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Landslide susceptibility assessment at the 1:10,000 scale: methods to implement expert knowledge in the statistical models.

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Landslide susceptibility assessment is frequently performed at coarse scales (1:50,000 – 1:25,000) by statistical models, which are often powerful at these scale given the knowledge on the landslide and the data available. The basic hypotheses to apply these models are also very well adapted to these mapping scales.

However, at more detailed scales (1:10,000 – 1:5000), the higher variability in predisposing factors (predictive variable, *Pv*) and the more accurate spatial delineation of the landslides may hamper the use of these statistical methods. Especially, if inappropriate data on the predisposing factors are introduced in the statistical model, the probabilities estimates can be severely biased and must be interpreted with caution. Specific strategies to collect and implement the data in the statistical models must be developed. A classic strategy consists in introducing expert knowledge in the model by implementing a neo-predictive variable with a geomorphological meaning.

The objective of this work is to present a landslide susceptibility assessment combining different approaches using small quantities of environmental data. Three exploratory approaches to derive a neo-predictive variable (*NPv*) with a geomorphological meaning are proposed and evaluated:

(1) The first approach is based on expert rules defined by fuzzy logic. Advantages of fuzzy logic rules are the integration of expert knowledge by simple coefficients

representing the weights of the predictive variables. A sensitivity analysis is performed on each class and their associated ‘subjective weights’ in order to obtain the best membership values. Their combination is then tested with several operators to identify the best ‘rules’ to define the *NPv*.

(2) The second approach associated expert knowledge and a statistical weighting of the variables with the Weight-of-Evidence (*WoE*) modelling technique. The expert allocates a weight to each *Pv’s* classes by ranking the most important variable characterizing landslide occurrences. A sensitivity analysis is performed to characterize the weights for each class, and the most important classes are combined in the *NPv*.

(3) The third approach is based on a statistical stepwise analysis of the predictive variables (χ^2-test, Cramer’s V test, multiple correspondence analyses) to explore the relative importance of each *Pv’s* classes in the distribution of landslides. Again, the most important classes are then combined in the *NPv*.

For each approaches, results are compared to a landslide inventory map and to an expert landslide susceptibility map. The results indicate the complexity to choose the good dataset for each landslide type and stress the difficulty to obtain accurate landslide susceptibility maps without incorporation of expert knowledge.