AIRCURRENTS

INTRODUCING THE VERISK CATASTROPHE INDEX

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EDITOR'S NOTE: Verisk Analytics, Inc., the parent company of AIRWorldwide and ISO Services, Inc.—of which Property Claim Services(PCS®) is a division— recently launched the Verisk Catastrophe Index. AIR manager of insurance-linked securities Pascal Karsenti and risk analyst Matthew Holland discuss the new Index's significant benefits.

By Pascal Karsenti and Matthew Holland

INTRODUCTION

Activity in the insurance-linked securities (ILS) market has not yet returned to its 2007 peak. Apart from a still-sluggish global economy, various other factors have contributed to the drop off, including soft premium rates that have made traditional reinsurance and retrocession more attractive to would-be issuers, and concerns about the basis risk associated with ILS. While reinsurance rates are largely determined by factors that cannot be controlled—such as prevailing market conditions and the occurrence of significant catastrophes—AIR has invested considerable effort in the development of innovative solutions aimed at facilitating transactions that are attractive to both issuers and investors by minimizing basis risk. A recent example is a novel approach to designing parametric triggers based on sophisticated optimization algorithms.

AIR's latest undertaking, in partnership with PCS, is the Verisk Catastrophe Index, which provides county-level industry loss estimates by line of business for natural catastrophes affecting the United States. Its high resolution allows companies to reduce the basis risk of various insurance risk transfer mechanisms, including reinsurance contracts, catastrophe bonds, industry loss warranty (ILW) transactions, and other catastrophe derivative instruments such as swaps, options and futures. As a common means for both benchmarking and triggering insurance-linked securities, the Verisk Catastrophe Index offers increased protection for issuers while providing investors with a familiar and transparent means of managing their risk.

A SOLUTION FOR MINIMIZING BASIS RISK

PCS is a trusted source of industry loss estimates and is widely used to benchmark non-indemnity[1] risk transfer instruments. Organizations exposed to more localized risks, however, may also want to consider a different solution. This includes:

- Owners, (re)insurers and third parties wishing to hedge against damage to localized exposure such as oil refineries, corporate campuses, and other large assets
- Re)insurers whose in-state distribution of risk is not similar to that of the broader insurance industry
- Insurance companies or specialty reinsurers with peak exposure in certain counties

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In instances such as these, using a state-level PCS insured industry loss trigger could result in basis risk, as the statewide loss tracked by PCS may not be an optimal proxy for actual loss in the counties that drive a cedant's risk. By combining AIR catastrophe modeling (which produces loss estimates at resolutions down to the individual location level) with industry estimates from PCS, the Verisk Catastrophe Index minimizes basis risk by providing post-event loss estimates by line of business at the individual county level. The methodology whereby state level PCS losses are disaggregated to the county level is discussed in the next section.

DISAGGREGATING STATE-LEVEL LOSSES TO THE COUNTY LEVEL

In the event of a catastrophe causing insured property damage in excess of $25 million, Property Claim Services conducts surveys of insurers, agents, adjusters, public officials, and others to estimate insured losses by state. Shown in Table 1 are final PCS estimates for Hurricane Wilma, at one point the most intense hurricane ever recorded in the open Atlantic, which swept through southern Florida in October 2005.

Table 1. PCS Industry Loss Estimates for Hurricane Wilma

State	Personal	Commercial	Auto	Total
Florida	7,350,000,000	2,200,000,000	750,000,000	10,300,000,000
Total all States	7,350,000,000	2,200,000,000	750,000,000	10,300,000,000

Using simulation techniques embedded in the AIR Hurricane Model for the United States, AIR recreates the storm using reported meteorological information obtained from the National Hurricane Center (NHC). The input parameters, which include storm track, forward speed, central barometric pressure, and radius of maximum winds, are used to recreate the event using the latest version of the AIR Hurricane Model for the United States. The simulated wind field for Hurricane Wilma, which made landfall in Cape Romano, Florida as a Category 3 hurricane, is shown in Figure 1.

Using CLASIC/2™, AIR's detailed modeling software, the modeled wind footprint is overlaid on AIR's latest industry exposure database (IED)[2], which contains counts, values, and physical characteristics of all properties in the U.S. at very high resolution. Insurance policy terms and take-up rates are then applied to the resulting loss estimates for all insurable properties to obtain a high resolution estimate of insured industry loss.

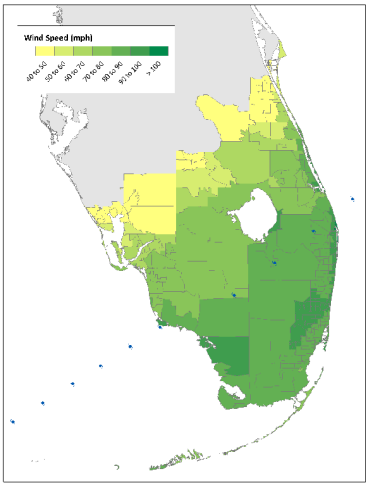

Figure 1. AIR Simulated Wind Footprint for Hurricane Wilma

These high-resolution modeled losses can then be aggregated for each line of business to the county and state level. AIR then determines, for each line of business, the contribution of each county to total losses in each state by dividing the county loss by the state loss. Table 2 shows modeled county-to-state loss ratios for Hurricane Wilma.

Table 2. AIR Simulated County Contributions to Total State Losses for Hurricane Wilma

State	County	Personal	Commercial	Auto
Florida	Brevard	0.30%	0.08%	0.31%
Florida	Broward	25.91%	30.29%	30.67%
Florida	Charlotte	0.06%	0.01%	0.08%
Florida	Collier	6.62%	4.23%	4.62%
Florida	DeSoto	0.00%	0.00%	0.00%
Florida	Glades	0.04%	0.01%	0.04%
Florida	Hendry	0.21%	0.11%	0.25%
Florida	Highlands	0.04%	0.01%	0.03%
Florida	Indian River	1.90%	0.95%	1.36%
Florida	Lee	3.93%	1.54%	3.04%
Florida	Martin	2.32%	1.64%	2.07%
Florida	Miami-Dade	22.37%	30.68%	29.15%
Florida	Monroe	4.67%	2.84%	1.87%
Florida	Okeechobee	0.21%	0.06%	0.21%
Florida	Oseola	0.00%	0.00%	0.00%
Florida	Palm Beach	28.48%	25.97%	23.36%
Florida	Sarasota	0.00%	0.00%	0.00%
Florida	St. Lucie	2.94%	1.59%	2.94%

Finally, these ratios are multiplied by state-level PCS loss estimates to produce the resulting Verisk Catastrophe Index, shown in Table 3 for Hurricane Wilma. The index may be refined as PCS loss estimates are updated or as event parameters are revised by the NHC.

Table 3. Verisk Catastrophe Index for Hurricane Wilma (in USD)

State	County	Personal	Commercial	Auto	Total
Florida	Brevard	21,807,618	1,777,128	2,347,000	25,931,746
Florida	Broward	1,904,471,712	666,412,904	230,024,795	2,800,909,412
Florida	Charlotte	4,478,223	250,848	614,506	5,343,577
Florida	Collier	486,867,122	93,113,568	34,635,890	614,616,579
Florida	DeSoto	178,744	9,963	16,949	205,656
Florida	Glades	2,874,520	280,564	337,433	3,492,517
Florida	Hendry	15,483,202	2,358,301	1,839,975	19,681,478
Florida	Highlands	2,784,335	166,853	230,061	3,181,249
Florida	Indian River	139,294,333	20,856,754	10,217,443	170,368,530
Florida	Lee	289,056,765	33,814,171	22,800,116	345,671,052
Florida	Martin	170,719,084	36,037,549	15,550,404	222,307,036
Florida	Miami-Dade	1,644,075,738	675,015,459	218,589,663	2,537,680,860
Florida	Monroe	343,160,883	62,388,173	13,989,784	419,538,840
Florida	Okeechobee	15,573,201	1,231,253	1,590,189	18,394,643
Florida	Oseola	7,810	477	–	8,287
Florida	Palm Beach	2,093,085,144	571,374,597	175,186,712	2,839,646,452
Florida	Sarasota	45,436	11,553	186	57,176
Florida	St. Lucie	216,036,130	34,899,885	22,028,895	272,964,910
Florida	**All Counties**	**7,350,000,000***	**2,200,000,000***	**750,000,000***	**10,300,000,000***

MODELING VERISK CATASTROPHE INDEX TRANSACTIONS

The Verisk Catastrophe Index allows risk transfer instruments to be custom tailored to a cedant's risk, county by county, line by line. In this section, three case studies are provided that describe the benefits to three very different companies, each of which has a compelling reason for choosing a custom alternative risk transfer mechanism to protect it (in these examples) against hurricane risk.

For each, a detailed catastrophe analysis of the cedant's exposure is first performed in CLASIC/2, followed by an industry-level loss analysis for the appropriate lines of business, which is performed in CATRADER. From these results, the cedant's market share of industry loss by county and line of business can be determined. The cedant and its advisors should consider the market share of loss for the layer of risk the cedant wishes to transfer. Indeed a cedant's market share of loss may differ at different return periods.

The structure of the instrument will then depend on the goal of the risk transfer. In the examples that follow, these goals are, in turn, protecting a localized high-value asset, protecting an entire portfolio, and protecting a portfolio's peak exposures while retaining profitable business.

Case Study 1: Protecting a Localized Asset

A large oil and gas extraction company ships a substantial fraction of its production through subsea pipelines to specific refineries on the Louisiana coast. With no easy means of distributing their product should these refineries become inoperative, they have substantial business interruption risk should a storm damage these complex facilities.

The oil company's broker has determined that hurricane damage to the refineries in excess of $10 million will cause them to shut down production for several months, cutting off the oil and gas company's only means of bringing their products to market. The broker runs a detailed analysis of the refineries' risk profile in CLASIC/2 to identify any storms in the hurricane model's stochastic catalog capable of causing damage in excess of $10 million.

Next, the broker runs an industry loss analysis in CATRADER to calculate the overall commercial industry loss from these storms in the counties where the refineries are located. The broker then determines that for these storms, losses to the refineries account for 15% and 10% of the total commercial industry losses in the two Louisiana parishes (counties) in which they are located. In other words, a 15% commercial market share in the first county and a 10% commercial market share in the second has a similar risk profile to that of the refineries with respect to these storms.

Figure 2. Refineries Processing Cedant's Gas

The broker therefore recommends placing a Verisk Catastrophe Index industry loss warranty triggering on losses in excess of $10 million against a portfolio consisting of 15% and 10% of the commercial PCS losses in the two affected counties. This transaction's risk profile and correlation with the rest of their risk portfolio can easily be modeled by potential counterparties using CATRADER by entering a 15% market share in the "COM" field of the first county and a 10% market share in the "COM" field of the second county. This analysis shows that the ILW has a 1.79% exceedance probability of loss, or a return period of 1-in-56 years.

Table 4. ILW Risk Profile

Exceedance Probability	Weighted Industry Loss (millions USD) (15% County A, 10% County B)
0.40%	$30.5
1.00%	$15.5
1.50%	$11.7
1.79%	$10.0
2.00%	$9.0
3.00%	$6.3

Case Study 2: Protecting a Multi-State Insurance Portfolio

Surf & Turf Insurance Company (STIC) insures a diversified portfolio of exposures across Alabama, Florida, Georgia, and South Carolina. Due to its relatively short operating history and fast growth, prices for indemnity reinsurance are relatively high so STIC is considering alternatives for their 1-in-50 year reinsurance layer. They suspect that their distribution of risk differs materially from that of the insurance industry as a whole, which was confirmed by a comparison between a detailed CLASIC/2 analysis of their exposure and a CATRADER analysis of the industry exposure, as measured by their 1-in-50 year tail value at risk (TVaR, the average loss for all events causing losses equal to or in excess of their 1-in-50 year loss).

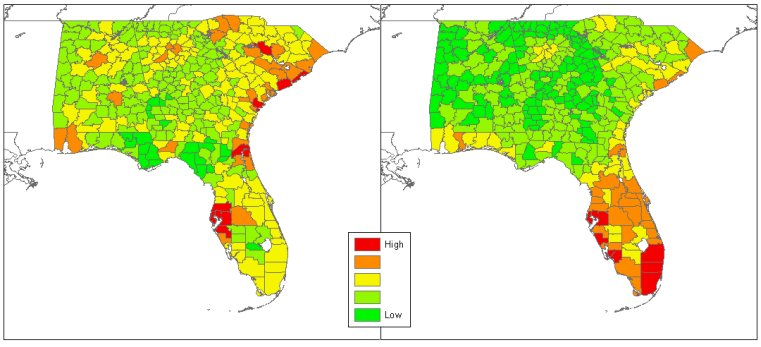

Figure 3. STIC (left) vs. Industry (right) Distribution of Loss, 1/50 Year TVaR

Consequently, a traditional industry loss alternative based on state-level PCS estimates could lead to some basis risk. In order to explore an alternative based on the Verisk Catastrophe Index, STIC identified their market share of industry losses by line of business across all counties in which they have exposure. Because they wish to purchase 1/50 year protection, they perform this optimization examining losses from events included in their 1/50 year TVaR, focusing on counties of highest risk.

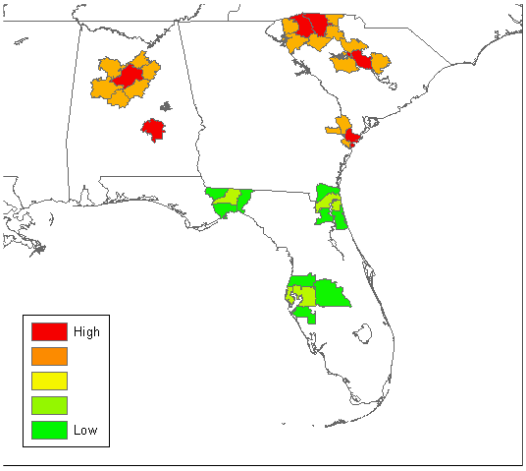

Figure 4. STIC Market Share of Counties Driving 1/50 Year TVaR

This analysis shows two main drivers of risk in the STIC portfolios. The first is relatively low market shares in the Florida counties around Tampa, Tallahassee and Jacksonville. Despite the low market shares, STIC's loss potential in those areas is substantial due to Florida's exposure to hurricanes, yet most of the industry risk is focused on the southeastern coast of the state, away from STIC's exposure. A traditional PCS transaction protecting Florida may therefore cause STIC to pay for protection against hurricanes in southeastern Florida, protection it does not need.

The second driver of risk is STIC's heavy concentration of exposure in less hurricane exposed areas such as Birmingham and Montgomery in Alabama, Savannah in Georgia, and Columbia and Greenville in South Carolina. This reflects STIC's conscious efforts to focus on areas in the southeast United States that are less exposed to hurricane risk. Despite this relatively lower hurricane risk, the substantial concentration of exposure requires protection.

Following this analysis STIC issues a catastrophe bond triggering on the Verisk Catastrophe Index for the counties in the southeast identified above. The bond is structured to be in line with the company's market share of 1-in-50 year tail value at risk in each of the peak counties.

Case Study 3: Protecting a Reinsurance Portfolio's Peak Counties

CatRisk Re provides reinsurance and writes direct insurance for a portfolio of high risk, primarily coastal exposure. CatRisk is reluctant to retrocede this profitable business, but extreme peaks of exposure in the Pasco, Pinellas, Hillsborough, and Manatee counties on the Western coast of Florida are a growing concern (see left panel in Figure 5).

Retrocession capital for Florida hurricane risk is scarce and expensive, and would require CatRisk to cede risk in the entire state, including Southern Florida, despite CatRisk's preference to retain its risk because it is very profitable and not yet concentrated enough to threaten CatRisk's capital.

By analyzing its total portfolio exposure in CATRADER, CatRisk determined that the events driving its tail risk tend to cause at least $10 billion of industry loss in an area encompassing the counties of Pasco, Pinellas, Hillsborough, and Manatee across all lines of business. CatRisk therefore arranges a swap with another reinsurer whose distribution of risk heavily skews toward Southeastern Florida. CatRisk exchanges a Verisk Catastrophe Index cover triggering at $10 billion in industry losses in Pasco, Pinellas, Hillsborough, and Manatee counties against another Verisk Catastrophe Index cover with similar probabilities of loss, but protecting the southeastern Florida counties of Miami-Dade, Broward and Palm Beach where the counterparty is overexposed.

This trade allows CatRisk to reduce its peak exposure around the St. Petersburg/Tampa area in exchange for manageable risk in Southeastern Florida. By swapping their respective peak risks, each reinsurer is able to achieve a lower overall tail risk for their entire Florida portfolio through greater geographical diversification.

CONCLUSION

The Verisk Catastrophe Index leverages AIR's state-of-the-art modeling capabilities and PCS's more than 60 years of experience in providing reliable industry loss estimates. Increasing resolution to the county level allows catastrophe-exposed organizations, insurers and reinsurers to design ILS instruments that are uniquely tailored to protect their particular interests, thereby minimizing basis risk. And because the index is based on the same catastrophe model and industry exposure database as those available in AIR's CATRADER software, CATRADER is uniquely suitable for designing and assessing risk transfer instruments based on the Verisk Catastrophe Index.

The Verisk Catastrophe Index is currently available for hurricanes, and plans are currently underway to expand to other perils in the United States.

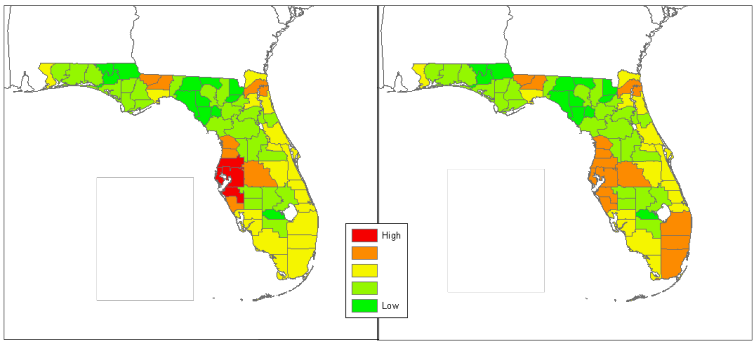

Figure 5. CatRisk Re's 1/100 Year TVaR before Swap (left) and after Swap (right)

REFERENCES

1 NON-INDEMNITY COVERAGE IS NOT DIRECTLY CORRELATED WITH THE CEDANT'S ACTUAL LOSSES. FOR A MORE DETAILED DISCUSSION OF CATASTROPHE BOND TRIGGER MECHANISMS, SEE THE AIRCURRENTS ARTICLE SO YOU WANT TO ISSUE A CAT BOND.

2 THE AIR U.S. INDUSTRY EXPOSURE DATABASE, UPDATED ANNUALLY, PROVIDES A FOUNDATION FOR ALL MODELED INDUSTRY LOSS ESTIMATES, WHETHER FOR SIMULATED EVENTS FROM A STOCHASTIC CATALOG, THE RECREATION OF HISTORICAL EVENTS, OR, IN THIS CASE, FOR ACTUAL EVENTS UNFOLDING IN REAL TIME. THE IED CONTAINS COUNTS OF ALL INSURABLE PROPERTIES AND THEIR RESPECTIVE REPLACEMENT VALUES, ALONG WITH INFORMATION ABOUT OCCUPANCY AND THE PHYSICAL CHARACTERISTICS OF THE STRUCTURES, SUCH AS CONSTRUCTION TYPE, YEAR BUILT AND HEIGHT CLASSIFICATIONS. FOR MORE INFORMATION ON THE DEVELOPMENT OF THE IED, SEE THE AIRCURRENTS ARTICLE THE AIR INDUSTRY EXPOSURE DATABASES.

ABOUT AIR WORLDWIDE

AIR Worldwide (AIR) is the scientific leader and most respected provider of risk modeling software and consulting services. AIR founded the catastrophe modeling industry in 1987 and today models the risk from natural catastrophes and terrorism in more than 50 countries. More than 400 insurance, reinsurance, financial, corporate and government clients rely on AIR software and services for catastrophe risk management, insurance-linked securities, site-specific seismic engineering analysis, and property replacement cost valuation. AIR is a member of the ISO family of companies and is headquartered in Boston with additional offices in North America, Europe and Asia. For more information, please visit www. air-worldwide.com.