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A simple method for producing probabilistic shallow landslide hazard maps using soil thickness dataset

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Recently, several physically-based models of predicting the landslide susceptibility have been proposed and showed that physically-based model have a powerful potential as a way to evaluate the probability of shallow landslide. However, the ability to obtain adequate underground information, including soil thcikness and soil hydraulic parameters, have to be overcome. Here we showed new data and proposed new method.

The study was conducted in a headwater of Hiroshima Seibu Mountains, western Japan. In June of 1999, many shallow landslides were triggered due to heavy rainfall. To clarify spatial patterns of soil thickness, we measured soil thicknesses at about 150 points in the catchment using a knocking pole test. Slope angle and upslope drainage area calculated for each of the 150 soil depth measurements was plotted against the observed soil depth, demonstrating that both slope angle and upslope drainage area showed no relationship with soil depth. We also showed that the soil thickness-frequency relationship could be characterized by log-normal distribution.

We linked a simple hydrological model and the infinite slope stability model to predict spatial pattern of critical steady-state rainfall required to cause slope instability. Once we used the data about spatial distribution of soil thickness, this model successfully identified shallow landslide location triggered by the heavy rainfall of June, 1999. However, if the data about soil depth was not available, the landslide location could not be predicted. So, we propose a new stochastic method for evaluation of shallow landslide susceptibility combined simple hydrological model, the infinite slope stability model and soil thickness-frequency relationship model.