CoreLogic®

CATASTROPHE RISK MANAGEMENT

Italy Earthquake Model

Offering the latest understanding of seismic science and engineering specific to Italy

The Italy Earthquake Model is part of the suite of Catastrophe Risk Management from CoreLogic® included in the global multi-peril catastrophe modeling platform, RQE® (Risk Quantification & Engineering).

Comprehensive Seismic Source Modeling Methodology

Comprehensive modeling of seismic sources is based on the SHARE seismic hazard data. 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.

Hazard Definition

Ground motion intensity defines the hazard to a building, and this intensity changes as seismic waves move outward from the event epicenter. 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 the associated event epicenters and recurrence rates.

Attenuation Relationships

Ground Motion Prediction Equations (GMPEs), or Attenuation functions, define how ground motion intensity decays with distance from the earthquake source. Multiple, appropriately-weighted GMPEs are used to represent each seismic source type for the defined tectonic environments of Italy, including:

- Active Shallow Crust
- Stable Shallow Crust
- Subduction Inslab (Wadati–Benioff zone)
- Volcanic

Key Benefits:

- One of the first models in the market to implement SHARE hazard data
- Offers a competitive advantage with a current, accurate, relevant model
- Enables confidence in risk management based decisions
- Validated against recent historical events
- The model has been updated with lessons learned from 2016 Central Italy earthquakes
- 12 Vulnerability regions reflecting varying building practices and building stock in different parts of Italy
- Fit for Purpose to aid in regulatory compliance such as Solvency II

Regionally Differentiated Vulnerabilities

The vulnerability module of the Italy Earthquake Model is based on extensive field investigation of major historical global earthquakes, including damage and loss data from the 2009 L'Aquila, 2012 Emilia-Romagna, and the 2016 Central Italy earthquakes. Together with an assessment of local building codes and practices, CoreLogic engineering knowledge leads to rational, consistent vulnerability functions specific to Italy. Vulnerability functions differ by region, structure, occupancy type, building height, and age for 12 defined vulnerability regions across Italy.

Model Validation

Validation testing was carried out to test the robustness of each model component. Examples of that testing include:

- Frequency and magnitude of events generated by the stochastic model were compared with those of historical seismicity in Italy and the SHARE seismic hazard data.
- Probabilistic ground-shaking intensities were compared with the latest available research from the Istituto Nazionale di Geofisica e Vulcanologia (INGV), the organization devoted to real-time earthquake and volcano monitoring in Italy.
- Modeled 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 modeled losses.
- Model results from historical events were compared to specific client portfolio losses.

Comprehensive Financial Modeling

CoreLogic uses an engineering approach, claims data, and expert opinion to develop the vulnerability functions within the model. Damage from earthquake ground shaking is calculated using a series of vulnerability functions specific to construction type and occupancy. Vulnerability functions are created to calculate damage impacts for different building heights (low, mid, and high-rise), and are based on historically observed damage, experimental research, and structural calculations performed by CoreLogic engineers.

Full Suite of Structure Types and Occupancies

With a full suite of representative structure types and dozens of occupancy categories for each line of business, the model differentiates risk across hundreds of combinations, and allows only realistic pairings of occupancy and construction. A common set of structure types and occupancies is available worldwide.

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1-ITAEMF-0318-02

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