



Prediction of potential landslides induced by earthquake based on events of the Chi-Chi earthquake, Taiwan

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Locating in the circum-pacific seismic zone with frequent earthquake activities, Taiwan is susceptible to hazard induced by earthquakes. In September 21st, 1999, the Chi-Chi earthquake with a magnitude of 7.3 struck central Taiwan, and caused severe damages to human lives and properties. Among all the damages, more than 20000 cases of landslides were identified with a total area of more than 8600 hectares. In order to mitigate such hazardous landslide induced by the earthquake, it is essential to develop prediction map for potential landslide. The objective of this study is to develop a methodology for generating the prediction map of potential landslide induced by the earthquake based on the recorded events induced by the Chi-Chi earthquake and evaluating the uncertainty of the prediction map.

A small study area located in the Nantou County close to the epicenter of the Chi-Chi earthquake was selected. The scars of the landslides induced by the earthquake were mapped, and a total number of 1061 landslides were identified. Database of the geology, topography, and geomorphology factors of the study area was constructed. Parameter study was performed, and the effective influence factors based on the geology, topography, and geomorphology were extracted, which include the geology factor, the elevation factor, slope angle, and slope aspect. Statistical analysis was performed using the likelihood ratio method and the model for data fitting and prediction could be established. The study area was divided into two zones, the prediction model was established based on data of one zone, and data of the second zone were used for cross validation of the prediction results.

From the results of the analysis, it was found that the elevation factor appeared to be insignificant for landslide induced by the earthquake, and the prediction model was established using the geology, slope angle, and slope aspect factors. The statistics from the comparison between the landslide prediction map generated using the model and the mapped scars in the cross validation zone provided the significance of the prediction. Thus, the method for generating not only the prediction map of landslide induced by the earthquake but also estimating the uncertainty of the prediction results has been satisfactorily established.