Geophysical Research Abstracts, Vol. 9, 09602, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-09602

Dynamic analysis of the Thurwieser rock avalanche, Italian Alps

G.B. Crosta (1), O. Hungr (2), R. Sosio (1) and P. Frattini (1)

(1) Università degli Studi di Milano Bicocca, Dipartimento di Scienze Geologiche e Geotecnologie, Milano, Italy

(2) University of British Columbia Department of Earth and Ocean Sciences, Vancouver, Canada

Rock avalanches are among the most threatening flow-like landslides because of their high mobility and impact energy. Modeling rock-avalanche runout and predicting their intensity can provide a guidance to estimate the extent of the potential impact area and to design mitigation strategies. A reliable replication of the landslide dynamics requires a good description of the event characteristics to minimize the uncertainty associated to the trial and error calibration of the input parameters to be used in the model.

The Thurwieser rock avalanche (September 2004, Central Italian Alps) is a recent example of a rock avalanche for which a large amount of quantitative data have been gathered. In particular, it is the first example ever of a large-scale mobile rock avalanche being recorded on video, and for which almost an exact value of the total time duration, from initial detachment to final deposition, is available. The landslide involved about 2.2 M m^3 of limestone and shale, and traveled over 2.9 km from its source partially in a glacial environment. The mean front velocities along different sectors of the path have been directly estimated from the video recording the landslide propagation. The final geometry and the characteristics of the deposit have been obtained by GPS measurements, aerial photos and field observations.

A continuum dynamic analysis of the landslide motion has been performed using the model DAN 3D. The model can account for variable shear-resistance at the basal interface according to the different superficial materials encountered (in this case glacier ice, glacial deposits and exposed bedrock), the branching and merging of the sliding

mass over a 3D terrain and non-hydrostatic, anisotropic internal stresses.

The landslide mass has been modeled assuming both a Voellmy and a frictional rheology. The characteristics of the terrains passed by the landslide and the estimated landslide front velocities formed the criteria for back analyses of the rheological parameters, together with the final shape and thickness of the deposit. The parameters, initially calibrated with the two-dimensional model DAN-W, were then adopted in DAN 3D, showing good consistency. Moreover, they are consistent with the existing database of calibrated cases of landslides of similar type and scale.

For both the rheologies, the model reproduces satisfactorily the final distribution of the material. Flow velocities are somewhat more accurately predicted by the Voellmy rheology. The presence of glacial ice plays a substantial role in increasing the mobility of the rock avalanche and must be accounted for in the model.