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Multiscale/multiresolution landslides susceptibility mapping

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Within the European strategies, landslides are considered an important threatening that requires detailed studies to identify areas where these processes could occur in the future and to design scientific and technical plans for landslide risk mitigation. In this idea, assessing and mapping the landslide susceptibility is an important preliminary step. Generally, landslide susceptibility at small scale (for large regions) can be assessed through qualitative approach (expert judgements), based on a few variables, while studies at medium and large scale requires quantitative approach (e.g. multivariate statistics), a larger set of variables and, necessarily, the landslide inventory. Obviously, the results vary more or less from a scale to another, depending on the available input data, but also on the applied methodology. Since it is almost impossible to have a complete landslide inventory on large regions (e.g. at continental level), it is very important to verify the compatibility and the validity of results obtained at different scales, identifying the differences and fixing the inherent errors. This paper aims at assessing and mapping the landslide susceptibility at regional level through a multiscale-multiresolution approach from small scale and low resolution to large scale and high resolution of data and results, comparing the compatibility of results. While the first ones could be used for studies at european and national level, the later ones allows results validation, including through fields surveys. The test area, namely the Barlad Plateau (more than 9000 sq.km) is located in Eastern Romania, covering a region where both the natural environment and the human factor create a causal context that favor these processes.
The landslide predictors were initially derived from various databases available at pan-european level and progressively completed and/or enhanced together with scale and the resolution: the topography (from SRTM at 90 meters to digital elevation models based on topographical maps, 1:25,000 and 1:5,000), the lithology (from geological maps, 1:200,000), land cover and land use (from CLC 2006 to maps derived from orthorectified aerial images, 0.5 meters resolution), rainfall (from Worldclim, ECAD to our own data), the seismicity (the seismic zonation of Romania) etc. The landslide inventory was created as polygonal data based on aerial images (resolution 0.5 meters), the information being considered at county level (NUTS 3) and, eventually, at communal level (LAU2). The methodological framework is based on the logistic regression as a quantitative method and the analytic hierarchy process as a semi-qualitative methods, both being applied once identically for all scales and once recalibrated for each scale and resolution (from 1:1,000,000 and one km pixel resolution to 1:25,000 and ten meters resolution). The predictive performance of the two models was assessed using the ROC (Receiver Operating Characteristic) curve and the AUC (Area Under Curve) parameter and the results indicate a good correspondence between the susceptibility estimated for the test samples (0.855-0.890) and for the validation samples (0.830-0.865). Finally, the results were compared in pairs in order to fix the errors at small scale and low resolution and to optimize the methodology for landslide susceptibility mapping on large areas.