How different PSHA is different enough?

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Probabilistic seismic hazard analysis (PSHA) is widely employed worldwide as the rational way to quantify the uncertainty associated to earthquake occurrence and effects. National-scale PSHA has its results typically expressed in the form of maps of ground motion measures intensities that all have the same exceedance return period. Classical PSHA relies on data that continuously increase due to instrumental seismic monitoring, and on models that continuously evolve with the knowledge on each of its many aspects. Therefore, it can happen that different, equally legitimate, hazard maps for the same region can show apparently irreconcilable differences, sparking public debate. This situation is currently ongoing in Italy, where the process of governmental enforcement of a new hazard map is delayed. The discussion is complicated by the fact that the events of interest to hazard assessment are intentionally rare at any of the sites the maps refer to, thus impeding empirical validation at any specific site. The presentation will show the result of two recent studies, which pursue a regional approach, regarding three different authoritative PSHA studies for Italy. The first one entailed formal tests on the output of PSHA against the observed ground shaking exceedance frequencies, obtained from about fifty years of continuous monitoring of seismic activities across the country (Iervolino et al., 2023a). The second compares the areas in which exceedance of PSHA-postulated ground motion intensity threshold is estimated according to ShakeMap for twelve years of instrumental earthquakes, with what expected from the considered PSHA models (Iervolino et al., 2023b). The bulk of analyses reveals that, apparently alternative hazard maps are, in fact, hardly distinguishable in the light of observations and ShakeMap estimations. This perspective, which may be relevant for the current debate, may be strengthened by the fact that recent studies (Baltzopoulos et al., 2023) also show that structural design, for example for reinforced concrete moment-resisting frames, is strictly dominated by seismic actions only in a fraction of the country, owing to the effect of building-code-prescribed minima and design for gravity loads.

References

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