



AN ABS GROUP COMPANY



USQuake™

EOECAT's US Earthquake Model

EOECAT released its updated USQuake™ Model on July 31, 2010. The model embodies EOECAT's heritage as earthquake engineering pioneers and with this update, EOECAT continues to set the standard of scientific rigor in catastrophe risk modeling. The model is part of EOECAT's global multi-peril platform WORLDCATenterprise™ and delivers results unbiased with respect to location through its comprehensive stochastic event set, which is selected using strict tolerance requirements. Both the hazard and vulnerability components of the model offer unique modeling innovations, including multi-parameter vulnerability for residential structures and soil-based ground motion functions that accurately capture physical phenomena while eliminating bias.

Key aspects of the model include:

- **Soil-Based Attenuation Functions:** EOECAT goes one step beyond using next-generation attenuation (NGA) functions by incorporating soil-based attenuation (SBA)—a subset of NGA equations that assumes seismic waves propagate through soil. EOECAT's SBA approach reduces the modeling uncertainty introduced by applying soil amplification factors to the more conventional rock-based equations. Since the vast majority of insured exposure is located on soil, use of SBA necessitates far less adjustment for site conditions, allowing EOECAT to retain the improved confidence of the NGAs.
- **Time-Dependent Recurrence Rates:** Model results are influenced significantly by recurrence frequencies associated with large earthquakes in the event set. EOECAT has used time-dependent recurrence frequencies since 1997 because they reflect the scientifically-accepted physical mechanism of frictional stress build-up at the tectonic plate interface (the fault plane). Deep within the earth, where rock is molten, faults glide smoothly relative to one another, but at the surface, rocks are solid, thus "locking" the fault. An earthquake occurs when strain from continuous plate motion at depth overcomes frictional resistance of the interlocked surface. An earthquake is more likely to occur on a fault that is "late in its seismic cycle," relative to the average time between large quakes, and less likely on a fault where an earthquake has occurred "recently" (in geologic time). In regions such as California where earthquakes are common, time dependence, and thus the EOECAT model, represents not only the definitive scientific consensus, but also portrays risk within the foreseeable future, not just the theoretical "long-term."
- **Stochastic Event Set:** EOECAT uses stringent acceptance criteria in the development of the stochastic event set. For example, at any geographic coordinate, the spectral acceleration parameter matches USGS mapped values within 2% for return periods associated with damage. The resolution grid of earthquakes is constant across the landscape. This means consistent results. Since all geographies are modeled with equal confidence, even the most specialized portfolio will be modeled to the same high standards of accuracy as a market portfolio.
- **Hazard Definition:** Hazard definition is based upon the USGS hazard models and rupture forecast released in 2008. USQuake also captures USGS insights gained since then, including revisions and corrections through the end of 2009.
- **Vulnerability:** USQuake incorporates vulnerability curves that are well-honed from thousands of seismic studies conducted by EOECAT and ABS Consulting during the past 30 years, and are also founded on data from observations of 90 earthquakes worldwide. Vulnerability is also calibrated to tens of thousands of claims and exposure data points from the Northridge (1994) and Loma Prieta (1989) events. For residential structures, EOECAT represents vulnerability using a three-dimensional surface to capture the phenomenon of "damage acceleration"—the more damage that occurs during a given quake, the more susceptible a building becomes to further damage. By estimating damage from multiple input parameters rather than a single spectral acceleration, USQuake more accurately reflects data from thousands of claims.

USQuake™

EQECAT's US Earthquake Model

- **Perils Covered:** In addition to calculating losses from ground shaking, the model covers associated perils, which can either be included or excluded from analysis. Results for each peril are reported separately.
 - Fire Following Earthquake: Conflagration—widespread, uncontrollable fire that is initiated by an earthquake—can be the primary agent of damage. The model incorporates a ground-up methodology to model the physical mechanism of conflagration, ignition, spread, and suppression.
 - Sprinkler Leakage: Water damage to contents from sprinkler leakage can exceed shaking contents damage. The model accounts specifically for the resulting sprinkler leakage losses.
- **Coverage Types:** The model calculates damage to structures (building damage), contents, and damage related to time (loss of operations or loss of use). Separate, independent vulnerability functions are used for calculating losses relating to each coverage type. Time-element vulnerability functions are a function of structural and contents damage.
- **Loss Amplification/Demand Surge:** EQECAT applies a rational approach to demand surge, based upon the demand and supply for construction materials and labor in the affected region. Since economic factors undergo constant change, EQECAT updates the supply-side database for demand surge with each release.

All 50 states have some degree of earthquake risk. Areas of high risk include California and the Pacific Northwest, as well as Memphis, TN and Charleston, SC. EQECAT integrates updated building codes and construction practices with the latest science and engineering to produce this state-of-the-art USQuake Model.

MODEL SPECIFICATIONS

- **Importing Resolution:** Import and risk evaluation is geocoded at lat/long, ZIP Codes, and county levels. When exposure data is provided at aggregate levels, model calculations are based on a disaggregation weighted by daytime and nighttime distributions of population, restoring a degree of refinement to loss results.
- **Model Validation/Expert Review:** The hazard and vulnerability modules have undergone stringent peer review by internationally-recognized scientific experts. The methodology used in the hazard module has been reviewed and consented to by USGS scientists including Dr. Ned Field, the primary author of the Uniform California Earthquake Rupture Forecast (UCERF 2.0). The residential vulnerability module has been reviewed and consented to by the Pacific Earthquake Engineering Research Center (PEER).
- **Hazard Analysis Resolution:** For soil condition mapping, one of the most sensitive components of earthquake modeling, EQECAT maintains its high standards for confidence in loss results and uses eight layers of soil map data, each with increasingly fine resolution. Soil conditions for regions with high hazard and dense population are mapped within a tolerance of 40 feet.
- **Geographic Coverage:** The update covers the contiguous US ("lower 48"). Alaska, Hawaii, and Puerto Rico have not been updated with this release.
- **Lines of Business:** Property (Residential, Commercial, and Industrial) and Workers' Compensation
- **Structure Types and Occupancies:** With 29 different structure types and dozens of occupancy categories for each line of business, the model differentiates risk across hundreds of combinations. EQECAT's technical documentation provides guidance regarding appropriate modeled combinations, allowing only realistic combination of occupancy and construction.
- **Model Output:** Risk metrics include loss exceedance curves such as OEP and AEP, AAL, TVAR, as well as event-by-event losses with associated uncertainty and simulations of historical events. Reporting of results supports multiple levels of refinement: total aggregate portfolio, ZIP Code or county, and detailed output by policy and site.
- **Financial Modeling:** All major insurance policy structures and reinsurance treaty types are modeled, based upon WORLDCATenterprise™ platform functionality.

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