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CAT 360

Catastrophe Risk from Every Perspective

The CAT 360 is a quarterly newsletter that features articles developed by our Research and Development Team and covers topics that relate to Catastrophe Modeling, Natural Perils and Information Technology on a global basis. Please feel free to contact the editors if you have any questions or comments regarding any of our publications.

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Feature Stories

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Katrina - A Five Year Retrospective

At over $40bn, Hurricane Katrina remains the biggest ever insurance industry loss from a single event. So five years after the event, what are the take-aways from a catastrophe modeling perspective?

The 2005 storm season broke records and followed an above-average hurricane season in 2004. In fact, having witnessed the cumulative impact of four hurricanes - Charley, Frances, Ivan and Jeanne - hitting Florida in quick succession in 2004 and costing USD$19bn in claims in that state, the catastrophe modeling firms were already questioning some of their assumptions and planning to update the models accordingly. But the updates were not released in time for the 2005 storm season.

When the 2005 storm season ended, and Hurricanes Katrina, Rita and Wilma had cost insurers in excess of USD$57bn, it became even clearer that the catastrophe models had not captured all of the characteristics of these major storms. It was also apparent that conditions created by a natural climatic cycle - the Atlantic Multi-decadal Oscillation (AMO) - had led to a period of heightened storm activity that could result in two highly active seasons in a row. As time passed and insurers increased their loss reserves it became evident that many had underestimated the potential losses.

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A Record-Breaking Season

The 2005 storm season was a record-breaker with 28 named storms, 15 of which were hurricanes and seven major hurricanes. The season was so long that letters of the Greek alphabet had to be used to name storms after Wilma exhausted the original list of 21 names. When Hurricane Katrina made landfall on 29 August for the second time on the coast of Louisiana (having first skimmed the Florida Peninsula as a moderate Category 1 storm on 25 August), it was a Category 3 hurricane with wind speeds of up to 124 mph (200kmh).

Katrina weakened as it moved inland but retained the offshore characteristics of a Category 5 hurricane producing a storm surge of up to 25ft (7.6m) as it moved up the gentle slope of the Mississippi Coast. New Orleans was on the weaker side of the storm surge, but the surge was still powerful enough to overcome the city's defenses, most significantly the levees built to withstand a Category 3 storm.

The resulting flood caused devastation throughout New Orleans, flooding more than 80% of the city and causing over 1,000 deaths. The catastrophe revealed failures in engineering, planning and disaster recovery with the city descending into chaos. Five years later, New Orleans has yet to recover its pre-Katrina population of over 454,863 (a 2010 census puts it at 329,304) and parts of the city remain vacant. While the levees and storm defense system have been rebuilt and strengthened, flood risk remains high and New Orleans is still a major loss scenario for catastrophe risk managers.

From a damageability perspective, even if the levees had not been breached, Katrina would have been one of the most destructive hurricanes on record due to its large size and strong winds. The hurricane was more than one standard deviation larger than any storm previously recorded in the Gulf of Mexico. Had it tracked further to the north west it could have caused even more damage as New Orleans lay on the leeward, or weaker, side of the storm with Mississippi on the stronger side.

The economic impact from Katrina was widely felt, with the storm affecting an area containing about half a trillion dollars worth of property. The storm ravaged vast residential areas, including those in New Orleans, and caused widespread destruction to ports, oil refineries, resorts, casinos and commercial properties along the coastline.

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Testing The Cat Models

Prior to the 2004 and 2005 storm seasons, catastrophe models had not been tested by major events. Before the lessons from 2004 could be calibrated into the models (a process that typically takes two years), Hurricane Katrina occurred. Any catastrophe analysis done in 2005 was therefore subject to pre-2004 assumptions, which had not taken into account new understandings of vulnerability, exposure and hurricane frequency. Some of the key findings included:

1. Vulnerability curves worked well for some lines of business, but did not work well for others;
2. The complexity and extent of business interruption had been underestimated;
3. Demand surge was exacerbated by the frequency of storms over a short period of time;
4. Thousands of storms are simulated in the models, but the characteristics of an actual storm may not be represented;
5. The frequency of hurricanes occurring was questioned; and
6. Problems emerged with respect to the capture of exposure data.

From a catastrophe modeling perspective, building vulnerability assumptions had not been tested in the Gulf Region, which did not have building codes implemented before Katrina. Since then, homes and buildings have been built to a much higher standard and models are better able to capture the risk.

In addition, there was a significant "miss factor" for certain types of commercial structures. A large number of coastal hotels, casinos and condominium buildings sustained considerable damage to lighter-weight cladding, such as Exterior Insulation and Finish Systems (EIFS) facades. This included severe damage to the EIFS of 13 steel-hulled casino-barge structures that were in place along the Mississippi coast. Seven broke completely free from their moorings and were washed inland with the storm surge.

Another significant lesson was the impact of business interruption (BI) on losses which had been understated in the models. Hospitality and recreation establishments, including hotels, restaurants and floating casinos, tend to have higher BI losses. In some cases there may be little structural damage, but power outages or blocked access routes instead affect the continuity of day-to-day business.

Katrina caused around $25bn in insured commercial losses, of which $6bn to $9bn was attributed to BI. For certain industrial risks, including chemical plants and offshore oil and gas platforms, the loss potential from BI can be higher than the risk of physical property damage.

Katrina was a very unique storm. Some of the catastrophe models had not simulated a Category 3 hurricane with such a large footprint, which helps to explain why there was more damage than expected. Since then, Hurricane Ike in 2008 has again shown that a relatively low intensity storm (in Ike's case a Category 2) can have a very broad impact.

The 2004 storm season highlighted the "clustering" of storms and the knock-on effects that can occur from multiple storms following the same track. When storms make landfall in the same area, structures weakened by a prior storm can be more easily damaged by the next, while demand surge, or "post-event inflation," is also heightened. There can also be confusion from an adjusting perspective, where there may not be enough time to assess damage to properties before the next storm hits. Finally, and perhaps most importantly, many catastrophe risk managers now consider whether we are in a period of heightened hurricane activity and how that might be translated into loss return periods.

Poor data quality was also an issue with the 2004 and 2005 storm seasons. By examining four data elements critical for accurate catastrophe loss estimates - replacement value, construction, occupancy and location - catastrophe modeling firm AIR Worldwide attempted to explain why modeled losses for Katrina had differed from some companies' actual losses. They concluded that while data for residential properties was reasonably accurate, there was a great deal of uncertainty surrounding data for commercial exposures, with data being coded incorrectly or not captured at all.

Despite the high industry loss and some criticism of the catastrophe models in the aftermath of Katrina, most insurers were able to absorb the losses and quickly recapitalize. Unlike Hurricane Andrew, which had caused much insolvency, Katrina had far fewer insurance company casualties, to some extent validating the practice of catastrophe risk management in the industry.

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Cat Models Today

Today, the hurricane catastrophe models put greater emphasis on building usage, as well as other building characteristics when determining loss potential. The same type of structure can have a very different vulnerability curve depending on whether it is used for residential apartments or as offices to give one example. Efforts to collect more complete exposure data should result in more accurate model output.

In 2006, all major modeling agencies released recalibrated "near term" models, which reflected a perceived increase in hurricane frequency resulting from cyclical climatic conditions. While there are still uncertainties associated with modeling the risk of storm surge, including the potential future impact of sea-level rise, subsidence and storm activity, today's model simulations show an elevated loss potential relating to storm surge loss, particularly in the Gulf Region.

Additionally, while the models already addressed demand surge (post-event inflation) in their loss simulations, the modeling firms recognized the effect of storm clustering, which causes demand surge to be far greater when compared to a single event occurring in a single year. As a result, the concept of "residual demand surge" became part of the cat modelers' vocabulary reflecting an inflated view of demand surge.

A review of various catastrophe models shows that an insured portfolio with a mix of commercial and residential risks in Louisiana would have had average annual simulated losses of $200M in the 2004 model. Today, that same portfolio (not adjusted for growth or inflation) would produce losses of over $500M in one model and over $300M in another model.

The revisions to the models over the last five years clearly show an elevated view of hurricane risk. However, despite the many lessons learned from Katrina it is still possible, and indeed likely, that future hurricanes will have attributes that are not captured by the models.

Catastrophe Models - Changes since the 2005 Hurricane Season

	Model X				Model Y			
Return Period	Florida	Louisiana	Gulf	All US	Florida	Louisiana	Gulf	All US
20	1.91	2.70	2.44	1.80	1.18	1.48	1.24	1.34
50	1.67	2.77	2.27	1.65	1.27	1.43	1.37	1.50
100	1.52	2.73	2.20	1.57	1.51	1.51	1.51	1.60
250	1.49	2.87	1.84	1.51	1.66	1.88	1.88	1.79
1,000	1.47	2.22	1.67	1.51	1.88	2.32	2.32	1.74
Expected Loss	1.85	2.71	2.28	1.83	1.29	1.58	1.33	1.39

The analysis compares model versions in place in 2004 to versions in place in 2010. The figures show the difference as a factor. For instance, a 1.5 factor means than a $10 loss has now increased to $15. Settings reflect the inclusion of storm surge and demand surge in both older and newer versions, and "near term" hurricane frequency in the newer versions.

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Conclusion

Hurricane Katrina provided many important lessons for those responsible for measuring catastrophe risk. While New Orleans had always been identified as a city that was highly vulnerable to hurricanes, few could have predicted the catastrophic series of failures that caused such devastation when Katrina hit in 2005. Today, with better understanding of the potential impact of storm surge and the behavior of different structures during high winds, the models (those providing both an average and a shorter-term view) are invariably closer in their approximation of expected loss from a Katrina-type event.

Current thinking is to proceed with caution. Models are approximations of reality and while a useful tool for managing exposures and allocating capital, they should not be taken as gospel. It is impossible to predict with any certainty where the next major hurricane will make landfall - be it Louisiana, Texas, Miami, Metropolitan New York or the New England coast - and hurricane forecasts are not always right. What is certain is that the popularity of the US coastline endures despite the risk from Mother Nature, leading to a concentration in insured values that is projected to increase still further in the foreseeable future.

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