Geophysical Research Abstracts
Vol. 20, EGU2018-2803, 2018
EGU General Assembly 2018


# Understanding Slow Moving Landslide Behaviour: validation of numerical model from on site monitoring outcomes

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The understanding of a landslide mechanism and the study of its evolution is of fundamental importance when dealing with alert thresholds and risk management.
This work presents one of these cases and in particular the study of the evolutionary mechanism of a landslide phenomenon, which insists on a section of the A16 Highway, near the regional border between Campania e Puglia region, in the south of Italy. Sequences of clay characterize the area, with gravitational translational and rotational movements, which influence the stability of the slope.
Starting from January 2015, the site has been investigated through on-site and laboratory tests in order to determine the geomorphological, lithological, local structure and geomechanical characterization of the area. A monitoring system was also set up with a series of automated sensors, both innovative and traditional, in order to study the kinematics that govern the slope, recording the displacements and determining the hydrogeological characteristics of the soil, the degree of influence of precipitations, the fluctuations of the groundwater level and any correlations between them. By taking advantage of the information obtained from the survey system, it was possible to reconstruct the altimetry profile, the stratigraphy and the mechanical and elastic parameters of the materials constituting the slope. This allowed the realization of a 2D FDM numerical model using FLAC8.0® software (Fast Lagrangian Analysis of Continua), developed by Itasca Consulting Group. From the observation of the data obtained by the inclinometric and piezometric monitoring system, the hypothesis of a secondary creep phenomenon, seasonally influenced by the fluctuations of the groundwater, was established. The model was realized by giving a viscous behaviour to the layer affected by the sliding surface, using the viscoelastic constitutive model of Burger and simulating the piezometric variations recorded during the two years of monitoring. A series of back analysis were carried out comparing the displacements provided by the model through time with those obtained from the monitoring database, to refine and validate the geotechnical parameter used. After the modelling of past events, a forecast analysis was completed for the year 2018, in order to forecast the possible future behaviour of the slope, starting from the estimation of the probable creep deformations. This permits to establish preliminary warning thresholds, which have to be verified in future, and allows the institutions of competence to check the compatibility of deformations with the structural work. The constructed numerical model is a useful tool for the assessment of the development of the landslide phenomenon and the obtained knowledge, with the statistic approach allowed by the high number of acquisitions provided by the monitoring system, permits the control of the highway stability in near real time.