Geophysical Research Abstracts
Vol. 20, EGU2018-8846, 2018
EGU General Assembly 2018

Pre-failure topography in statistical landslide susceptibility modelling and its relation to landslide size and raster resolution

Stefan Steger (1), Elmar Schmaltz (2), and Thomas Glade (2)

(1) Eurac Research, Institute for Earth Observation, Bolzano-Bozen, Italy (stefan.steger@eurac.edu), (2) University of Vienna, Geography and Regional Research, Vienna, Austria

Several studies highlight that the selection of a specific landslide sampling strategy affects the outcome of a subsequent statistical susceptibility model. Various approaches have been proposed in order to represent past landslides within grid-based models. In fact, most published models are fitted with morphometric explanatory variables that specifically refer to the topography after landslide occurrence (i.e. post-failure situation). However, locations that will potentially fail in the future might not yet display such distinct post-landslide terrain conditions. Thus, statistical models fitted on the basis of post-failure topographic explanatory variables might not represent the topographic conditions that were apparent at the moment of slope failure, when a considerable high raster resolution is used. This is why a handful of previous studies tried to approximate pre-failure topographies in order to improve the predictive power of statistical models.
From our knowledge, a systematic evaluation of differences between conventional susceptibility models (post-failure) and their counterparts based on an approximated pre-failure topography is still missing. This study predicates that the usefulness of a pre-failure approximation is closely related to landslide size and the envisaged raster resolution. The main aim was to quantify differences between models that consider either post-failure morphologies or approximated pre-failure situations, while considering the effects of topographic generalization (i.e. raster resolution) and landslide size.
The research was performed for a test area located in Vorarlberg (Austria) where a detailed polygon-based shallow landslide inventory was available. The methodical approach encompassed (i) an interpolation-based approximation of pre-failure morphologies, (ii) a derivation of topographic variables from resampled DTMs (1m, 2.5m, 5m, 10m, 25m), (iii) a splitting of the original landslide inventory according to the median landslide size (smaller and larger landslides), (iv) modelling of landslide susceptibility applying a mixed-effects approach (30 models) and (v) a detailed quantitative evaluation of all results.
The findings highlight that differences between “post-failure models” and “pre-failure models” were strongly reliant on raster resolutions and landslide size. Models based on a more detailed topographic representation (i.e. high resolution DTMs) and landslides that leave a larger footprint on the surface topography (i.e. larger landslides) displayed the highest portion of mismatch (post-failure vs. pre-failure) in terms of estimated modelled relationships, predictive performances, relative variable importance and prediction surfaces. In contrast, no relevant discrepancies were detected among all low resolution models. The results indicate that an approximation of pre-failure morphologies might be of value in the case that a model is based on high resolution DTMs and/or larger landslides. The obtained highest performances for post-failure models might be misleading, mainly because the landslides of all independent test sets do not relate to the required pre-failure topography.