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Enhanced Assessment of Rainfall Duration and Intensity Effects on the Triggering Mechanism of Slope Instability in Unsaturated and Saturated Zones

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This study presents an approach to enhance the pioneering method by Rosso *et al*., (2006) which indicating that a simple model coupling soil mechanics with hydrology can provide an insight of shallow landslide initiation with respect to certain rainfall characteristics. Although the previous method capable of describing combined effect of duration and intensity of a rainfall event in triggering shallow landslides it does not consider the effect of hydrological responses at unsaturated subsurface flow. Thus the proposed study was intended to enhance the pioneering approach by Rosso *et al*., (2006). Accordingly, a coupled grid-based kinematic wave rainfall-runoff model and infinite slope stability approach was simplified. The process yields relatively simple representation of dynamic hydrology –including unsaturated and saturated subsurface flows –, instead of steady state representation. Linking the simplified rainfall-runoff model with infinite slope stability approach yields the critical rainfall depth and subsurface water depth triggering shallow landslides. The model is intended for describing combined effects of duration and intensity of rainfall as well as its hydrologic response in triggering shallow landslides. The innovative aspect of the proposed method is that the produced critical rainfall and hydrologic condition considers the hydrologic processes not only in non-capillary pores but also in capillary pores. Figure 1 presents the relationship between dynamic hydrological responses and the safety factor using New and Rosso Methods.

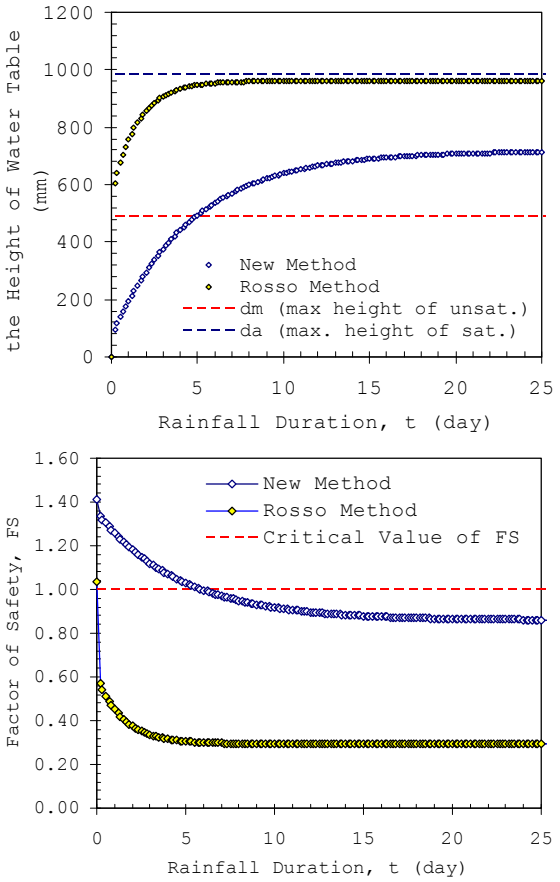

Figure 1. Comparison of water table and factor safety changes in response to certain rainfall with different duration in a grid using New and Rosso Methods.

The intensity-duration-frequency (IDF) for a station rainfall provides the probability that a given rainfall intensity is exceeded over a specified duration. Thus coupling of the developed model with the simple scaling model for the frequency of heavy rainfall will be addressed for understanding the climate/ meteorology control on landscape development associated with the occurrence of shallow landslides.