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Soil matric suction and its contribution for slope stability assessment on a near real time monitoring basis: a case study from Povoação council (Azores)

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The matric suction plays a crucial role in the soil shear strength, thus in the stability of slopes. In order to evaluate the contribution of the matric suction on volcanic deposits strength, an experimental monitoring network with tensiometers was installed, in the beginning of 2008, in a slope at the Povoação council (S. Miguel island, Azores). This work presents the hydrological regime results and a method to predict the cohesive component of the shear strength of unsaturated soil, obtained from consolidated drained direct shear tests performed with different soil moisture contents. The empirical equation obtained, the geometrical features of the test site and the matric suction were incorporated into an infinite slope model (1D), to compute the dynamic variation of the safety factor at depths of 30, 60 and 100 cm with a 15 min. resolution.
Since monitoring started, a small number of slope failures occurred, and it was possible to capture some relevant features during the transition from a stability condition to an instability state at different depths. The stability model applied, with the incorporation of the cohesive shear strength in function of water content and using specific hydrological monitoring devices, revealed to be an excellent tool to assess the dynamic stability conditions of volcanic deposits on natural slopes for rainfall-triggered landslides forecast, on a near real time basis.
The approach presented in this work may be integrated into a regional landslide early warning system, as a specific module for specific test sites.

Keywords
Soil matric suction, shear strength, infinite slope model, slope stability, Povoação council.