Using conditional probability method for estimation of landslide occurrence probability

Meei-Ling Lin (1), Sheng-Chi Lin (1, and 2)

(1) Department of Civil Engineering, National Taiwan University, Taipei,Taiwan (linml@ntu.edu.tw/Fax:886-2-23626281), (2) National Science and Technology Center for Disaster Reduction, Taipei, Taiwan (sclin@ncdr.nat.gov.tw/Fax:886-2-23626281)

Landslide risk assessment consists of occurrence probability for spatial and temporal distributions and the concurrent scenario for damage and loss estimation of elements at the risk. Although items of the landslide risk elements and assessment processes have been proposed by previous researchers, process for estimating the occurrence probability of landslide disaster and risk assessment remains a difficult issue. In this study, we adopt the conditional probability to estimate the occurrence probability of landslide. We propose using likelihood ratio function method (Chung and Fabbri, 2003) to evaluate spatial probability in neighboring region, which deals with the insufficient historic landslide data for local area and avoid unreasonable results caused by extrapolation in statistics method. The likelihood ratio function for the spatial probability is based on the conditional probability derived from *Bayes's formula*, and the annual probability of occurrence is estimated based on the probability of landslide events triggered in the local area given the typhoon occurrences. Therefore, the joint probability of occurrence can be obtained by combining the spatial probability and temporal probability. The resulting conditional probability method has been applied to case study in Taiwan; in particular, the Lushan study area with field monitoring system (Lin, et al. 2007). Through evaluation of likelihood ratio method, the resident area is within the spatial probability greater than 80%, and the annual probability of landslide induced by typhoons is 22% according to the historic event data. Thus the overall annual landslide occurrence probability for resident area is greater than 18%, and the accumulated occurrence probability is larger than 50% over the five-year period. According to the field monitoring data since 2007 including the displacement records from extensometer, the ground-based Lidar, and close-range photogrammetry surveys all provided evidences of sliding, and the observed ?eld sliding conditions were considered consistent with the results of landslide occurrence probability analysis.