Landslide susceptibility mapping at large scale over Georgia using heuristic model

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Landslide susceptibility mapping is considered as the first step in the framework of landslide risk assessment. Nowadays, this type of information, which provides spatial information on possible future location of landslides and helps to reduce the associated risk, is more and more obtained by remote sensing, GIS and spatial modelling. Finally, the final information can be used by end-users and planners.

Characterized by hilly and mountainous landscapes, the territory of Georgia is widely affected by different types of landslides but still few information about landslide susceptibility, hazard and risk is available. The landsliding processes are caused by wide range predispositing factors (complex lithology and surficial deposits, different landuse configurations etc.) and triggering factors (precipitation, tectonic movement, slope degradation, human activities) that lead to damage. Monetary and life lost illustrate the high risk that landslides make up for the exposed populations and economy of the country.

Despite the high level of hazard and risk in this country, few data regarding to the landslides predisposing and triggering factors are available. Thus, few studies have focused on the landslide susceptibility, hazard and risk mapping using GIS and remote sensing techniques for Georgia. In the framework of the French and Georgian bilateral research program ("The satellite based precipitation analysis for landslide hazard zones") a project to map landslide susceptibility for the territory of Georgia was proposed. This project constitutes a first step:

(1)To obtain spatial information about landslide susceptibility;
(2)To quantify landslide hazard in this country.

The research aims to identify the landslide prone areas using available thematic and free environmental dataset i.e. geological map (Geological Survey of Georgia), SRTM, ASTER and Landsat satellite imagery. The 1:500.000 scale has been chosen to harmonize all the data on the whole territory of Georgia. The landslide susceptibility map is performed with heuristic modelling procedure considered as very well adapted for this type of problematic at this scale of work. The procedure used for the calibration/validation model is divided in 3 steps:

(1) Each class of data (slope angle, the slope aspect, the geology and the land cover generated using direct available and free dataset) are weighted by expert opinion;
(2) Each data is stepwise introduced in the model in order to know its influence on the final landslide susceptibility map;
(3) The validation is performed on small test sites with accessible landslide inventory by calculation of the relative error and a success curve. These quantitative tests are completed by different experts' opinion about the general shapes and the reliability of the different landslide susceptibility areas.

For this study, no distinction regarding to landslides types and their activity has been done for the model calibration and validation. Results show a good correlation with the available landslide inventory dataset and the final landslide susceptibility map. The final landslide susceptibility map allows choosing and focusing some high susceptible zone in Georgia in order to assess landslide hazard and risk at more detailed scale (i.e. 1:25.000 or 1:10.000).