

- ADVANCED HAZARD MODELING
- STATE-OF-THE-ART ENGINEERING
- INDUSTRY EXPOSURE DATABASE

# The AIR Earthquake Model for Mexico

## ADVANCED HAZARD MODELING

**Comprehensive Data Set to Improve Assessment of Seismic Potential**

Earthquake risk in Mexico is dominated by subduction-related earthquakes—those that result when one tectonic plate is moving under another. Segments of a subduction zone can rupture singly or in “cascades” to produce even larger magnitude events.

## THE ISSUE.

## THE SOLUTION.

The AIR model takes into account information about historical earthquakes and the rate at which tectonic plates are moving toward each other in the region’s known subduction zones to capture Mexico’s complex seismicity. The model also considers cascading scenarios that have larger magnitudes than in the historical record to capture the full range of possible future seismic activity.

**Ground Motion Prediction Equations (GMPEs) Reflect Mexico-Specific Characteristics**

Mexico’s varied geology impacts the way seismic energy attenuates with distance from the earthquake rupture.

The GMPEs used in the AIR model capture the unique characteristics of Mexico’s crustal, subduction zone, and deep in-slab earthquakes. In addition, AIR seismologists developed custom modifications to reflect the impact of the Trans-Mexico Volcanic Belt—an active volcanic system situated in southern Mexico—which can amplify ground motion under certain conditions.

**High Resolution Geological Maps Capture Potential for Soil Amplification**

Soil properties play a critical role in amplifying or de-amplifying seismic waves.

The AIR model features three sets of soil maps at different resolutions, including a custom-designed map at 100 m resolution for the capital, Mexico City, which sits on an ancient lakebed consisting of soft clays that amplify long-period seismic waves.

## STATE-OF-THE-ART ENGINEERING

**Damage Estimation Based on Rigorous Engineering Analysis**

How buildings respond to earthquakes depends on both the ground motion and the building type. Traditional approaches to damage estimation, which rely heavily on expert opinion, don’t capture these complex interactions.

Damage estimation in the AIR model uses local expertise and state-of-the-art engineering analysis, including results from detailed computer simulations of buildings subjected to actual ground motion records from historical earthquakes. The model has also been calibrated to reproduce the unique damage patterns caused by the 1985 Michoacán earthquake.

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## MODEL AT A GLANCE

**FIRST RELEASED** 2006

**MODELED PERILS** Ground shaking

**CATALOG** The model incorporates a 10,000-year catalog of 505,439 simulated events, 47,467 of which cause loss to industry exposure.

**HAZARD MODULE** With a complete historical catalog that integrates all global, regional, and local catalogs, including:

- Global Earthquake Hazard Assessment Program (GSHAP)
- United States Geological Survey (USGS) Preliminary Determination of Epicenters (PDE) Worldwide Catalog of Earthquakes
- Harvard Centroid Moment Tensor (CMT) Earthquake Catalog
- Pan American Institute of Geography and History (El Instituto Panamericano de Geografía e Historia) Earthquake Catalog
- University of Mexico, Mexico City (UNAM)

**VULNERABILITY MODULE** Supports 42 occupancy classes and 22 construction classes; accounts for the impact of the evolution of Mexico's building codes and other local factors affecting the seismic performance of buildings in Mexico.

### STATE-OF-THE-ART ENGINEERING (contd.)

#### Considers Impact of Regional Construction on Building Vulnerability

The seismic performance of buildings in Mexico is greatly influenced by local construction practices, variations in workmanship and materials, and building code enforcement.

The AIR model takes into account these local factors and the evolution of Mexico's building codes in assessing the vulnerability of Mexico's various building types.

### SUPPORT FOR COMPLIANCE WITH CAPITAL REQUIREMENTS

### NO ISSUE HERE.

Mexico's insurance market is experiencing strong growth. Mexico-based insurers can use AIR models to manage their risk and make the case to regulators for a more tailored capital reserve that better reflects their portfolio's unique risk.

### INPUT SCHEMA FOR DATA IS TRANSPARENT AND PUBLICLY AVAILABLE

AIR has long been a proponent of open exposure data standards, as reflected by the UNICEDE® standard, which AIR makes available to the industry via a public website, [unicede.com](http://unicede.com). AIR was also the first catastrophe modeling firm to support the ACORD® exposure data standard.

### INDUSTRY EXPOSURE DATABASE

AIR's industry exposure databases provide a high-resolution view of properties and their respective replacement values—an invaluable tool in calculating industry loss estimates for all event types, whether simulated events from a stochastic catalog, or for actual events unfolding in real time.

### ABOUT AIR WORLDWIDE

AIR Worldwide (AIR) is the scientific leader and most respected provider of risk modeling software and consulting services. AIR founded the catastrophe modeling industry in 1987 and today models the risk from natural catastrophes and terrorism in more than 90 countries. More than 400 insurance, reinsurance, financial, corporate, and government clients rely on AIR software and services for catastrophe risk management, insurance-linked securities, detailed site-specific wind and seismic engineering analyses, and agricultural risk management. AIR is a member of the Verisk Insurance Solutions group at Verisk Analytics (Nasdaq:VRSK) and is headquartered in Boston with additional offices in North America, Europe, and Asia. For more information, please visit [www.air-worldwide.com](http://www.air-worldwide.com).