Geophysical Research Abstracts
Vol. 20, EGU2018-6163, 2018
EGU General Assembly 2018

Hydraulic factors affecting landslide triggering in shallow pyroclastic soil covers: a sensitivity analysis

Pasquale Marino, Luca Comegna, Emilia Damiano, Armando Di Nardo, Giovanni Fancesco Santonastaso, and Roberto Greco

Università degli Studi della Campania, Dipartimento di Ingegneria, Aversa (CE), Italy (roberto.greco@unicampania.it)

Slopes covered with shallow deposits of loose pyroclastic materials, lying upon a fractured limestone bedrock, are frequent in the mountainous areas around the city of Naples (southern Italy). The stability of such slopes is ensured, up to inclination angles of 50°, by the contribution of unsaturated soil suction to shear strength. Wetting of the soil cover during rainfall infiltration causes reduction of suction, which may lead to the triggering of shallow landslides, sometimes developing in form of fast and destructive flows. While the vanishing of suction is unanimously recognized as the triggering mechanism of landslides along such slopes, there is still debate about the hydrological processes causing the establishment of the conditions predisposing to landslides. In fact, the pyroclastic materials constituting the covers usually exhibit extremely high porosity (even up to 75%) and saturated hydraulic conductivity (in the order of 10-5m/s). During the rainy season, from late autumn to early winter, the mean water content of the cover is around 35-40%, implying that the vanishing of suction requires a great storage of water within the cover (e.g. up to 700-800mm for 2m of soil cover). Even during the maximum ever observed rainy periods, such an amount of rain falls in several weeks (the mean annual rainfall in the area is around 1500mm), a time interval long enough to let the cover drain out most of the infiltrating water. Nonetheless, in soil covers with thickness around 2m, landslides have been triggered by rainfall events characterized by 250-350mm falling in 36-72hours. This highlights the importance and the dynamic nature of the hydraulic boundary conditions of the soil cover (i.e. at the interface between soil cover and bedrock), which in some cases hamper the fast drainage of water out of the slope.
In this study, a sensitivity analysis is carried out, to quantify the effects on slope stability of the hydraulic properties of the soil cover and of the permeability of the soil-bedrock interface. In particular, the sensitivity analysis refers to the slope of Cervinara, around 40 km northeast of Naples (Italy), covered by a pyroclastic deposit with an average thickness around 2.0 m, and characterized by an average slope angle of 40°. For the sake of simplicity, the analysis is carried out by means of a 2D infiltration model, based on the Richards' equation written for a single homogeneous soil layer. The obtained results point out that the equilibrium of the slope during rainfall infiltration is affected not only by the hydraulic characteristics of the soil cover, but a major role is played by the permeability of the soil-bedrock interface.