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Landslide susceptibility assessment using logistic regression and its comparison with a rock mass classification system, along a road section in the northern Himalayas (India)

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Abstract

Landslide studies are commonly guided by ground knowledge and field measurements of rock strength and slope failure criteria. With increasing sophistication of GIS-based statistical methods, however, landslide susceptibility studies benefit from the integration of data collected from various sources and methods at different scales. This study presents a logistic regression method for landslide susceptibility mapping and verifies the result by comparing it with the geotechnical-based slope stability probability classification (SSPC) methodology. The study was carried out in a landslide-prone national highway road section in the northern Himalayas, India. Logistic regression model performance

was assessed by the receiver operator characteristics (ROC) curve, showing an area under the curve equal to 0.83. Field validation of the SSPC results showed a correspondence of 72% between the high and very high susceptibility classes with present landslide occurrences. A spatial comparison of the two susceptibility maps revealed the significance of the geotechnical-based SSPC method as 90% of the area classified as high and very high susceptible zones by the logistic regression method corresponds to the high and very high class in the SSPC method. On the other hand, only 34% of the area classified as high and very high by the SSPC method falls in the high and very high classes of the logistic regression method. The underestimation by the logistic regression method can be attributed to the generalisation made by the statistical methods, so that a number of slopes existing in critical equilibrium condition might not be classified as high or very high susceptible zones.

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Keywords

Landslide susceptibility; Slope stability; Logistic regression; SSPC; GIS

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