Geophysical Research Abstracts
Vol. 14, EGU2012-4968, 2012
EGU General Assembly 2012

Numerical analysis of the creeping behavior of the S. Andrea di Perarolo secondary landslide (Italian Eastern Alps)

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The S. Andrea landslide is a complex secondary phenomenon characterized by continuous movements causing a very high hazard condition for the near Perarolo di Cadore village (Italian Eastern Alps). A significant amount of geological and geotechnical investigations has been carried out in the past allowing the detection of the basal sliding surface. In specific, the sliding surface coincides with the contact between the bedrock and the overlying mass of an old landslides, involving a volume of about 180.000 cubic meters.

A numerical approach has been adopted to analyze the stability of slope. This method is able to simulate the formation and development of shear zones as areas of strain localization in the model. Indeed, the S. Andrea landslide has been, then, investigated using FLAC, a two-dimensional explicit finite difference program, particularly useful in case of slopes with complex geometry.

In order to build up a suitable model, variation of geological, hydrogeological and geotechnical parameters have been identified from the interpretation of all available data. In a preliminary stage, a Mohr-Coulomb plasticity model has been adopted except for the bedrock, which was characterized by an isotropic elastic model. Groundwater flow condition has been performed evaluating the change in pore pressure coupled to the mechanical deformation calculation. Numerical results show that this model cannot simulate real displacement behavior of the slope mainly due to both the complex material behavior and lithological heterogeneity, and due to geotechnical spatial complexity of different soils and mechanical parameters.

It has been assumed that it was necessary to improve the model in the light of a time dependent behavior of existing soils.

An elastic-viscoplastic model has been then used to reproduce the observed creeping behavior, and only in viscoplastic region time effects have been considered. Discussion of results points out on: i) the evolution of the "mechanical damage" within the moving mass; ii) the identification of possible causes of the displacements recorded in the field; iii) the utility of the computational approach for the creeping response of the soil slopes under constant load conditions and for two dimensional applications.