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Time prediction of an onset of shallow landslides based on the monitoring of the groundwater level and the surface displacement at different locations on a sandy model slope

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Location of monitoring of the deformation and the groundwater level in a slope is important for time-prediction of an onset of shallow landslides based on the monitoring. The analysis of the monitored data of the surface displacement and the groundwater level at different locations in sandy model slope under artificial rainfall was conducted in this study. The monitored data showed that the surface displacement increased with the increase of the groundwater level significantly. Then the analysis of the monitored data revealed that the relation between the surface displacement and the groundwater level can be modified as hyperbolic curve. The surface displacement grew larger and maximum groundwater level was smaller at farther location from the toe of the slope. Time-prediction of an onset of a landslide based on the monitored data at different location on the slope was proposed as following procedures. (1) To make a regression equation for the relation between the surface displacement and the groundwater level based on the monitored data at any time before the failure, (2) To make a regression equation for the relation between the time and the groundwater level based on the same data with (1), and (3) To incorporate the equation for the relation between the time and the groundwater level into that between the surface displacement and the groundwater level to derive the time - the surface displacement relation. (4) To derive the time - the inverse of the surface displacement velocity from the equation for the time - the surface displacement relation. The equation for the time - the surface displacement and the equation for the time - the inverse of the surface displacement velocity could simulate the actual phenomena of the slope well based on the monitored data at any location on the model slope.