AIR Currents Special Edition

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What Would a USD 100 Billion Hurricane Mean for the Cat Bond Market?

71% of outstanding cat bond principal is exposed to US hurricane risk. But does a large industry loss necessarily translate to large losses for investors?

Leveraging the AIR US hurricane model and AIR's comprehensive catastrophe bond database, which contains all active classes of notes[1] in the market and represents more than USD 20.3 billion in principal outstanding, we can assess the relationship between industry loss and catastrophe bond principal loss to investors. Let's take a look at three events from the model's 10,000-year standard catalogue and consider these in the context of a "market portfolio" consisting of all catastrophe bonds currently on risk, weighted by size of issuance.

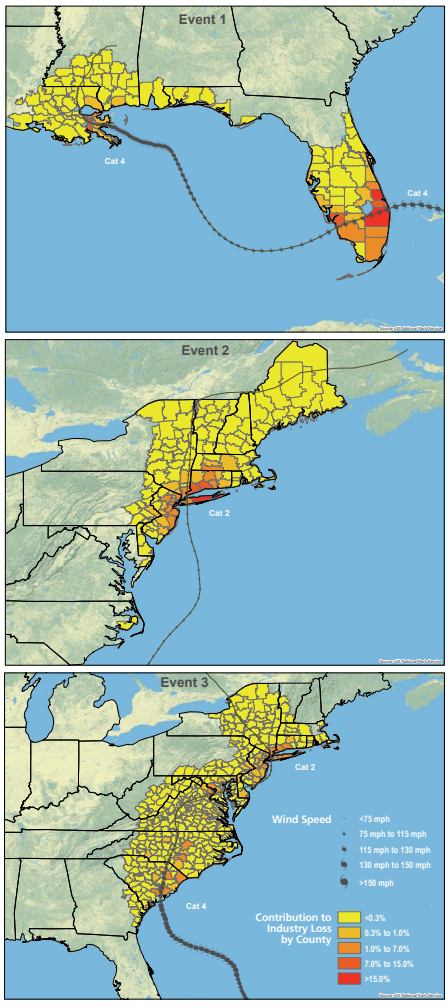
EVENT 1 causes USD 104 billion of modelled insured industry loss, which corresponds to a 1.40% exceedance probability (EP). To give some context, that would be the second highest loss-causing hurricane in history, after the 1926 Miami hurricane (~USD 119 billion in modelled industry loss given today's exposures). While this event would cause principal loss to 35 transactions, it only erodes 9.8% of the invested principal in the market portfolio. While it would be a dramatic disturbance to the cat bond market, the principal loss is perhaps smaller than one would expect for a >USD 100 billion event.

Conversely, a much smaller industry loss event could have a similar impact on the cat bond market. **EVENT 2** causes industry insured losses of USD 36 billion (6.37% EP). It causes principal loss to just 13 transactions but, similar to the much larger Event 1, is estimated to cause a principal loss of 9.6% to the market portfolio.

EVENT 3 causes an industry loss (USD 96 billion, 1.61% EP) similar to Event 1, but incurs a significantly higher principal loss. This event causes principal loss to 70 transactions and a 41% principal loss to the cat bond market. The storm makes landfall in Charleston, SC, as a Cat 4 and hits major metropolitan areas along the Eastern Seaboard.

From these three simulated events, it is clear there is high variability in the relationship between principal loss to the cat bond market and industry losses. There are 56 events in AIR's 10K standard hurricane catalogue that cause industry loss between USD 90–110 billion. These events cause principal loss to the cat bond market ranging from 9% to 44%, with an average of 21%. The principal loss is a function not only of industry loss but also the concentration of principal in different region/peril combinations, pre- and post-landfall activity, cat bond structures, the sequence of events within a risk period, and exposure concentrations.

[1] Only publicly known 144A property transactions are included in this analysis. As of September 1, 2014, there are 125 such notes in the market.



Monte Carlo

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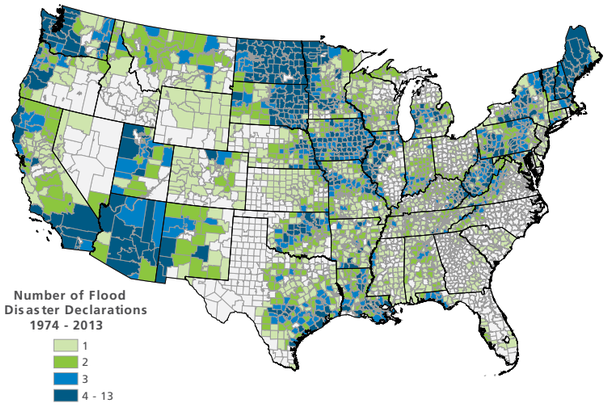
AIR WORLDWIDE®

Managing US Inland Flood Risk—Challenges and Opportunities

Managing flood risk in the US has always been a challenge. While probabilistic models have been available for US earthquakes and hurricanes for more than 25 years, effective tools to help the insurance industry understand, price, and transfer flood risk have been absent. Yet the risk is ubiquitous and perennial; only a few inches of water in basements and ground floors can cause damage to contents and nonstructural components. Replacement of drywall, insulation, and flooring, as well as treatment for mould and bacterial growth, can add up to high losses.



The flood peril itself is a complex phenomenon that results from the interaction of many factors. The precipitation might be very intense and highly localised, or it can occur in the form of extreme snowfall over a long winter and subsequent rapid snowmelt. If the ground is already saturated, even a small amount of precipitation can lead to flooding.

Flood modelling requires enormous amounts of data at very high resolution. Recently available data sets, combined with more advanced technology and near exponential increases in compute power (power that has enabled a 10,000-year continuous simulation of the global atmosphere), have allowed AIR to take on the challenge of modelling inland flood risk in the US.

The new model offers a granular view of both on- and off-floodplain risk using detailed terrain data and technological improvements in large-scale weather simulation. It combines historical data with a robust atmospheric model, taking into account the effects of multiple weather systems, snowmelt, the presence of lakes and reservoirs, soil types, flood defences, regional differences in building vulnerability, and other factors that contribute to flood losses.

Unlike commonly used flood maps that can only identify a property as being on or off the floodplain, a probabilistic approach allows for a much more granular level of risk differentiation in terms of both hazard and vulnerability. Beyond basic building attributes, model users can enter information like foundation type, custom flood protection, base flood elevation, first floor height, floor of interest, and contents vulnerability to obtain the most robust view of potential losses.

The new model from AIR offers a significantly improved approach to underwriting this complex risk and for uncovering new opportunities in the evolving flood insurance market, including the possibility of indemnity-triggered ILS transactions for at-risk portfolios.

While many of the largest flood *occurrence* losses are the result of hurricanes, the aggregation of inland flood losses can be significant, with potentially hundreds of smaller events adding up to very large losses.

The Importance of the Multi-Peril View

Many countries, especially large and geographically diverse ones, are prone to multiple types of natural disasters. Risk from each peril varies regionally, as well as at different parts along the exceedance probability curve. Understanding, managing, and pricing catastrophe risk effectively requires a holistic view across all perils.

In this article, we examine three perils that affect China—typhoons, earthquakes, and agriculture risk—and explain why a multi-peril view yields the most realistic risk perspective

TYPHOON

Earlier this year, Typhoon Rammasun caused economic losses estimated at more than USD 4 billion. Typhoons in the Asia-Pacific region—even those with relatively low wind speeds—can be accompanied by catastrophic flooding that extends hundreds of kilometres inland and persists for several days after landfall. Risk is concentrated along China's southeast coast, although precipitation-induced flooding often causes losses far inland.

EARTHQUAKE

The 2008 M7.9 Wenchuan earthquake caused economic losses estimated at well over USD 100 billion. If the epicentre were closer to Chengdu, or to Beijing, which is also in an area of relatively high seismicity, an earthquake of this magnitude could cause much more significant losses. At present, insured losses would be a small portion of total economic losses from such an event, but this is changing.

AGRICULTURE RISK

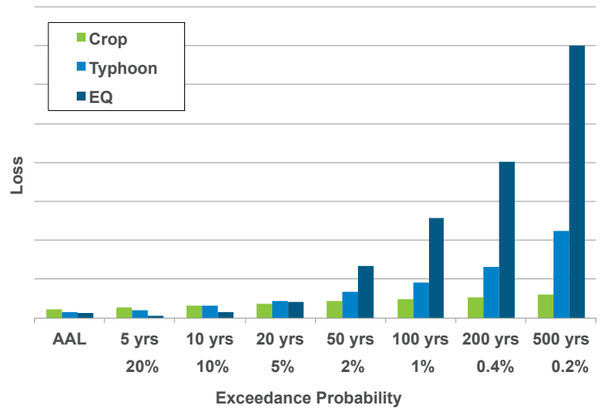
Crop insurance is the fastest growing sector in China's insurance industry, with premiums totalling more than USD 4.8 billion in 2013. A primary distinction between crop insurance and other lines is the correlation of losses across wide regions—the result of large-scale adverse weather events like droughts and floods.

THE RELATIVE RISK

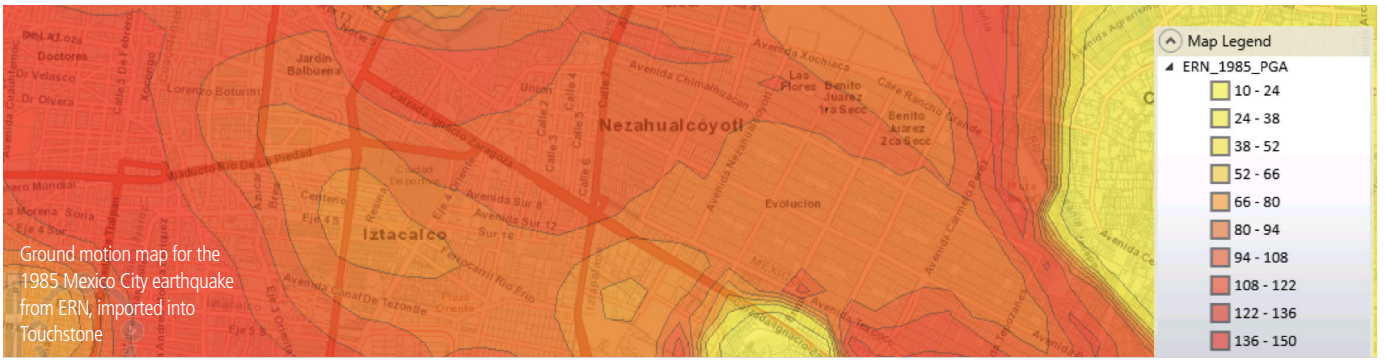
According to AIR's China models, typhoon and crop losses are significant at lower return periods (higher exceedance probabilities), but at higher return periods (lower exceedance probabilities), earthquake loss potential is several times higher than it is for the other two perils.

Given a geographically diversified portfolio, analysing risk across multiple perils will provide a more realistic view of loss potential. When considering all three perils together, the combined modelled loss at higher return periods is typically significantly less than the sum of the individual peril losses at that return period, which can benefit insurers looking to reduce capital requirements in order to grow business. On the other hand, the combined loss from multiple perils is always higher than the loss from a single peril at any return period. Only considering the highest loss-causing peril in risk transfer decisions can result in a significant underestimation of the potential losses.

The ability to accurately estimate combined losses is just one of the benefits of having catastrophe models for several perils in a single country.



Modelled losses for crop, typhoon, and earthquake (Source: AIR)



Ground motion map for the 1985 Mexico City earthquake from ERN, imported into Touchstone

Touchstone's Open Platform Architecture Facilitates Third-Party Data Integration

The insurance industry has welcomed the development and availability of "open" catastrophe modelling platforms. Whether to expand model coverage beyond the scope of existing traditional cat models, or to incorporate multiple views of risk, open platforms enable insurers and reinsurers to better manage risk across a wide range of perils.

Events like the Thailand floods and the Japan tsunami in 2011 made it apparent that there are significant gaps in model coverage.[1] Understanding non-modelled risk—whether from modelled perils in non-modelled regions (e.g., earthquake risk in the Middle East), from non-modelled perils (e.g., volcano) and secondary perils (e.g., landslides), or from certain lines of business or coverages (e.g., marine cargo or contingent business interruption)—is becoming a top focus across the industry.

To help address these gaps, AIR is in the midst of the most ambitious program of model development in our history. However, well-constructed and well-validated cat models require many person-years of research, building, and testing. Consequently, model development does not always keep up with the demand. Offering open platform flexibility improves workflow and productivity and encourages innovation and differentiation among model providers.

AIR's Touchstone® platform seamlessly integrates data from a wide variety of third-party providers. For example, a user can import shapefiles or grid files—produced by third parties or created internally—to quantify risk for perils and regions not yet modelled, such as third-party terrorist target locations in Beirut or return period flood footprints for Australia. The user can then accumulate not only replacement values within the footprints, but also exposed limits after the application of financial terms.

Due to the widespread and successful market adoption of Touchstone, many third-party providers have chosen to provide hazard data through Touchstone, and the list is growing. To date, providers and some of the example data include:

- Ambiental—flood hazard in Australia and other regions
- ERN—earthquake hazard in Mexico
- EuroTempest, Met Office (UK), University of Exeter (UK), and University of Reading (UK)——historical data for extratropical cyclones in Europe
- IHS—potential terrorist target locations around the world
- KatRisk—flood hazard in Southeast Asia
- PERILS—footprints for major flood events in Europe and Canada, industry exposure information
- SSBN—flood hazard in Asia
- Verisk Climate—US severe thunderstorm footprints
- Global Earthquake Model—earthquake hazard maps

In addition, many freely available third-party hazard layers are available to import into Touchstone.

At AIR we believe that accounting for non-modelled risk and assessing alternative views is a fundamental part of "owning the risk." In future releases of Touchstone, AIR will begin to introduce integrated third-party models.

[1] AIR has since released tsunami models for both Japan and Canada, and has just released a probabilistic flood hazard map for Thailand.

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