



Probabilistic landslide initiation hazard assessment along a transportation corridor in the Nilgiri area, India

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In this paper a quantitative landslide initiation hazard model is presented for a transportation corridor, with a road and railway alignment, in parts of Nilgiri hills in southern India. Separate hazard maps were generated for cut and natural slopes, taking into account temporal probability, size probability and spatial probability. For the study area a multi-temporal landslide inventory map was prepared from historical records, based on road and railway maintenance reports, for the period 1987 to 2008. The inventory contains data on 790 landslides with volume ranging from 2 to 150000 m³ that were triggered on 94 different dates. A generalized linear model was used to determine the spatial probability of landslide initiation at each pixel by taking landslide source area as dependent, and slope, aspect, regolith thickness and land use as independent variables. The temporal probability as an annual probability of landslide initiation was estimated based on rainfall thresholds, which were determined by correlating the landslide dates with antecedent and daily rainfall, derived from a number of rain gauges in the area. Different rainfall thresholds were established for cut slopes and natural slopes, and for different parts of the study area. The probability of landslide size was estimated using frequency-volume and frequency-area statistics of landslides along cut and natural slopes, respectively. To incorporate the probability of landslide size in the hazard model the pixel-based susceptibility map was converted to slope facet-based mapping units for which a single probability was assigned based on the maximum percentage distribution of the probability values. By assuming independence among the three probabilities, we obtain a quantitative estimate of landslide initiation hazard for each slope unit as the joint probability of landslide size, of annual probability of landslide occurrence and of spatial probability of landslide initiation. The landslide hazard will be used subsequently in quantitative risk assessment of the road and railway corridor.