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Weighting predisposing factors through sensitivity analysis for landslide susceptibility assessment

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The assessment of susceptibility associated to mass movements reveal in recent years significant improvements in indirect statistically-based methods. Current Spatial Data Analysis (SDA) techniques allow the independent validation of results in post-processing operations, for prediction models based on both bivariate and multivariate statistical methods. Therefore, validation is not anymore exclusively dependent on the occurrence of new instability events. Assessment of landslide susceptibility is always based on the assumption that future mass movements are more probable to occur in areas with conditions similar to those that originate slope instability in the past. In this context, recent developments in Geographical Information Systems allow the development of models resulting from the spatial relationships between landslides and an increasing number of landslide predisposing factors. However, the quality of landslide prediction models do not automatically increase with the number of layers used in the modelling procedures, and the significance of such layers as conditioning factors is frequently not evaluated. In the present work we apply a sensitivity analysis to statistic/probabilistic landslide susceptibility models, performed for three different types of slope movements (rotational, translational and shallow translational slides) occurred in a test site located in the area North of Lisbon (Portugal). The main goal of this procedure is to evaluate, for each type of landslide, the relevance of the different conditioning layer within the spatial data set (e.g., slope, aspect, transverse slope profile, geomorphology, lithology, superficial deposits, land use and vegetation cover). The statistical models were applied individually to each layer and to different combinations of overlapped layers. The computation of success-rates for such models allows concluding that: (i) the relation between the number of variables within the prediction model and the quality of predicted results is not linear; (ii) the weight of a particular instability factor is dependent on landslide typology; and (iii) it is possible to obtain

accurate landslide susceptibility maps using a limited number of instability conditioning factors in the prediction model. Finally, significance of these conclusions is tested trough the computation of prediction rate curves, based on the partition of the original landslide data base using a temporal criterion.