AvH8-32
8th Alexander von Humboldt International Conference
Cusco, Peru, 12 – 16 November 2012

A strategy to address the task of seismic micro-zoning in landslide-prone areas

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Nowadays, micro-zonation maps drawn by means of Geographic Information Systems (GIS) tools represent the first level of planning and management in inhabited territories. At the same time, in landslide-prone areas many inventories have been populated and used as bases for reducing the damage from natural disasters as landslides, floods and earthquakes. As concerns landslide prevention and mitigation policies at the urban scale, the ability of GIS tools to manage multiple information with sufficient precisions enables professionals and researchers to devote efforts in managing the combination of hazards, as for instance in the case of seismically-induced slope movements. Many sites in the Southern Apennines of Italy are characterized by active sliding mechanisms that are seasonally remobilized by rainfall. In additions, these sites are placed along or nearby one of the most significant seismogenic source area of Italy, that is the Apennine Chain. Thus, in these territories the landslide monitoring, forecasting and prevention has necessarily to deal with two possible triggers of instability (earthquakes and/or rainfalls) with different time distribution, magnitude and modality of occurrence.
At this aim, GIS tools can be useful whether Digital Elevation Models (DEM) are as accurate as a few meter pixel and detailed mechanical and hydraulic characterization of the outcropping materials over the great part of the urban territory is available. Moreover, the classic methods for estimating the seismic-induced permanent displacements within natural slopes are drawn from the generalization of Newmark's method. Such method can be applied to planar sliding mechanism that can be considered still valid for shallow landslides generated by seismic shocks. The mechanism of slope movements depends essentially on the mechanical properties of the superficial deposits.
In this paper, the village of Castelfranci (Campania, Southern Italy) is being studied. This small city of some two thousand inhabitants suffers from the seasonal reactivation of shallow landslides within prevailing clay deposits due to rainfall. Furthermore, the site is seismically classified as zone 1, with a maximum expected ground acceleration of 0.35g. Several studies on the evolution of slopes have been undertaken at Castelfranci and maps have been drawn at the urban scale without taking into account the seismic hazard. This study aims at figuring out possible hazard scenarios of seismically-induced instability for two different conditions of occurrence of hypothetical seismic events: i) during the wet season; and ii) during the dry season.
The available DEM at the site has 10m resolution and is drawn from the project TINITALY developed by the Istituto Nazionale di Geofisica e Vulcanologia (INGV; Tarquini et al. 2007, 2012). Moreover, a widespread geotechnical characterization of unstable and stable clay soils has been collected and geo-referenced in order to use either kriging technique to spatially distribute the measurement results or clustering the local properties. The high-resolution DEM allowed to develop an accurate zonation in the study area. Further, the reconstruction of the historical evolution of the active landslide-prone areas gave the possibility to describe the basic conditions of both the wet and dry seasons and accordingly to estimate the permanent displacements by means of a few equations suggested by the Civil Protection Office for Seismic Risk Prevention (DPC 2008), such as Romeo (2000) and Jibson (2007).

References

Jibson R. 2007. Regression models for estimating coseismic landslide displacement. Engineering Geology, 91, 209-218.
DPC - Dipartimento della Protezione Civile e Conferenza delle Regioni e delle Province Autonome (2008) Indirizzi e criteri per la microzonazione sismica. Protezione Civile Nazionale, Roma.
Romeo, R. (2000) - Seismically induced landslide displacements: a predictive model. Engineering Geology, vol. 58 (3).
Tarquini S., I. Isola , M. Favalli , F. Mazzarini, M. Bisson, M.T. Pareschi, E. Boschi (2007). TINITALY/01: a new

Triangular Irregular Network of Italy. Annals of Geophysics, 50, 407-425.
Tarquini S., Vinci S., Favalli M., Doumaz F., Fornaciai A., Nannipieri L., (2012). Release of a 10-m-resolution DEM for the Italian territory: Comparison with global-coverage DEMs and anaglyph-mode exploration via the web. Computers & Geosciences, 38, 168-170. doi: doi:10.1016/j.cageo.2011.04.018