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Effect of lithological data of different scales on modelling landslide susceptibility maps

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In landslide susceptibility modelling, lithology is often only available at rather coarse scales. The effects of this course resolution on the final map are often unknown. Thus, the aim of this study is to investigate how different lithological data affect the results of landslide susceptibility modelling and to analyse spatial differences in the resulting maps in Scheibbs, a district of Lower Austria. Within this study logistic regression is used to model landslide susceptibility, focusing on the consequences deriving from the use of two different lithological datasets (mapping scale 1:200,000 and 1:50,000). Here, the dependent variable is the landslide inventory and the independent variables are derivates of the digital elevation model (DEM) at a 10m resolution (slope, aspect, and curvature), the land cover map (10m x 10m) and lithological maps. Nominal data (land cover and lithology) were transformed to metric data by frequency ratios.
Three different techniques are applied to evaluate model performance to allow for a comparison of the models/maps using lithological data with varying scales. The first approach uses AUROC curves of the test and training datasets, which were generated by random sampling. Secondly, the resulting susceptibility maps were classified into four classes with equal intervals. Then, the performance was evaluated from the percentages of terrain units that each model correctly classifies and the number of landslides falling within the area classified as unstable (true positives). In a third evaluation step the geomorphological quality of the resulting susceptibility maps was visually interpreted. Different classification methods (e.g. quartiles, jenks) were tested.
The results show that the lithological data (1:50,000) have slightly better AUROC values. Surprisingly, the statistical validation of the true positives does not allow a definite preference in terms of best accuracy for either dataset. Test results on geomorphological value show that the lithological data (1:50,000) performed better on valleys and at small scale landforms, due to better resolution. The lithological data (1:200,000) show abrupt changes between the highest and lowest susceptibility class. However, the lithological data (1:200,000) react less sensitively to different classification methods. In summary the statistical methods do not show significant differences. There are more discrepancies between geomorphological quality. We conclude that evaluating the performance of landslide susceptibility models and their input data is needed to ensure their reliable application to risk management and land-use planning.