Geophysical Research Abstracts
Vol. 15, EGU2013-7502, 2013
EGU General Assembly 2013

Comparing temporal and spatial change of pore water pressure and slope stability between wet soil condition and unsaturated soil condition

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Intense rainfall event during short duration is the most significant reason of landslide in South Korea. Typically, it increases pore water pressure in soil and reduces soil effective stress, which cause landslide. In rainfall-induced landslide, saturation rate of soil at initial condition can affect whether landslide occurs. The objective of this study is to compare temporal and spatial pore water pressure and slope stability between in wet soil and in unsaturated soil under same rainfall condition. Two different infiltration models of TRIGRS 2 (Fortran Program for Transient Rainfall Infiltration and Grid-Based Regional Slope-Stability Analysis) were employed to analyze difference of pore water pressure and soil stability under different soil initial conditions. The study site was two small watersheds of Mt. Umyeon in South Korea, where several landslides occurred under an extreme rainfall event on July 27, 2011. Topographical data were generated based on 1 m x 1 m-LiDAR data, and parameters of soil and water characteristics were measured in-situ for TRIGRS 2 simulation. In addition, soil water characteristic curve of the site for the unsaturated soil condition was estimated by the pressure plate method and the filter paper method. The simulation results showed that pore water pressure differently responded between the different water conditions of soil. Ground water table rise appeared relatively faster and higher in the wet soil condition than in the unsaturated soil condition. Moreover, in the wet soil condition, pore water pressure increased with depth while in the unsaturated soil condition, vertical distribution of pore water pressure varied in time. In terms of slope stability, lower factor of safety (FS) were estimated in the wet soil condition than in the unsaturated soil condition. Comparing with landslide initiation positions in reality, FS were calculated more reasonably in the wet soil condition while FS were under-estimated in the unsaturated soil condition. These results indicate that estimating accurate initial water condition of landslide site is important for assessing landslide susceptibility.