Geophysical Research Abstracts
Vol. 12, EGU2010-12569, 2010
EGU General Assembly 2010

Modeling the propagation of volcanic debris avalanches by a depth averaged finite element solution

Rosanna Sosio (1), Giovanni Battista Crosta (1), Joanna Chen (2), and Paolo Frattini (1)

(1) University of Milano Bicocca, Scienze Geologiche e Geotecnologie, Milano, Italy (rosanna.sosio@unimib.it), (2) Golder Ass. Ltd, CAlgary, Alberta, Canada

Debris avalanches originated from volcanic collapses are particularly mobile and devastating compared to their non volcanic counterpart. Nevertheless, despite edifice collapse is a quite common process, only a few cases of volcanic debris avalanches have been replicated numerically.

A Coulomb frictional, a Pouliquen, or a plastic rheology have been alternatively selected, which best replicate the propagation of volcanic debris avalanches.

This work focuses at evaluating the exceptional mobility of volcanic debris avalanches for hazard analyses purposes by providing a first set of calibrated cases. We model the propagation of eight debris avalanche selected among the best known historical events originated from sector collapses of seven volcanic edifices. The events have large volumes (ranging from 0.01-0.02 km3 to 25 km3) and are well preserved to be recognizable from satellite images. Moreover, they vary with respect to their morphological constrains, materials, triggering conditions and styles of failure and they developed in a variety of settings and conditions.

The modeling has been performed using a finite element method to solve the depth averaged quasi-3D motion equations (Chen and Lee, 2000). The code allows for different rheological models and earth pressure yield criteria. To the already used plastic and frictional rheologies we include the Voellmy rheology, which is commonly adopted to model non-volcanic rock and debris avalanches particularly in wet conditions. The post-event topographies are extracted from the ASTER satellite grid, with a cell size of 22 m. The pre-event topographies have been reconstructed by modifying the original terrain data in the area interested by the detachment and the deposition outlined by available maps and morphological evidences. The event reconstruction and the back analyses are based the best available observations from the literature.

The back analyses provide a set of best fitting parameters for each case and rheological assumption considered. The parameter values are compared to those obtained for the other volcanic debris avalanches presented in the literature. The parameters obtained from the back analyses could be useful to predict the possible evolution of future collapses.