Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07176, 2008
EGU General Assembly 2008

A statistical modelling tool in R for the evaluation of landslide susceptibility

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The assessment of landslide spatial hazard, also known as landslide susceptibility, is a key issue for the assessment of landslide risk. Many studies have attempted to evaluate landslide susceptibility, using a variety of statistical classification techniques. However, only a few attempts have been made to compare the results of models obtained using different classification techniques. In this work, a statistical modelling tool in R for landslide susceptibility assessment is presented. In the tool, four statistical classification techniques are implemented, including: (i) a linear discriminant analysis by least square, (ii) quadratic discriminant analysis, (iii) logistic regression, and (iv) a self-optimizing neural network. Other classification techniques can be added. The proposed tool is scale independent, and it requires in input a configuration file and a data file containing the grouping and the explanatory variables, which can be dummy or numeric. A diagnostic procedure is implemented to detect collinearity in the explanatory variables. A preliminary procedure for the stepwise selection of explanatory variables in linear and quadratic discriminant analysis is used. The performance of each model - measured by its ability to "predict" the original data - is tested. Results are shown using contingency tables and Fourfold plots. Receiver Operating Characteristic (ROC) plots, providing a measure of the forecast's accuracy, are prepared, with confidence intervals calculated using a bootstrapping technique. We tested the landslide susceptibility statistical modelling tool in the Staffora River basin, which extends for about 275 square kilometres in the northern Italian Apennines (Lombardy Region). For the analysis, we used the partition of the study area into 2243 litho-hydro-morphological units and an initial set of 58 dummy and numeric explanatory thematic variables, in-

cluding morphological, lithological, structural and land use variables. Results indicate a good accuracy of the obtained susceptibility forecasts, with the best performance obtained using the self-optimizing neural network model.