Geophysical Research Abstracts
Vol. 12, EGU2010-2222, 2010
EGU General Assembly 2010

GIS-based landslide hazard assessment at regional scale in Sicily (Central Mediterranean)

fabrizio nigro (1), antonino pisciotta (1), marcella perricone (1), pietro renda (2), and rocco favara (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Sezione di Palermo, via U. La Malfa n. 153, 90146, Palermo, Italy (f.nigro@pa.ingv.it), (2) Dipartimento di Geologia e Geodesia dell'Università, via Archirafi n. 20, 90100, Palermo, Italy

The presence, type and abundance of landslides in an area depend on the characteristics of the triggers and on the predisposing conditions. Natural conditions that control these factors include the local and regional morphological and lithological setting, the presence and abundance of geological discontinuities including bedding planes, faults, joints, and cleavage systems, the type and depth of the soil, the extent and type of the vegetation cover, and the mechanical and hydrological properties of the rocks and soils.
In order to evaluate the landslides susceptibility requires understanding of spatial distribution of all these factors that control slope instability. They depend on intrinsic and extrinsic variables. Intrinsic variables determining hazards include bedrock geology, topography, soil depth, soil type, slope gradient, slope aspect, slope curvature, elevation, engineering properties of the slope material, land use pattern and drainage patterns. Extrinsic variables include heavy rainfall, earthquakes and volcanic activities. Although the probability of landslide occurrence depends on both intrinsic and extrinsic variables, the latter possess a temporal distribution which is more difficult to handle in modelling practice. Therefore, for landslide hazard assessment, "landslide susceptibility mapping" is often conducted in which the extrinsic variables are not considered in determining the probability of landslide occurrence.
The landslide susceptibility zoning methods mainly applied are: qualitative, statistical methodologies, and geotechnical/safety factor models. Qualitative approaches are based on the judgment of those conducting the susceptibility or hazard assessment; the statistical approach uses a predictive function or index derived from a combination of weighted factors; and the deterministic, models are based on the physical laws of conservation of mass, energy, and momentum. Regarding the statistical methodologies, the combination of factors that have led to landslides in the past are determined and quantitative predictions are made for areas currently free of landslides. In these methods the use of complex statistics requires the collection of large amounts of data to produce reliable results. Instead, deterministic landslide hazard maps normally provide the most detailed results, expressing the hazard in absolute values in the form of safety factors, or the probability of failure given a set of boundary conditions for groundwater levels and seismic acceleration.
A methodology for landslide susceptibility mapping of the Sicily using a GIS technology is presented, based on a weighted approach. The degree of susceptibility was weighted considering the extrinsic variable of rainfall and the prevalence of the condition of geology, elevation, slope and land cover. Finally, an overlay analysis is carried out by evaluating the layers obtained according to their weight, and the landslide susceptibility map is produced. The study area was classified into five classes of relative landslide susceptibility, namely, very low, low, moderate, high and very high.