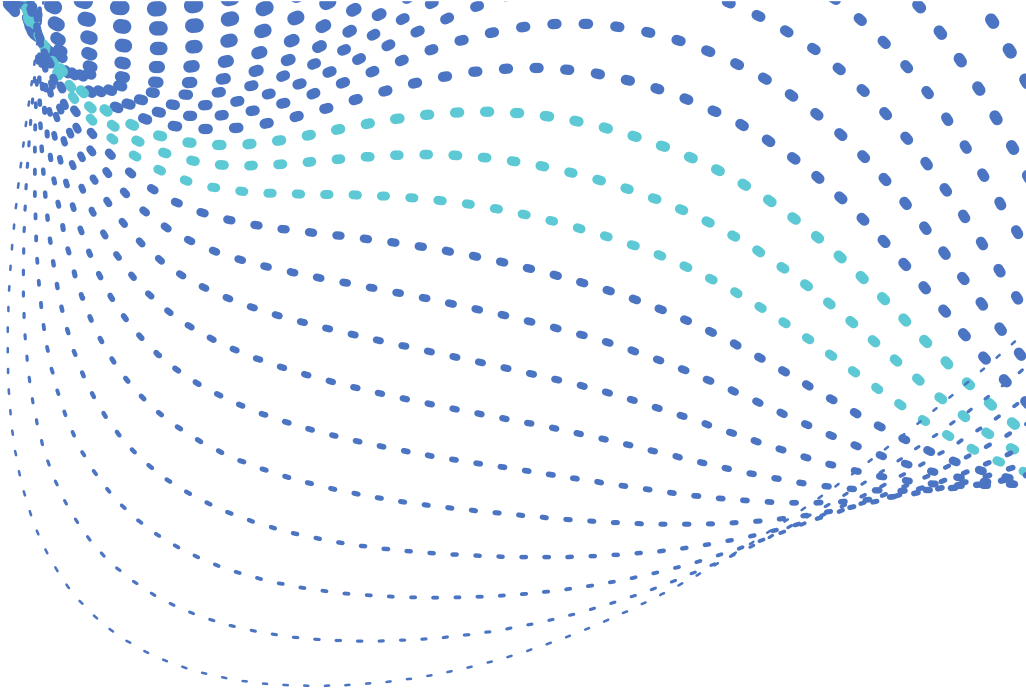

Climate Change Projections

U.S. Hurricane and Caribbean Tropical Cyclone Models

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Industry challenge

Insurers and reinsurers are actively working to assess the impacts of climate change on their portfolios. To help the (re)insurance market understand how the risks written today are expected to change over the next few decades, Verisk has released climate change projections for our industry-leading U.S. hurricane and Caribbean tropical cyclone models.

Catastrophe models have been developed over the past three decades to model the financial impacts of extreme weather. While frequent updates to models ensures the risk posed by the near-present (0-10 years) climate is better reflected, additional research and analyses are necessary to project a forward-looking view of risk decades into the future. To estimate the longer-term (10+ years) view of climate risk, Verisk has leveraged its robust catastrophe models and implemented the latest science and state-of-the-art methodologies to create climate change projections to help assess the future risk of climate change.

Climate Change Projections offer a range of plausible outcomes

A catastrophe model can be climate-conditioned in several ways so that the event set in the model reflects projected future climate states. Verisk offers climate change projections that can be applied to results from the U.S. Hurricane and Caribbean Tropical Cyclone Models produced from Touchstone® and Touchstone Re™ 2022.

These Climate Change Projections provide a probabilistic view of future risk in 2030, 2050, 2075, and 2100. Applying them across the full distribution of simulated events lets users estimate the projections' impact on how average annual losses (AALs) and key return period metrics, such as 100-year losses, may change in the future. The projections are developed as a set of mapping files that can be used to adjust U.S. and Caribbean year event loss tables (YELTs) to account for changes in tropical cyclone frequency by Saffir-Simpson category under four climate scenarios at four future time horizons.

The climate change projections were developed using Verisk's industry-leading models for U.S. hurricanes and Caribbean tropical cyclones. Verisk's climate change experts resampled events from the 10,000-year Standard and Warm Sea Surface Temperature (WSST) catalogs to match hazard projections under each climate scenario and created a new 10,000-year catalog representing future impacts of climate change.

With these projections, clients can simulate the effects of climate change across four coupled shared socioeconomic pathway (SSP) and representative concentration pathway (RCP) scenarios between 2030 and 2100. The SSP-RCP scenarios were used by the Intergovernmental Panel on Climate Change (IPCC) for their sixth and latest assessment report.

*** It is important to note that the projections are not a prediction of what the future climate will bring. Rather, they represent a set of plausible outcomes based on a specific set of assumptions and interpretation of current scientific literature. The climate change projections enable clients to evaluate potential outcomes, test sensitivity to various climate scenarios, and assess a level of risk compared to today.*

Climate Change Projections - delivery

The Climate Change Projections consist of 16 mapping files in comma-separated value (CSV) format that can be used inside and outside of Touchstone. Using Custom Frequency, clients can create climate projections for their exposures as a Touchstone analysis and compare baselines within the Touchstone UI. Custom Frequency is available on the analysis configuration screen, where users can import the climate projections and run analyses for one or multiple projections, accurately modeling all financial terms and fitting their workflow.

The projections' flexibility also allows users to apply them to post-analysis exposures outside of Touchstone. Event remapping can be performed through a variety of different tools including Microsoft SQL, R, Microsoft Excel, Python, C++, and Java. Example scripts for MS SQL and R are provided within the Climate Change Projections documentation.

The Standard and WSST versions of the 10,000-year Verisk Hurricane Model each have separate mapping files, for a total of 32 different mapping files.

The solutions include a detailed technical document describing how the solutions were developed and the impact they can have on present-day exposure.

Climate Change Projections - use cases

The projections can be leveraged to assess future losses for residential, commercial/industrial, manufactured (mobile) home, and automobile lines of business. The results have a variety of use cases, including:

- Responding to regulatory climate disclosure requirements and environmental, social, and governance (ESG) reporting
- Stress-testing and rebalancing portfolios
- Improving climate risk insights and streamlining reporting to stakeholders and investors
- Gaining peril-specific insights to inform mitigation and adaptation strategies

Methodology – downscaling from general circulation models

Verisk adopted projections in tropical cyclone frequencies in the North Atlantic basin and at landfall, which were derived from dynamically downscaled climate simulations. "Dynamic downscaling" refers to the use of high-resolution regional simulations to extrapolate the effects of large-scale climate processes to regional or local scales of interest. Nine general circulation models (GCMs) from the sixth and most recent phase of the Coupled Model Intercomparison Project (CMIP6) provide the latest view of future environmental conditions under a doubling of carbon dioxide concentration, which is then fed through a physically based, dynamical downscaling model that simulates realistic hurricanes at every Saffir-Simpson category.

Methodology - RCP scenarios

Verisk scientists have used these basin projections to derive separate projections at landfall for the U.S. for four combinations of SSPs and RCPs: SSP1-RCP2.6, SSP2-RCP4.5, SSP3-RCP7.0, and SSP5-RCP8.5. Each scenario has four mapping files representing that scenario in 2030, 2050, 2075, and 2100.

For more information about our climate change solutions or how to license the climate change projection mapping files, please contact the Verisk Climate Change Practice.

Verisk.com

About Extreme Event Solutions at Verisk

Extreme event solutions at Verisk (AIR Worldwide) provides risk modeling solutions that help individuals, businesses, and society become more resilient to extreme events. In 1987, Verisk founded the catastrophe modeling industry; today, the company models the risk from natural catastrophes, supply chain disruptions, terrorism, pandemics, and casualty catastrophes.

Insurance, reinsurance, financial, corporate, and government clients rely on Verisk's advanced science, software, and consulting services for catastrophe risk management, insurance-linked securities, longevity modeling, site-specific engineering analyses, and agricultural risk management.

Verisk's extreme event solutions team is headquartered in Boston, with additional offices in North America, Europe, and Asia. For more information, please visit www.air-worldwide.com. For more information about Verisk, a leading data analytics provider serving customers in insurance and energy, please visit www.verisk.com.