



GEM's Global Earthquake Model

Marco Pagani, Vitor Silva, Paul Henshaw, and John Schneider
GEM Foundation, Pavia, Italy

The Global Earthquake Model (GEM) Foundation released at the end of 2018 the first version of two maps describing the patterns of seismic hazard and risk at a global scale. These maps were computed using a collection of hazard and risk models developed by a broad community of scientists, engineers and the support of various public and private organisations. Overall, the maps, the collection of models, the underlying datasets and the large set of tools created for developing models and computing hazard and risk form a framework stemming from a multi-year collaborative effort which involved several hundred individuals from dozens of institutions, companies throughout the world.

The 2018 GEM global seismic hazard map describes the geographic distribution of peak ground acceleration with 10% probability of being exceeded in 50 years. It is the combination of the results computed using 30 national and regional probabilistic seismic hazard models representing the vast majority of recent and publicly accessible hazard models. Altogether, this set of models comprises about 3.5 million earthquake sources including several newly defined shallow fault sources selected from the recently compiled GEM Global Active Fault Database. The 2018 GEM global seismic risk map describes the geographic distribution of average annual loss (USD) normalised by the average construction costs of the respective country (USD/m²) due to ground shaking in the residential, commercial and industrial building stock, considering contents, together with structural and non-structural components. It is the summary of the results computed using a new and unique collection of exposures and the vulnerability and fragility functions defining the behaviour under the seismic load of about 300 categories of buildings included in GEM's global vulnerability database.

We describe the main characteristics of the hazard and risk models; we illustrate the principal results obtained; and, we present plans to maintain and improve this framework following the principles of collaboration and openness, which are at the roots of the GEM initiative. The maps are currently accessible on the website of the GEM Foundation (www.globalquakemodel.org); the hazard and risk models will be gradually distributed publicly throughout 2019.