



Resilience of the Italian power network against natural hazards: a methodology for the spatial susceptibility mapping of landslides

Nunzia Bernardo and Andrea Abbate

Ricerca sul Sistema Energetico - RSE Spa, Sustainable Development and Energy Sources, Italy (andrea.abbate@rse-web.it)

Catastrophic events, such as Val Pola 1987, Sarno 1998, Casamicciola Terme 2009 and 2022, have showed the fragility of the Italian territory towards geo-hydrological hazards, that represent a serious threat to buildings, infrastructures and, of course, for human beings. Given local geological and morphological factors (predictor factors), and following the climate crisis, the connection between flash floods and landslides is becoming stronger and stronger. For this reason, both the scientific community and stakeholders, such as the owners/ managers of the electro-energetic system (EES), are moving their interest in this field especially for risk planning purposes. According to national and European policies, in fact, they are called to increase the resilience of power network against natural hazards, particularly those related to climate change, trying to predict their temporal and spatial occurrence.

Rockfalls, slides and debris flow represent the most rapid processes of slopes evolution and they are conditioned by the local morphology, geology and hydrology. For this study, three methods for determining a reasonable susceptibility mapping to these phenomena were evaluated, moving from the most subjective up to the most physically based. In the first one, a simple reclassification of the territory using the slope and the spatial frequency of landslides was adopted. For the second method, a linear model was implemented considering three different predictors of superficial landslide susceptibility i.e., slope, geology, and use of soil. This model has been compared with the reference landslide catalog obtaining a good “visual” accordance but with R^2 coefficient = 0.4, not so satisfactorily. The third method discriminates areas prone to rockfall, debris and slides using an elaborated General Linear Model-GLM that considers several predictors directly taken from spatial data of morphology (Digital Terrain Model), geology, hydrology and use of soil. This method was validated using the Relative Operating Characteristic-ROC error scores obtaining fairly good performance (Area Under the Curve-AUC = 0.65).

Even though there are several open problems regarding the most appropriate scale for studying geo-hydrological processes, the estimation made by the third method can be considered a suitable methodology to map landslide susceptibility. Italian EES is rather dense and covers the whole national territory, including large parts of mountain areas. Since it is necessary to predict the most vulnerable components of electrical networks, a well-built susceptibility map can increase the territorial information highlighting those areas where more investigations are needed due to possible hazardous situations that may occur in the future with a particular kinematics

(rockfalls, slides or debris), because of the activation/reactivation of landslides.

This study provides information to government or private company to assure the protection of the infrastructure and to prepare quick reply during the early stages of emergency.