Geophysical Research Abstracts
Vol. 12, EGU2010-11290, 2010
EGU General Assembly 2010

Spatial agreement of predicted results in landslide susceptibility maps

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Landslides occur worldwide in response to a broad variety of natural predisposing conditions and triggering factors that include heavy rainfalls, earthquakes, and human activity. Landslides constitute a serious source of danger causing environmental damage and substantial human and financial losses. At a regional scale, landslide susceptibility zonation constitutes the first effective step to achieve a thorough risk assessment and management and contribute to public safety. For this reason, the predicted susceptibility maps must be carefully analysed and critically reviewed before disseminating the results. The tuning of statistical techniques and the independent validation of the results are already recognized as fundamental steps in any natural hazard study to assess model accuracy and predictive power. Validation also may permit to establish the degree of confidence in the model and to compare results from different models. For this reason, the spatial agreement among susceptibility maps, produced by different models, should also be tested, especially if these models have similar prediction power. This is usually a rather common occurrence as it may happen that two or more maps with similar predictive power may not have the same agreement in term of predicted spatial patterns.

This study is aimed at assessing the degree of spatial agreement among different patterns of predicted values in susceptibility maps with almost similar success and prediction rate curves and areas under curves (AUC). A data-driven Bayesian method (Weights of Evidence modelling technique) is applied and the output maps reclassified to compare the predicted results. A relative classification, based on the proportion of area classified as susceptible, is performed. Maps are investigated by Kappa Statistic, Principal Component Analysis, and Distance Weighted Entropy procedures. The results show great differences within the output spatial patterns of the predicted maps and also within the highest predicted classes. Our approach is applied to an alpine environment (Italian Alps) where debris flows represent one of the most frequent and damaging processes.

This topic is of great importance for achieving a reliable communication of the results to the final users.