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Spatial validation of statistical models of landslide susceptibility.

Y. Thiery (1), J.-P. Malet (2, 3), A. Remaître (2), O. Maquaire (3)

(1) Faculty of Geography, University Louis Pasteur, Strasbourg, France, (2) CNRS UMR 7516, School and Observatory of Earth Sciences, University Louis Pasteur, Strasbourg, France, (3) CNRS UMR 6554, University of Caen Basse-Normandie, Caen, France (thiery@equinoxe.u-strasbg.fr / Phone: +33-390-240-928)

Evaluation of the quality of landslide susceptibility assessments with statistical models is very often performed using either time or spatial partitioning procedures of the dataset. Less attention has been focused on the application of the weights or probabilities of landslide susceptibility from one independent site to another independent site with the same environmental characteristics (predictive variables) and the same landslide types (observed variable).

As the calibration and validation steps are essential points in susceptibility analyses, the aim of this work is to estimate the robustness of a Bayesian inference statistical model by applying the best set of predictive variables identified on a first area to two distinct areas without any additional calibration procedure, and to quantify the degree of model fit. The model is applied to three alpine catchments of the South French Alps developed in black marls (Barcelonnette Basin Zone 1, Barcelonnette Basin Zone 2, Moulin Catchment). These catchments are affected by rotational slumps, debris-slides, complex translational slides and rock-block slides. The modelling strategy is split in four steps:

(1) First, the statistical model is calibrated on a pre-defined number of events observed on a ‘sample area’ representative of the test site. This calibration step allows to define the best set of predictive variables per landslide types;

(2) Second, the weights of each ‘predictive variable’ classes obtained in step 1 are ap-

plied on a larger area, and the susceptibility map is compared to a landslide inventory map and to an expert landslide susceptibility map;

(3) Third, the weights are applied on two distinct mountain catchments with the same geomorphological and physio-geographical environments as the calibration site, and the same set of predictive variables is used. This step allows to quantify the representativeness of the weights.

(4) Finally, the susceptibility maps for the two validation catchments are compared to a landslide inventory map and to an expert landslide susceptibility map.

The results stress the difficulty to obtain robust statistical models for each landslide types. Nevertheless, it is possible to increase the quality (e.g. reliability and robustness) of the susceptibility models by applying specific procedures of calibration and validation.