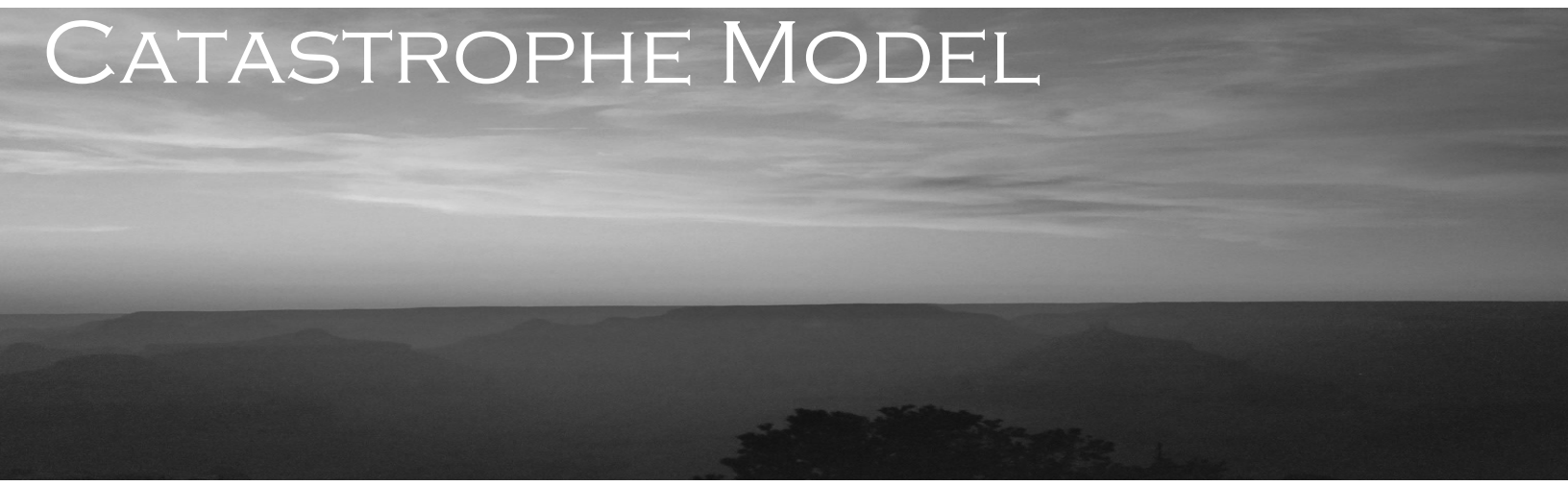
The Impact of Changes to the RMS U.S. Hurricane Catastrophe Model



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Introduction

In May, Risk Management Solutions, Inc. released a newly calibrated catastrophe model for Atlantic tropical storms that has dramatic implications for property insurance capacity, underwriting, and pricing. The revision reflects a re-examination of the factors that drive the RMS hurricane model based on newly available data and analysis in the wake of record storm seasons in 2004 and 2005.

The new model projects greater potential losses based on an increase in Atlantic hurricane activity, new assessments of building performance and a more detailed understanding of how a confluence of circumstances amplifies losses in a severe catastrophe.

The revisions in RMS RiskLink 6.0 will accelerate a shift that is already under way in the property insurance industry as primary carriers and reinsurers re-evaluate their exposure. During this period of transition, the property specialists at Napco will use risk assessment capabilities, market intelligence, and relationships with underwriters to ensure that our partners in the agent/broker and risk management community experience as little disruption as possible.

This report summarizes the major changes in the RMS hurricane model and how they will impact retail agents and brokers and their clients.

Highlights: Major Changes and Implications

Greater loss projections reflect a new era of hurricane activity with an expected increase in the frequency of major hurricanes (Category 3-5) making landfall in the U.S. The updated RiskLink model provides a five-year, forward-looking view of risk for estimating potential catastrophe losses, in contrast to a long-term historical average baseline used for previous catastrophe model results.

- ***As a result of these changes, modeled losses will increase by 25% to 40% on average for the coastal regions of the U.S***

Property vulnerability has been redefined to provide greater sensitivity to occupancy, year built, construction type and number of stories.

- ***Underwriters will demand far more explicit, accurate and complete information than ever before to properly evaluate and price risks.***

The notion of ***demand surge*** has been expanded in scope and in severity. It is also now considered one component in a new concept called ***loss amplification***. Loss amplification takes into consideration several new causes of additional loss, including delay in repair, claim inflation and coverage leakage.

- ***Demand surge alone now can increase estimated losses by up to 30% in the most severe cases.***

A new loss modifier called Super Cat now applies to some regions. RMS has identified 10 metropolitan areas that could experience a Super CAT event—a combination of factors that could lead to the scale of damages seen in Hurricane Katrina.

- ***A Super Cat event can add up to 125% in additional damages.***

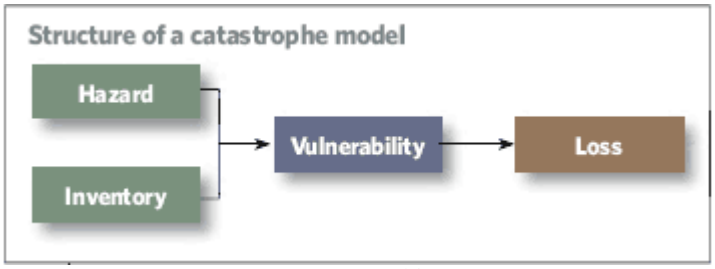
The revisions to the RiskLink Atlantic hurricane model, though part of a regularly scheduled update, are more significant than any previously undertaken, with far-reaching ramifications for the entire insurance industry and insurance buyers. As the new version of the model is implemented, major changes will be required of primary insurance carriers, reinsurers, wholesalers, brokers, agents and clients. Pricing in vulnerable areas will be greatly impacted, and patterns of availability transformed. As insurers—and rating agencies—reassess coastal exposure through the lens of the new loss projections, there will be a continued rebalancing of portfolios and realignment of capital reserves. An investment in gathering of complete and accurate property data is critical to avoid costly, worst-case classification and pricing.

Behind The Changes

Following the severe 2004 hurricane season, RMS had already begun to re-examine its hurricane model as part of a regularly scheduled review. Among the six major hurricanes of 2004, Hurricanes Charley, Frances, Ivan and Jean all made landfall in Florida, setting records for multiple storm season statistics and causing billions of dollars in damage. The 2005 hurricane season was even more severe, breaking the one year old records for the number of named storms and the lowest central pressure measured in a hurricane, among many others. Updating the model became more critical than ever. Two concurrent research efforts led to the dramatic changes in the "hazard" and "vulnerability" aspects of RMS RiskLink 6.0, each of which is discussed in the following sections.

Anatomy of a Cat Model

Catastrophe models help insurers identify the likelihood of a natural disaster event, and then project the range of expected losses. Models apply simulation techniques in combination with a vast store of data on storm frequency and behavior (Hazard) and property construction and location (Inventory) to measure the vulnerability of a portfolio. Based on the vulnerability of the portfolio, losses can be estimated based on the direct costs of repair and replacement, along with the indirect costs due to business interruption and relocation expenses.



Source: New Catastrophe Models for Hard Times, *by Patricia Grossi and Howard Kunreuther*

The "hazard" part of the model deals with the likelihood and behavior of hurricane events. In the past, RMS has used a 100-year historical record of storms, mostly emphasizing the last 50 years as a basis for their stochastic event set. This event set is a bank of storms, tracks, severities, landfalls and associated storm surges that serves as the basis on which the model predicts physical and economic damages. When a property portfolio is imported into RiskLink, the model picks a representative selection of storms across all probabilities that threaten the property in question and assigns calculated damages to the property for each scenario.

While the event set is historically accurate, it does not account for cyclical variations—such as the presence of an El Niño or La Niña or long-term temperature fluctuations, whether natural or manmade—that could affect the severity of a hurricane season. Consequently, model results have been accurate over the long term, but less so in any given three- to five-year period.

To address this weakness, RMS conducted extensive research on storm activity patterns and climate variability. Its analysis found that since 1995, there has been a marked increase in sea surface temperatures and associated changes in atmospheric circulation. Higher sea surface temperatures are strongly linked to a higher rate of hurricane activity in the Atlantic, and it appeared that climate changes might cause higher sea surface temperatures to persist. To validate their findings, RMS convened a panel of esteemed researchers from Florida State University, the Massachusetts Institute of Technology, Princeton University and University College London. The panel confirmed that whether the result of natural cycles of variability, or due to global warming, higher sea surface temperatures are here to stay for at least five years.

RMS plans to annually review and assess climate conditions and research on hurricane activity and to incorporate new information into future updates.

A Medium-Term View of Risk

The evidence collected by RMS indicated that over the next five years, the frequency of hurricanes that make landfall would be greater than the long-term historical average. The recognition that the long historical record is no longer a good predictor of future activity necessitated a new view of risk.

The RMS model now incorporates a five-year, forward-looking perspective when estimating hurricane activity and landfall rates. With every revision of the model, the event set will change to reflect the most recent five-year period. This represents a significant departure from the historical perspective previously used, which drew from a sample database of storms going back 100 years.

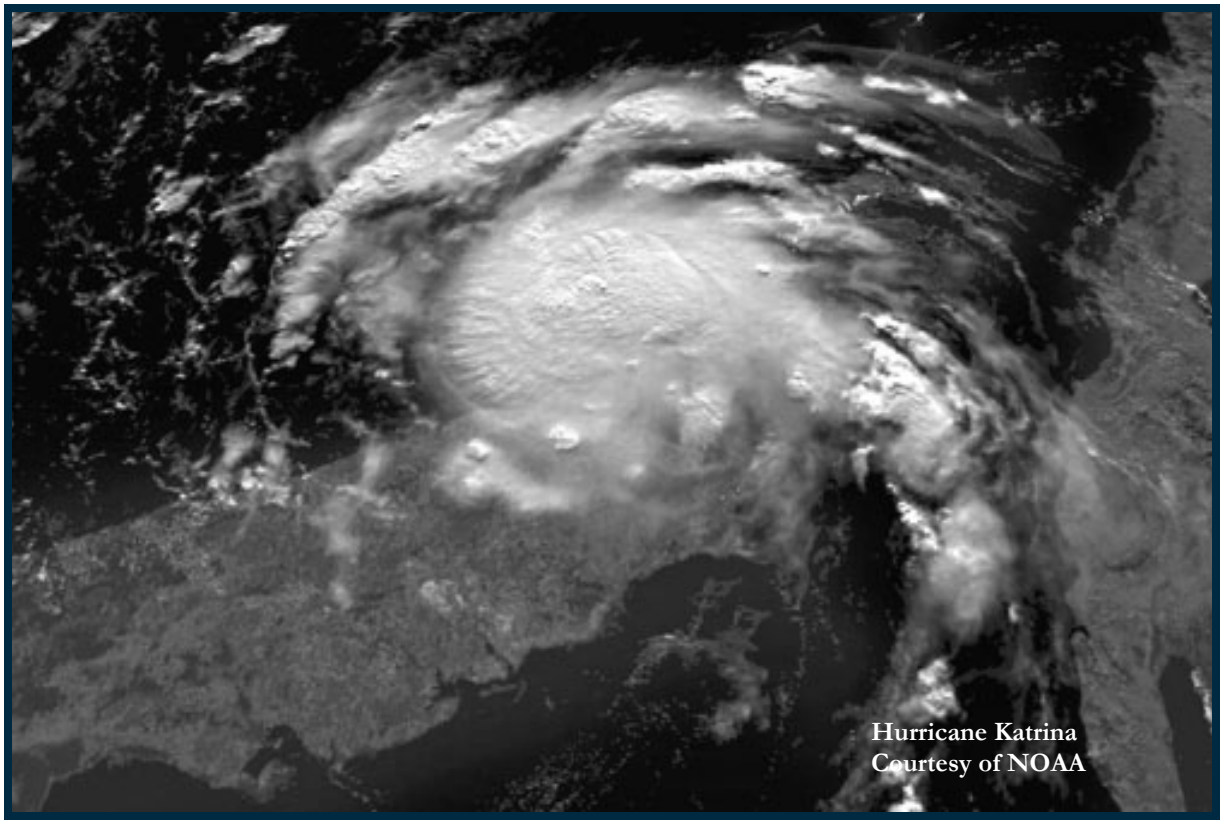
Instead of looking a century behind, model results will now be based on events in the most recent five years.

Greater Losses Expected

As expected, the shift from a long-term to medium-term perspective dramatically increased loss projections. Based on the new five-year perspective, RMS expects that:

- The likelihood of a Cat 3 storm-making landfall on the U.S. coast will be about **20% higher** than previously modeled.
- Modeled losses will **increase by 40%** on average for the Gulf Coast, Florida, and the Southeast.
- Modeled losses will **increase by 25% to 30%** on average for mid-Atlantic and Northeast coastal regions.

These changes in loss estimates are solely attributable to revisions in storm frequency and severity. Additional increases are possible through other aspects of the model, such as vulnerability functions and loss amplification. It is also important to note that the new five-year perspective doesn't heavily weight the impact of Hurricane Katrina. While Katrina certainly provided new and important lessons, particularly regarding the amplification of insured losses in severe catastrophes, increased losses in the new five-year perspective is driven primarily by the consequences of climate changes.



Hurricane Katrina
Courtesy of NOAA

RMS analyzed the unprecedented amount of claims data available from the past two storm seasons to enhance the model's ability to calculate wind and storm surge losses based on the vulnerability of properties. The new vulnerability analysis was facilitated by the collection of $13 billion in insurance claims data from the 2004 and 2005 hurricane seasons, the increasing cooperation of carriers and better quality information about properties. This represented a rich and varied source of knowledge that was previously unavailable to the model's designers.

RMS field investigators gathered physical data in areas struck by Hurricane Katrina and consulted with officials of the U.S. Federal Emergency Management Agency and U.S. Army Corps of Engineers to recreate the circumstances that made Katrina and the associated flooding such a monumental disaster. They also studied the effect of the continued economic dislocation in Florida, which was struck repeatedly by severe hurricanes over the last two seasons.

The analysis allowed RMS to better describe what constitutes vulnerability to a hurricane and modify the model to account for it. RMS also will recommend improved methodologies that users of its model can implement for more accurate results.

- Most importantly for agent/brokers and their clients, ***RMS has determined the priority of property-specific data most important for the software to accurately model potential losses.***

Key Vulnerability Factors

The new model has increased and re-ordered the importance of four key property factors that define vulnerability: **occupancy, year built, construction,** and **number of stories.**

Detailed information on the impact of these four elements greatly affects the sensitivity of the model.

- ***It will be more important than ever to have explicit, accurate and complete data on high priority property characteristics.*** Properties with the worst possible combination of these four factors could generate estimated losses up to **eighteen times** greater than losses for a property with the best possible combination of the factors, as compared to **three times** under the previous version of RiskLink.

1. Occupancy Type

How a property is occupied has moved to the top of the list in determining vulnerability. In the past, occupancy was considered only with regard to time element losses, most specifically business interruption. With new data available, RMS has determined that occupancy is a strong predictor of content losses and modifies building loss projections to a smaller degree. Some occupancies also result in much larger than average property damage claims because of their unique characteristics. Knowing the building is a retail establishment, the model can project losses from a write-off of damaged inventory. Hotels and restaurants are vulnerable to spoilage and contamination losses. Golf courses face significant losses due to landscape damage while gas stations are exposed to additional risk from canopies that blow over.

2. Year Built

The year in which a property was built is next in importance. Building codes and permit standards in effect at time of construction greatly impact the ability of the property to withstand hurricane damage. For example, in Florida, post-2001 construction is in a better position to withstand damage than construction completed between 1994 and 2000. RMS has identified six geographic vulnerability zones along the U.S. coastline to reflect differences in such factors as the quality of building codes and the degree to which they're enforced and building performance during previous hurricanes. Louisiana, Mississippi and Georgia, for example, are penalized for very lax code enforcement and permitting standards.

3. Construction Type

Although the type of construction is still important in modeling losses, general construction information is less valuable today than in the past. That is because the model itself contains almost street-level data about the average distribution of building types in most coastal areas. In order for construction type to significantly alter loss projections, ***very detailed data about construction is needed***. For example, while analysts have found that most modern steel and concrete buildings are equally resistant to storms, a metal deck roof makes a building much more vulnerable to windstorm damage than a building with a cast-in-place concrete roof. It is also important to distinguish light metal from steel frame construction, as they are very different in wind load resistance.

4. Number of Stories

The number of stories in a property has always been a very significant factor, though in the current model it is of lower importance relative to occupancy, year built and construction type. The number of stories determines the building's aerodynamic profile when faced with a severe hurricane as well as the extent of damage from a potential storm surge. Lower buildings, for example, are more exposed to surge losses, since the majority of their values are low to the ground. Taller buildings have more exposure to wind shear; if, however, a building's roof is damaged, less of it is exposed to wind damage, than if it was shorter.

Improvements in the granularity of data and analytical techniques have enhanced the ability of the model to differentiate risk based on the number of stories in a building.

Focus on Fundamentals

These four factors are considered the most essential in assessing the vulnerability of commercial property to a hurricane. While these factors have been present in previous versions of the catastrophe model, ***the most recent update is significantly more sensitive to how varying these characteristics affects vulnerability***.

Unless all of the fundamental information is provided, the model will ignore any additional modifiers. For example, secondary modifiers, such as whether the windows are wind-resistant and roof is anchored, will be ignored if the building's height and age are unknown. Once those four primary factors are known, the most significant secondary modifiers for windstorm vulnerability are shutters/windows, roof anchors, basements and cladding type.

There also will be much greater emphasis on using more physically descriptive construction and occupancy class coding schemes, such as those from RMS or Applied Technology Council (ATC). The insurance industry has, in the past, relied a great deal on the ISO Fire Scale. While extremely useful for assessing fire exposure, it can be misleading in hurricane models. For example, the RMS hurricane model always translates ISO 4 (non-combustible) as "braced steel frame," which is very resistant to wind. However, that same ISO classification, accurately applied to an airplane hangar, would severely underestimate the windstorm vulnerability of the light metal structure.

- ***In the coming months, carriers will be requiring that the primary factors be brought up to date for the properties they insure in addition to new business.*** Data integrity and accuracy are of the utmost importance. The models include tools to flag incomplete and potentially fraudulent data. Firms that provide valuation tools to the industry will continually test the models for data integrity and accuracy.

The revised model also encompasses a new concept called "**loss amplification**," which represents a broadening of previous efforts to model additional classes of economic damage. Loss amplification looks beyond "demand surge" to encompass several new causes of additional loss necessary to project losses accurately under severe conditions. In addition to demand surge, they include repair delay, claims inflation and coverage leakage.

Demand Surge

Demand surge refers to incremental losses that result from an increase in replacement costs attributable to shortages in building materials and service providers. For example, when a major hurricane strikes and many of the city's building roofs need replacement or repair, roofers increase their prices and suppliers run low on materials. The increased demand drives up replacement costs, and therefore increases the losses estimated by the model.

Demand surge was the only loss amplifier included in the previous release of RiskLink, and its effect was capped at about 17%. The RMS analysts have found, however, that the effect of demand surge was previously underestimated and that it also has an effect on contents and business interruption losses**. The new cap has been increased to 30% in the most severe cases.**

When there is leftover demand from prior disasters, the new model adds an implicit residual amount of inflation, even before the next season's events occur. For the current hurricane season, Florida and the Gulf Coast have a 15% residual added to damage results. Even with this addition, the model caps the additional recovery costs at 30%.

Delay in Repair

Evacuation, labor shortages and other factors can cause a delay in repairs to damaged properties. When the delay is lengthy, additional damage from mold, spoilage, contamination and moisture infiltration can occur, exacerbating the direct storm damage. Delays in repair can amplify property, contents and time element losses.

Claims Inflation

Claims inflation or exaggeration can occur after a severe event results in an overwhelming number of claims. The desire to help policyholders by settling claims promptly may conflict with prudent and proper claims adjusting practices. Insurers also face societal and political pressure to settle large volumes of claims quickly—and generously—to restore the community and local economy. Given these circumstances, inflated and fraudulent claims invariably slip through the cracks. The amount of additional damages due to claims inflation is capped at 7%.

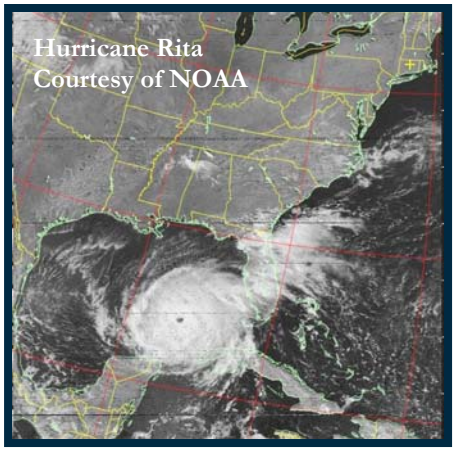
Coverage Leakage

Coverage leakage occurs when policyholders report property damage in the most favorable light based on their coverage. For example, those without flood coverage or with large flood deductibles tend to portray all losses as resulting from wind damage. In situations with widespread damage, and pressed with a need to resolve claims quickly, carriers may not aggressively dispute the characterization of claims.

Super Cat Events: The Perfect Storm

The extraordinary devastation wrought by Katrina on New Orleans redefined the concept of a super catastrophe, or Super Cat. Was this an historical "fluke" to be written off as a statistical outlier? Or should we look at Katrina as symbolic of the shift in the size and scope of hurricane-related damage? These were questions the RMS analysts had to consider as they revised the U.S. hurricane model.

While many scientists had predicted widespread damage if a hurricane struck New Orleans, no one was truly prepared for the scale and scope of Katrina's wrath. The most recent models did explicitly include "catastrophe following catastrophe" events—such as coastal storm surges following a windstorm and fire following earthquake—but they failed to anticipate the full force of cascading consequences that can prove far more damaging than even the initial event.


Hurricane Rita
Courtesy of NOAA

Super Cats, as described by RMS, are characterized by "damage on a massive scale that gives rise to nonlinear loss amplification, correlation and feedback." In addition to an extensive demand surge, modeling for Super Cat events must take into consideration the possibility of "consequential hazards." In New Orleans, for example, additional un-modeled forms of damage such as infrastructure collapse, looting, crime, water contamination, pervasive business interruption and prolonged economic recovery all resulted in a multiplier effect on losses.

An RMS researcher has said that predicting losses in Super Cats requires "a whole new tier of economic, behavioral, and systems-based modeling." For the current revision, they used the lessons from Katrina and the furious series of 2004 storms to develop a new loss multiplier that is designed to account for the wide-ranging nature and tremendous scope of damage that can occur in a Super Cat event. The effect is considerable:

- ***Super Cat events can increase all damage calculations by up to 125%, mostly from business interruption losses.***

New Orleans: Could it Happen Somewhere Else?

The particular conditions in New Orleans and several Gulf coast cities made them ripe for extreme devastation. New Orleans had been subject to several large hurricanes in the past century that were nearly as powerful as Katrina at landfall, pushing significant storm surges that defeated levees and flooded a large portion of the city. Why was Katrina so severe in comparison?

New Orleans and Gulf coasts of Mississippi and Alabama are very developed regions on extremely low-lying ground with significant shipping and oil industries that are important to national commerce. But with lax zoning and building regulations, a great number of high-value properties were built in extremely vulnerable areas: barrier islands, lands that lie below sea level and behind levees of inferior design. Political idiosyncrasies led to a booming floating casino industry outside Gulf coast cities. The end result was an unprecedented amount of commercial property in extremely hazardous locations.

The hazards were magnified by the geography of the Mississippi Delta and artificial "improvements." The land in and around New Orleans has been both eroding and sinking into the sea. In the last 40 years, the land has sunk about 15 inches, making it more vulnerable to storm surges. Other changes include the widening of the navigational channel, allowing storm surge direct access into the city's interior from the east.

There is no denying that economics also played a role in the devastation. Many people in the most vulnerable areas of New Orleans lacked the financial means to safely protect their property from damage or to evacuate effectively.

Other Vulnerable Areas

Given the devastation of Katrina on New Orleans, RMS analysts examined other metropolitan areas to determine if they too could be subject to severe urban catastrophe. They concluded that several coastal U.S. cities resemble New Orleans in key ways: low-lying, densely populated, subject to significant storm surge and having constricted evacuation routes. **Tampa, Houston, Miami, Charleston** and **New York** are among the cities that have been identified as having these factors in common with New Orleans. Under very severe catastrophe conditions, these areas could see the same kind of secondary effects New Orleans saw from Katrina. RMS continues to work on identifying other metropolitan areas that should be included in this category.

Conclusion

The changes made to the U.S. hurricane model are the most significant upgrade RMS has performed. As the revised model is fully implemented, the consequences are great for all insurance markets and at all levels of the market chain. Difficult times are ahead as market dynamics will likely transform pricing and limit availability as insurers reshape their portfolios.

There will also be a dramatic change in the type and amount of data required to make informed insurance decisions. Collecting detailed, accurate and complete data on properties is more critical than ever for owners of commercial property to avoid a worst-case assessment of potential hurricane losses, and consequently, pay more for insurance than necessary.

The 2006 hurricane season is upon us, with projections of a higher than average frequency of major storms. The professionals at Napco are here to provide support and expertise to help you navigate the rough seas and find the protection commercial property owners need to weather the storm.