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Earthquake Hazard Assessment: Basics of Evaluation

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Seismic hazard assessment (SHA) is not an easy task that implies a delicate application of statistics to data of limited size and different accuracy. Earthquakes follow the Unified Scaling Law that generalizes the Gutenberg-Richter relationship by taking into account naturally fractal distribution of their sources. Moreover, earthquakes, including the great and mega events, are clustered in time and their sequences have irregular recurrence intervals. Furthermore, earthquake related observations are limited to the recent most decades (or centuries in just a few rare cases). Evidently, all this complicates reliable assessment of seismic hazard and associated risks. Making SHA claims, either termless or time dependent (so-called t-DASH), quantitatively probabilistic in the frames of the most popular objectivists' viewpoint on probability requires a long series of "yes/no" trials, which cannot be obtained without an extended rigorous testing of the method predictions against real observations. Therefore, we reiterate the necessity and possibility of applying the modified tools of Earthquake Prediction Strategies, in particular, the Error Diagram, introduced by G.M. Molchan in early 1990ies for evaluation of SHA, and the Seismic Roulette null-hypothesis as a measure of the alerted space. The set of errors, i.e. the rates of failure and of the alerted space-time volume, compared to those obtained in the same number of random guess trials permits evaluating the SHA method effectiveness and determining the optimal choice of the parameters in regard to specified cost-benefit functions. These and other information obtained in such a testing supplies us with a realistic estimate of confidence in SHA results and related recommendations on the level of risks for decision making in regard to engineering design, insurance, and emergency management.

These basics of SHA evaluation are exemplified in brief with a few examples, which analyses in more detail are given in a poster of NH4.7 session.