



## **Comparison between neo-deterministic and probabilistic seismic hazard assessment for the Italian territory**

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Seismic hazard assessment can be performed in various ways, following probabilistic or deterministic approaches. The probabilistic analysis, on which is based the new Italian seismic code, is formally inaccurate, since it relies on convolutive techniques and approximations in the calculation process, which cannot be rigorously applied and that may lead to unrealistic results. These basic formal pitfalls of the probabilistic approach are overcome when resorting to the neo-deterministic approach, which is based on the calculation of synthetic seismograms and hence does not require the mentioned, often not valid, approximations.

From a factual point of view, probabilistic hazard assessment performances proved to be very unsatisfactory by recent destructive earthquakes. On the other side, neo-deterministic hazard maps have been satisfactorily compared with observations available so far. Moreover recent earthquakes occurred in the areas where neo-deterministic maps were available, successfully confirmed the (neo-deterministically) predicted ground shaking.

We compare the hazard maps obtained in Italy with the probabilistic and neo-deterministic approaches, focussing on the probabilistic map on which is based the seismic code in force, and different neo-deterministic maps. The neo-deterministic maps are computed using at first just the same elements as the probabilistic map (i.e. an earthquake catalogue and a set of seismogenic zones). Then also the information on the areas prone to strong earthquakes is incorporated.

Two kinds of comparison have been performed. The first one is in terms of Intensity scale. Acceleration values have been converted in intensity-like scale, i.e. grouping peak ground motion parameters in doubling intervals (power law in base 2), consistently with the MCS scale. The use of intensity-like scale simplifies the problem of estimating the uncertainty of the neo-deterministic results, since this quantity will correspond to about one degree intensity (i.e. the sensitivity of the macroseismic scale), that is about doubling of ground motion parameters. The second comparison is performed in terms of seismic zones, since the probabilistic map is used to assign every municipality to one of the four seismic zones for the Italian territory, to which correspond specific building criteria.