GuyCarpenter

MODEL CHANGE MANAGEMENT

RISKLINK V23 NORTH ATLANTIC HURRICANE MODEL

July 2024

Key Takeaways

- Moody's RMS RiskLink v23 North Atlantic Hurricane model represents the most substantial update since 2011.
- There are changes in all model components, but the greatest contributors to modeled loss increases are the vulnerability updates.
- Although modeled losses increase moderately, or even decrease, for certain risk types and regions—such as residential risks in the Mid-Atlantic and Northeast—there are large increases for multi-family dwellings and commercial risks, especially homeowners associations, restaurants, and hotels.
- This model update causes meaningful loss changes to many portfolios, but should not trigger a significant change in pricing risks for catastrophe reinsurance because many risk bearers had adjusted baseline modeled losses from the prior version to bridge gaps in their underwriting results.
- With v23, some industry users have rolled back their adjustments partially or completely, since they consider this latest update more consistent with their view of risk.
- A meaningful percentage, but a minority of reinsurers already have adopted v23, and we expect adoption of this model version to increase as January 2025 renewals approach.
- Carriers will need to evaluate how v23 affects their own view of risk, including potential implications for underwriting practices, risk management strategies, and risk transfer needs.

This report on RiskLink v23's North Atlantic Hurricane Model Change Management covers the following topics:

- Impact on US Modeled Losses
- Hazard Changes
- Vulnerability Changes
- Other Changes
- Industry Exposure and Loss
- Market Impact
- Guy Carpenter Advisory on Model Change Management

Impact on US Modeled Losses

Guy Carpenter applied the RiskLink v23 North Atlantic Hurricane model to a sample of US client portfolios and observed a range of loss changes depending on property characteristics, lines of business, and geographical distribution. Table 1 shows the percentage changes by line of business and region. Exceptions occur for portfolios with high concentrations of property characteristics that are the key drivers of modeled loss changes. Insurer portfolio loss increases tend to be higher than the changes indicated by the model vendor. This is because the updated version assumes an increased percentage of newer and better built properties in the vendor's industry exposure, thus moderating its loss increases, whereas the building age of most insurance portfolios remains the same.

Moody's RMS North Atlantic Hurricane (NAHU) model has been updated biennially and submitted for approval to the Florida Commission on Hurricane Loss Projection Methodology (FCHLPM) for use in rate filings since its establishment. However, apart from event frequency, there have been no significant model changes to states outside Florida since 2015. In the meantime, new lessons have been learned from recent hurricane landfalls.

The RiskLink v23 NAHU model has incorporated updates to many model components. The largest contributors to loss changes are the revised vulnerabilities for certain occupancies, such as multi-family dwellings, commercial operations, homeowners associations, restaurants, hotels, and educational institutions. Vulnerability curves have been updated or refined by occupancy, construction class, year of construction, building height, and geographical region. This report summarizes the component changes to assist users with model change management.

Table 1: Guy Carpenter portfolio gross occurrence loss changes based on long-term event rates.

	AAL		50-Year Return Period		100-Year Return Period	
Region	**Residential**	**Commercial**	**Residential**	**Commercial**	**Residential**	**Commercial**
Texas	0% to 10%	15% to 30%	-5% to 10%	10% to 25%	0% to 10%	10% to 25%
Gulf	5% to 30%	20% to 40%	5% to 25%	20% to 35%	5% to 25%	15% to 30%
Florida	-5% to 20%	15% to 35%	-5% to 20%	15% to 35%	-5% to 20%	15% to 45%
Southeast	0% to 15%	35% to 45%	5% to 15%	35% to 45%	5% to 15%	30% to 40%
Mid-Atlantic	-10% to -5%	15% to 35%	-10% to -5%	20% to 35%	-10% to -5%	15% to 30%
Northeast	-10% to -5%	10% to 25%	-10% to 0%	10% to 40%	-10% to 0%	10% to 30%

Source: Guy Carpenter Client Loss Data

Hazard Changes

Event Rates

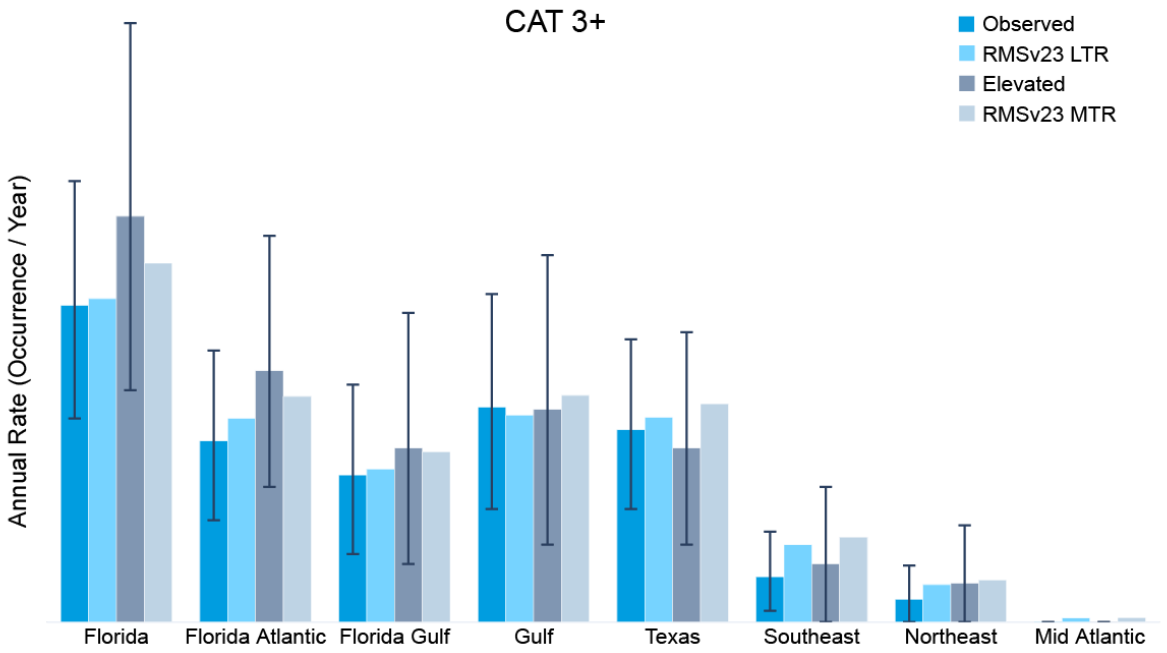
Long-Term Rates: The v23 NAHU model incorporated additional meteorological data, including the 2019 and 2020 hurricane seasons. The historic 2020 season brought 30 named storms, stretching to the 9th letter of the Greek alphabet, Iota. Of the 13 hurricanes in the Atlantic Basin in 2020, 6 made landfall in the continental US, and 4 struck the Gulf coast from Louisiana to Alabama. The overall v23 long-term event rate changes are on the order of +/- 2% to 3%, except for a larger increase in the Gulf region and a small reduction in Florida attributable to the inclusion of two seasons with no hurricane landfalls.

Medium-Term Rates: The v23 medium-term rates went further, incorporating the 2021 and 2022 hurricane seasons, with Hurricanes Ida hitting Louisiana and Ian hitting Florida. The resulting medium-term rates are higher than the corresponding long-term rates for all regions and hurricane categories, reflecting the continued elevated state of the Atlantic Basin relative to the climatological long-term average from 1900 to the present. Using medium-term over long-term event rates can result in an additional 2% to 5% increase in modeled loss changes.

Alternative Event Rates: Similar to prior releases, v23 offers 5 additional event rate sets to represent lower and higher storm activities. These alternative views are helpful at a time when insurers have concerns regarding both current elevated sea surface temperatures in the Atlantic Basin and developing La Niña climate conditions, with the latter tending to reduce vertical wind shear, thus favoring hurricane formation and intensification.

Figure 1 provides a comparison of the v23 model long-term (light blue) and medium-term (light gray) rates of major hurricanes (Category 3 or above), alongside the observed historical averages from 1900-2022 (blue) and the elevated periods of 1926-1969 + 1995-2022 (gray) with 95% confidence limits (black vertical bars).

Figure 1: Comparison of event rates of major hurricanes



Sources: Moody's RMS, NOAA/HURDAT2

Vulnerability Changes

A key lesson from recent US hurricane events is that model vulnerability for certain occupancies was underestimated in RiskLink v22. Claims data and observations from Hurricanes Irma (2017), Michael (2018), and Ian (2022) showed aggravated losses from wind-driven rain. In addition, observations revealed numerous instances of cladding and open protection damages for mid- and high-rise properties (see Figure 2). New residential and commercial claims data and reanalyzed claims from older events making landfall outside Florida (e.g., Katrina, Rita, Gustav, Ike, Irene, Sandy, Harvey, Florence, Laura, and Sally) also supported the need for a rigorous reexamination of vulnerability curves by construction, occupancy, building age, height, and secondary modifiers.

Figure 2: Cladding and opening protection damages

Source: Guy Carpenter Post-Ian Reconnaissance

Construction Class

Differentiated Damage Curves: Previously, construction class RMS4A (steel frame with concrete roof deck) was treated the same as RMS3A (cast-in-place reinforced concrete with concrete roof deck). Similarly, there was no distinction between RMS4C (steel frame with wood or metal roof deck) and RMS3C (reinforced concrete with wood/metal roof deck). Steel-frame buildings generally have more glazing than concrete structures, and taller steel-frame buildings are more likely to have glass curtain walls. Since these characteristics tend to make steel-frame structures more susceptible to damage than their concrete counterparts, the newly differentiated RMS 4A and RMS 4C exhibit slightly greater vulnerability than RMS3A and RMS3C, respectively, all else being equal.

Construction Class Damage Functions: The damageability of wood and masonry, precast reinforced concrete, and steel has increased. There also is a large increase in light metal risks. On the other hand, the damageability of cast-in-place reinforced concrete has decreased. No updates have been made in the damageability of mobile homes or automobiles. Portfolios using ISO Fire Codes to represent construction class may exhibit larger modeled loss increases because ISO Fire 3 for masonry non-combustible is mapped to only one RMS code, 4B, representing light metal in the NAHU model.

Occupancy Class

Multi-Family Dwellings, Commercial and Industrial Risks: Claims data and field observations show that multi-family dwellings and homeowners associations (not including condo unit owners policies) suffered substantial damage at lower return periods from water intrusion, and their common areas and exterior cladding produced higher losses than previously modeled. However, residential risks in New England, particularly urban brownstones, were found to be less vulnerable. These changes primarily affect modeled losses at lower return periods.

Commercial occupancies such as hotels, retail shops, and warehouses exhibited higher claims, as did educational

institutions. However, since restaurants often are inside a mall or commercial property, their damageability has been reduced. Separately, modeled losses for general industrial risks were deemed to have been underestimated, and therefore increased.

Industrial Facilities: Large industrial facility vulnerability curves have been completely rebuilt using an updated component-based methodology with smaller regional variations. The exact direction and magnitude of loss impacts due to these changes are highly dependent on exposure composition (including year of construction) and region. As a result of decreased regional variability for the same class of risks, modeled losses in Florida have increased, whereas a reduction is seen outside the state. Users will find an increase in modeled losses for petrochemical refineries, but a decrease for wind farms at lower wind speeds to reflect improved turbine construction. Modeled losses for airports and substations also have decreased. If a risk is coded with an unknown year of construction, then its modeled losses generally decrease because v23 assumes a greater share of newer risks than the prior version.

Age of Construction

Vulnerability for the construction-year band beginning in 2009 was refined with a new band starting in 2021 for the continental US. In v23, vulnerability differentiation by year built has been recalibrated to reflect:

- regional building code updates;
- variation in roof age and degradation within each construction-year band, taking into consideration increased prevalence of water intrusion damage at lower wind speeds; and
- more appropriate code impacts in each region for different occupancies associated with various building heights and construction classes.

As a result, users will see modeled losses increase for risks built between 1995 and 2020. In addition, credits to newer high-rise multi-family homes and commercial risks were reduced because improvements in building codes to strengthen roofs have less impact on these properties.

Building Height

Contrary to prior releases, the v23 damage curves diminish with increasing building height across all wind speeds. For this update, vulnerability curves were updated differently for mid- and high-rise commercial buildings compared to low-rise commercial buildings. These updates account for increased water intrusion effects at lower wind speeds, particularly in high-rises, and a reduced impact of construction class variation with increasing height. The net result of the updates is a greater modeled vulnerability for mid- and high-rise commercial structures at lower wind speeds and potential reductions at higher wind speeds. Overall, this leads to increases in modeled losses, more so for high-rise than mid-rise properties.

Florida Roof Replacement

On May 26, 2022, Florida Senate Bill 4-D took effect, modifying the state's rule that an entire roof had to be replaced if 25% or more were repaired or replaced. Now, as long as the rest of the roof complies with the 2007 or later Florida Building Code, a full roof replacement is not necessary. Consistent with this change, v23 was updated to recognize that the property owner is not required to complete a full roof replacement for roofs built after March 1, 2009 (the effective date of the 2007 Florida Building Code).

Secondary Modifiers

Credits and penalties for roof age and construction quality were updated. In addition, construction quality codes were updated to align with the IBHS Fortified program standards.

Vulnerability Regions

The v23 model has updated regional vulnerability relativities for specific, particularly commercial, lines. In Florida, the new release has updated regional relativities for multi-family dwellings and commercial risks, as well as concrete/steel buildings based on claims analyses and damage observations from hurricanes Irma (2017) and Michael (2018). Some point postcodes (often associated with large enterprises) were reassigned to coastal vulnerability, recognizing improved, less damageable construction.

Other Changes

Some of the changes indicated below may have a large impact on individual risks and underwriting decisions, but not necessarily cause material changes in portfolio losses.

Geocoding: For risks whose geographical location cannot be determined to street level accuracy, v23 reaggregates the postcode or county wind hazard based on updated (i.e., March 2022 vs March 2020) US mainland postal code and county boundaries. Furthermore, an expanded reference of building level, address point, street coverage, and points of interest database was used to improve geocoding results for US mainland risks.

National Land Cover Database: The National Land Cover Database (NLCD) was updated from NLCD 2011 to NLCD 2016 for Florida according to FCHLPM's specifications, thus

capturing new land development. An example is the growth in Bradenton, Florida (see Figure 3), between Tampa and Sarasota.

Figure 3: Boston Common Glen, Bradenton, Florida

Source: GC AdvantagePoint®

NLCD 2016 was released in 2019. Given the lag in release, catastrophe models have been behind in capturing more recent land development. An example is the growth in Fort Meyers, Florida (see Figure 4).

Figure 4: Hidden Estates Circle, Fort Meyers, Florida

Source: GC AdvantagePoint®

Building Inventory: The v23 update introduced a greater differentiation of building stocks, representing the most extensive change since 2011. In this version, suburban is split into suburban high and suburban low to recognize the different prevalences of high-rise (>14-stories) vs. low-rise (1-3 story) buildings. The update includes newer construction and taller buildings, particularly in CBD and urban regions. It also includes more high-rise apartments and hotels along the coastline. In general, the update added many newer properties with better performance against hurricanes, leading to lower damage ratios, although this does not hold for all regions. For example, there are more vulnerable masonry and wood construction residential risks in the Northeast and commercial risks in the mid-Atlantic and Northeast Urban and CBD regions. The inventory profile is used to derive a distribution of vulnerability curves when a particular risk's primary building characteristic is absent in the modeling data, and this can lead to a lower or higher than actual modeled damage ratio.

Post-Event Loss Amplification (PLA): In the past, PLA factors were a function of region and coverage, with no differentiation among occupancies except in Florida, where specific PLA factors were applied to single-family dwellings. In v23, PLA factors are further differentiated by line of business, where they are often larger for commercial and industrial risks and business interruption coverage. Furthermore, their variabilities are modeled. Informed by Hurricane Michael (2018), v23 allows super catastrophe effects beyond metropolitan areas. Together with the vulnerability increases, PLA is triggered for more events in v23. Guy Carpenter has seen material PLA increases in the updated model, most notably for commercial portfolios in Florida.

Industry Exposure and Loss

Prior updates of the RMS Industry Exposure Database (IED) were based on trending 2010 US census data. In v23, a new methodology and 2020 census data were used. For residential risks, v23's IED shows increases in the number of units and/or insured value per unit. In Florida, the difference came mostly from increased unit value, whereas in New York, there were increases in both the number of units and value per unit. For commercial and industrial risks, the database recognizes a significant increase in insured values to account for larger building stocks and replacement costs informed by updated building footprints to estimate square footage and building height. The overall exposure increase was responsible for a large increase in modeled industry losses and a major shift in the exposure profile across the US. This has important implications for market share analyses and strategic growth studies that depend on Moody's RMS IED. An insurer that wants to use industry loss warranties or Guy Carpenter's CWIL® (County-Weighted Index Loss) will need to compare the correlation of its portfolio with that of v23's IED to understand the basis risk better.

Market Impact

Guy Carpenter surveyed (re)insurers on their views regarding RiskLink v23, and found they generally considered it a positive upgrade, more consistent with their own views of risk. (Re)insurers had adjusted v22 loss

estimates by including additional loads, so in migrating to v23, many rolled back their adjustments partially or completely – although some (re)insurers believe additional loadings are still needed to account for climate change. Reinsurers report receiving some v23 modeled losses for mid-year renewals.

Although the expected impact on reinsurers' views of risk is minimal, cedants will need to consider potential impacts on their own views. Internal corporate, regulatory, and/or rating agency implications may affect underwriting practices, risk management strategies, and risk transfer needs. The v23 update has been approved for use in rate filings in Florida, South Carolina, and Louisiana.

Guy Carpenter Advisory on Model Change Management

Model users adjust default outputs to incorporate new scientific discoveries, engineering advances, claims observations, and regulatory reforms—all of which can occur in the absence of a model change. Therefore, a model change initiated by a model vendor, if done correctly, should be consistent with user expectations.

Guy Carpenter has reviewed v23 extensively and acknowledges that the updated version has taken many new observations into account and is in better agreement with our view of risk. We believe a comprehensive understanding of the impact of this model change on insurance portfolios is valuable for underwriting and capital management, as well as communications with reinsurers, regulators, rating agencies, and market analysts.

The present report described the model update's range of effects on a large sample of insurers' portfolios; provided an overview of its changes by component; and considered its current market impact. Since every insurer possesses a unique portfolio of risks, the fitness of v23 requires careful validation and attention in each specific application. To this end, we make the model change management recommendations of Table 2.

For further information, please contact Guy Carpenter's Global Analytics and Advisory Team to support RiskLink v23 NAHU model change management.

Table 2. Guy Carpenter Model Change Recommendations

Model Changes	Guy Carpenter Recommendations
Event rates	• Long-term rates exhibit good agreement with the historical record. Medium-term rates offer a more conservative view, but there is volatility from version to version. The alternative rate sets remain valuable for sensitivity testing.
Construction mapping of ISO Fire Code 3 (masonry non-combustible) to RMS 4B (light metal)	• Guy Carpenter recommends mapping ISO Fire 3 to RMS 2 (masonry), or for high-rise and other appropriate buildings to RMS 4 (steel) in modeling the peril of hurricane. Take care not to make the mapping to RMS 2 for the earthquake peril.
Unknown roof age assumption derived from year of construction	• Specify roof age in modeling data. Otherwise, the model will assume an older roof based on the risk's year of construction.
Increased modeled losses from rain intrusion	• If policy wording excludes coverage for water intrusion, then specify the extent of opening protection in modeling data.
Increased modeled losses based on claims and post-event reconnaissance from past hurricanes, including Irma (2017), Florence and Michael (2018), and Ian (2022)	Insurers should validate the model with their recent loss experience, since several legislative reforms designed to control claims were passed in Florida. • SB 2-D and subsequent bills funded and expanded the My Safe Florida Home Program to provide matching funds up to $10,000 to homeowners for strengthening their properties against hurricane damage (38,000 grants were distributed as of May 23, 2024). • SB 4-D stated that if a roof is built in compliance with the 2007 (or later) Florida Building Code, then full roof replacement is no longer required if 25% or more of the roof is repaired or replaced. • SB 2-A: (i) forbids assignment of benefits to third parties; (ii) ends one-way attorney fees that favor policyholders in legal disputes against insurers; and (iii) reduces the claims reporting period from 2 years to 1 year.
Post-event loss amplification (PLA)	• If modelled PLA effect increases above claims experience, consider taking advantage of the new feature in v23 for PLA adjustments.
Increase in RMS industry exposure and losses	• If an insurer is interested in an industry loss warranty or other industry-linked risk transfer, then a recalibration of its own portfolio's match with the RMS IED is needed to understand the basis risk. • Strategic growth studies that depend on the RMS IED should validate its goodness of fit with other data sources.

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About Guy Carpenter

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