Geophysical Research Abstracts
Vol. 18, EGU2016-15135, 2016
EGU General Assembly 2016

Characterising large scenario earthquakes and their influence on NDSHA maps

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The neo-deterministic approach to seismic zoning, NDSHA, relies on physically sound modelling of ground shaking from a large set of credible scenario earthquakes, which can be defined based on seismic history and seismotectonics, as well as incorporating information from a wide set of geological and geophysical data (e.g. morphostructural features and present day deformation processes identified by Earth observations).
NDSHA is based on the calculation of complete synthetic seismograms; hence it does not make use of empirical attenuation models (i.e. ground motion prediction equations). From the set of synthetic seismograms, maps of seismic hazard that describe the maximum of different ground shaking parameters at the bedrock can be produced. As a rule, the NDSHA, defines the hazard as the envelope ground shaking at the site, computed from all of the defined seismic sources; accordingly, the simplest outcome of this method is a map where the maximum of a given seismic parameter is associated to each site. In this way, the standard NDSHA maps permit to account for the largest observed or credible earthquake sources identified in the region in a quite straightforward manner. This study aims to assess the influence of unavoidable uncertainties in the characterisation of large scenario earthquakes on the NDSHA estimates.
The treatment of uncertainties is performed by sensitivity analyses for key modelling parameters and accounts for the uncertainty in the prediction of fault radiation and in the use of Green's function for a given medium. Results from sensitivity analyses with respect to the definition of possible seismic sources are discussed. A key parameter is the magnitude of seismic sources used in the simulation, which is based on information from earthquake catalogue, seismogenic zones and seismogenic nodes. The largest part of the existing Italian catalogues is based on macroseismic intensities, a rough estimate of the error in peak values of ground motion can therefore be the factor of two, intrinsic in MCS and other discrete scales. A simple test supports this hypothesis: an increase of 0.5 in the magnitude, i.e. one degrees in epicentral MCS, of all sources used in the national scale seismic zoning produces a doubling of the maximum ground motion. The analysis of uncertainty in ground motion maps, due to the catalogue random errors in magnitude and localization, shows a not uniform distribution of ground shaking uncertainty. The available information from catalogues of past events, that is not complete and may well not be representative of future earthquakes, can be substantially completed using independent indicators of the seismogenic potential of a given area, such as active faulting data and the seismogenic nodes.