Geophysical Research Abstracts
Vol. 12, EGU2010-15426, 2010
EGU General Assembly 2010

Modelling the Bindo (Italy) landslide mobility from rainfall intensity records using a simple 1D viscoplastic model

Jose Antonio Fernandez Merodo (1), Giovanni Battista Crosta (2), and Marco Secondi (2)

(1) Instituto Geológico y Minero de España (IGME), Madrid, Spain (jose.fernandez@igme.es), (2) Universita' degli Studi di Milano - Bicocca, Milano, Italy (giovannibattista.crosta@unimib.it)

The Bindo-Cortenova landslide is a large, active slope failure located in the Italian Prealps close to the Lake of Cuomo. The unstable area covers 1.2 km2 and extends between 450 and 1200 m a.s.l. The landslide site is formed by the paleo-landslide material that consists of large to extremely large blocks of reddish sandstone and conglomerate (Verrucano Lombardo) immersed in a matrix of gravely sand, from coarse to fine. A first major landslide of about 80.000 m3 took place on 29 Novembre 2002, two days after a second landslide involved about 1 to 1.2 million m3 of debris covering a slope sector of about 85.000 m2 and causing important damages on properties. These failures coincide with a period of extraordinary heavy rainfall, 493 up to 875 mm of cumulative rainfall were measured in Novembre 2002 and the most intensive rainfall season is generally in May with the average monthly precipitation between 160 and 190 mm. Until today field observations show a close relation between ground movement and rainfall intensity.

Monitoring and modeling are two important tools to predict the landslide behavior and prediction is necessary to guarantee the safety of this area. This work presents a simple 1D infinite slope model to reproduce slow landslides mobility directly from the known daily rainfall intensity. The model reproduces in a simple coupling way: rainfall infiltration, ground water changes and kinematic deformation. Concerning rainfall infiltration, changes in groundwater level have been taken directly proportional to the rainfall intensity and governed by a dissipation model of the excess pore-fluid through a simple consolidation equation. Concerning the kinematic deformation, the 1D infinite slope model assumes a pre-existing slip surface where the shear strength is at residual conditions and includes a viscoplastic behavior, the predicted movements are concentrated within a relatively narrow shear zone above which the sliding mass moves essentially as a rigid body.

The time evolution of the computed ground water level has been compared to the recorded data given by a borehole. In turn, computed deformation evolution has been compared to the ground displacement data given by novel inSAR monitoring system.

The main advantage of such a model lies in its relatively simple applicability, very few parameters are needed to reproduce qualitatively and "quantitatively" the recorded motion. The main drawback is that the computed solution depends strongly on the given input data, that means that very slight changes in an input parameter induce important changes in the computed solution.