# Modeling of rainfall-induced shallow landslides by coupling of hydrological processes and hillslope stability analysis: an example from the Hiroshima disaster in 2014

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This study reveals soil layer structure and characteristics of pore-water pressure fluctuation at hillslopes underlain by granite and metamorphic rock in Hiroshima City, southwest Japan, where heavy rainfall triggered numerous shallow landslides on 20 August 2014. We reconstructed processes of shallow landslides using hydro-slope stability analysis and verify the model by inputting the rainfall recorded on the date of the disaster, referring to the timing of landsliding and the depth and slope angle of landslides. Change in mechanical strength of soil seems to control the position of sliding surface in granite hillslopes, whereas hydraulic discontinuity in soil profile affects the formation of slip plane in hillslopes underlain by metamorphic rock. Depth and slope angle of landslides were obtained by airborne laser scanning of land surface before and after the disaster. Shear strength of soil around the sliding surface was measured by direct shear testing using undisturbed specimens. Pore water pressure at potential sliding surface in granite hillslope increased rapidly in cases of a wet condition by preceding precipitation. In hillslopes underlain by metamorphic rock, pore water pressure at a shallow part increased rapidly and a parched groundwater table formed occasionally; pore water pressure at a deeper area increased gently within few hours later from rainfall peaks. Based on these results, we modeled response of pore water pressure to rainfall infiltration and hillslope destabilization to reconstruct processes of landslide initiation.

Keywords: Shallow landslide, Rock control, Soil layer structure, rainfall infiltration, slope stability analysis

 