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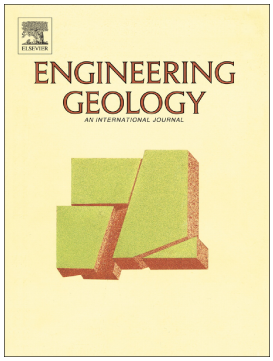

Investigation on rainwater infiltration into layered shallow covers in pyroclastic soils and its effect on slope stability

E. Damiano, R. Greco, A. Guida, L. Olivares, L. Picarelli

PII: S0013-7952(17)30195-3
DOI: doi: 10.1016/j.enggeo.2017.02.006
Reference: ENGEO 4486

To appear in: *Engineering Geology*

Received date: 12 July 2016
Revised date: 31 October 2016
Accepted date: 5 February 2017

Please cite this article as: E. Damiano, R. Greco, A. Guida, L. Olivares, L. Picarelli , Investigation on rainwater infiltration into layered shallow covers in pyroclastic soils and its effect on slope stability. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Engeo(2017), doi: 10.1016/j.enggeo.2017.02.006

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Investigation on rainwater infiltration into layered shallow covers in pyroclastic soils and its effect on slope stability

E. Damiano, R. Greco, A. Guida, L. Olivares, L. Picarelli
DIcDEA, Seconda Università di Napoli, via Roma 29, Aversa 81031, Italy

Abstract
In recent years, a number of flowslides and debris flows triggered by rainfall affected a wide mountainous area surrounding the Piana Campana (Southern Italy). The involved slopes are covered with unsaturated air-fall layered pyroclastic deposits, which stability is guaranteed by the contribution of suction to shear strength. To understand the mechanisms of infiltration and to assess the soil suction distribution in such layered deposits, infiltration experiments have been carried out in small-scale slopes. The interpretation of the results has been made with the aid of a 2D mathematical model.
The results highlight that the presence of coarse-textured unsaturated pumiceous layers, interbedded between finer ashy layers, can delay the wetting front advancement, thus initially confining the infiltration process within the uppermost finer layer. A diversion of the flow from the vertical towards the slope direction occurs when the soil approaches saturation. However, whereas a high hydraulic gradient establishes across pumices, water infiltration into the deepest layer begins, and part of the water crosses the pumices, before the complete saturation of the uppermost soil profile.

Keywords: unsaturated pyroclastic soils; layered deposits; small-scale infiltration tests; capillary barrier; slope stability

1. Introduction

Rainfall-induced flowslides and debris flows are among the most destructive types of landslides owing to their sudden triggering, their long run-out and high speed even over flat areas. In the last decades some catastrophic events (Olivares and Picarelli, 2003; Cascini, 2004; Calcaterra et al., 2004; Guadagno et al., 2005) occurred on the massifs surrounding the wide flat and densely urbanized area called Piana Campana, Southern Italy, causing heavy damage (Figure 1).

The involved slopes are constituted of shallow air-fall cohesionless soil deposits originated by several eruptions of the volcanic complexes of Somma-Vesuvius and Phlegrean Fields. Depending on the slope distance from the eruptive center, on the direction and wind speed at the moment of the eruption, and on later weathering processes, the soil covers present complex stratigraphical sequences, characterized by variable hydraulic and mechanical properties (Di Crescenzo and Santo, 2005; Orsi et al., 2004; Picarelli et al., 2006; Rolandi et al., 2003). In the distal areas from the

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