The Use of LiDAR DTM in Landslide Susceptibility/Hazard Analysis

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High-resolution DTM does not always help build a good landslide prediction model. When we are using LiDAR DTM in producing a topographic-related factor for grid-based landslide susceptibility/hazard analysis, the selection of an optimal measurement scale becomes important. Because the resolution of LiDAR DTM may be up to 1 meter, and the average landslide size may be more than 1 thousand square meters, to use a conventional 3x3 kernel for calculation of a factor value is not valid. Actual tests tell us, to use a 15x15 and larger kernel for calculation may yield a more effective factor for interpreting the landslide distribution in a study area.

A test area was selected at the catchment of the Zengwen Reservoir in southwestern Taiwan. The original 1mx1m LiDAR DTM was firstly reduced to a 2mx2m DTM for analysis. Factors of slope gradient, slope aspect, topographic roughness, slope roughness, plan curvature, profile curvature, tangential curvature and total curvature are analyzed by using a series of kernels in different sizes up to 25x25 for comparison. And success rate curve method was used to evaluate the effectiveness of each factor in interpreting landslide distribution. Highest AUC is selected as the most effective one and the kernel size which yield that is the optimal measurement scale of the factor.

A 3x3 kernel has a measurement scale of 2h and is 4 meters (h is grid size of 2 meters), a 25x25 kernel has a measurement scale of 24h and is 48 meters. Factors calculated from an optimal measurement scale will be selected for construction of a landslide susceptibility model. The success rate and prediction rate of this model would be significantly increasing as compared with the model built from conventional 3x3 kernel calculated factors. Finally this optimal susceptibility model was used to construct a landslide hazard model for prediction of landslide distribution under different triggering events.