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STATE-OF-THE-ART APPROACHES TO SEISMIC HAZARD ASSESSMENT

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 regions). Evidently, all this complicates reliable assessment of seismic hazard and associated risks. SHA, from term-less, either probabilistic PSHA or deterministic DSHA, to time-dependent (t-DASH) including short-term earthquake forecast/prediction (StEF), is not an easy task that implies a delicate application of statistics to data of limited size and different accuracy. Regretfully, in many cases of SHA, t-DASH, and StEF, the claims of a high potential and efficiency of the methodology are based on a flawed application of statistics and hardly suitable for communication to decision makers. 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, is evident, and such a testing must be done in advance claiming hazardous areas and/or times. 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. Naturally and same as in case of the errors in estimation seismic hazard, the errors in estimation of a distributed object of risk may propagate non-linearly into inflicted errors when estimating seismic risks. These and other information obtained in such a testing may supply 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. Model estimates must pass regular control by the updated national data and be revised accordingly. The estimations addressing realistic and practical kinds of seismic risks should involve experts in earthquake engineering, social sciences and economics.

These basics of SHA are exemplified with state-of-the-art reliable and misleading “seismic hazard maps”, “precursors”, and “forecast/prediction methods”.