

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.

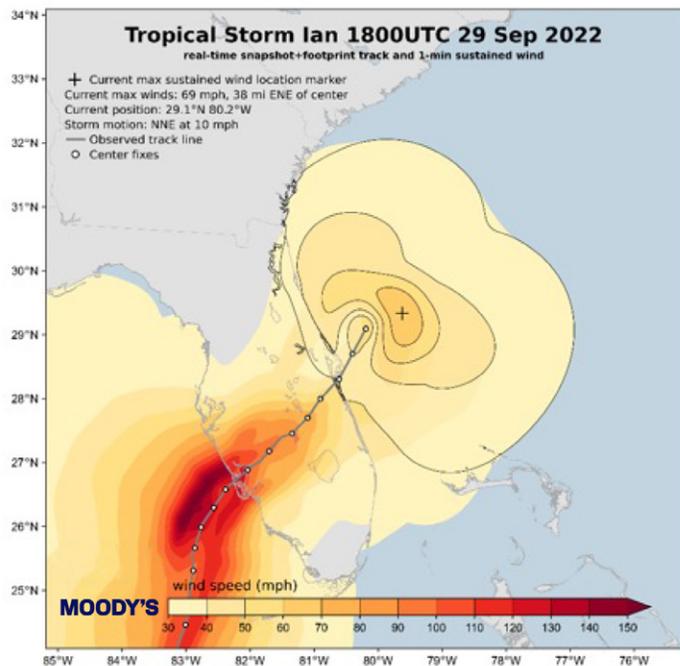
HWind data products produce real-time and historical wind field analyses in the western North Atlantic, East Pacific, and Central Pacific Basins, along with real-time wind and storm surge forecasting products for the North Atlantic Basin.



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.

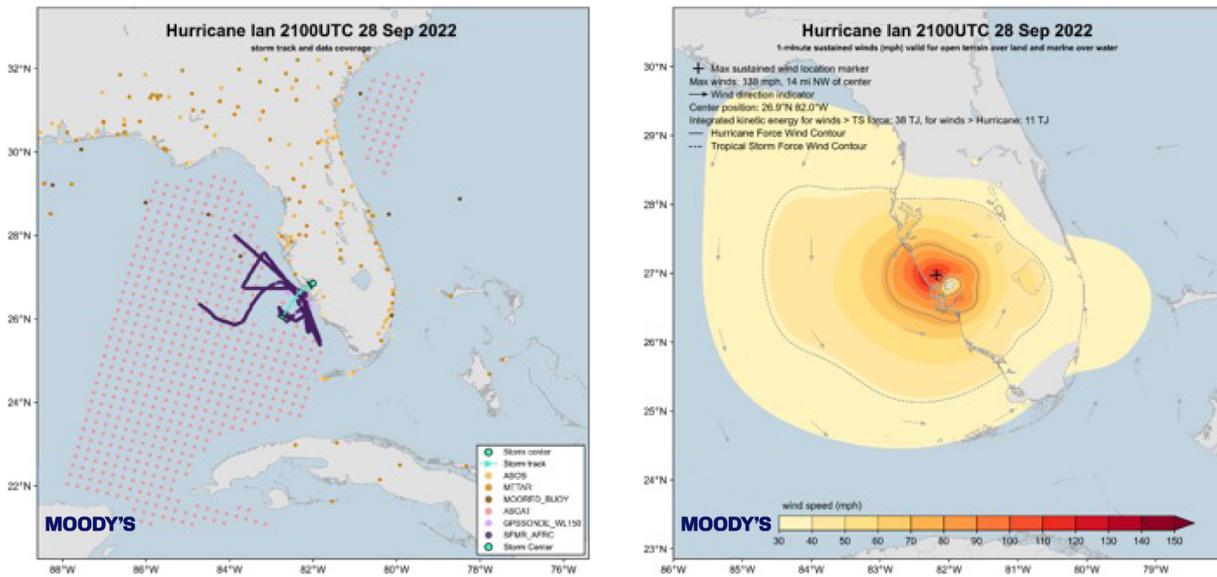
Following this quality assurance, an objective analysis method is applied to the observations – to define the wind field at the chosen valid snapshot time at the relevant point on the storm’s track. The resulting wind field represents over-water wind speeds using marine surface roughness conditions and 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.

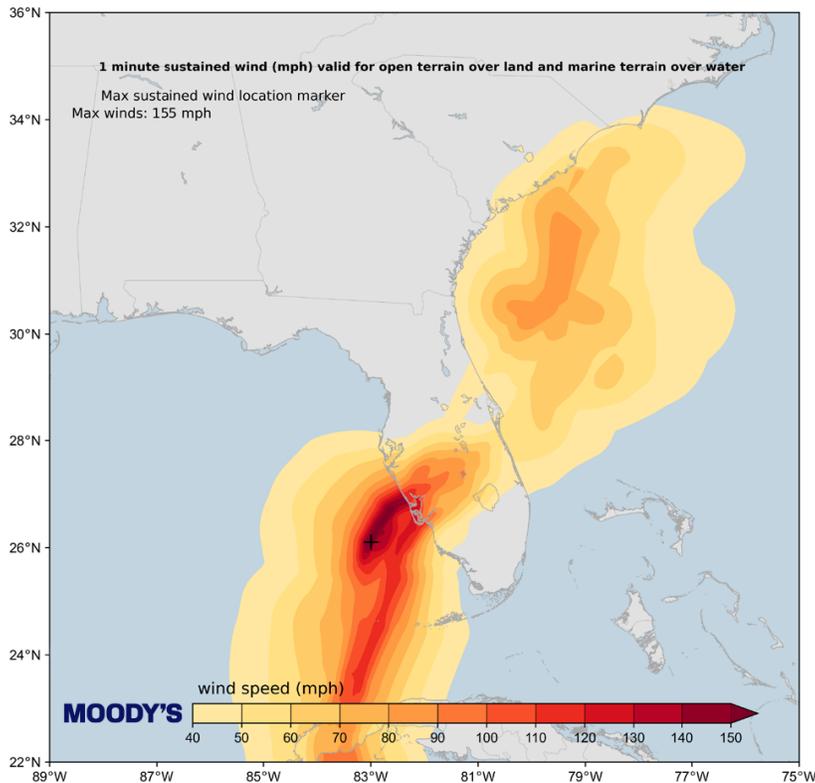
Cat-in-a-Box or circle trigger methodologies rely purely on peak intensity estimates to circumvent the challenge of using the publicly available information. However, significant basis risk is introduced – with the potential for the storm’s maximum wind speed to differ substantially from wind speeds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

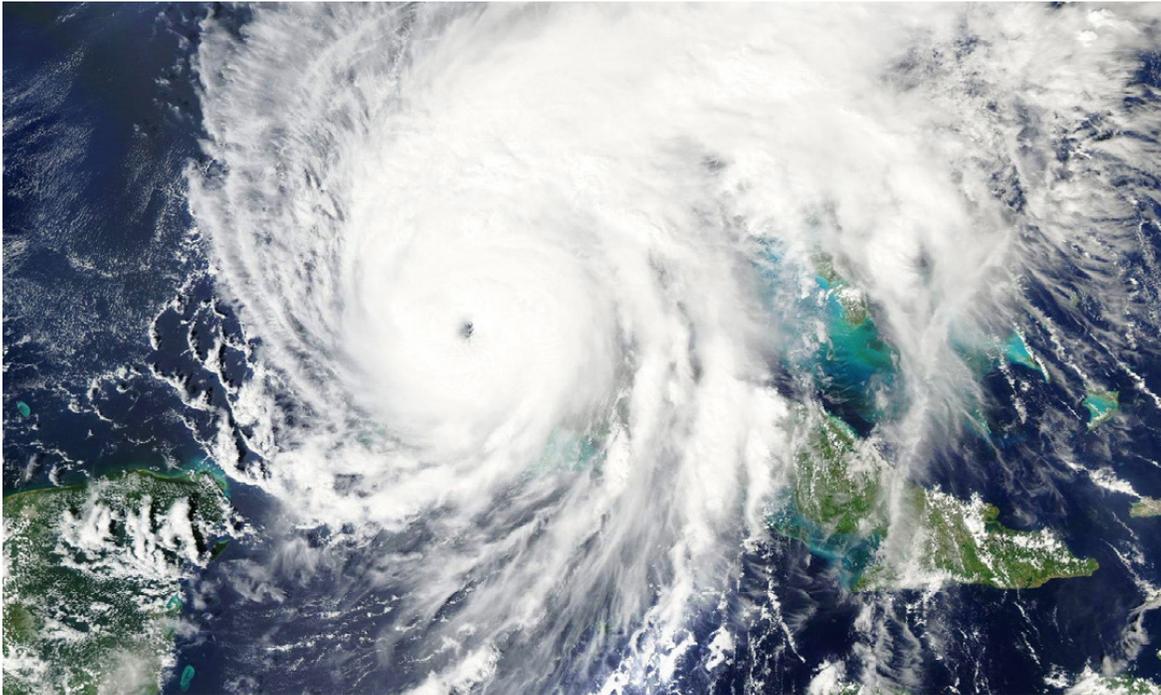
A DIFFERENCE OF DATA AND MISSION

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:

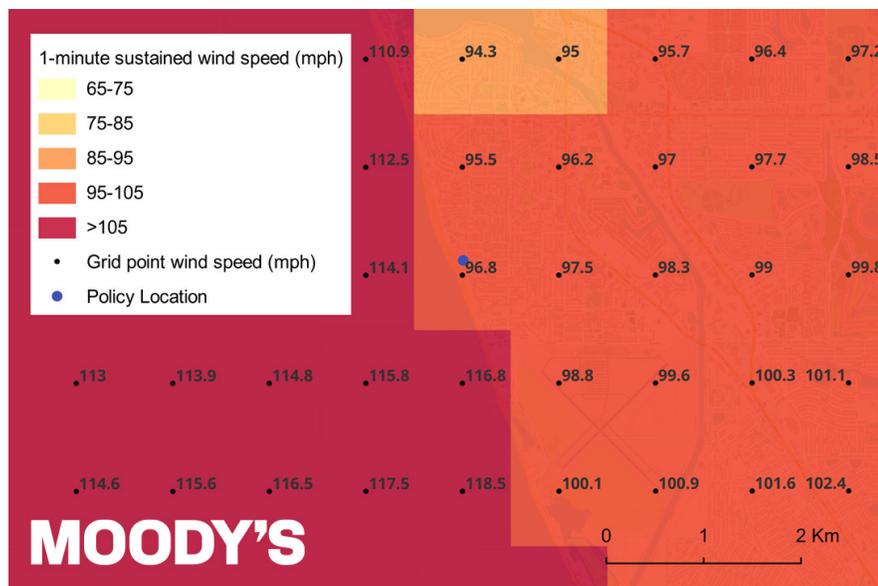
- Single-location hotel resort in Venice, Florida
- Policy limit per occurrence: US\$5 million
- Trigger location: 27.08636°, -82.4549°
- Payout based on the following table:

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.

MOODY'S

Contact us

AMERICAS

+1.212.123.4567
clientservices@moodys.com

EMEA

+44.20.1234.5678
clientservices.emea@moodys.com

ASIA (EXCLUDING JAPAN)

+852.1234.5678
clientservices.asia@moodys.com

JAPAN

+81.1234.5678
clientservices.japan@moodys.com

© 2025 Moody's Corporation, Moody's Investors Service, Inc., Moody's Analytics, Inc. and/or their licensors and affiliates (collectively, "MOODY'S"). All rights reserved.

CREDIT RATINGS ISSUED BY MOODY'S CREDIT RATINGS AFFILIATES ARE THEIR CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES, AND MATERIALS, PRODUCTS, SERVICES AND INFORMATION PUBLISHED OR OTHERWISE MADE AVAILABLE BY MOODY'S (COLLECTIVELY, "MATERIALS") MAY INCLUDE SUCH CURRENT OPINIONS. MOODY'S DEFINES CREDIT RISK AS THE RISK THAT AN ENTITY MAY NOT MEET ITS CONTRACTUAL FINANCIAL OBLIGATIONS AS THEY COME DUE AND ANY ESTIMATED FINANCIAL LOSS IN THE EVENT OF DEFAULT OR IMPAIRMENT. SEE APPLICABLE MOODY'S RATING SYMBOLS AND DEFINITIONS PUBLICATION FOR INFORMATION ON THE TYPES OF CONTRACTUAL FINANCIAL OBLIGATIONS ADDRESSED BY MOODY'S CREDIT RATINGS. CREDIT RATINGS DO NOT ADDRESS ANY OTHER RISK, INCLUDING BUT NOT LIMITED TO: LIQUIDITY RISK, MARKET VALUE RISK, OR PRICE VOLATILITY. CREDIT RATINGS, NON-CREDIT ASSESSMENTS ("ASSESSMENTS"), AND OTHER OPINIONS INCLUDED IN MOODY'S MATERIALS ARE NOT STATEMENTS OF CURRENT OR HISTORICAL FACT. MOODY'S MATERIALS MAY ALSO INCLUDE QUANTITATIVE MODEL-BASED ESTIMATES OF CREDIT RISK AND RELATED OPINIONS OR COMMENTARY PUBLISHED BY MOODY'S ANALYTICS, INC. AND/OR ITS AFFILIATES. MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND MATERIALS DO NOT CONSTITUTE OR PROVIDE INVESTMENT OR FINANCIAL ADVICE, AND MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND MATERIALS ARE NOT AND DO NOT PROVIDE RECOMMENDATIONS TO PURCHASE, SELL, OR HOLD PARTICULAR SECURITIES. MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND MATERIALS DO NOT COMMENT ON THE SUITABILITY OF AN INVESTMENT FOR ANY PARTICULAR INVESTOR. MOODY'S ISSUES ITS CREDIT RATINGS, ASSESSMENTS AND OTHER OPINIONS AND PUBLISHES OR OTHERWISE MAKES AVAILABLE ITS MATERIALS WITH THE EXPECTATION AND UNDERSTANDING THAT EACH INVESTOR WILL, WITH DUE CARE, MAKE ITS OWN STUDY AND EVALUATION OF EACH SECURITY THAT IS UNDER CONSIDERATION FOR PURCHASE, HOLDING, OR SALE.

MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS, AND MATERIALS ARE NOT INTENDED FOR USE BY RETAIL INVESTORS AND IT WOULD BE RECKLESS AND INAPPROPRIATE FOR RETAIL INVESTORS TO USE MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS OR MATERIALS WHEN MAKING AN INVESTMENT DECISION. IF IN DOUBT YOU SHOULD CONTACT YOUR FINANCIAL OR OTHER PROFESSIONAL ADVISER.

ALL INFORMATION CONTAINED HEREIN IS PROTECTED BY LAW, INCLUDING BUT NOT LIMITED TO, COPYRIGHT LAW, AND NONE OF SUCH INFORMATION MAY BE COPIED OR OTHERWISE REPRODUCED, REPACKAGED, FURTHER TRANSMITTED, TRANSFERRED, DISSEMINATED, REDISTRIBUTED OR RESOLD, OR STORED FOR SUBSEQUENT USE FOR ANY SUCH PURPOSE, IN WHOLE OR IN PART, IN ANY FORM OR MANNER OR BY ANY MEANS WHATSOEVER, BY ANY PERSON WITHOUT MOODY'S PRIOR WRITTEN CONSENT. FOR CLARITY, NO INFORMATION CONTAINED HEREIN MAY BE USED TO DEVELOP, IMPROVE, TRAIN OR RETRAIN ANY SOFTWARE PROGRAM OR DATABASE, INCLUDING, BUT NOT LIMITED TO, FOR ANY ARTIFICIAL INTELLIGENCE, MACHINE LEARNING OR NATURAL LANGUAGE PROCESSING SOFTWARE, ALGORITHM, METHODOLOGY AND/OR MODEL.

MOODY'S CREDIT RATINGS, ASSESSMENTS, OTHER OPINIONS AND MATERIALS ARE NOT INTENDED FOR USE BY ANY PERSON AS A BENCHMARK AS THAT TERM IS DEFINED FOR REGULATORY PURPOSES AND MUST NOT BE USED IN ANY WAY THAT COULD RESULT IN THEM BEING CONSIDERED A BENCHMARK.

All information contained herein is obtained by MOODY'S from sources believed by it to be accurate and reliable. Because of the possibility of human or mechanical error as well as other factors, however, all information contained herein is provided "AS IS" without warranty of any kind. MOODY'S adopts all necessary measures so that the information it uses in assigning a credit rating is of sufficient quality and from sources MOODY'S considers to be reliable including, when appropriate, independent third-party sources. However, MOODY'S is not an auditor and cannot in every instance independently verify or validate information received in the credit rating process or in preparing its Materials.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability to any person or entity for any indirect, special, consequential, or incidental losses or damages whatsoever arising from or in connection with the information contained herein or the use of or inability to use any such information, even if MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers is advised in advance of the possibility of such losses or damages, including but not limited to: (a) any loss of present or prospective profits or (b) any loss or damage arising where the relevant financial instrument is not the subject of a particular credit rating assigned by MOODY'S.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability for any direct or compensatory losses or damages caused to any person or entity, including but not limited to by any negligence (but excluding fraud, willful misconduct or any other type of liability that, for the avoidance of doubt, by law cannot be excluded) on the part of, or any contingency within or beyond the control of, MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers, arising from or in connection with the information contained herein or the use of or inability to use any such information.

NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, TIMELINESS, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY CREDIT RATING, ASSESSMENT, OTHER OPINION OR INFORMATION IS GIVEN OR MADE BY MOODY'S IN ANY FORM OR MANNER WHATSOEVER.

Moody's Investors Service, Inc., a wholly-owned credit rating agency subsidiary of Moody's Corporation ("MCO"), hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by Moody's Investors Service, Inc. have, prior to assignment of any credit rating, agreed to pay to Moody's Investors Service, Inc. for credit ratings opinions and services rendered by it. MCO and Moody's Investors Service also maintain policies and procedures to address the independence of Moody's Investors Service credit ratings and credit rating processes. Information regarding certain affiliations that may exist between directors of MCO and rated entities, and between entities who hold credit ratings from Moody's Investors Service, Inc. and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually at www.moody's.com under the heading "Investor Relations — Corporate Governance — Charter Documents - Director and Shareholder Affiliation Policy."

Moody's SF Japan K.K., Moody's Local AR Agente de Calificación de Riesgo S.A., Moody's Local BR Agência de Classificação de Risco LTDA, Moody's Local MX S.A. de C.V., I.C.V., Moody's Local PE Clasificadora de Riesgo S.A., and Moody's Local PA Calificadora de Riesgo S.A. (collectively, the "Moody's Non-NRSRO CRAs") are all indirectly wholly-owned credit rating agency subsidiaries of MCO. None of the Moody's Non-NRSRO CRAs is a Nationally Recognized Statistical Rating Organization.

Additional terms for Australia only: Any publication into Australia of this document is pursuant to the Australian Financial Services License of MOODY'S affiliate, Moody's Investors Service Pty Limited ABN 61 003 399 657AFSL 336969 and/or Moody's Analytics Australia Pty Ltd ABN 94 105 136 972 AFSL 383569 (as applicable). This document is intended to be provided only to "wholesale clients" within the meaning of section 761G of the Corporations Act 2001. By continuing to access this document from within Australia, you represent to MOODY'S that you are, or are accessing the document as a representative of, a "wholesale client" and that neither you nor the entity you represent will directly or indirectly disseminate this document or its contents to "retail clients" within the meaning of section 761G of the Corporations Act 2001. MOODY'S credit rating is an opinion as to the creditworthiness of a debt obligation of the issuer, not on the equity securities of the issuer or any form of security that is available to retail investors.

Additional terms for India only: Moody's credit ratings, Assessments, other opinions and Materials are not intended to be and shall not be relied upon or used by any users located in India in relation to securities listed or proposed to be listed on Indian stock exchanges.

Additional terms with respect to Second Party Opinions (as defined in Moody's Investors Service Rating Symbols and Definitions): Please note that a Second Party Opinion ("SPO") is not a "credit rating". The issuance of SPOs is not a regulated activity in many jurisdictions, including Singapore. JAPAN: In Japan, development and provision of SPOs fall under the category of "Ancillary Businesses", not "Credit Rating Business", and are not subject to the regulations applicable to "Credit Rating Business" under the Financial Instruments and Exchange Act of Japan and its relevant regulation. PRC: Any SPO: (1) does not constitute a PRC Green Bond Assessment as defined under any relevant PRC laws or regulations; (2) cannot be included in any registration statement, offering circular, prospectus or any other documents submitted to the PRC regulatory authorities or otherwise used to satisfy any PRC regulatory disclosure requirement; and (3) cannot be used within the PRC for any regulatory purpose or for any other purpose which is not permitted under relevant PRC laws or regulations. For the purposes of this disclaimer, "PRC" refers to the mainland of the People's Republic of China, excluding Hong Kong, Macau and Taiwan.