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Techniques for the evaluation and comparison landslide susceptibility models

P. Frattini (1), G.B. Crosta (1), A. Carrara (2)

(1) Universita' di Milano Bicocca (paolo.frattini@unimib.it), (2) CNR-IEIIT (acarrara@bo.ieiit.cnr.it)

The evaluation of landslide susceptibility models is a key issue to ensure a reliable application of these models to land planning and risk management. In this contribution, we analyze different approaches for model evaluation and comparison, and we test them on different debris-flow susceptibility models that we developed for the upper Avisio river basin (Val di Fassa, Italian Alps, 300 km2). These models have been developed using different method (statistical and physically-based models) or terrain unit type (pixel and slope-units). First, we apply cutoff-dependent accuracy statistics, ROC curves, Success-rate curves, and Cost Curves. Then, we propose a new technique, Total Cost Curves, that allows to express the performance in terms of expected misclassification monetary cost. The cut-off dependent accuracy statistics prove to poorly discriminate among the different models, and require an a-priori choice of the cut-off value that is not always trivial. ROC curves are optimal to evaluate the statistical performance of models, but do not include costs. Success-rate curves can be applied to different terrain units, but they show some inconsistencies (both practical and theoretical) with pixel models and do not include costs. Cost curves have the advantage that include costs, and that use normalized costs that are easier to treat; on the other side, they are not applicable to models with different terrain units. Total cost curves can be applied to models with different units, and express the results in terms of actual economical costs; this is an advantage as far as administrator can easily understand the results, but it is a disadvantage because the estimation of total cost can be somehow complicated.