Geophysical Research Abstracts
Vol. 16, EGU2014-5563, 2014
EGU General Assembly 2014

Seismic hazard and risks based on the Unified Scaling Law for Earthquakes

Vladimir Kossobokov (1,2,3) and Anastasia Nekrasova (1)

(1) Institute of Earthquake Prediction Theory & Mathematical Geophysics, RAS, Moscow, Russian Federation (nastia@mitp.ru), (2) Institut de Physique du Globe de Paris, Paris, France (volodya@ipgp.fr), (3) International Seismic Safety Organization (ISSO)

Losses from natural disasters continue to increase mainly due to poor understanding by majority of scientific community, decision makers and public, the three components of Risk, i.e. Hazard, Exposure, and Vulnerability. Contemporary Science is responsible for not coping with challenging changes of Exposures and their Vulnerability inflicted by growing population, its concentration, etc., which result in a steady increase of Losses from Natural Hazards. Scientists owe to Society for lack of knowledge, education, and communication. In fact, Contemporary Science can do a better job in disclosing Natural Hazards, assessing Risks, and delivering such knowledge in advance catastrophic events.

Any kind of risk estimates R(g) at location g results from a convolution of the natural hazard H(g) with the exposed object under consideration O(g) along with its vulnerability V(O(g)). Note that g could be a point, or a line, or a cell on or under the Earth surface and that distribution of hazards, as well as objects of concern and their vulnerability, could be time-dependent. There exist many different risk estimates even if the same object of risk and the same hazard are involved. It may result from the different laws of convolution, as well as from different kinds of vulnerability of an object of risk under specific environments and conditions. Both conceptual issues must be resolved in a multidisciplinary problem oriented research performed by specialists in the fields of hazard, objects of risk, and object vulnerability, i.e. specialists in earthquake engineering, social sciences and economics.

To illustrate this general concept, we first construct seismic hazard assessment maps based on the Unified Scaling Law for Earthquakes (USLE). The parameters A, B, and C of USLE, i.e. $\log N(M,L) = A - B\bullet(M-6) + C\bullet\log L$, where N(M,L) is the expected annual number of earthquakes of a certain magnitude M within an area of linear size L, are used to estimate the expected maximum magnitude in 50 years and the corresponding expected ground shaking intensity in a cell g of a uniform grid of the region of interest. Then such a seismic hazard map is used to generate earthquake risk maps based on the exposed population density. Some oversimplified convolutions $R(g) = H(g)\bullet gP\bullet F(gP)$ of seismic hazard assessment maps H(g) are applied in a few regions with population density distribution P of vulnerability V=F(gP), where g is a cell of a uniform grid and gP is the integral of the population density over the cell g.