Geophysical Research Abstracts
Vol. 17, EGU2015-2079-1, 2015
EGU General Assembly 2015

Improving accuracy in shallow-landslide susceptibility analyses at regional scale

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Calabria (southern Italy) is particularly exposed to geo-hydrological risk. In the last decades, slope instabilities, mainly related to rainfall-induced landslides, repeatedly affected its territory. Among these, shallow landslides, characterized by abrupt onset and extremely rapid movements, are among the most destructive and dangerous phenomena for people and infrastructures.
In this study, a susceptibility analysis to shallow landslides has been performed by refining a method recently applied in Costa Viola - central Calabria (Iovine et al., 2014), and only focusing on landslide source activations (regardless of their possible evolution as debris flows). A multivariate approach has been applied to estimating the presence/absence of sources, based on linear statistical relationships with a set of causal variables. The different classes of numeric causal variables have been determined by means of a data clustering method, designed to determine the best arrangement.
A multi-temporal inventory map of sources, mainly obtained from interpretation of air photographs taken in 1954-1955, and in 2000, has been adopted to selecting the training and the validation sets.
Due to the wide extend of the territory, the analysis has been iteratively performed by a step-by-step decreasing cell-size approach, by adopting greater spatial resolutions and thematic details (e.g. lithology, land-use, soil, morphometry, rainfall) for high-susceptible sectors.
Through a sensitivity analysis, the weight of the considered factors in predisposing shallow landslides has been evaluated. The best set of variables has been identified by iteratively including one variable at a time, and comparing the results in terms of performance. Furthermore, susceptibility evaluations obtained through logistic regression have been compared to those obtained by applying neural networks.
Obtained results may be useful to improve land utilization planning, and to select proper mitigation measures in shallow-landslide prone areas. The susceptibility map may also be included into a regional warning system, combined with suitable threshold evaluations (Vennari et al., 2014), to help Civil Protection Authorities to managing emergencies for events triggered by intense rainfalls. At this purpose, both hydrological (e.g. Capparelli et al., 2012) and geotechnical (e.g. Iovine et al., 2010) modelling approaches may also be profitably included.

References

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