Estimation of rainfall threshold and its use in landslide hazard mapping of Kuala Lumpur metropolitan and surrounding areas

ABSTRACT

This paper presents rainfall-induced landslide thresholds and predicts landslide hazard in Kuala Lumpur metropolitan city and surrounding areas. Landslide events from 2000 to 2012 were collected. The long and short antecedent rainfall days were prepared for landslide and non-landslide days simultaneously. First, threshold analysis was conducted by using data obtained from rainfall stations located in highly urbanized areas of Kuala Lumpur metropolis. Six rainfall gauges were selected, and the study area was divided into six zones according to rainfall gauges: Taman Desa Station (TD-KL), Genting Klang (GK-KL), LDG Edinburgh Station (LDGE-KL), SG Raya Hulu Langat Station (SRHL-Slg), Puchong Drop Station (PD-Slg), and Bukit Antarabangsa (BTA-Slg). After the threshold analysis was conducted for different periods (10, 15, and 30 days) in each station, reliability index test was conducted to optimize the best threshold that limits the predicted events along the study period for each region. Second, the threshold analysis results were used as input in the Poisson probability model to estimate landslide temporal probability (P T). Third, the spatial probability (P S) analysis was prepared by using the evidential belief function multiplied by the P T to obtain the hazard maps for 1-, 3-, and 5-year scenarios. Finally, a validation process was conducted to test the prediction performance of the resultant hazard map for a 1- and 2-year prediction by using the landslide inventory of 2012 to early 2014, which was not included in the modeling of the hazard map. Results showed a valid correlation between the high and moderate hazardous areas for the six zones. The predicted hazard maps indicated a quantitative assessment of the prone areas and proved to be a valid disaster management tool. The produced hazard maps may play a vital role as input component in risk analysis.

Keyword: Antecedent rainfall; GIS; Hazard; Landslide; Malaysia; Remote sensing; Threshold