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Quantifying uncertainty in NDSHA estimates due to earthquake catalogue

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The procedure for the neo-deterministic seismic zoning, NDSHA, is based on the calculation of synthetic seismograms by the modal summation technique. This approach makes use of information about the space distribution of large magnitude 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 ongoing deformation processes identified by earth observations). Hence the method does not make use of attenuation models (GMPE), which may be unable to account for the complexity of the product between seismic source tensor and medium Green function and are often poorly constrained by the available observations. NDSHA defines the hazard from the envelope of the values of ground motion parameters determined considering a wide set of scenario earthquakes; accordingly, the simplest outcome of this method is a map where the maximum of a given seismic parameter is associated to each site.

In NDSHA uncertainties are not statistically treated as in PSHA, where aleatory uncertainty is traditionally handled with probability density functions (e.g., for magnitude and distance random variables) and epistemic uncertainty is considered by applying logic trees that allow the use of alternative models and alternative parameter values of each model, but the treatment of uncertainties is performed by sensitivity analyses for key modelling parameters. To fix the uncertainty related to a particular input parameter is an important component of the procedure. The input parameters must account for the uncertainty in the prediction of fault radiation and in the use of Green functions for a given medium. A key parameter is the magnitude of sources used in the simulation that is based on catalogue informations, seismogenic zones and seismogenic nodes. Because the largest part of the existing catalogues is based on macroseismic intensity, a rough estimate of ground motion error can therefore be the factor of 2, intrinsic in MCS scale. We tested this hypothesis by the analysis of uncertainty in ground motion maps due to the catalogue random errors in magnitude and localization.