Peresan A.

ASSESSING PERFORMANCES OF SEISMIC HAZARD MAPS: ISSUES AND PERSPECTIVES

Objective testing is the key issue towards any reliable seismic hazard assessment (SHA). Different earthquake hazard maps must demonstrate their capability in anticipating ground shaking from future strong earthquakes before an appropriate use for different purposes – such as engineering design, insurance, and emergency management. Quantitative assessment of maps performances is an essential step also in scientific process of their revision and possible improvement. Cross-checking of probabilistic models with available observations and independent physics based models is recognized as major validation procedure.

The existing maps from the classical probabilistic seismic hazard analysis (PSHA), as well as those from the neo-deterministic analysis (NDSHA), which have been already developed for several regions worldwide (including Italy, India and North Africa), are considered to exemplify the possibilities of the cross-comparative analysis in spotting out limits and advantages of different methods. Where the data permit, a comparative analysis versus the documented seismic activity observed in reality is carried out, showing how available observations about past earthquakes can contribute to assess performances of the different methods.

Neo-deterministic refers to a scenario-based approach, which allows for consideration of a wide range of possible earthquake sources as the starting point for scenarios constructed via full waveforms modeling. The method does not make use of empirical attenuation models (i.e. Ground Motion Prediction Equations, GMPE) and naturally supplies realistic time series of ground shaking (i.e. complete synthetic seismograms), readily applicable to complete engineering analysis and other mitigation actions. The standard NDSHA maps provide reliable envelope estimates of maximum seismic ground motion from a wide set of possible scenario earthquakes, including the largest deterministically or historically defined credible earthquake. In addition, the flexibility of NDSHA allows for generation of ground

shaking maps at specified long-term return times, which may permit a straightforward comparison between NDSHA and PSHA maps in terms of average rates of exceedance for specified time windows. The comparison of NDSHA and PSHA maps, particularly for very long recurrence times, may indicate to what extent probabilistic ground shaking estimates are consistent with those from physical models of seismic waves propagation.

A systematic comparison over the territory of Italy is carried out exploiting the uniqueness of the Italian earthquake catalogue, a data set covering more than a millennium (a time interval about ten times longer than that available in most of the regions worldwide) with a satisfactory completeness level for M>5, which warrants the results of analysis. By analysing in some detail seismicity in the Vrancea region, we show that well constrained macroseismic field information for individual earthquakes may provide useful information about the reliability of ground shaking estimates. Finally, in order to generalise observations, the comparative analysis is extended to further regions where both standard NDSHA and PSHA maps are available (e.g. State of Gujarat, India). The final Global Seismic Hazard Assessment Program (GSHAP) results and the most recent version of Seismic Hazard Harmonization in Europe (SHARE) project maps, along with other national scale probabilistic maps, all obtained by PSHA, are considered for this comparative analysis.