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Five Ways Moody's RMS™ High-Definition Modeling Helps You Manage Windstorm Risk

Between 1900 and 2021, tropical cyclone events accounted for eight of the top 10 costliest global natural disasters, with a combined insured loss of US$318 billion.[1]

1 Insurance Information Institute. (2022). Facts + statistics: Global catastrophes; source: Aon [table]. https://www.iii.org/fact-statistic/facts-statistics-global-catastrophes#Top%2010%20Costliest%20World%20Natural%20Disasters%20By%20Insured%20Losses,%201900-2021%20(1)

The Challenge of Estimating Windstorm Losses

Tropical and extratropical cyclones remain the driver of global natural catastrophe insured loss, due in part to high levels of insurance penetration across Europe, Japan, and the U.S. Regulatory focus is therefore high, and (re)insurers are required to provide evidence that they hold adequate capital for these types of events.

Yet, estimating losses is challenging due to the complex dynamics of windstorm events. For example, antecedent conditions can greatly influence the size of loss. This happened with Hurricane Harvey in 2017 when a previous severe storm had saturated the ground leading to the increased possibility of flooding as Harvey made landfall.

In addition, extratropical cyclones have the propensity to cluster - when a group of cyclones occur close in time - complicating the application of per-event reinsurance coverage, such as hours clauses, and increasing the volatility of aggregated loss figures.

HD Models Yield More Informed Decisions

Continuing on our 30 year experience modeling windstorm risk, we are expanding our portfolio of high-definition (HD) models for windstorms. The Moody's RMS™ Japan Typhoon and Moody's RMS™ Europe Windstorm HD Models are already available and have been fully rebuilt utilizing the most recent science and data, with plans to deliver the Moody's RMS™ North Atlantic Hurricane HD Models in the future.

The HD-model framework delivers a more realistic representation of wind risk, empowering the (re)insurance industry to make informed decisions on portfolio and risk management. With more transparent and accurate calculations, organizations gain a competitive advantage by better understanding windstorm risk.

WHY HIGH-DEFINITION MODELING?

Moody's RMS™ HD Models are the newest generation of our probabilistic modeling suite. The HD-model framework leverages cloud-based computing to enhance catastrophe model components and eliminate the need to make simplified assumptions.

Benefits of HD models include:

- → Temporal simulation of hazards and financial losses
- → Proprietary exposure disaggregation methodology
- → Ground-up loss calculations by sub-peril
- → High spatial resolution
- → And much more

Understanding Windstorm Risk Drivers

CHALLENGES IN MODELING TROPICAL AND EXTRATROPICAL CYCLONE RISK ARISE FROM SEVERAL FACTORS, INCLUDING:

- → Multiple perils: wind, storm surge, and flood following heavy rainfall
- → Seasonality and antecedent conditions
- → Storm clustering, when a group of cyclones occur close in time
- → Regional variability: several states or countries at a time can be impacted
- → Exposure resolution and primary characteristics, particularly for storm surge
- → Local wind and storm surge mitigation strategies and preparedness
- → Storm characteristics, such as peak wind speed, forward speed, and radius

Five Ways HD Models Help You Understand Windstorm

Let's explore how the Moody's RMS HD-modeling framework helps you address the unique characteristics of windstorm risk – so you can confidently deliver superior risk pricing.

1. Model the effect of storm clustering on losses

2. Understand the potential volume of claims before, during, and after an event

3. Incorporate time-dependent coverage conditions into decision-making

4. Overcome gaps in exposure data in storm-surge areas

5. Unify your view of climate risk across perils and regions

1.

MODEL THE EFFECT OF STORM CLUSTERING ON LOSSES

Typically, catastrophe models incorporate either an event-based or a time-based stochastic set. Both capture the range of catastrophic event characteristics relevant to potential losses and the relative probability of occurrence. However, event-based stochastic sets assume that events are fully independent.

Yet, the number of storms occurring within the same season and their proximity are influenced by the year-on-year variability in climate patterns. It increases the volatility in losses and drives the tail of the aggregate exceedance probability distribution. This happened with multiple storms in 1990 (Daria, Herta, Vivian, and Wiebke), 1999 (Lothar and Martin), 2015 (Desmond, Eva, and Frank), and 2022 (Dudley, Eunice, and Franklin, or Ylenia, Zeynep, and Antonia). Event-based models, therefore, do not appropriately consider storm clustering's impact on losses.

The HD-model framework uses a full simulation engine to provide a detailed and explicit time-based evolution for each event within realistic multiannual periods. This allows for a better representation of seasonality and the native implementation of windstorm clustering. The result? You can better cost the risk, from pricing to accumulation and reinsurance, using more realistic loss distributions.

“ Year-on-year variability in climate patterns increases the volatility in losses and drives the tail of the aggregate exceedance probability distribution. This happened with multiple storms in 1990, 1999, 2015, and 2022. Event-based models, therefore, do not appropriately consider storm clustering's impact on losses.”

2.

UNDERSTAND THE POTENTIAL VOLUME OF CLAIMS BEFORE, DURING, AND AFTER AN EVENT

Tropical and extratropical cyclones can impact areas exceeding 400 kilometers and 1,000 kilometers, with the most damaging wind speeds found close to the storm center. While there is a greater probability that buildings next to each other that are experiencing higher wind speeds will all be damaged, due to the scale of these storms, many claims can also originate from areas that experienced lower wind speeds, in which only a subset of buildings will be damaged.

Moody's RMS HD Models have been built using a four-parameter vulnerability approach. It explicitly models the probability of zero damage or total damage for a given hazard intensity. Coupled with a recalibrated vulnerability module, the innovative methodology delivers a more realistic view of claim frequency, where fewer buildings are damaged and those that are, use a realistic damage ratio (Figure 1, right).

More realistic location- and coverage-level damage ratios means generating more realistic gross loss distributions (after the application of limits and deductibles). This gives you more confidence in modeling results and the potential volume of claims a portfolio could generate for a given storm is easier to understand. The outcome is that, with HD modeling, your claims management is improved, and you are empowered to better know when and where to send claims adjusters.

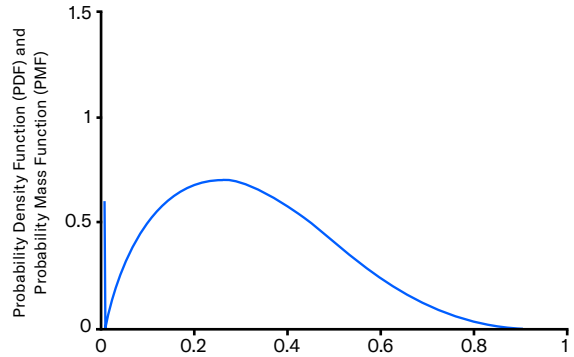


Figure 1: Example of the four-parameter probability density function and probability mass function used to describe vulnerabilities

3.

INCORPORATE TIME-DEPENDENT COVERAGE CONDITIONS INTO DECISION-MAKING

Windstorm reinsurance coverage often contains an hours clause – typically 72 hours – which is the duration an event can be considered as a single loss. But the tendency for storms to cluster makes this more complex, meaning losses within a 72-hour window could stem from more than one storm or the hours clause coverage could cut off in the middle of an event.

Clustered wind events happen more often than you think. In the years 1990, 1999, 2015, and 2022, Europe experienced several cluster storms within 72 hours (Figure 2). The challenge is to aggregate losses into one loss occurrence, or more in the case of reinstatements.

Accurately applying the hours clause and the number of reinstatements can improve your understanding of which terms and conditions are most suitable and help reduce the amount of litigation following an event. Yet, many catastrophe models are limited by computational power and do not account for time-based conditions.

With temporal simulation, Moody's RMS HD Models extend the catalog of reinsurance coverages you can model, including aggregated terms, multiyear contracts, bespoke hours clauses, and the number of reinstatements. This transparent and scientifically based approach to financial HD modeling helps you improve your risk transfer processes.

Storm Series

1990

Daria	January 26-27
Herta	February 1-6
Vivian	February 25-27
Wiebke	February 28-March 1

1999

Lothar	December 25-27

2015

Desmond	December 5-6
Eva	December 24
Frank	December 29-30

2022

Ylenia (Dudley)	February 14-19
Zeynep (Eunice)	February 14-19
Antonia (Franklin)	February 20-22

Figure 2: Storm series in 1990, 1999, 2015, and 2022, with those that occurred within 72 hours are in blue

4.

OVERCOME GAPS IN EXPOSURE DATA IN STORM-SURGE AREAS

Risk and corresponding losses from cyclone-induced storm surge are expected to grow because of rising sea-levels and increasing coastal exposures. And with a high gradient peril like storm surge, seemingly small differences in exposure details can result in large differences in modeled loss.

Exposure data plays a key role in your business decisions at the location, account, and portfolio level. For many regions, low-resolution or aggregate exposure data remains the norm, increasing uncertainty in risk pricing. This implies that the general location of a building is within a provided resolution or aggregation, such as postcode or CRESTA zone, but the exact location is unknown which can have a significant impact on losses including making risk more expensive for both the customer and for risk transfer.

Moody's RMS HD Models incorporate an HD disaggregation methodology that ensures more realistic mapping between possible building geocoding and local hazard severity across different lines of business and resolutions. This methodology distributes exposure data from low resolution to high resolution using the latest geographic information system (GIS) and satellite technology.

Better modeling of local hazard severity leads to a more realistic claims distribution for aggregate data. It also ensures improved decision-making across all use cases from pricing to accumulation and reinsurance.

5.

UNIFY YOUR VIEW OF CLIMATE RISKS

In recent years, flood, hail, and convective storm losses have dominated market discussions, causing (re)insurers to re-evaluate their exposure to climate risks. However, many catastrophe models do not have sufficient geographic coverage for these perils, causing users to adapt to different methodologies across multiple vendor models, even leaving some risk unmodeled. The lack of cross-country and/or cross-vendor correlation can lead to highly uncertain modeling results, underestimation of risk volatility, and the possible underestimation of reinsurance protection and reinsurance pricing.

For example, this situation occurred in 2021, when severe convective storms struck parts of France, Belgium, the Netherlands, Switzerland, Germany, and the Czech Republic, closely followed by catastrophic flooding. The result was that risk carriers were surprised by the need to buy extra protection in the middle of the year at very expensive rates.

With the full suite of Moody's RMS HD Models, critical situations can be prevented by making better-informed management decisions ahead of difficult times. HD Models are built on a consistent framework – utilizing the same exposure data, building inventory, simulation engine, vulnerability approach, and financial engine.

With this consistent, seamless framework, you can unify your climate analyses across perils for improved insight in both the near and long term. Detailed information helps you build a comprehensive view of risk to inform pricing, risk selection, and treaty structures.

“ HD Models are built on a consistent framework – utilizing the same exposure data, building inventory, simulation engine, vulnerability approach, and financial engine.”

MOODY'S RMS HIGH-DEFINITION MODEL PORTFOLIO

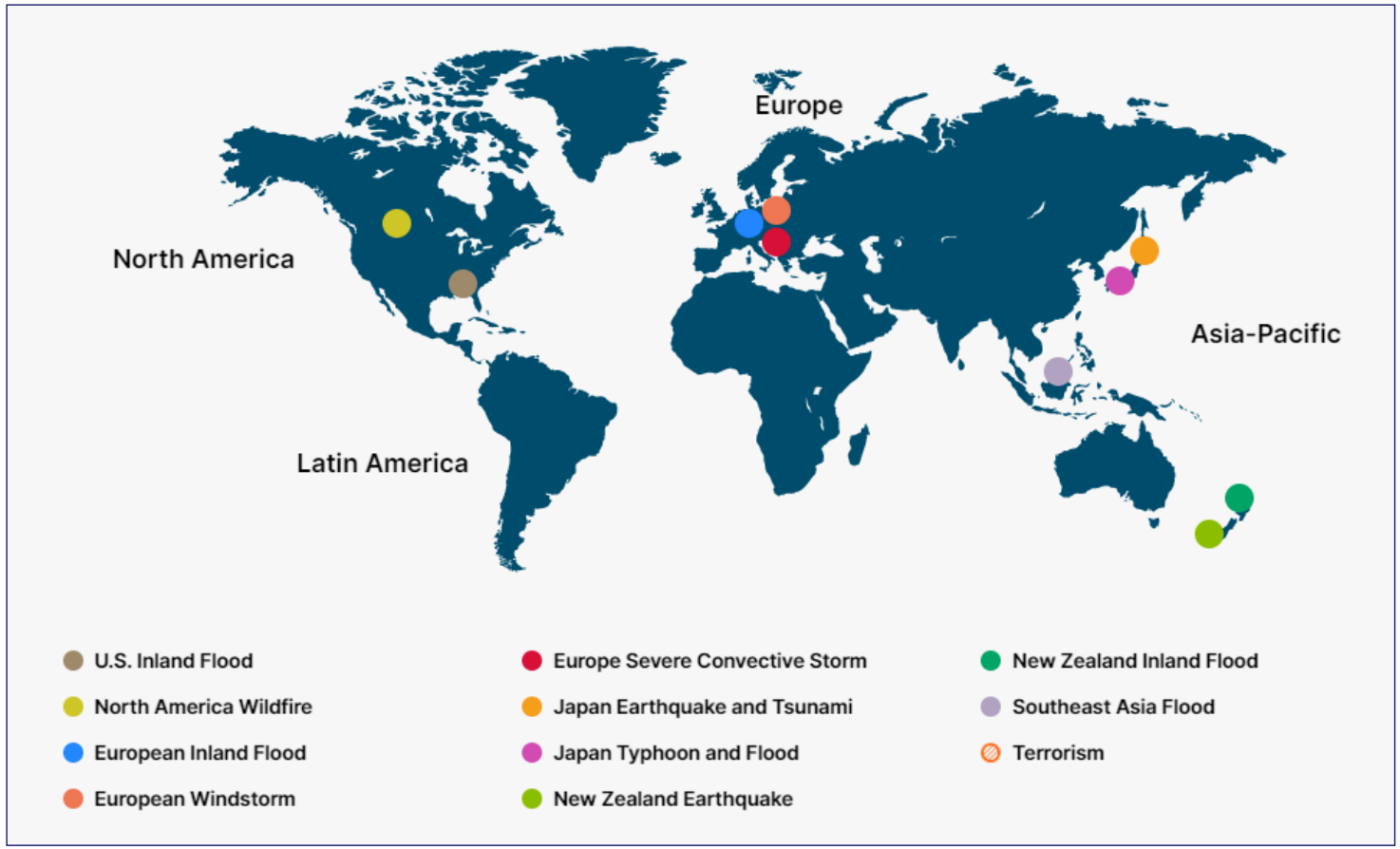


Figure 3: Coverage of the Moody's portfolio of HD models

Innovative Step Forward for Improved Windstorm Modeling

Moody's has been building catastrophe risk models for 30-plus years, and we are dedicated to serving the market with more detailed analytics and richer data insights. The innovative HD-model framework is the next step in addressing the industry's need for improved windstorm risk quantification.

The HD-model framework helps you understand a more realistic representation of wind, storm surge, and climate change risk ensuring you get the necessary insights to inform sound underwriting, portfolio management, reinsurance, and risk transfer decisions.

We fundamentally believe the HD methodology is the best way to understand catastrophe risk, which is why we will continue to develop HD models - adding to those already available - across perils including flood, earthquake, severe convective storm, wildfire, and windstorm.

If you would like to learn more about Moody's RMS High Definition Models™ or about specifics of modeling windstorm risk, contact your Moody's RMS sales representative.

Resources to explore now:

Europe Windstorm HD Models

Moody's RMS Europe Windstorm HD Models Unify Climate Modeling to Enhance Risk Selection Across the Continent

Moody's RMS Japan Typhoon and Flood HD Model

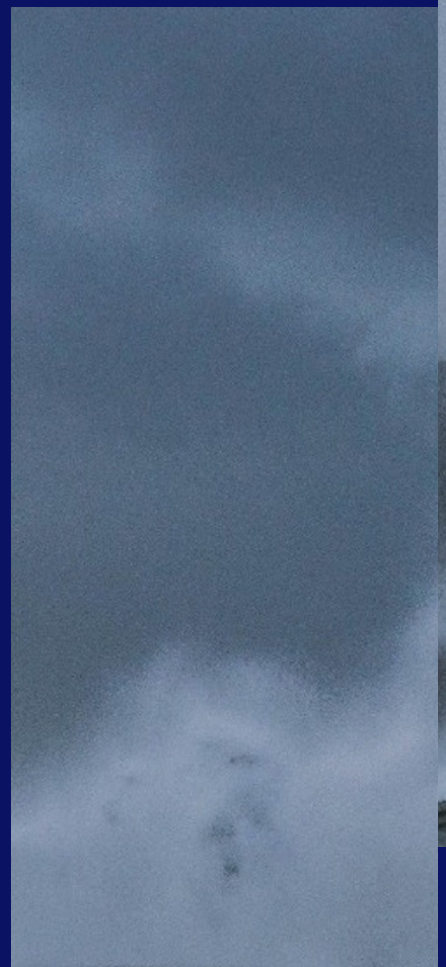
New Insights within the Japan Typhoon and Flood HD Model

ABOUT INSURANCE SOLUTIONS FROM MOODY'S

Moody's shapes the world's view of risk for insurers, reinsurers, financial services organizations, and the public sector, with Moody's Models underlying the nearly $2 trillion USD Property & Casualty industry. We empower organizations to evaluate and manage global risk from natural and man-made catastrophes, including hurricanes, earthquakes, floods, climate change, cyber, and pandemics.

Our unmatched science, technology, and 300+ catastrophe risk models help (re) insurers and other organizations evaluate and manage the risks of natural and man-made disasters. Leaders can address the risks of tomorrow with the Intelligent Risk Platform™, the only open cloud with collaborative applications and unified analytics that can power risk management excellence across organizations and industries.

Today's risk professionals trust Moody's to help them manage and navigate the risks of natural and man-made catastrophes.



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