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Landslide susceptibility mapping at regional scales using weight of evidence method – a revision of the methodical concept from a practical point of view

Torizin, J.[1], Fuchs, M.[1], Balzer, D. [1] and Kuhn, D.[1]

[1]Federal Institute for Geosciences and Natural Resources (BGR) Stilleweg 2, 30655 Hannover, Germany, michael.fuchs@bgr.de

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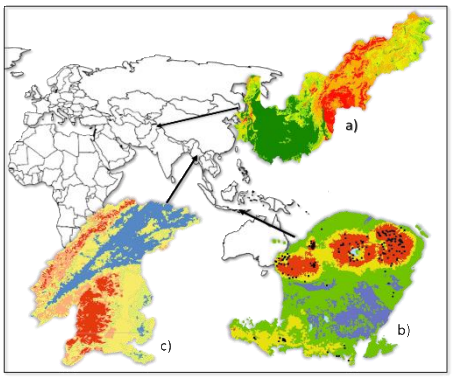
Weight of Evidence (WofE) is a popular bivariate statistical method for landslide susceptibility assessment (LSA). Being a Naïve Bayes classifier, WofE represents a generative model that facilitates a straightforward data-driven estimation of the spatial landslide occurrence probability that can be easily implemented in both open source Geographical Information Systems (GIS) such as GRASS and QGIS or proprietary GIS such as ArcGIS.



In the last decade, BGR implemented several technical cooperation projects encompassing LSA-related issues worldwide [1, 3]. The gained experience on the practical application of statistical methods for susceptibility assessment in areas prone to landslides such as Pakistan, Indonesia, and Thailand (Figure 1) has led to a revision and a discussion of the WofE concepts regarding their applicability to data from different sources and quality. The efforts needed to conduct the assessment successfully and reliably have been defined.

Figure 1: Working areas in which the WofE was used for regional landslide susceptibility mapping: a) District Mansehra, Pakistan; b) Lombok Island, Indonesia; c) Yom River Basin, Thailand.

Attention was paid to minimize redundancies in the input parameters [1] resulting in straightforward decision criteria for the selection of controlling factors, which can best delineate landslide susceptibility. A correction for the remaining informational redundancy among controlling factors has been introduced [2].

The controlling factors must be analysed based on the basic model requirements such as conditional independence, prediction power, model parsimony and model plausibility (causal relations). The latter both have frequently been ignored in applications of statistical models in LSA in favour of purely statistical measures such as supposedly better correlation and model fit, which does not necessarily stand for a causal relation.

Regional models are usually established based on landslide inventories collected from remote sensing data. For the modelling purposes these inventories are commonly subdivided into training and test datasets by random algorithms. The effects of this subdivision were scrutinized providing additional constraints for the reliability of the estimated weights and interpretation of the model uncertainties. This also applies for validation methods such as Receiver Operation Characteristics curves. Therefore, the application of resampling algorithms such as bootstrapping or subsampling enables a suitable

uncertainty analysis in the framework of WofE. Consequently, the improved uncertainty characterization is a sensible move towards a comprehensive probabilistic characterization of the landslide hazard.

References:

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