M.-H. (3)

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

Uplifts indicate the vertical component of the movement of the earth's crust and the effect of erosion. These vertical movements can be subdivided into high velocities and lower velocities. A zone of low or zero uplifts may be considered stable if non-horizontal movements are assumed. Higher velocity zones can also be stable if the movements affect the whole area uniformly.

It can be assumed from a tectonic perspective that potentially more active areas are those that are located between zones affected by constant low and high velocities. These areas correspond to the highest slope of an uplift surface map. The Swiss historical map of earthquakes (Pavoni, 1977) indicates that most of the seismically active zones are located within such areas.

Alpine landscapes often display large ledges spaced by hundreds of meters, with very small observed movements. For instance, vertical measurements in the Swiss Alps indicate a differential uplift movement of 0.6mm/year for a 20km portion of the Mattertal (Kahle et al., 1997). Assuming vertical discontinuities spaced by 100m, the vertical displacement along each discontinuity is equal to 30cm for a period of 100,000 years, which is compatible with observed fault displacements.

This implies that these vertical displacements induced fracturing, and it can therefore be assumed that potentially unstable rock slopes are located within, or at the limit, of those areas. The 1991 Randa rockslide, for example, is located at the limit of such a zone, and the recent 2002 St-Niklaus rockfall is located within this area. Furthermore, an initial inspection of various sets of ledges in the Western Alps can be related to such zones.

Utilizing this approach with future GPS data is really promising, and can provide a 3D partial derivative of movements.

References

Kahle, H.-G et al.: Recent crustal movements, geoid and density distribution: contribution from integrated satellite and terrestrial measurements. In: Pfiffner, O.A et al. (eds): Deep Structure of the Swiss Alps. Results of NRP 20, Birkhauser, 251-259, 1997.

Pavoni, N. Erdbeben im Gebiet der Schweiz. Eclogae geol. Helv. 70/2, 351-370, 1977.