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The influence of statistical models and terrain mapping units on landslide susceptibility assessment at the regional scale

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The spatial component of landslide hazard, or landside susceptibility, has been assessed worldwide at the regional scale using direct (geomorphological) and indirect (quantitative and semi-quantitative) methods. Both approaches are based on the general assumption that future slope movements of a given type are more likely to occur under conditions similar to those that led to past landslides. In the particular case of data-driven indirect statistical models, the landslide susceptibility is assessed at the regional scale by combining the observed distribution of past landslides with the spatial patterns of mappable predisposing factors of slope instability. The present study aims to assess the sensitivity of landslide susceptibility results applying bi-variate and multivariate statistical techniques, and using different types of terrain mapping units. Although some attempts have been made in order to assess the influence of the statistical method on landslide susceptibility results, the role exerted by the type of terrain-unit has not yet received satisfactory attention in the literature. The study was applied to the small test site of Calhandriz (11.3 km2) located in the Lisbon region (Portugal). 144 landslides were identified in the field using standard geomorphological mapping techniques. Previous work has shown that different types of landslides in the test site are not equally conditioned by the same set of instability factors. Therefore, the present study is based only on the group of shallow translational slides (60 cases). In a first step, landslide susceptibility assessment was performed using three well known data-driven methods: Information Value Method, Discriminant Analysis and Logistic Regression. These methods were applied over 1111 'morpho-lithologic' mapping units that were defined crossing lithology, slope deposits and slope angle classes. Moreover the following independent layers were considered in the analysis: lithological units, slope deposits, slope angle, relationships between slope aspect and

dip of bedding planes, presence of fluvial channels, presence of artificial cuts (roads). The obtained results do not differ substantially, although the best result was achieved with the logistic regression model. In a second step, the logistic regression method was applied using the same cartographic data set, but considering two additional types of terrain mapping units: slope-units (defined as the half-part of elementary hydrological basins) and grid-cells. The obtained results are compared through the computation of success-rate curves, by confronting each susceptibility assessment with the set of landslides used to build the model. Finally, results of landslide susceptibility based on different terrain mapping units are critically evaluated taking in account the application of landslide susceptibility maps for land management purposes.