ERN and RED announce the implementation of their Pan-European Earthquake Risk Model on the Oasis Platform

The European Model

The European Earthquake Risk Model, developed by RED – Risk Engineering and Development, in partnership with ERN – Evaluación de Riesgos Naturales, is a borderless model, which includes newly developed and updated hazard, exposure and vulnerability models for earthquake risk assessment of 44 countries in Europe. Based on state-of-the-art methodologies, tools, software and data, it tackles the generation of all the components necessary to the probabilistic evaluation of the effects of earthquake-induced ground shaking on residential, commercial, public and industrial buildings in Europe at both country and portfolio scales.

The hazard module of the model, which is fully consistent with the approach of the EU-funded project SHARE (Giardini et all., Mapping Europe's Seismic Hazard, 2014), is based on a unique harmonized historical earthquake catalog for Europe, on a new homogenized European seismic source model, and on the first pan-European database of active faults and seismogenic sources. Different views of seismicity were explicitly accounted for: the first is the classical area source approach (with more than 400 considered); the second considers fully parameterized faults embedded in large background seismicity zones; and finally the third consists of a smoothed seismicity model that is more faithful to the empirically-derived rates and locations of past earthquakes. Ground motion intensity calculations –represented by means of different spectral accelerations for different vibration periods– are performed using ground-motion prediction equations (GMPEs) suitable for the seismogenic context of the different regions, and site-amplification factors that are computed based on the assessed site-conditions. As a result, a stochastic catalogue of about 4 million earthquake ruptures was generated, with different magnitudes, locations and mechanisms, to represent a comprehensive view of potential future seismicity.

A new harmonized database of country-specific vulnerability curves for structural response assessment was developed differentiated by country, material and lateral load resisting system, height of buildings and design code level. The vulnerability module is based on the most recent research findings and on more than 300 fragility functions, vulnerability functions and damage matrices from all major empirical, analytical and hybrid studies about building vulnerability across Europe, comprising large EU research projects (Risk-UE, LessLoss, Syner-G). The new database is compatible with the main existing taxonomies, such as HAZUS, Risk-UE and GEM. These vulnerability functions were calibrated and validated using damage data from the main past seismic events that affected Europe.

A country-specific high-resolution (1km x 1km grid) Industry Exposure Database (IED), validated with the aid of satellite images, was developed using the latest information about building characteristics across Europe and multiple data sources, including national and international housing statistics and the results of all the main recent EU-funded projects. The IED covers seven lines of business: Residential, Wholesale and Retail, Hotels and Restaurants, Health Care, Educational, Offices and Industrial.

Finally, the modeled loss estimates were calibrated and validated both in amounts and geographical distribution across different building classes for a large collection of past historical earthquakes that affected many countries in Europe.

Oasis and ERN/RED

In recent years, Oasis LMF and ERN/RED have been working on achieving compatibility between the European Earthquake Risk model and the Oasis platform. The European model is now fully compatible with the Oasis LMF platform, giving results equivalent to those of its native R-PLUS system. This was achieved through a combination of different methodologies used in both systems, taking advantage of R-PLUS features and of the compatibility and uniformity of the open source Oasis platform. The release of the ERN/RED European Model on the Oasis Platform opens interesting possibilities for future collaboration and for the implementation of other ERN/RED models on this platform. ERN/RED is interested in continuing the collaboration with Oasis and creating a synergy, which would highlight the ERN/RED experience in the development and implementation of multi-hazard risk assessment models for different regions of the world as well as the open and transparent features of the Oasis platform.

About ERN and RED

Established in 1996 in Mexico City, ERN specialized in seismic engineering, evolving later to include the assessment of a wide range of natural and anthropogenic phenomena in order to mitigate their impact on people, buildings and infrastructure, by way of seeking solutions through specialized studies and software. ERN developed several risk models and risk related technology assets, with projects in Mexico, Latin America, Europe, Africa and Asia.

Established in Pavia, Italy in 2008, RED originally dealt with the analysis and modeling of structures for achieving optimal seismic performance. In 2012 the company acquired its current name and increased its range of services to include the development of natural and man-made hazard and risk assessment models, with focus mainly on earthquake and flood perils. RED has been involved in many risk assessment projects worldwide, including Europe, America, Africa and Asia.

The staff of both companies is also involved in academic activities and research, with ERN having a significant presence in the Mexican National Autonomous University (UNAM) and RED with collaborations in the University of Pavia, the University of Bologna, the School of Advanced Studies of Pavia (IUSS) and the European Centre for Training and Research in Earthquake Engineering Foundation (EUCENTRE).