

## Hydrological Analyses of Intense-Rainfall Induced Shallow Landslides

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### ABSTRACT

Rainfall induced shallow landslides are frequent and severe in the tropics due to characteristically intense tropical rainfall. Rainfall triggers landslides via rapid increase in pore water pressure associated with rapid infiltration. In this paper we carry out a hydrological analysis of intense rainfall-triggered shallow landslide events based on some documented events in Kenya and other parts of the world. This analysis indicate that the critical rainfall event (within which shallow landslides are triggered) occurs after several days into the rainfall season. Moreover, within the critical rainfall event, landslides are usually triggered after several hours of the rainfall. Based on the basic principles of hydrological processes and the above timings of landslide occurrence, it is concluded that infiltration might not be the cause of the rapid landslide-triggering pore-pressure. These observations support a recently proposed theory that the rapid increase in pore water pressure that triggers shallow landslides are mainly a result of rapidly induced and diffusely transmitted pressure head, derived from kinetic energy-laden intense rainfall at the ground surface. Using a recently proposed pressure head diffusion equation and the infinite slope model, it is illustrated that, while antecedent and critical rainfalls are significant in adding to the driving forces of the soil mass, in the triggering process, they are particularly important for creating tension saturated (or near saturated) continuous pore-water phase necessary for the rapid transmission of the triggering intense-rainfall-induced pressure head to a potential failure plane.

**Keywords:** Antecedent rainfall, intense-rainfall, pore-water pressure, shallow landslides