Ono, Keisuke; Kazama, So

Assessment of Rainfall-Induced Shallow Landslide in Thailand by the Use of Physically-Based Model and Statistic Model

HAZARD ASSESSMENT OF RAINFALL-INDUCED SHALLOW LANDSLIDE IN THAILAND BY THE USE OF PHYSICALLY-BASED MODEL AND STATISTIC MODEL

Keisuke Ono[1] and So Kazama

For the landslide hazard management and to mitigate subsequent damages, it is important to predict the occurrence of rainfall-induced shallow landslide in regional scale, especially in developing countries which often face difficulties for predictions due to the relative scarcity of meteorological data. In this context, the use of global gridded rainfall data for shallow landslide assessment is attractive for the researchers. This paper used a physically-based stability model (SLIP: Shallow Landslide Instability Prediction) proposed by Montrasio *et al*. (2011) and a simple statistic model, along with a new global gridded daily rainfall dataset (the APHRODITE: Asian Precipitation Highly Resolved Observational Data Integration Towards the Evaluation of Water Resources).

Firstly, the two models were compared based on one recent shallow landslide which occurred in central Thailand (Figure 1). In the statistic model, a logistic regression relationship was developed based on the data of landslide inventory, local slope and observed rainfall induced the landslide in Phetchabun, 2001. In SLIP model, soil parameters for the calculation were referred by a literature. The study area was described in geological and climatic viewpoints. The acquisition of geospatial information regarding the topography, the soil properties and the local landslide inventory was also described. The location of landslide induced by the extreme rainfall in 2001 was also mapped in Figure 1 (Black color).

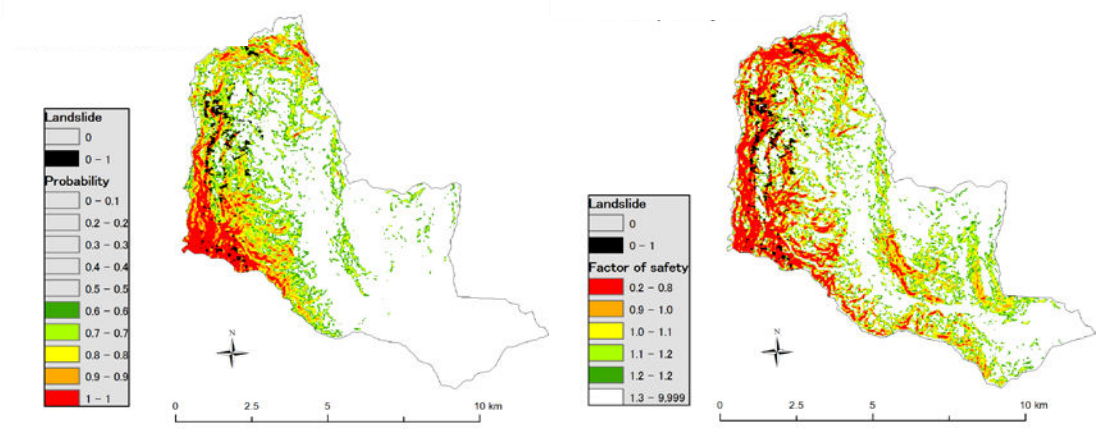

Figure 1 Hazard map of rainfall-induced shallow landslide derived by statistic model (left) and physical model (right), given the heavy rainfall event on August 10, 2001, in Phetchabun

[1] Department of Civil Engineering, Tohoku University, Aobayama 6-6-06, Aoba, Sendai, Miyagi, 980-8575, Japan (ono@kaigan.civil.tohoku.ac.jp)

The results were discussed in terms of safety factor and probability of occurrence of landslide corresponding to the rainfall event. The paper compared observed landslide localization with those predicted by SLIP model and the statistic model by the use of ROC (Receiver-Operating Characteristic) curve. A further quantitative comparison between the two models, both applied to the landslide event occurred in the extreme rainfall events, was presented.

Secondly, shallow landslide hazard map for whole Thailand was developed by using the APHRODITE data and SLIP model (Figure 2). For the calculation, the extreme rainfall of 5-yr return period in whole Thailand, which was estimated by using APHRODITE data in Ono *et al.* (2011), was used as the triggering factor of shallow landslide. In the result, given more amount of extreme rainfall and steep topography, smaller value in factor of safety was estimated in southern and northwestern part of Thailand. This result indicated that unstable slopes seemed to be induced by the extreme rainfall in those areas, leading the shallow landslide hazard to people living there and their properties. Although an improvement, in terms of spatial accuracy, is needed, the SLIP model applied on the study area showed certain potential as a landslides forecasting tool in a regional scale.

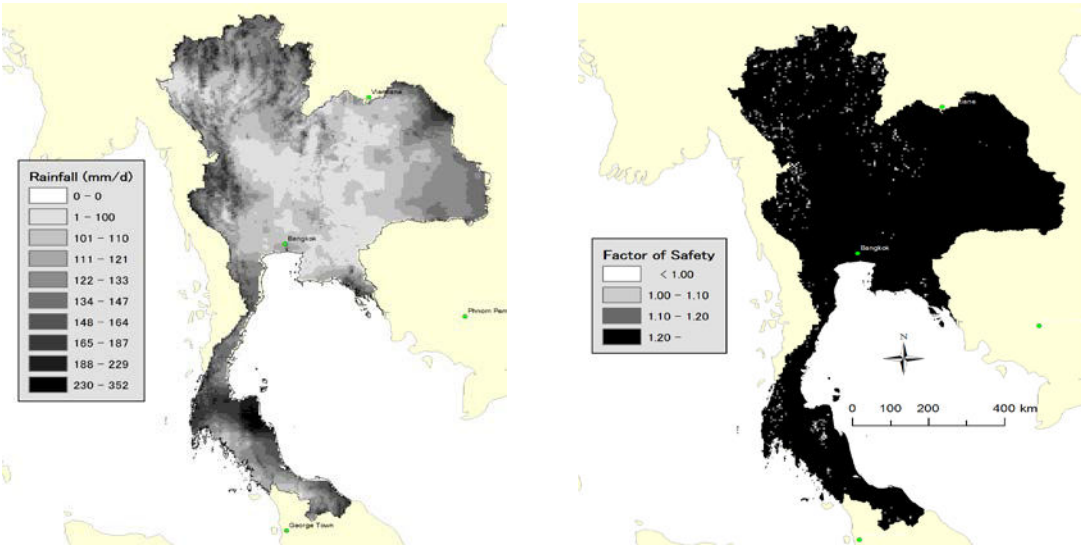

Figure 2 Extreme rainfall of 5-yr return period estimated by APHRODITE data (left) and hazard map of rainfall-induced shallow landslide of 5-yr return period (right)

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