Slope deformation mechanism caused by the change of saturation degree and water level with rainfall using large-scale model test

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Recent landslide disasters in Japan are often caused by localized torrential rain.
Typically, these landslides occur in initially unsaturated residual soils overlying the bedrock. Although the failure mechanism is a key issue to estimate positive pore water pressure at the sliding surface due to rainfall infiltration, the mechanism of slope failure has not been adequately clarified based on the change of moisture content and water level in rainwater infiltration.

Our purpose of this study is to clarify the slope failure process in rainfall filtration.
In particular, we focus on hydraulic properties (moisture content and water level) due to rainfall infiltration.

The authors conducted two model tests of sandy slope collapse by rainfall in 1G field.
The mechanism is investigated very precisely by installing many sensors.
The saturation degrees, groundwater level, surface displacement and ground deformation were monitored very well.
Through these test results, main two results are obtained as follows.
1) Development of the distribution of the moisture content and water level are observed with the changes of rainfall intensity.
2) Ground deformation in rainfall infiltration prior to the failure is varied with the distribution of saturation degree and water level.

Furthermore, a numerical simulation was conducted coupling seepage analysis and non-linear deformation analysis alternatively, based on the finite element method.
The limitation and applicability of the analysis were discussed.