A method to predict landslide based on gradient of volumetric water content

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Early detection of landslide triggering in a broad natural terrain can be performed by monitoring rainfall and physical property changes of soils in real time or nearly real time. This study installed a real time monitoring system to observe physical property changes in soil along a valley during rainfall events. Among the measured data by the monitoring system, volumetric water content was analyzed to identify landslide indications in soil along with comparison with the results of laboratory flume tests. The response of volumetric water content is faster than pore water pressure, and volumetric water content maintains the maximum value for some time before slope failure. The field monitoring results show a direct proportionality of the effective cumulative rainfall to the gradient of volumetric water content in unit time (t/tmax). As a preliminary study, this study compared the slope failure with the gradient of volumetric water content dependent on rainfall amount. The results explain that a large rainfall amount and a high gradient of volumetric water content induce slope failures. Based on the results, it is possible to suggest a threshold of the gradient of volumetric water content between failure and non-failure of a slope. The threshold could be a baseline for early warning of landslides related to rainfall.