



Landslide susceptibility assessment by logistic regression in the Pays d'Auge plateau (Normandy, France): improvement of a procedure in a hilly valley context

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Face to the natural hazards management, end-users and government authorities usually need detailed information in an operational mapping and landuse planning context i.e. 1:10.000 – 1:5.000 scale. In the case of landslide susceptibility mapping, different approaches to provide information about the future spatial location of phenomena exists and generally two main approaches are used; i.e. the expert opinion analysis and the geostatistical analysis. In one hand, at local scale, the expert approach is often considered as subjective, that limit its reliability and reproducibility. In the other hand, the geostatistical approaches (often considered as more objective) could also be an alternative to the expert opinion, but they are rather performed at coarser scales i.e. 1:50.000 – 1:25.000 given the available data. Even if some strategies have already shown that the adaptation of these methods to the 1:10.000 scale is possible, model calibration and database building steps are often time consuming procedures that limit their use in an operational context. Fieldworks (landslide inventory, surficial formations mapping, geomorphological analysis etc.) is often the most time consuming procedure, but provide essential information for landslide susceptibility assessment at 1:10.000 scale. Finally, end-users need a simple and easy to calibrate method which could be transposable with low cost available data.

Given those considerations, this study proposes to assess the quality of three susceptibility maps simulated with different sets of data available at different time and financial costs for the 1:10.000 scale in the Pays d'Auge plateau (Normandy, France). All maps are simulated with the same approach (logistic regression) chosen for its simplicity of calibration and implementation (i.e. the program can be directly implemented in a GIS software).

The strategy to simulate the landslide susceptibility maps consists in using 50% of the landslide triggering zones cells for the model calibration, in order to preserve a set of data for the validation step. Successive model iterations are performed with a stepwise introduction of the predictive variables. The maps showing the weakest relative error and the best rate of predicted cells are selected as the best maps. This procedure is applied to three different types of datasets available at different time and financial costs:

(1) The direct available data, slope angle, slope curvature, slope aspect (BDAlti[®], French DEM), landuse (Corine Landcover) and landslide database (BDMvt, BRGM) are tested. (2) Same variables with a higher accuracy are introduced. The DEM is obtained by contour lines digitalized on topographic maps, the landuse and landslide database are obtained by air photo interpretation and limited fieldworks validation campaigns. (3) More complex datasets based on important fieldwork investment are added: a detailed landslide inventory (systematic field survey) is proposed, and a surficial formations map combined with morphological parameters of the valleys is introduced.

This research is performed in the hilly context of the Pays d'Auge plateau (Normandy, France) where still few studies on landslides have been performed. The results previously obtained in terms of landslide susceptibility mapping have not been considered as stratifying, and therefore those results should allow improving the quality of the operational mapping in Normandy.