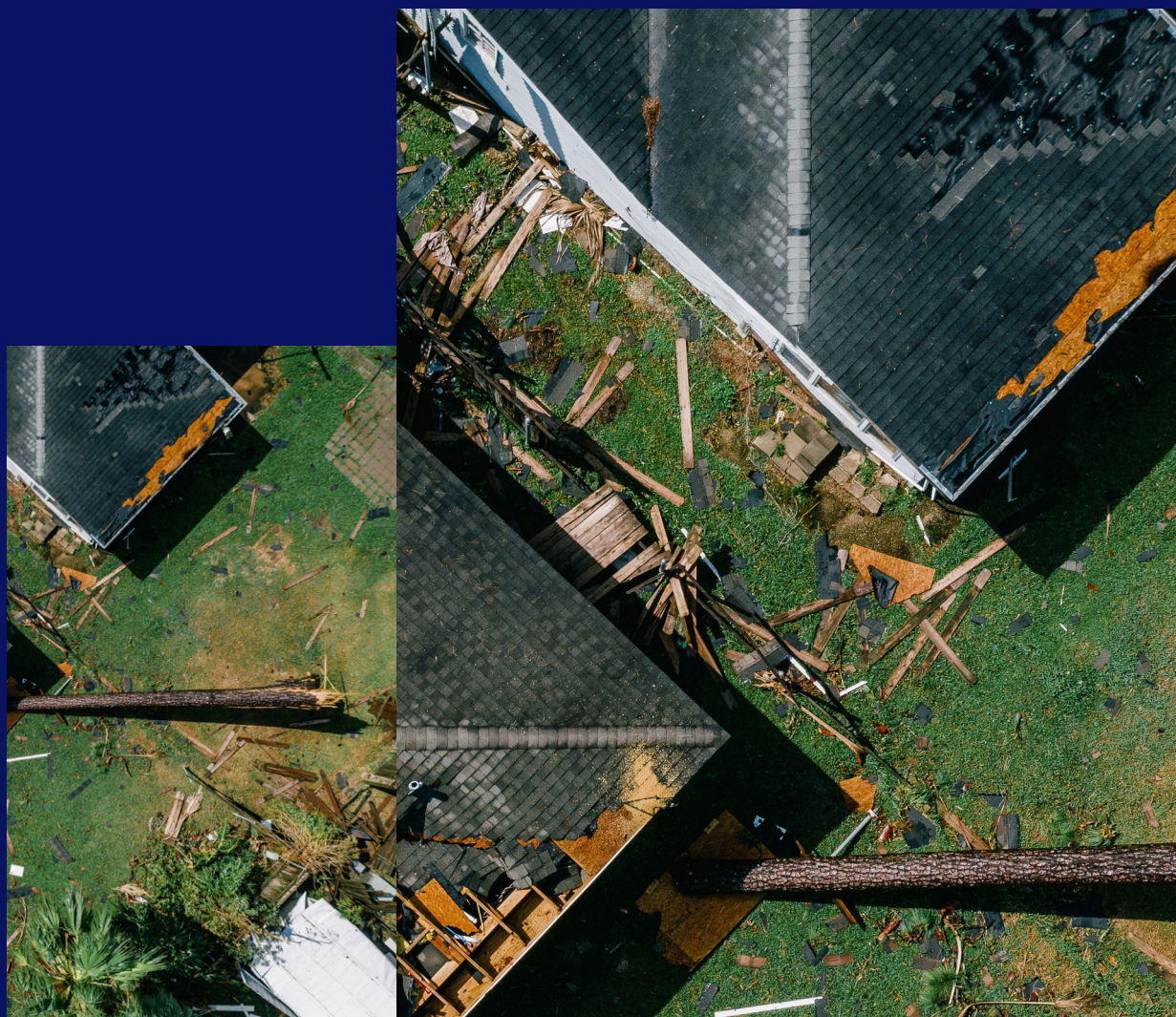
MOODY'S

Insurance Solutions

WHITE PAPER

Using Moody's HWind as a trigger for parametric insurance contracts



Executive summary

Parametric insurance contracts for hurricanes offer the promise of quicker payouts and the ability to fill in coverage gaps from traditional insurance. This enables businesses to recover more quickly in the aftermath of an event.

However, commonly used trigger methodologies, such as Cat-in-a-Box, can come with significant basis risk as these approaches only take into account the peak intensity of the storm and do not sufficiently consider the actual wind speeds experienced at a location.

Using Moody's HWind cumulative footprints as a trigger helps minimize basis risk. By relying on an extensive network of observational data to reconstruct the wind field of storms at a high resolution, wind speeds experienced at a specific site can be closely represented.

The wealth of knowledge HWind offers has helped proliferate its widespread usage as a parametric trigger for commercial insurance contracts in the industry today.

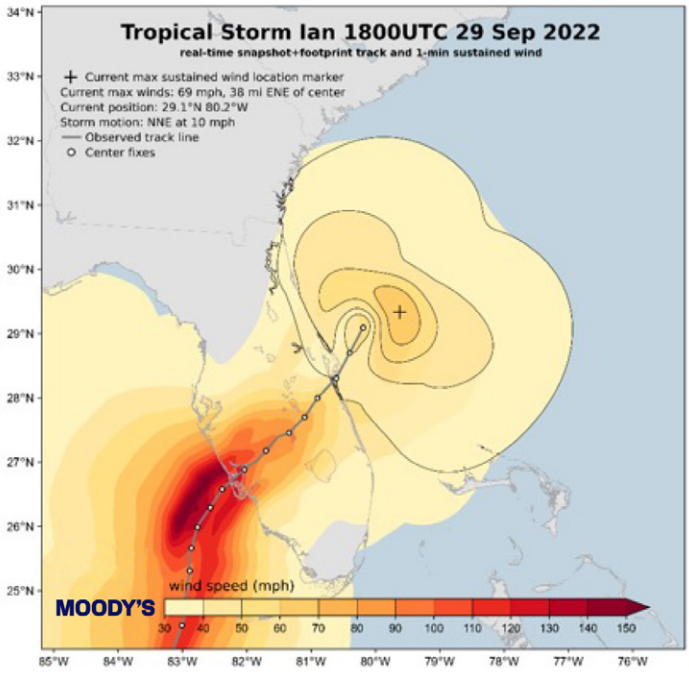
INTRODUCTION

Moody's HWind provides a comprehensive range of observation-based data products that deliver unique capabilities to help understand, anticipate, and manage tropical cyclone risk effectively. Developed over more than 25 years by world-leading hurricane observation researchers, this high-quality data is the industry standard for assessing damaging characteristics of tropical cyclones during and after landfall.

HWind data products produce real-time and historical wind field analyses in the western North Atlantic, East Pacific, and Central Pacific Basins, along with real-time wind and storm surge forecasting products for the North Atlantic Basin.

Parametric insurers primarily use HWind for its cumulative footprints, which provide a swath of the maximum wind speeds experienced during the storm (Figure 1). The final footprint is released within one to three days of the conclusion of the event. HWind encourages quick evaluation of hurricane trigger/payout conditions, enabling parametric policyholders to have rapid access to capital following impactful events.

FIGURE 1
HWind cumulative footprint of Hurricane Ian as of September 29, 2022, at 18:00 UTC.



HWIND CUMULATIVE FOOTPRINT METHODOLOGY

HWind snapshots represent instantaneous views of a storm's wind field and are created every six hours through its life cycle. These are the building blocks used to create the final footprint of a storm's maximum winds.

To generate these snapshots, HWind ingests observational data from more than 30 sources, including satellite data, aircraft reconnaissance, buoys, and land-based anemometers, as the data becomes available. This results in tens of thousands of individual measurements for each event. Usually, each snapshot reflects a six-hour data window before the valid snapshot time.

To create a snapshot, all relevant wind speed observations are standardized to represent the one-minute sustained wind at a height of 10 meters above the surface. In addition, the track of the storm is defined using a combination of existing track data and these detailed observations.

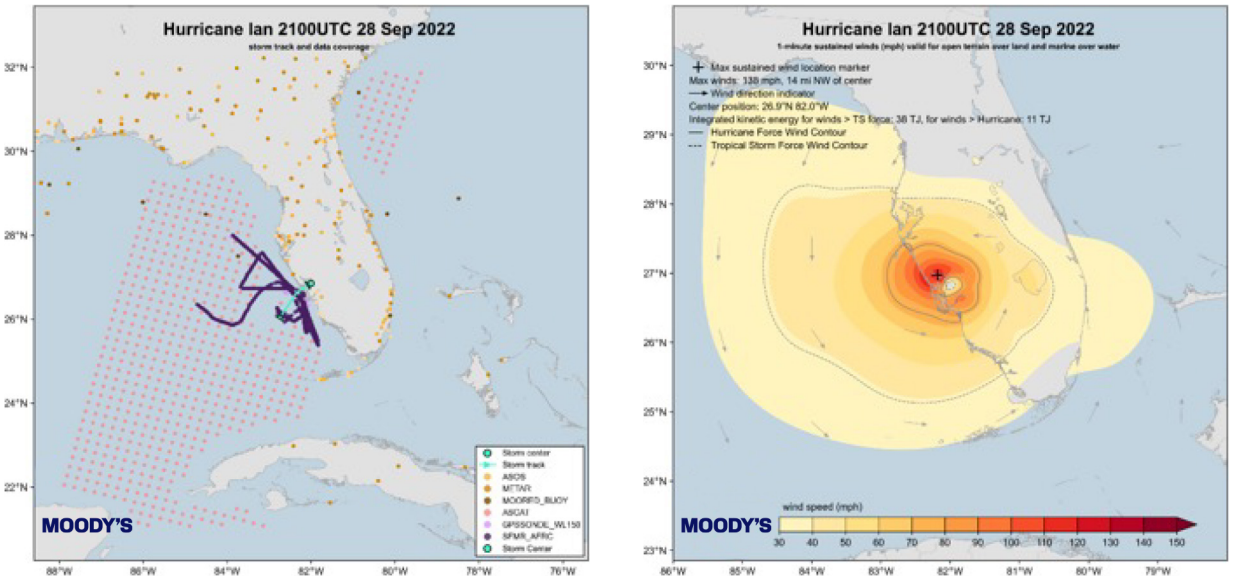
Then, as part of this process, meteorological analysts manually check the quality of the wind observation data. They remove any poor-quality data points, for instance those inconsistent with surrounding observations or likely to have been contaminated by rainfall.

Following this quality assurance, an objective analysis method is applied to the observations – to define the wind field at the chosen valid snapshot time at the relevant point on the storm's track. The resulting wind field represents over-water wind speeds using marine surface roughness conditions and over-land wind speeds using open terrain conditions, and it is output onto a high-resolution 1 kilometer uniform grid (Figure 2).

Cumulative footprints representing a swath of the maximum winds from the storm are then developed by interpolating between each of the individual snapshots across the storm's life cycle. The quality of the HWind methodology is backed by hundreds of citations in publications and scientific journals across a variety of fields.

Where insufficient observational data is available to use HWind's objective analysis method, the parametric wind field model from Moody's RMS™ North Atlantic Hurricane Models is leveraged to generate snapshots using data from the National Hurricane Center (NHC) as an input. This ensures coverage for all tropical storms affecting land in the North Atlantic, East Pacific, and Central Pacific Basins.

FIGURE 2
On the left, the plot shows coverage of data leveraged for snapshot generation on September 28, 2022, at 21:00 UTC for Hurricane Ian; on the right, the corresponding HWind snapshot of the wind field.



DIFFERENCES BETWEEN HWIND CUMULATIVE FOOTPRINTS AND NHC INFORMATION

One key advantage of HWind footprints as a parametric trigger for insurance policies, rather than publicly available information from the NHC, is the granular nature of the data. In HWind, wind speeds (in miles per hour) are measured to two decimal places at a resolution of 1 by 1 kilometer. This enables accurate identification of the actual wind speeds experienced at a location, minimizing the basis risk.

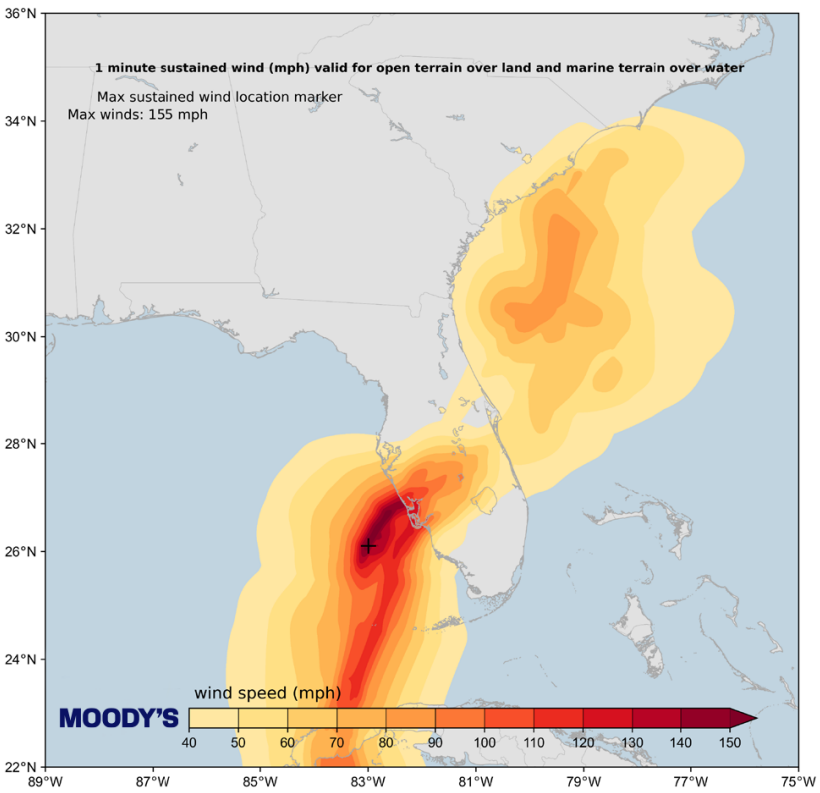
NHC information typically only includes the overall characteristics of the storm, such as the peak intensity, radius to maximum winds, or broad bands of hazard representing the areas of tropical storm and hurricane force winds. As a result, NHC information is unsuitable on its own for determining the precise wind speeds experienced at a location.

Cat-in-a-Box or circle trigger methodologies rely purely on peak intensity estimates to circumvent the challenge of using the publicly available information. However, significant basis risk is introduced – with the potential for the storm's maximum wind speed to differ substantially from wind speeds at the site of interest.

CAPTURING COMPLEX FEATURES OF STORM STRUCTURE

High resolution HWind footprints based purely on observations (where possible) can capture complex features of storm structure such as any significant asymmetries in the wind field, which can have significant implications for the maximum wind speeds assessed to have occurred at a location. A good recent example of this is Hurricane Ian which unusually had its strongest winds on the left side of the storm center. Figure 3 shows the final cumulative footprint developed in real time for Hurricane Ian.

FIGURE 3
The final, real-time cumulative HWind footprint for Hurricane Ian reflecting 1 minute sustained winds (mph).



The HWind footprint correctly captured the maximum winds on the left side of storm motion. This ensured that maximum wind speeds for locations to the left of the storm center would not be underestimated when determining a payout from a parametric insurance contract.

A DIFFERENCE OF DATA AND MISSION

The focus of HWind on what near-surface observations are reporting is another significant difference from the NHC. Where possible HWind uses purely the observational data available to estimate peak intensity. However, the NHC can sometimes use the Dvorak technique, an indirect estimate of peak intensity based on cloud-top satellite presentation, or a sea level pressure estimate for peak intensity and/or make assumptions about missing data.

In addition, HWind uses several data sources that are not available to the NHC or other data vendors. For instance, Moody's has exclusive access to data from the StickNet portable anemometers deployed by Texas Tech University.

Proprietary data sources made a significant difference during Hurricane Maria (2017). When Maria passed over Puerto Rico, many data providers were largely reliant on weather stations which were knocked out of service by blackouts or failed under the high wind speeds. However, with the extensive observational network exclusive to HWind, other observations were available to help fill in the gaps.

Finally, HWind and the NHC have different objectives and missions. This may lead to notable differences in reported wind speeds. The primary goal of HWind footprints is to provide the most accurate representation of tropical cyclone hazard characteristics data using objective, ground-truth observations. Whereas the primary goal of the NHC is to protect life and property, and thus they are more likely to err on the side of conservatism when reporting wind speeds during an event to ensure the evacuation and safety of the public.

Case study: Hurricane Ian

Let's take a look at how HWind could have triggered a parametric insurance contract in the wake of Hurricane Ian in this sample scenario:

→ Single-location hotel resort in Venice, Florida

→ Policy limit per occurrence: US$5 million

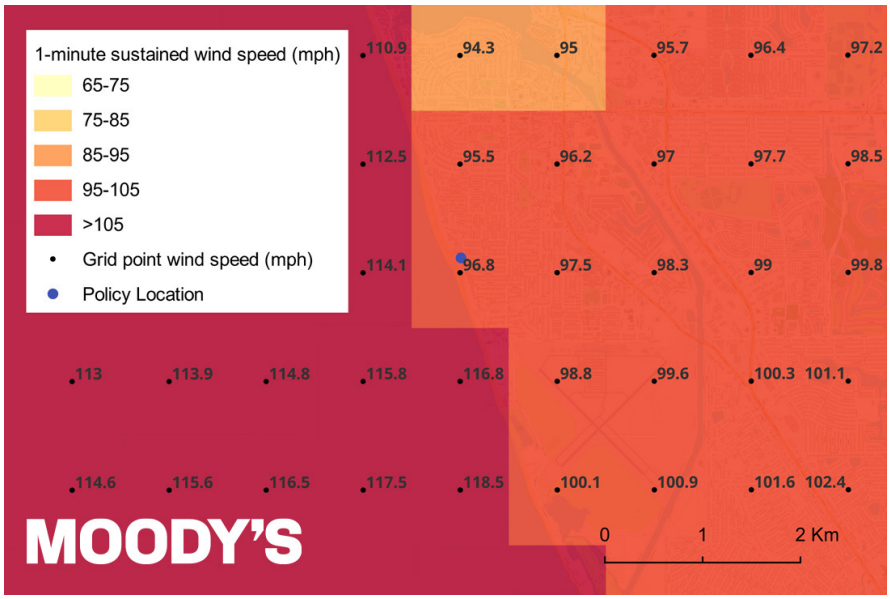
→ Trigger location: 27.08636°, –82.4549°

→ Payout based on the following table:

Max 1-min sustained wind speed	Payout (% of limit)
65-75 mph	5%
75-85 mph	15%
85-95 mph	50%
95-105 mph	75%
105+ mph	100%

By examining the final HWind cumulative footprint for Hurricane Ian at this location, as seen in Figure 4, the maximum one-minute sustained wind speed experienced at the nearest HWind grid point to the location during the event was 96.8 mph. This would have resulted in a 75 percent policy payout corresponding to US$3.75 million.

FIGURE 4
Gridded one-minute sustained wind speeds from HWind's cumulative footprint for Hurricane Ian, including the policy location.



Rather than using the wind speed at the nearest grid point, trigger structures can instead take the highest wind speed value of the four grid points within a kilometer of the location or interpolate between them to generate a wind speed for the specific location of interest. HWind permits these different options, which provides both insurers and insureds the flexibility to decide what is most suitable for their policies.

WIDESPREAD USAGE WITHIN THE PARAMETRIC INSURANCE INDUSTRY

HWind has widespread usage within the insurance industry as a parametric trigger and is relied on by our customers, including Swiss Re Corporate Solutions and AXA Climate.

Swiss Re Corporate Solutions leverage HWind as the trigger for its parametric STORM insurance solution in the U.S. and Caribbean.

Martin Hotz, Head Parametric Nat Cat at Swiss Re Corporate Solutions, said: “For many years we have been using HWind to quickly settle parametric hurricane insurance claims. HWind provides us with the data we need to identify the wind speed that occurred at the insured’s location to closely mirror a client’s experience during a hurricane. Every hurricane is unique, and the HWind data reflects this in an objective and consistent way.”

With HWind, AXA Climate is fully flexible in how and where it structures parametric policies. The company is now able to reassure clients that when damaging winds occur, they will quickly receive the protection they purchased.

Amaury Dufetel, Head of Insurance at AXA Climate, said: “As an engaged climate insurer, we believe the preciseness of sophisticated real-time data is essential to improve the use and uptake of parametric insurance solutions. Data coming from independent reputable organizations like Moody’s HWind solutions, developed over more than 25 years by one of the world’s leading hurricane observation researchers, will allow us to structure innovative parametric covers and bring to our clients the best tailor-made tropical cyclone coverage both in terms of price and claim settlement.”

Conclusion

Based on thousands of observations, HWind cumulative footprints provide the best-available representation of a wind field following a tropical storm or hurricane event. With final footprints released one to three days after the dissipation of a storm, HWind can be leveraged as a parametric trigger that comes with the benefit of enabling speedy payouts.

While this is similar to other parametric insurance offerings, HWind provides a reduced basis risk due to its ability to accurately capture the hazard experienced at a specific location. As a result, HWind is increasingly being used for this purpose throughout the insurance industry.

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