CoreLogic®

CATASTROPHE RISK MANAGEMENT

Europe Earthquake Model

Region specific innovations in both hazard and vulnerability

This suite of Europe earthquake models covers all major seismically-exposed countries across the continent, including the 16 main "Euroquake" countries extending across northern, western, and central Europe into Romania. In addition, models are provided for key seismically-exposed southern European states: Cyprus, Greece, Italy, Malta, Portugal, Spain, and Turkey

Catastrophe Risk Management from CoreLogic® offers a suite of earthquake models for Europe incorporated in RQE™ (Risk Quantification & Engineering).

Key Features

SEISMIC SOUCES

Comprehensive modelling of seismic sources is based on investigations of all available regional and national earthquake catalogues, detailed geological and tectonic maps, and evidence of seismic movement. Each seismic source and its associated events are defined by:

- Location / Depth
- Geometry / Fault area
- Magnitude-frequency relationship
- Minimum and maximum magnitudes

Recurrence relations were independently established for each source type and statistically tested for robustness. A regionally homogenous seismotectonic model in the main 'Euroquake' bloc captures hazard correlation across the political boundaries of northern, central, and Eastern Europe. CoreLogic developed a unique shallow-depth seismic source model to overcome incomplete knowledge of seismogenic parameters for the region. For Romania, a complementary intermediate-depth source model reflects the distinctive nature of the peril in this area.

HAZARD DEFINITION

Ground motion intensity defines the hazard to a building, and this intensity changes as seismic waves move outward from the event epicenter. For the vast majority of European country models, spectral acceleration is the hazard parameter used to define ground motion intensity.

STOCHASTIC EVENT SETS AND SIMULATION

Comprehensive stochastic event sets were constructed by sampling earthquakes across the full range of possible magnitudes for each specific source and defining associated event epicenters and recurrence rates. Recurrence probabilities in Turkey are time-dependent, to reflect the changes in stress and increased risk of an event since the previous occurrence. A sufficiently long simulation horizon is essential to avoid underestimating tail risk driven by relatively infrequent, yet highly destructive, events. For all catastrophe models, comprehensive probabilistic event sets are translated into 300,000 years of simulated losses, beginning with RQE version 13.

Key Features (cont'd)

ATTENUATION RELATIONS

Attenuation functions define how intensity decays with distance from the earthquake source. Multiple, appropriately-weighted relations are used to represent each region and source type. Variable parameters include:

- Magnitudes
- Fault mechanisms
- Focal depths
- Source-to-site distance

Distinct attenuation functions are applied in Romania where the city of Bucharest is under the influence of long-term soil vibration, resulting in amplification of ground motion and damage.

A unique innovation of soil-based attenuation (SBA) reduces hazard uncertainty where exposed assets are located on soil sites, as is the case in most urban areas. This is a significant improvement over reliance on more conventional rock-based attenuations.

REGIONALLY DIFFERENTIATED VULNERABILITIES

Vulnerability functions are based on extensive field investigation of scores of major earthquakes. Together with an assessment of local building codes and practices, this engineering knowledge leads to rational, consistent vulnerabilities. Functions are then refined with evaluation of claims data. Vulnerabilities differ by region, structure, and occupancy type, as well as building height and age.

MODEL VALIDATION

Validation testing has been carried out to test the robustness of each model component. Examples of validation testing include:

- Frequency and magnitude of events generated by the stochastic model were compared with those of historical seismicity in Europe and its vicinity.
- Probabilistic ground-shaking intensities were compared with the latest available research from authoritative bodies.
- Modelled historical earthquake output was compared against recorded economic damage.
- Probabilistic losses were calculated based on the analysis of national exposure data. Probabilistic return periods were studied, and, where possible, insurance industry burning costs over the last century were compared to modelled losses.
- Model results from historical events were compared to specific client portfolio losses.

2012 Enhancements to Portugal, Spain, Italy, Greece, and Turkey Models

The RQE v. 13 release in 2012 includes fully revised earthquake models for Spain and Portugal. These hazard modules are constructed using the latest event catalogues to enhance magnitude-frequency relationships.

- A higher resolution of hazard analysis has been introduced for Spain and Portugal. Vulnerabilities for both countries are improved using the latest scientific and engineering data.
- For Italy, vulnerabilities are updated for consistency with Spain and Portugal.
- For Greece and Turkey, the hazard and vulnerability modules for both countries are enhanced using the latest scientific data, and consistency is added to the analysis methodology.

The quality of aggregate exposure geocoding is increased with administrative boundary updates for all countries.

Model Specifications

GEOGRAPHIC COVERAGE

Austria, Belgium, Czech Republic, Denmark, France, Germany, Hungary, Ireland, Luxembourg, Monaco, Netherlands, Norway, Romania, Sweden, Switzerland and the UK (the 'Euroquake' bloc), Cyprus, Greece, Italy, Malta, Portugal, Spain, and Turkey

LINES OF BUSINESS

Residential, commercial, industrial, municipal, and agricultural lines of business are supported. Modelling of automobile exposures is newly introduced in RQE v. 13.

COVERAGE TYPES

Building, contents, and time-element risk are all modelled with separate vulnerability relations.

STRUCTURE TYPES AND OCCUPANCIES

With a full suite of representative structure types and occupancy categories, the model differentiates risk across hundreds of combinations. A common set of structure types and occupancies is available worldwide.

IMPORT RESOLUTION

Exposure data is accepted at resolutions of lat/long, postal code, city, CRESTA Zone and country. When input data is available only at aggregate levels, the model adds refinement to loss results by disaggregating exposure to a resolution consistent with the hazard generation. The disaggregation scheme is weighted by daytime and nighttime distributions of population.

HAZARD ANALYSIS RESOLUTION

Variable resolutions are based on population density and range between 0.1 and 0.05 degrees.

MODEL OUTPUT

Risk metrics include OEP and AEP loss exceedance curves, AAL, TVAR, and simulations of historical events. In addition, RQE's Year Loss Table (YLT) uniquely features three-dimensional output: simulation year, events, and sample outcomes. YLT and event loss results are supported at the portfolio level. Other risk metrics are supported at multiple levels of refinement: from total aggregate portfolio results to detailed output by policy and state.

FOR MORE INFORMATION, PLEASE CALL 866-774-3282
OR EMAIL US AT hazardrisk@corelogic.com

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