

A circular graphic with a blue border. The left side shows a photograph of a coastal area in ruins after a typhoon, with debris and damaged buildings. The right side shows a satellite map of Asia. The text 'ASIA TYPHOON MODEL' is overlaid in large, white, bold, sans-serif letters.

ASIA TYPHOON MODEL

**For a Better Understanding
of Risk Correlation in Asia**

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A Basin-Wide Typhoon Model for Asia

In 2010, EOECAT released the first basin-wide typhoon model for the western Pacific region. Introduced in 2011, WORLDCATenterprise 3.16 allows analysis of wind only and wind and rainfall-induced flooding combined.

The western Pacific basin is known for producing some of the world's most intense tropical cyclones. The combination of growth and underlying risk has created an increased risk profile that has profound implications for the global re/insurance industry. Recent notable events include Typhoons Morakot (2009), Hagupit (2008), Krosa (2007), and Saomai (2006), each of which resulted in more than USD \$1 billion in damage.

Broad Geographic Coverage

EOECAT's typhoon model for Asia provides consistent risk assessment

throughout the region and appropriately captures the relevant spatial correlations. Individual typhoon events in the region have the potential to affect multiple countries. Geographic coverage of the Asia Typhoon Model includes: Japan, China (PRC), including Hong Kong), Taiwan (ROC), South Korea (ROK), the Philippines, Thailand and Malaysia.

The global property insurance market continues to evolve. EOECAT will expand its geographic coverage to include additional countries.

Robust Hazard Definition

The Asia Typhoon Model derives the hazard definition from four data sources available for the period from 1945 to 2009, including the Joint Typhoon Warning Center in Hawaii, the Regional Specialized Meteorological Center in Japan,

the Hong Kong Observatory and the Shanghai Typhoon Institute in China. Statistics for key storm parameters are developed directly from location-dependent distributions for wind speed and other parameters such as radius to maximum winds, translational velocity, and azimuth. Tropical cyclone frequencies are based on the long-term storm climatology.

Comprehensive Agents of Damage

Primary agents of damage from tropical cyclones worldwide are the direct action of extreme winds upon structures, damage due to storm surge and rainfall-induced flooding.

The Asia Typhoon Model was updated in 2011 to allow analysis of wind only and wind and rainfall-induced flooding combined. With this update, users experience improved run times for wind only analyses. Clients also have greater insight into the underlying model assumptions.

EOECAT's Asia Typhoon Model is the first model to provide wind only and combined wind and rainfall-induced flood damages for all countries within the model. Storm characteristics, local geography, topography and settlement patterns in Asia elevate the importance of storm surge and rainfall-induced flooding.

EOECAT's Asia Typhoon Model has detailed hazard and vulnerability modeling for wind, with loss results

calibrated to the total losses from all three perils via elevation and geographically-based algorithms to appropriately reflect the storm surge and rainfall-induced flood losses spatially.

Local Vulnerability Functions

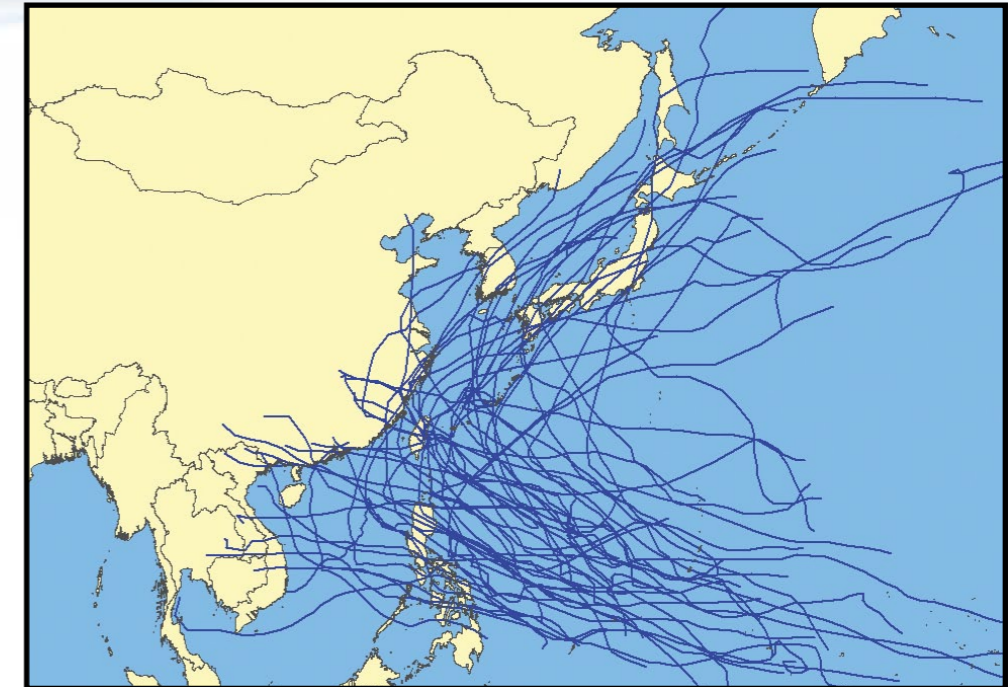
Separate damage functions are created for three main types of coverages—structure, contents, and time element. In addition to considering the variation in local building practices, design, and building codes, the model considers the age and height of the building to properly model damages caused by wind, storm surge, and rainfall-induced flooding. The model also includes separate damage functions for auto coverage.

EOECAT leveraged the expertise of ABS Consulting structural engineers throughout the region to gain valuable insights on regional variations in construction practices and quality, historical evolution of building codes and their enforcement, and other regionally-dependent factors in damageability.

EOECAT uses a blended approach of claims data, engineering, and expert opinion to create vulnerability curves that relate wind speeds to damageability.

Variable Import Resolution

Detailed risk differentiation is provided in the model, enabling the importation and evaluation of risks geo-coded to latitude/longitude



Key historical events since 1945, impacting the Asian eastern sea-board.

coordinate pairs, selected levels of postal codes and other commonly used geo-political entities, large city/urban areas, and CRESTA zones. For aggregate levels of exposure data, the model performs appropriate disaggregation for analysis and risk estimation.

Detailed Financial Modeling

In the last decade, Asian countries have had significant development of infrastructure and commercial and industrial development, with large investments in production plants and real estate. The Asia Typhoon Model supports facultative and high value re/insurance underwriting. The financial loss model is consistent with the financial modeling in other regions of the world. It supports a wide variety of policy terms and conditions, aligned with the local underwriting practices.

Flexible Reporting Hierarchy

EOECAT's Asia Typhoon model is suitable for risk differentiation and

pricing, risk aggregation as well as portfolio risk management, with suitable risk metrics and reports.

Model Validation with Expert Review and Historical Data

The model for typhoons in Asia is comprehensive and leverages historical data to create a robust probabilistic event set providing uniform extreme risk metrics for all locations in the basin. The event set includes approximately 150,000 stochastic and approximately 1,800 historical events. The model has been developed using detailed historical data, including storm footprint representations for each storm. The hazard and vulnerability models have been reviewed by the scientific community to ensure the model incorporates the best available science and provides plausible model outputs.



Typhoon damaged furniture showroom, second floor. Heavy damage was sustained to contents.