The estimation of a rainfall index triggering landslides based on hydrological observations at Mt. Mihara, Izu-oshima Island, Japan.

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Typhoon Wipha brought many shallow landslides in Izu-oshima Island on 16 October, 2013. We investigated the physical properties of slope materials and the subsurface-water responses for rainstorms at a shallow landslide site. Alternation of tephra and loess layers within 2.5 m depth overlays the basaltic spatter and lava around the investigated site. Slip surface of the shallow landslide was formed in a tephra layer (the so-called Y1.0). The Y1.0 tephra layer mostly composed of sand had a hydraulic conductivity of approximately 10^{-3} cm/s with the high gravitational drainage capacity (5-10%). The loess layer within ~115 cm depth mostly composed of silt and clay had a hydraulic conductivity of 10^{-5} cm/s and high water retention capacity (50-55% within the field capacity). During a rainfall event with total rainfall more than 97 mm, the positive pressure head was observed both in the loess layer and in the bottom of Y1.0 tephra layer above the loess layer.Statistical analysis based on the records of 14 rainfall events from 2014 to 2016 showed a liner relationship between maximum pressure heads and an antecedent precipitation index (half-life of 4 hours). Based on statistical analysis of the past severe rainstorms, the slope would become unstable with the antecedent precipitation index (half-life of 4 hours) more than 217-253 mm. During typhoon 26th event in 2013, the maximum pressure head at the bottom of the Y1.0 tephra layer could have reached at +5.4 kPa. This high pore-water pressure in the Y1.0 tephra layer must be a cause of the shallow landslide in 2013.

Keywords: tephra, loess, alternation, hydraulic conductivity, subsurface storm flow, antecedent precipitation index

