Geophysical Research Abstracts
Vol. 15, EGU2013-12609, 2013
EGU General Assembly 2013

Prospective testing of neo-deterministic seismic hazard scenarios for the Italian territory

Antonella Peresan (1,2), Andrea Magrin (1), Franco Vaccari (1,2), Vladimir Kossobokov (3,4), Giuliano F. Panza (1,2,5)

(1) University of Trieste, Department of Mathematics and Geosciences, Trieste, Italy (aperesan@units.it), (2) The Abdus Salam International Centre for Theoretical Physics, SAND Group, Trieste, Italy, (3) IIEPT, Russian Academy of Sciences, Moscow, Russian Federation, (4) Institut de Physique du Globe de Paris, France, (5) Institute of Geophysics, China Earthquake Administration, Beijing

A reliable and comprehensive characterization of expected seismic ground shaking, eventually including the related time information, is essential in order to develop effective mitigation strategies and increase earthquake preparedness. Moreover, any effective tool for SHA must demonstrate its capability in anticipating the ground shaking related with large earthquake occurrences, a result that can be attained only through rigorous verification and validation process.

So far, the major problems in classical probabilistic methods for seismic hazard assessment, PSHA, consisted in the adequate description of the earthquake recurrence, particularly for the largest and sporadic events, and of the attenuation models, which may be unable to account for the complexity of the medium and of the seismic sources and are often weekly constrained by the available observations. Current computational resources and physical knowledge of the seismic waves generation and propagation processes allow nowadays for viable numerical and analytical alternatives to the use of attenuation relations. Accordingly, a scenario-based neo-deterministic approach, NDSHA, to seismic hazard assessment has been proposed, which allows considering a wide range of possible seismic sources as the starting point for deriving scenarios by means of full waveforms modeling. The method does not make use of attenuation relations and naturally supplies realistic time series of ground shaking, including reliable estimates of ground displacement readily applicable to seismic isolation techniques.

Based on NDSHA, an operational integrated procedure for seismic hazard assessment has been developed, that allows for the definition of time dependent scenarios of ground shaking, through the routine updating of formally defined earthquake predictions. The integrated NDSHA procedure for seismic input definition, which is currently applied to the Italian territory, combines different pattern recognition techniques, designed for the space-time identification of strong earthquakes, with algorithms for the realistic modeling of ground motion. Accordingly, a set of deterministic scenarios of ground motion at bedrock, which refers to the time interval when a strong event is likely to occur within the alerted area, can be defined by means of full waveform modeling, both at regional and local scale. CN and M8S predictions, as well as the related time-dependent ground motion scenarios associated with the alarmed areas, are regularly updated every two months since 2006. The routine application of the time-dependent NDSHA approach provides information that can be useful in assigning priorities for timely mitigation actions and, at the same time, allows for a rigorous prospective testing and validation of the proposed methodology. As an example, for sites where ground shaking values greater than 0.2 g are estimated at bedrock, further investigations can be performed taking into account the local soil conditions, to assess the performances of relevant structures, such as historical and strategic buildings.

The issues related with prospective testing and validation of the time-dependent NDSHA scenarios will be discussed, illustrating the results obtained for the recent strong earthquakes in Italy, including the May 20, 2012 Emilia earthquake.