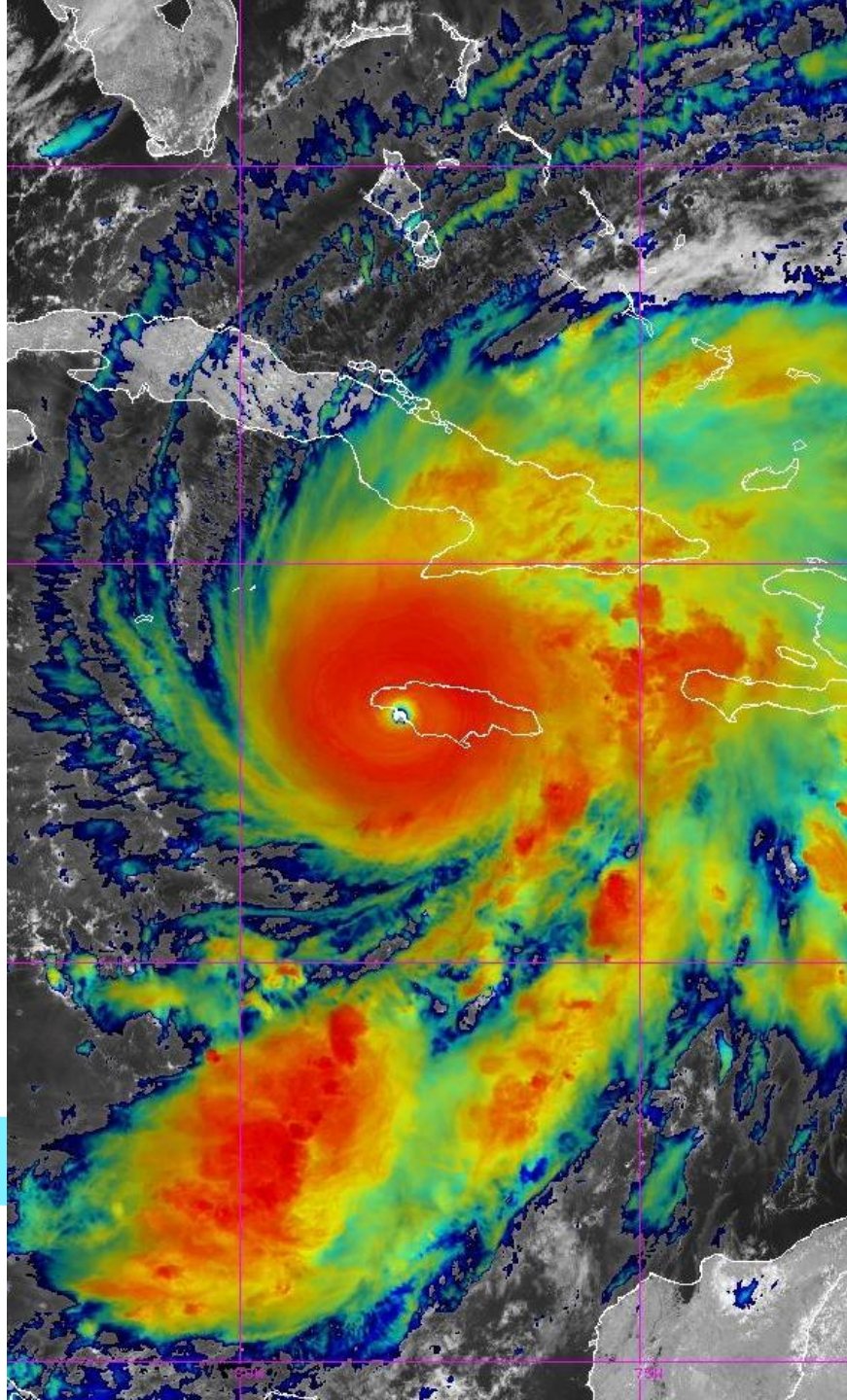
Verisk™

2025 U.S. Hurricane Season Review

Jeff Strong, PhD, Senior Scientist



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Today's agenda

1 **Season Overview**

How did the 2025 Atlantic hurricane season shape up?

2 **Notable Storms**

What were the most significant storms of the season?

3 **Forecast Validation**

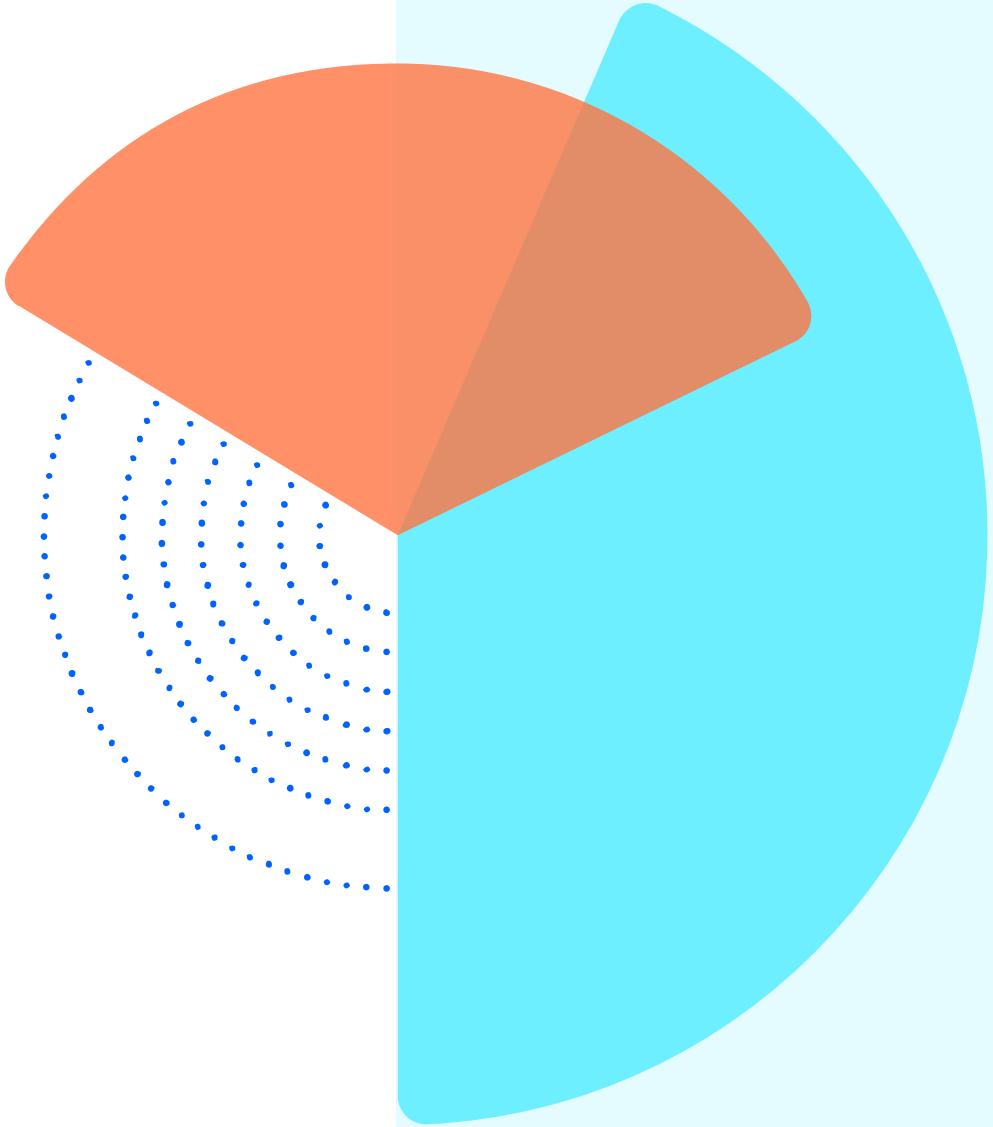
How did the pre-season predictions fare?

4 **Climate Signals**

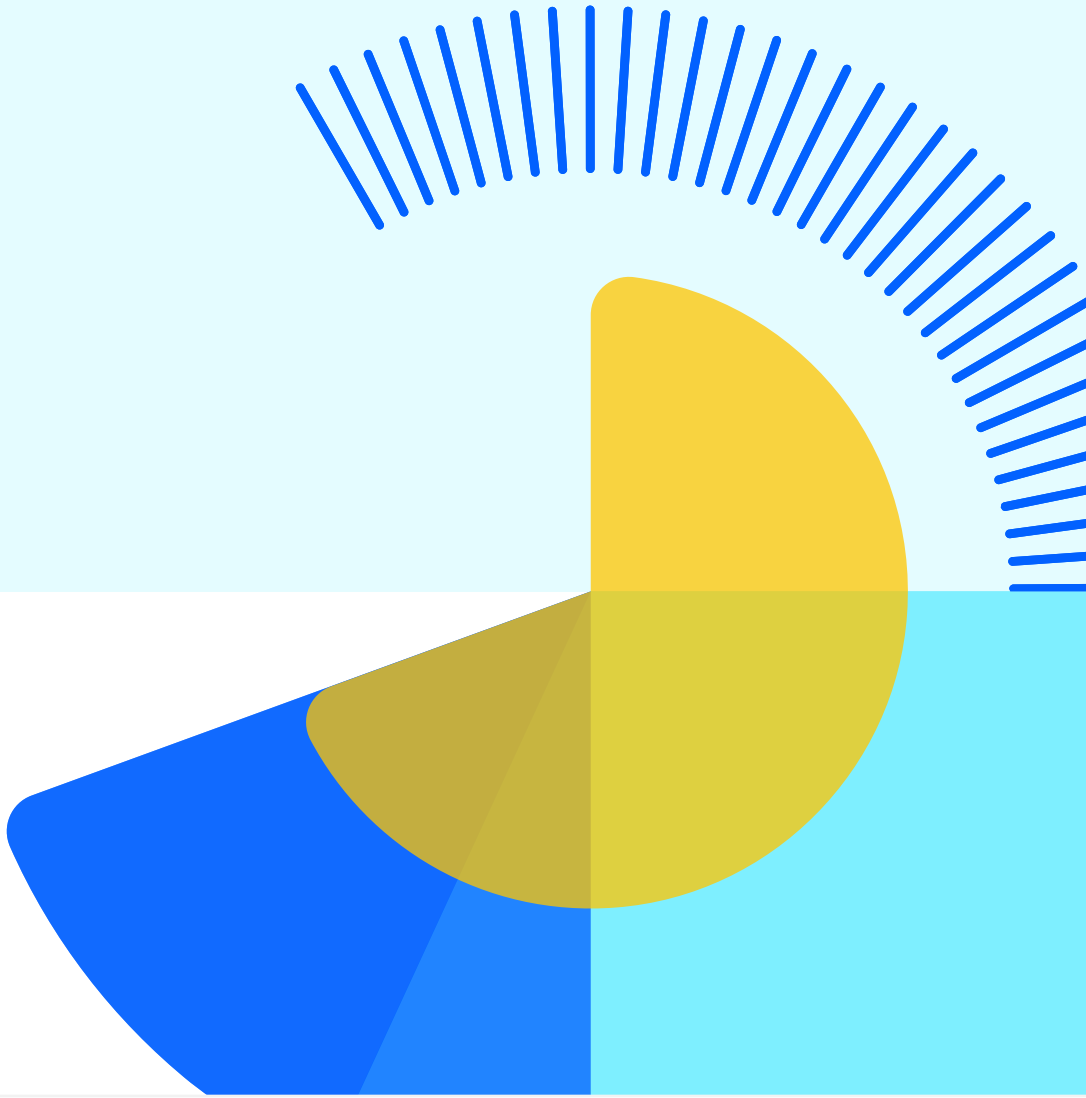
What were the signals behind this past year?

5 **Verisk Offerings**

What can Verisk offer to our clients?



1 Atlantic Season Overview



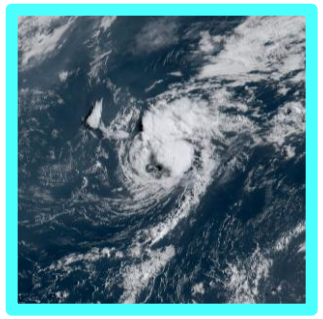
The end of the U.S. landfalling hurricane streak alongside one of the strongest hurricanes on record

Atlantic Tropical Cyclones in 2025

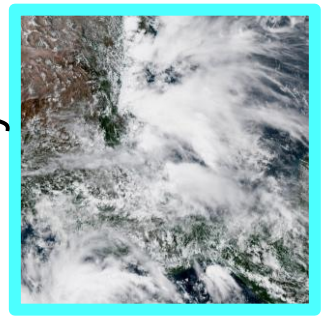
Peak Intensities

JUN

Andrea[1]



Barry[2]



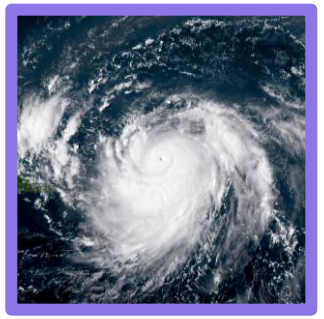
JUL

Chantal[3a]

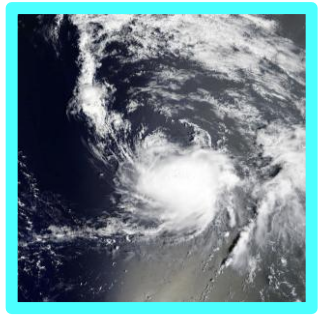
AUG

Dexter[1]

Erin[2]

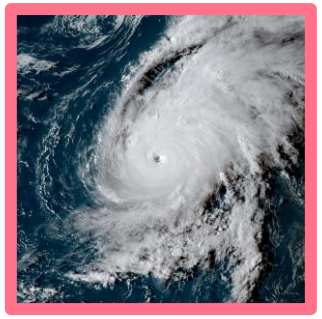


Fernand[3b]

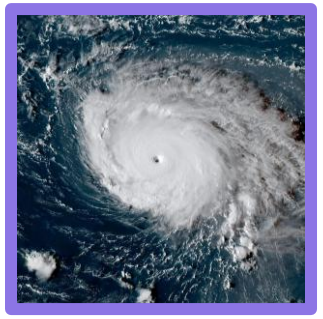


SEP

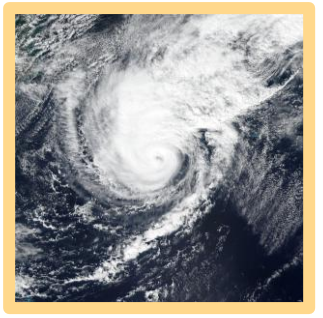
Gabrielle[2]



Humberto[2]

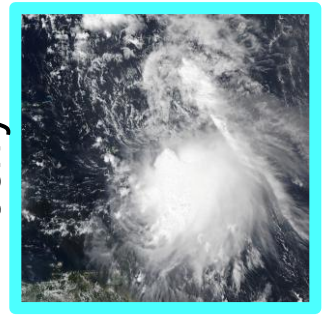


Imelda[1]

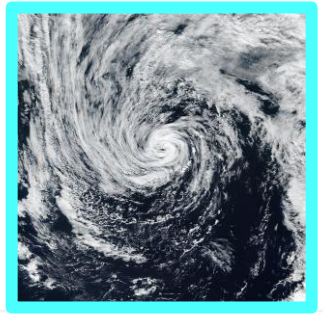


OCT

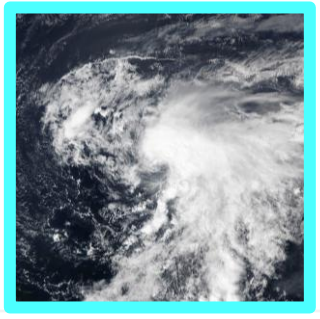
Jerry[1]



Karen[1]



Lorenzo[1]



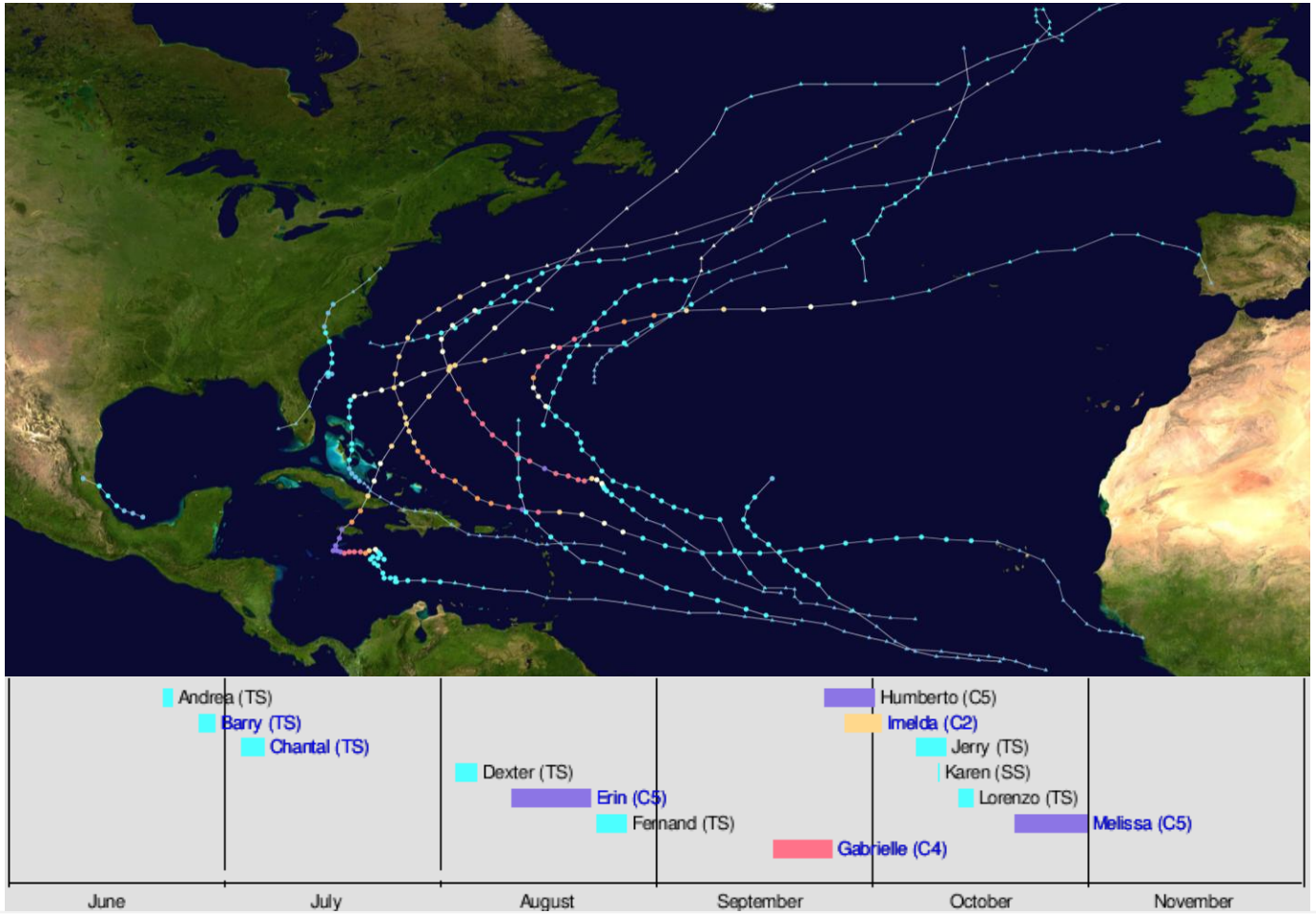
Melissa[2]

- Category 5 (≥157 mph)
- Category 4 (130 – 156 mph)
- Category 3 (111 – 129 mph)
- Category 2 (96 – 110 mph)
- Category 1 (74 – 95 mph)
- Tropical Storm (39 – 73 mph)
- Tropical Depression (≤38 mph)

1. VIIRS Imagery from NOAA's Suomi NPP Satellite
2. ABI Imagery from NOAA's GOES-19 Satellite
3. MODIS Imagery from NASA's Aqua(a)/Terra(b) Satellite

Atlantic Tropical Cyclones in 2025

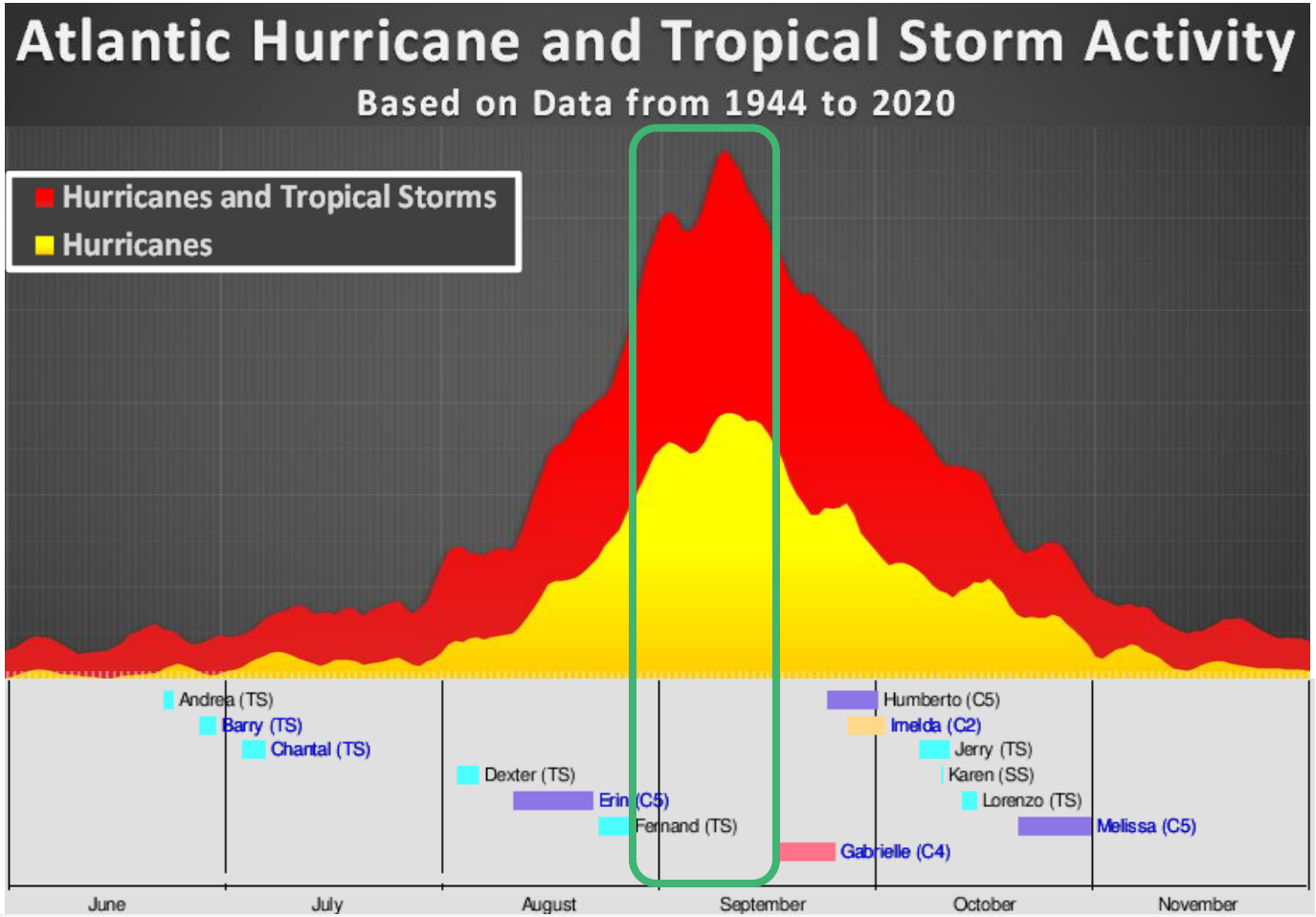
Synoptic History



	2025		Avg.
Named Storms	13	»	14
Hurricanes	5		7
Major Hurricanes	4	»	3
U.S. Hurricane Landfalls	0		1-2
U.S. Major Hurricane Landfalls	0	»	<1

Atlantic Tropical Cyclones in 2025

Synoptic History



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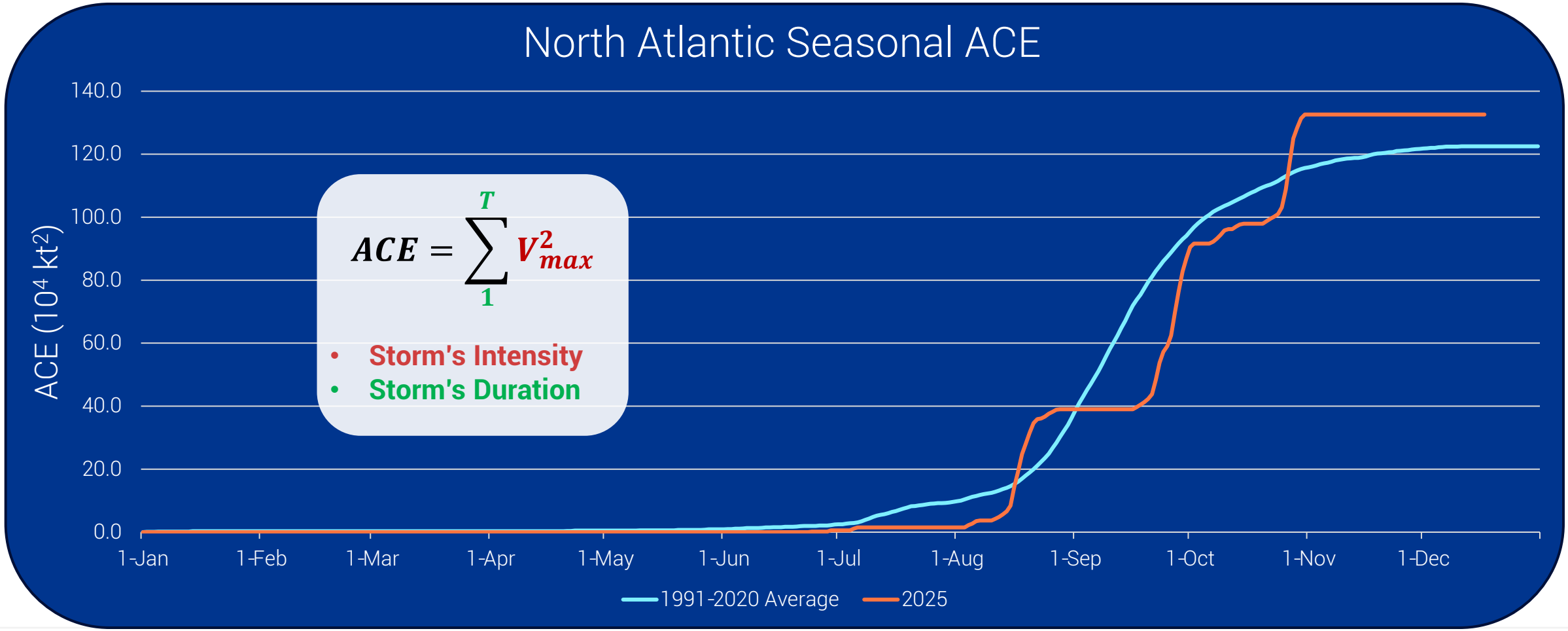
Atlantic Tropical Cyclones in 2025

Accumulated Cyclone Energy (ACE)



1. Statistics calculated from operational best tracks of the National Hurricane Center

Atlantic Tropical Cyclones in 2025

Seasonal Records

2nd year ever with more than two Category 5 Atlantic hurricanes

2nd time two consecutive years with multiple Category 5 Atlantic hurricanes

End of nine consecutive years with a U.S. landfalling hurricane and **five consecutive years** with a U.S. landfalling major hurricane

Major Hurricane Erin tied for the **fifth-fastest** wind-based RI and tied for the **third-fastest** pressure-based RI

Major Hurricane Melissa tied for the **strongest landfalling Atlantic hurricane** by both winds and pressure

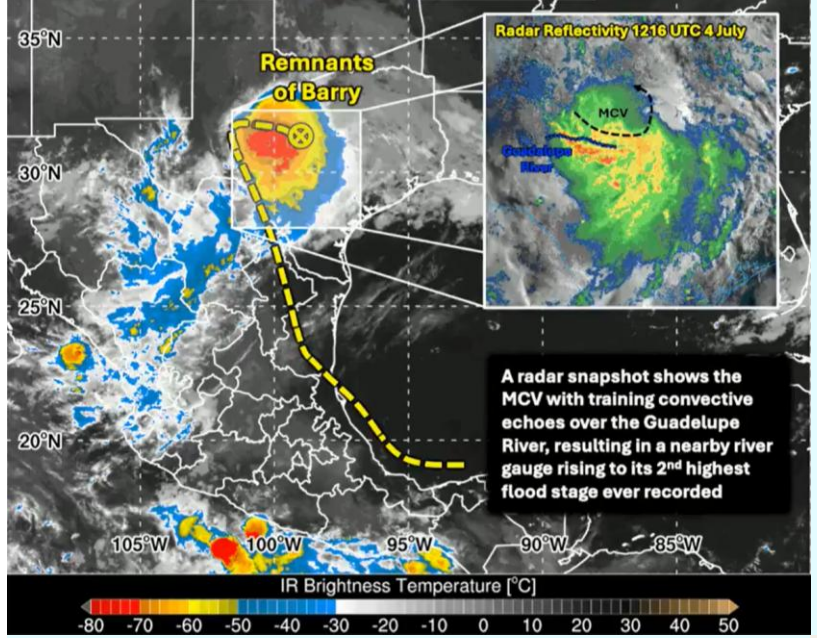
30% of named storms and **80% of hurricanes** reached major hurricane strength

2 Notable Storms

Extreme bouts of rapid intensification and three Category-5 hurricanes

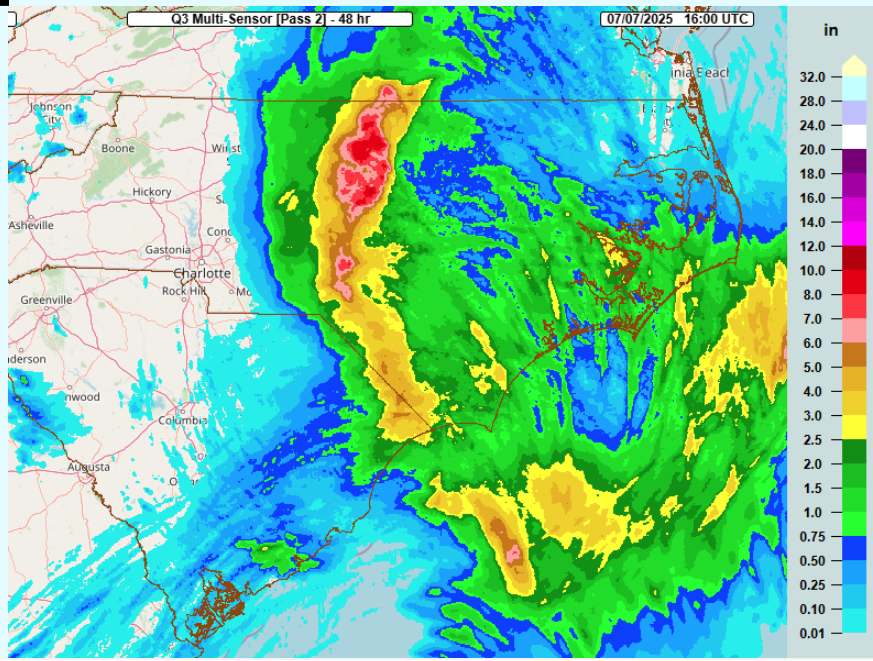
Heavy Precipitation

Even without a direct hurricane strike, the threat of extreme rainfall continues to grow



The four-day old remnants of Tropical Storm Barry combined with another decaying system to produce one of the deadliest flash flooding events in years

The only U.S. landfalling cyclone, Tropical Storm Chantal dropped as much as 11" of rain across parts of the Carolinas

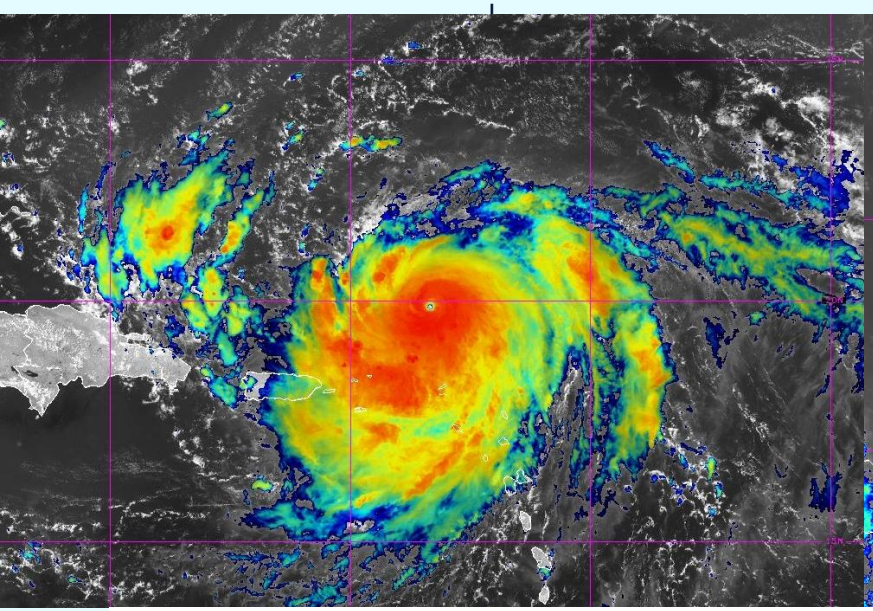


1. Graphic by Philippe Papin @pppapin.bsky.social
2. NOAA NSSL Multi-Radar/Multi-Sensor System

Extreme Intensification

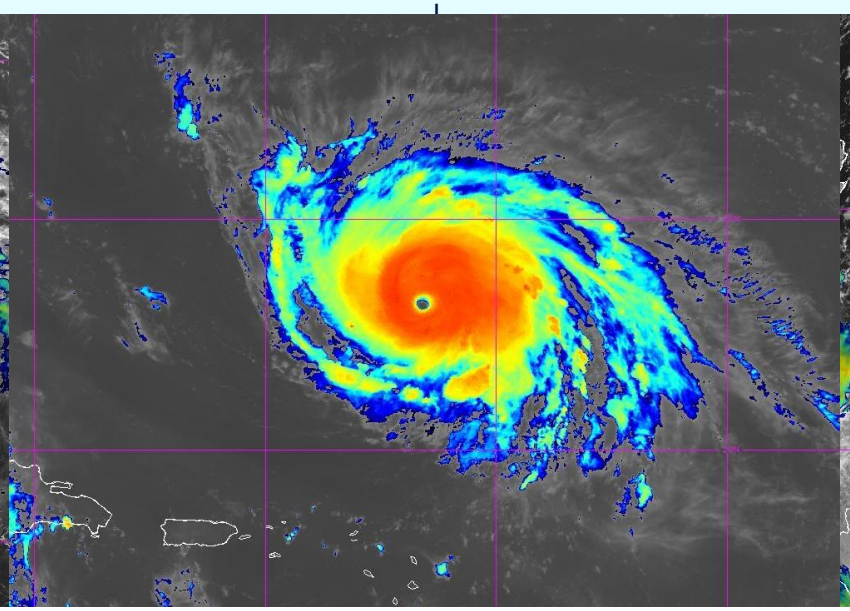
Major Hurricane Erin

Peak Intensity: 160 mph / 915 mb
Max 24hr Intensification: +86 mph / -78



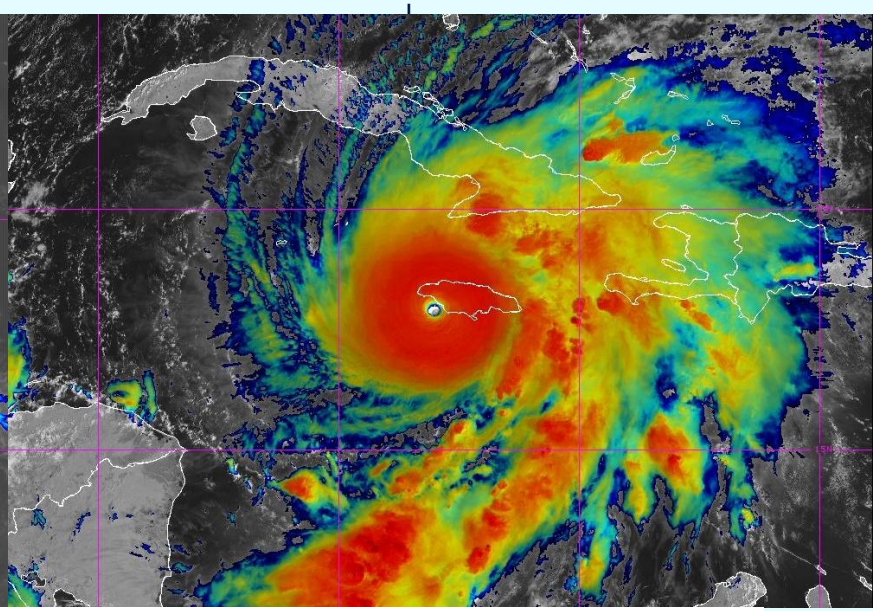
Major Hurricane Humberto

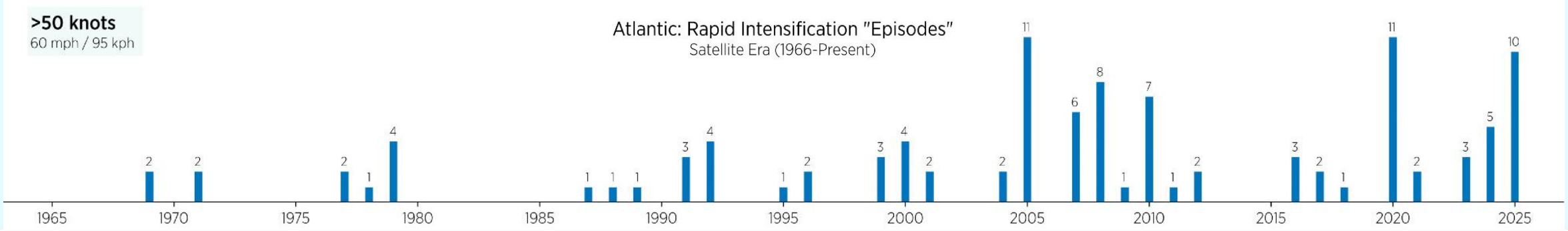
Peak Intensity: 160 mph / 924 mb
Max 24hr Intensification: +75 mph / -56



Major Hurricane Melissa

Peak Intensity: 185 mph / 892 mb
Max 24hr Intensification: +70 mph / -40





1. Satellite imagery from NOAA NESDIS STAR GOES Image Viewer
2. Graphic and analysis by Steve Bowen @stevebowen.bsky.social

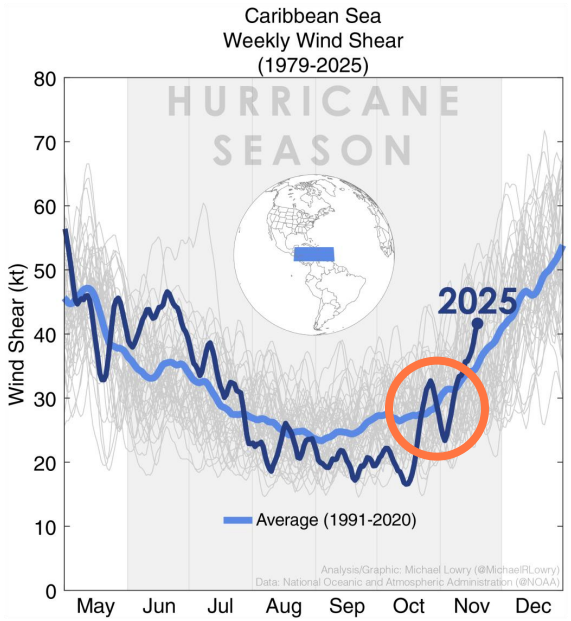
Hurricane Melissa

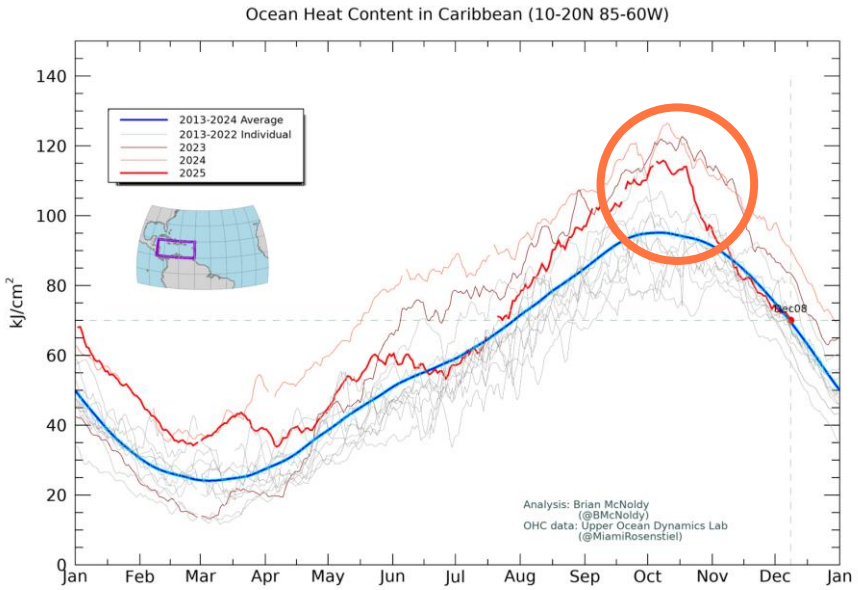
Meteorological Synopsis

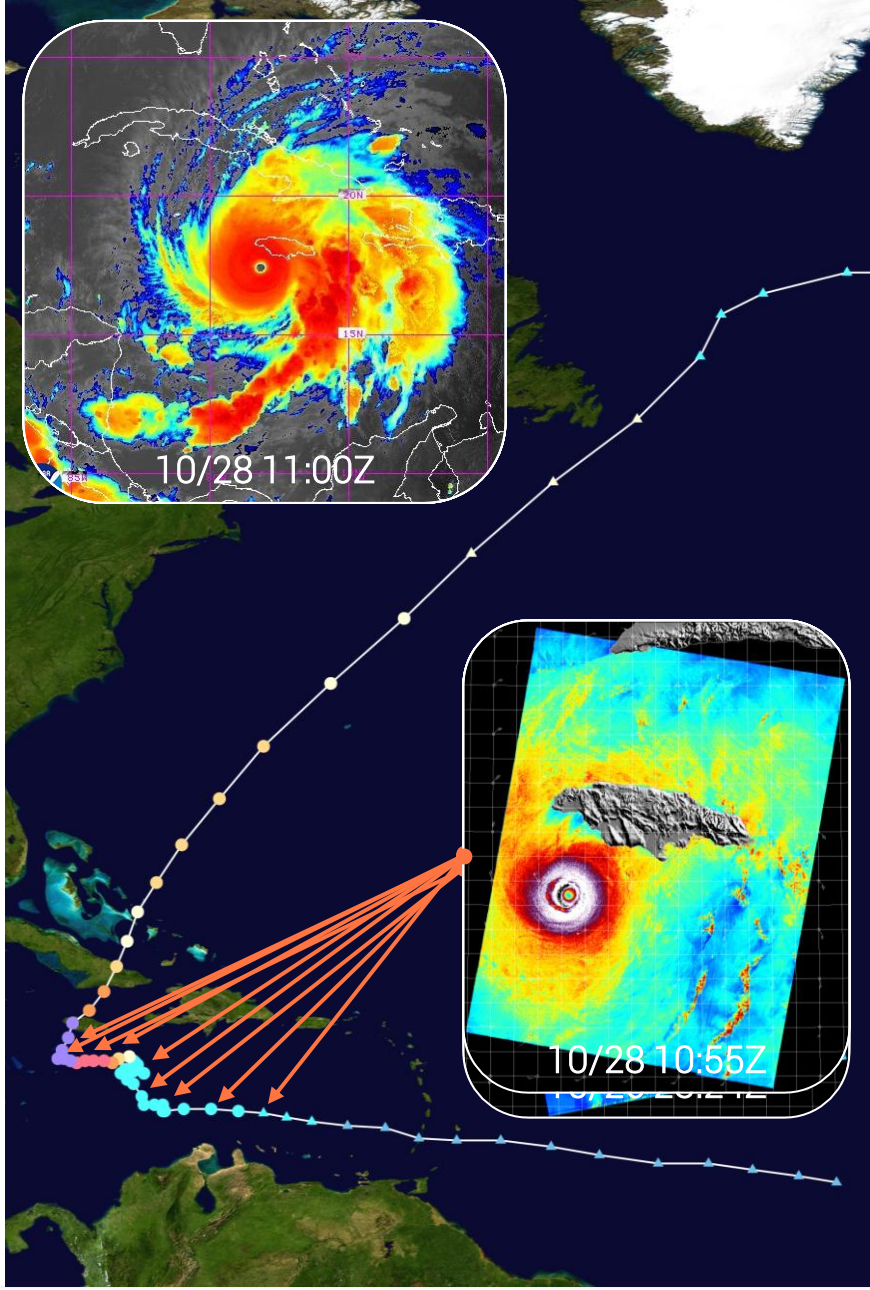
Formed from African Easterly Wave crossing the central Atlantic

Developed into Tropical Storm on October 21st, but faced considerable wind shear

Once shear abated, deep oceanic heat content allowed for explosive intensification



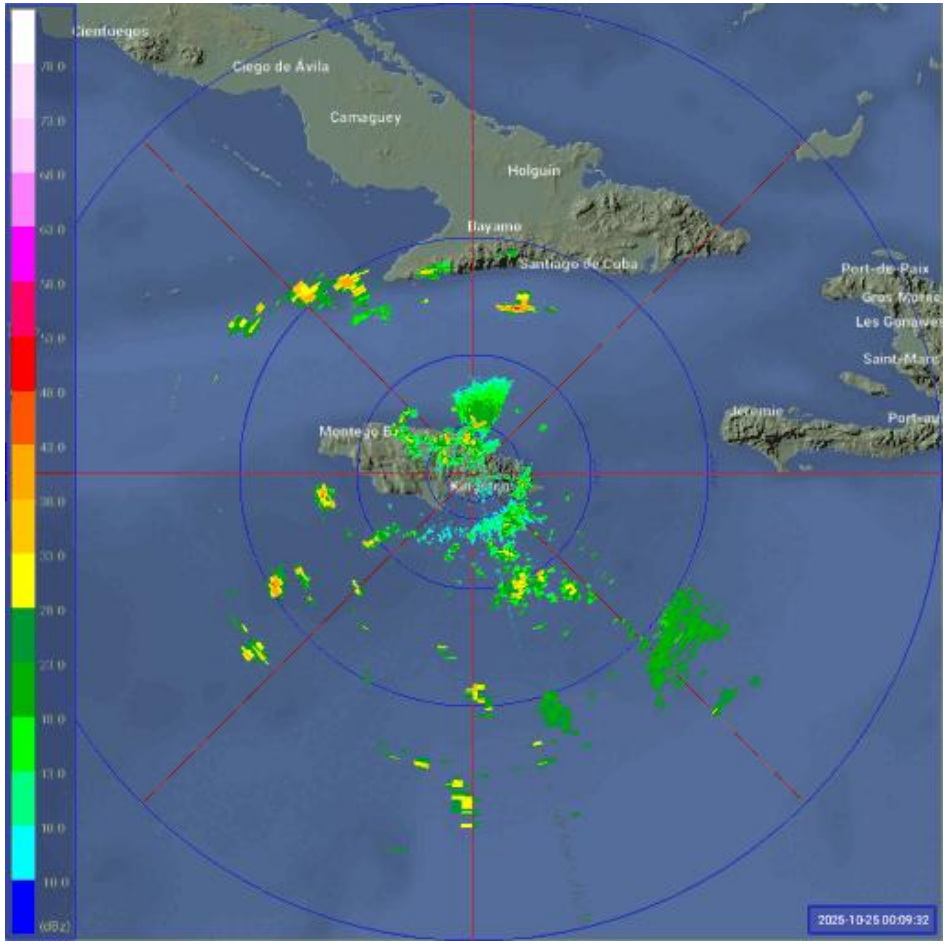


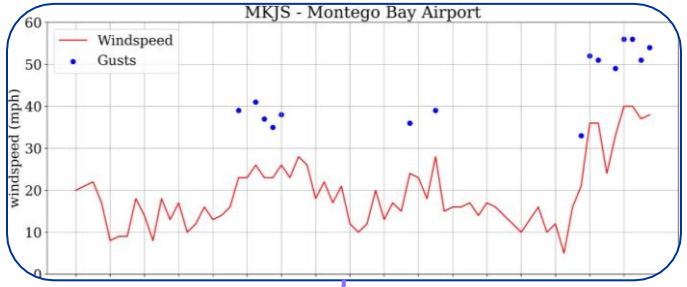


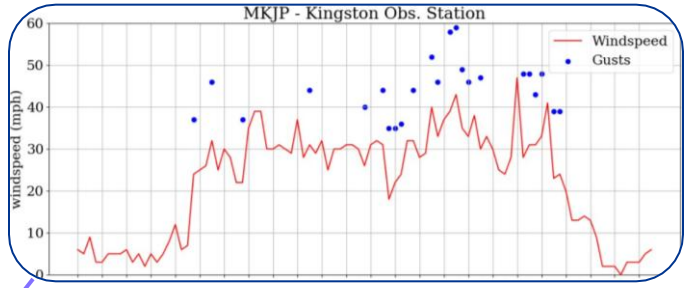
1. Satellite imagery from NOAA NESDIS STAR GOES Image Viewer
2. Synthetic Aperture Radar (SAR) based winds through the STAR Water Surface Conditions Science Team's tropical cyclone winds program

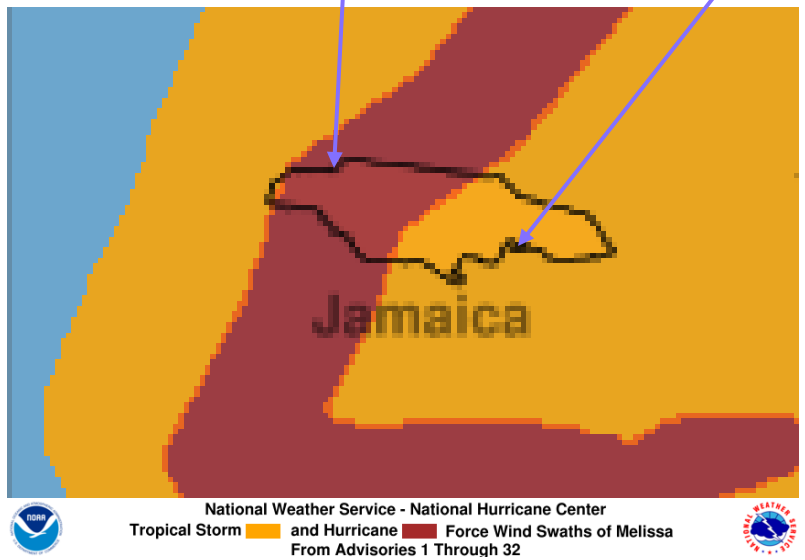
Hurricane Melissa

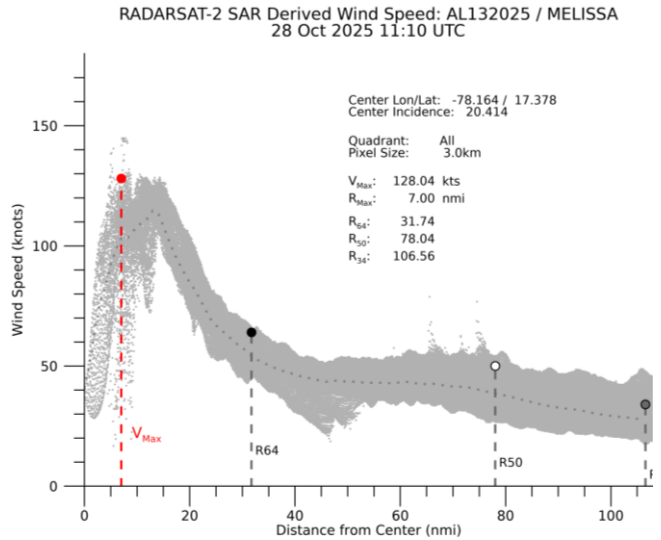
Local Hazard











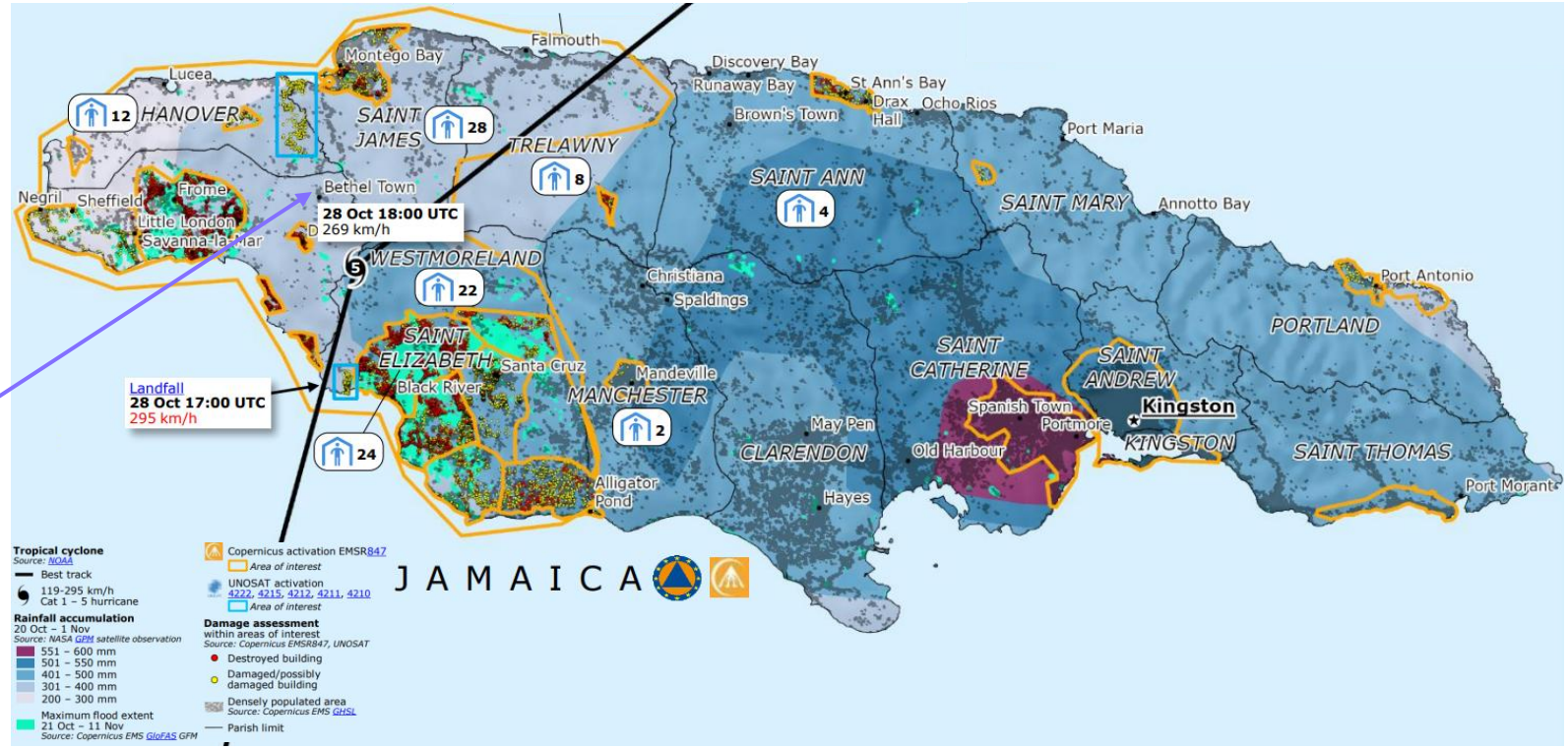
Despite intensity, Melissa did not experience a secondary eyewall replacement nor was severely disrupted by Jamaica's topography

Very small core kept strongest winds along track, sparing Kingston in Eastern Jamaica

1. Jamaica radar made available by Brian McNoldy (U. Miami, Rosenstiel School)
2. Synthetic Aperture Radar (SAR) based winds through the STAR Water Surface Conditions Science Team's tropical cyclone winds program

Hurricane Melissa

Damage



- Residential building inventory dominated by masonry (~70%) and wood framed buildings (~30%) with take-up rates typically less than 20%
- Many neighborhoods in St. Elizabeth parish reported 80-90% damage among residential and commercial buildings and in certain areas 100% of roofs destroyed
- Wind-induced damage dominated Western Jamaica while Eastern Jamaica had significant reports of flooding as far away as Kingston
- Verisk CRS estimated industry insured loss to onshore property between $2.2b - $4.2b USD with majority coming from wind damage

1. Damage photo released by the USAF with ID 251106-F-YT028-1164
2. Daily map provided by the EU Emergency Response Coordinate Centre's DG ECHO program

3 Forecast Validation

Seasonal forecasts fell short of expectations while a new model stood out

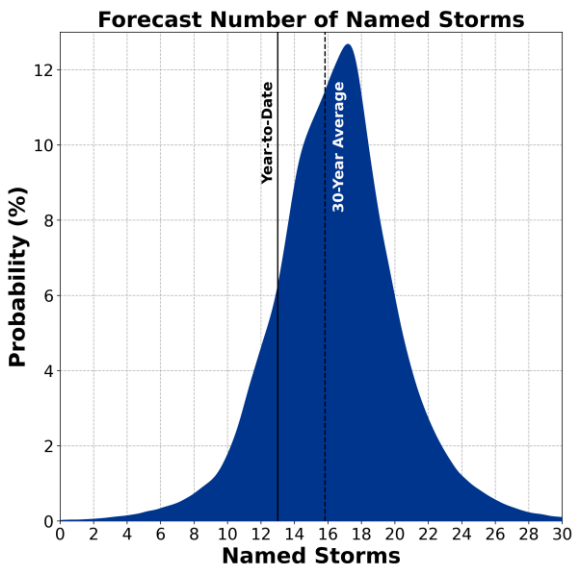
Seasonal Forecasts

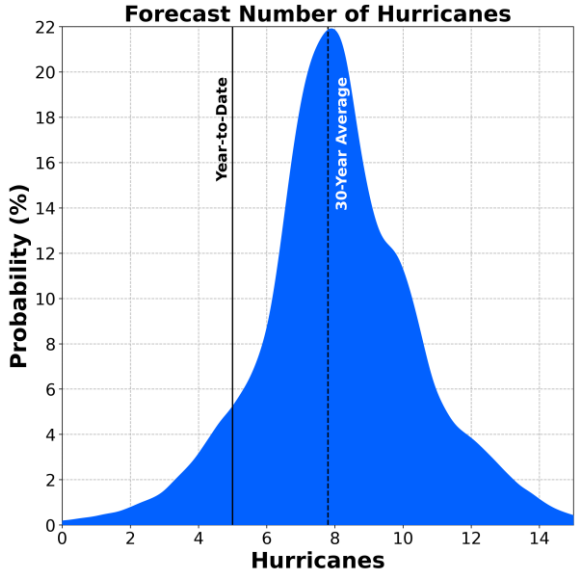
Forecast Bodies

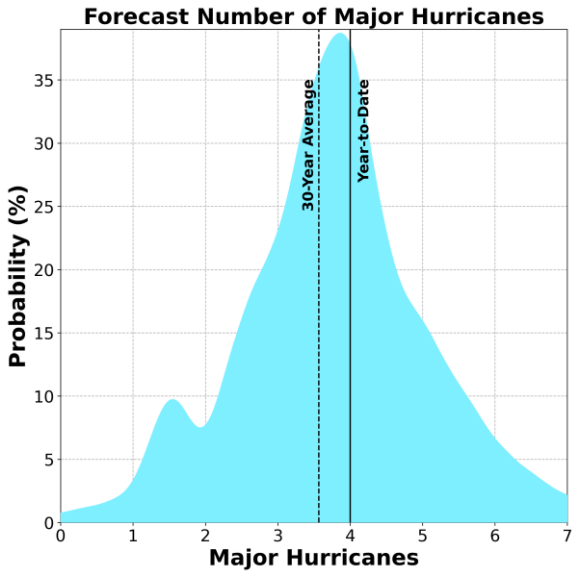
1. https://seasonalhurricanepredictions.bsc.es/

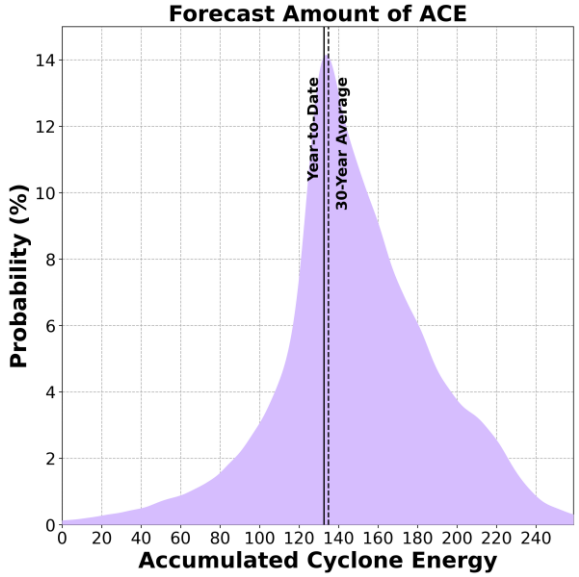
Seasonal Forecasts

Pre-Season Forecast Validation









Forecasted values at or above the average of the last 30 years

Year-to-date named storms and hurricanes below forecasted values while major hurricanes and ACE meet or exceed forecasts

Major hurricanes above the average of the last 30 years

Seasonal Forecasts

Inter-Season Forecast Validation

	Named Storms			Hurricanes			Major Hurricanes			ACE		
	LOW	MEAN	HIGH	LOW	MEAN	HIGH	LOW	MEAN	HIGH	LOW	MEAN	HIGH
Year to Date		13			5			4			132.6	
30-Year Average	8	15	30	2	7	15	0	3	7	36.1	134.8	245.3
Average												

Pre-season forecasts overestimated general activity, but were lower for major hurricanes

Early-season forecasts began reducing expectations on basin-wide activity

Middle-season forecasts narrowed down on a range higher than what occurred

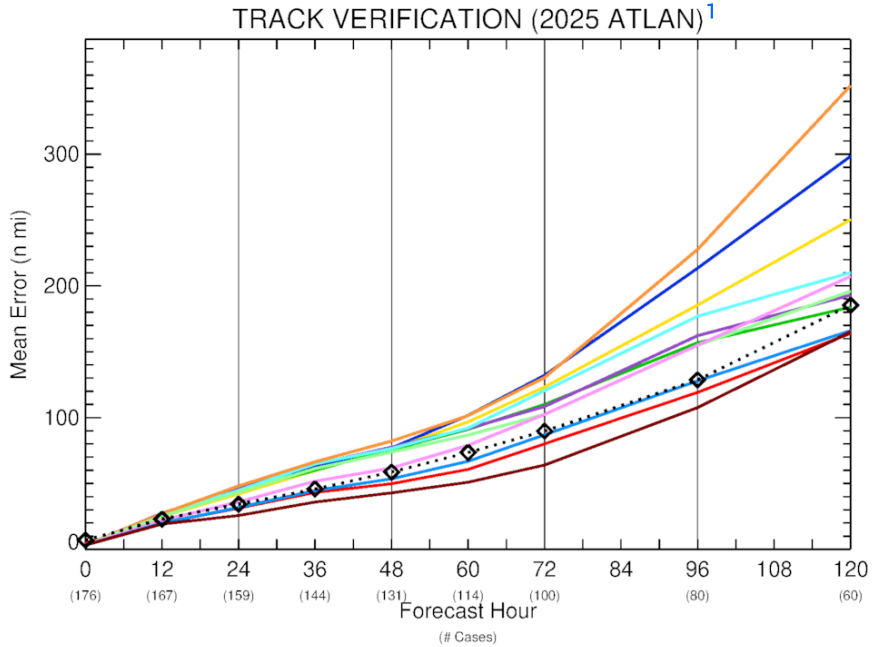
Sub-Seasonal Forecas

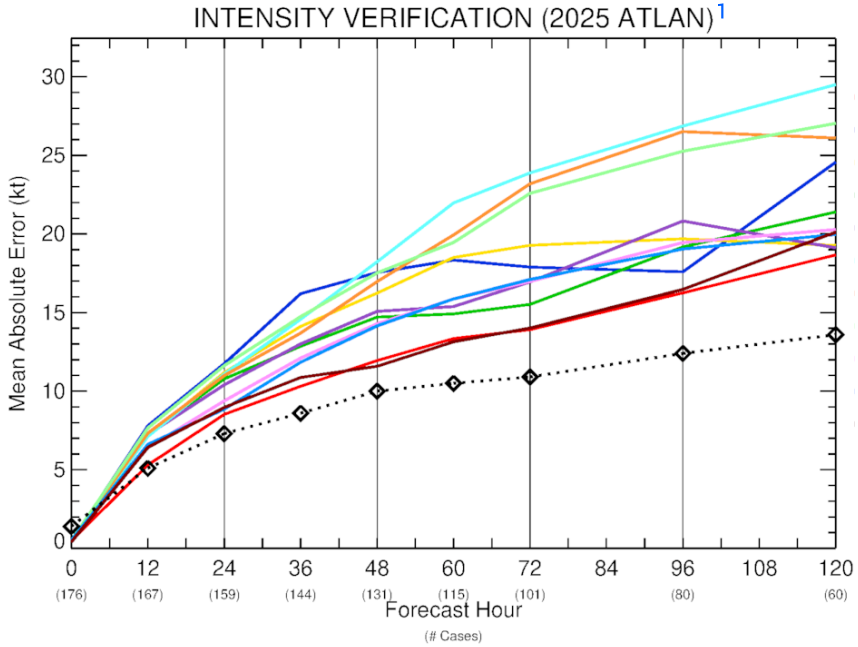
Model Forecast Validation

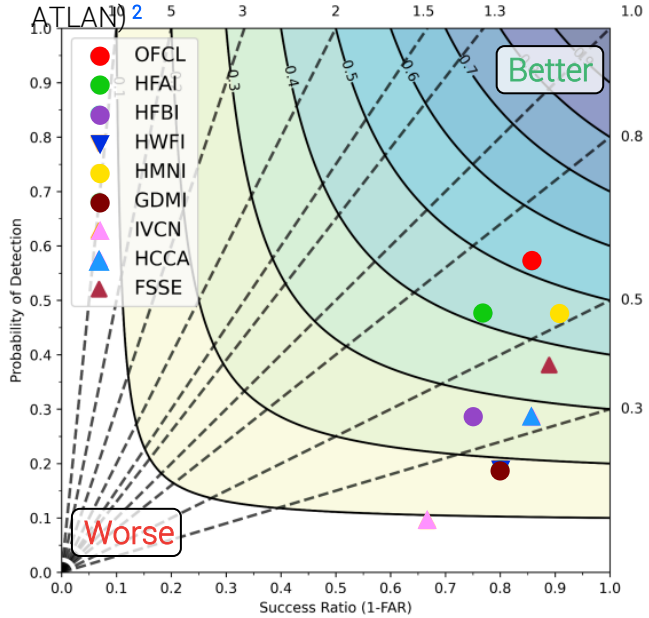
- Official Average 2020-2024
- Official NHC Forecast
- Hurricane Specific Models:
  - HWRF
  - HMON
  - HAFS-A
  - HAFS-B
  - COAMPS-TC
- For Track / Intensity Verification:
  - GFS / Decay-SHIPS
  - GFS Ensemble / LGEM
  - TVCN / IVCN (Consensus)
- HCCA (Skillful consensus)
- Google DeepMind AI Model

Worse

Better







Only HCCA, NHC Official, and Google DeepMind below 5-year average track error, with American GFS performing worst

NHC Official and Google DeepMind had lowest intensity error, although still above 5-year average

NHC Official still best performers of skillfully forecasting periods of rapid intensification

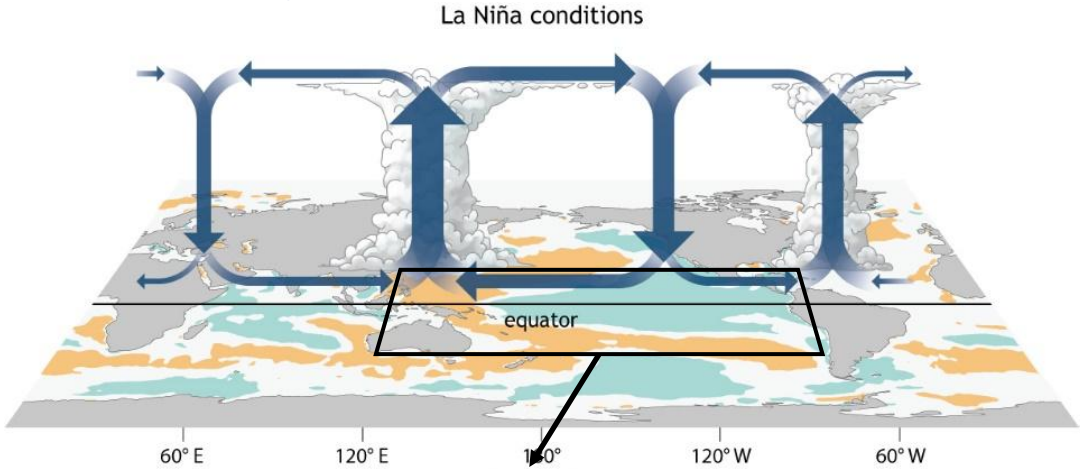
1. Tropical Atlantic Update – Brian McNoldy https://bmcnoldy.blogspot.com/2025/11/summary-of-unusual-2025-hurricane-season.html
2. 2025 NHC Verification Report Preview

4 Climate Signals

Atmospheric conditions battling a warming ocean

El Niño / Southern Oscillation (ENSO)

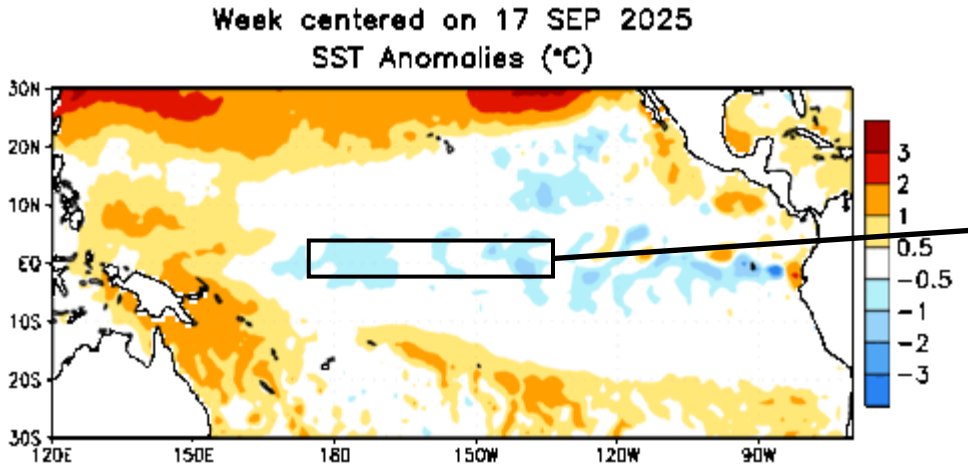
Synoptic History

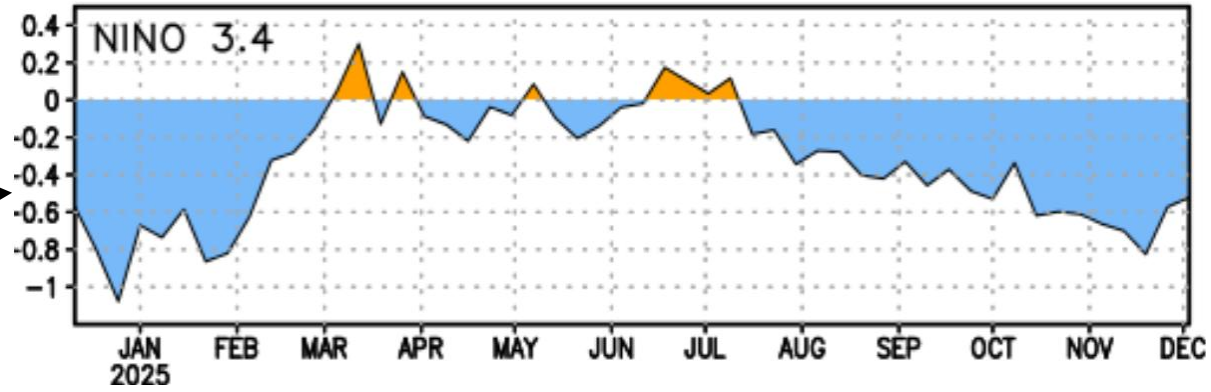


ENSO a coupled climate mode occurring in the Equatorial Pacific that can affect worldwide circulations

Recently cooler sea surface temperatures in line with ENSO negative (La Niña) conditions

Early season dominated by ENSO neutral conditions before transitioning to weak ENSO negative

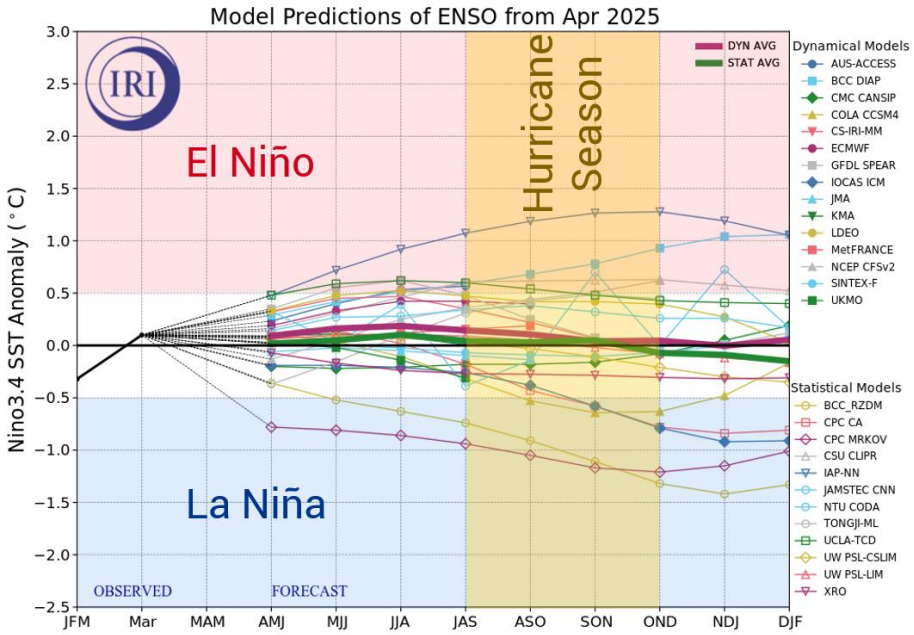


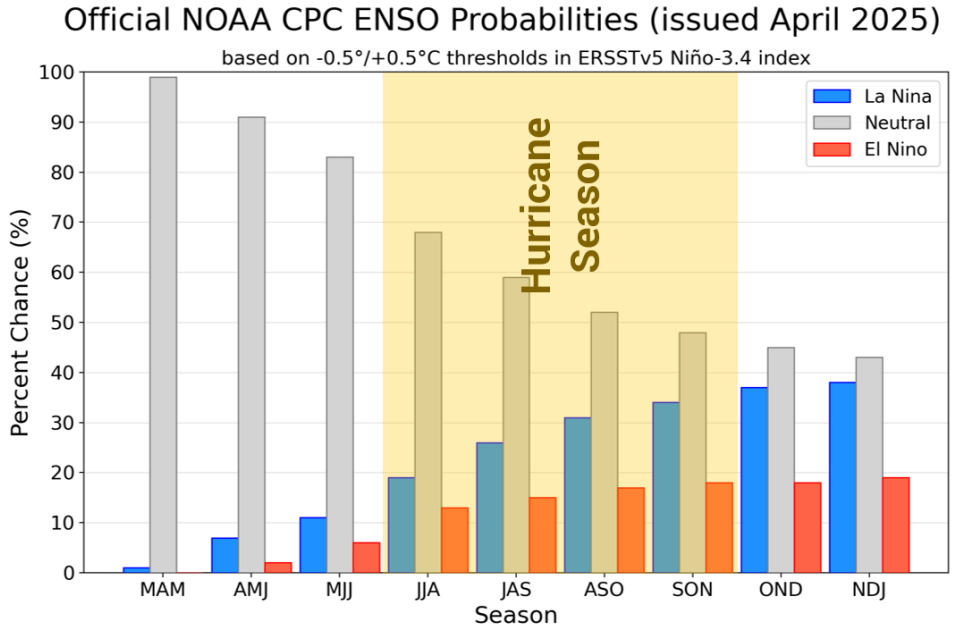


El Niño / Southern Oscillation (ENSO)

Forecast Validation

ENSO neutral conditions correctly predicted by consensus of modeling centers





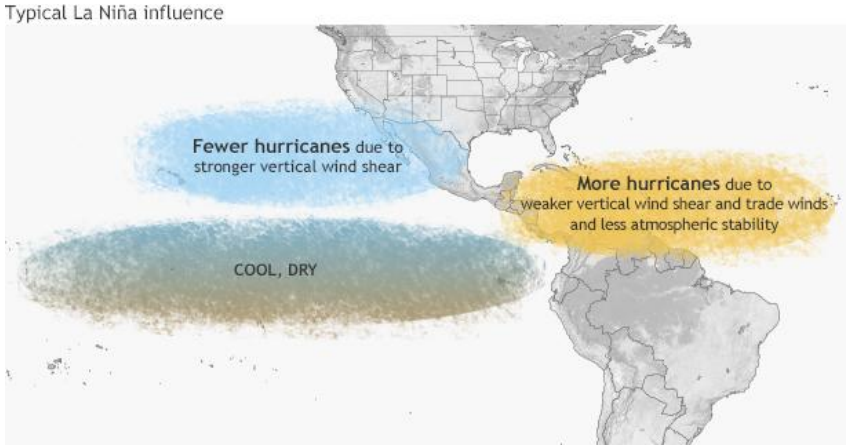
Official NOAA Climate Prediction Center's forecast correctly predicted growing likelihood of La Niña conditions

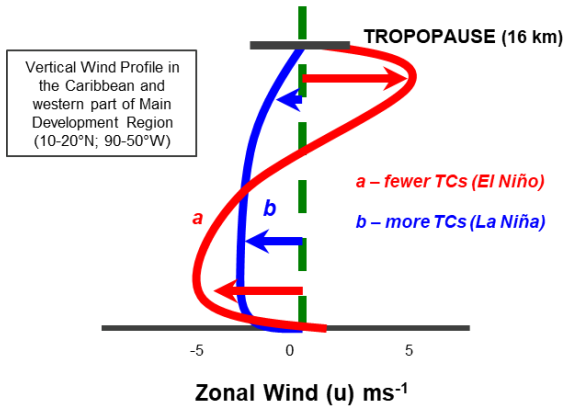
El Niño / Southern Oscillation (ENSO)

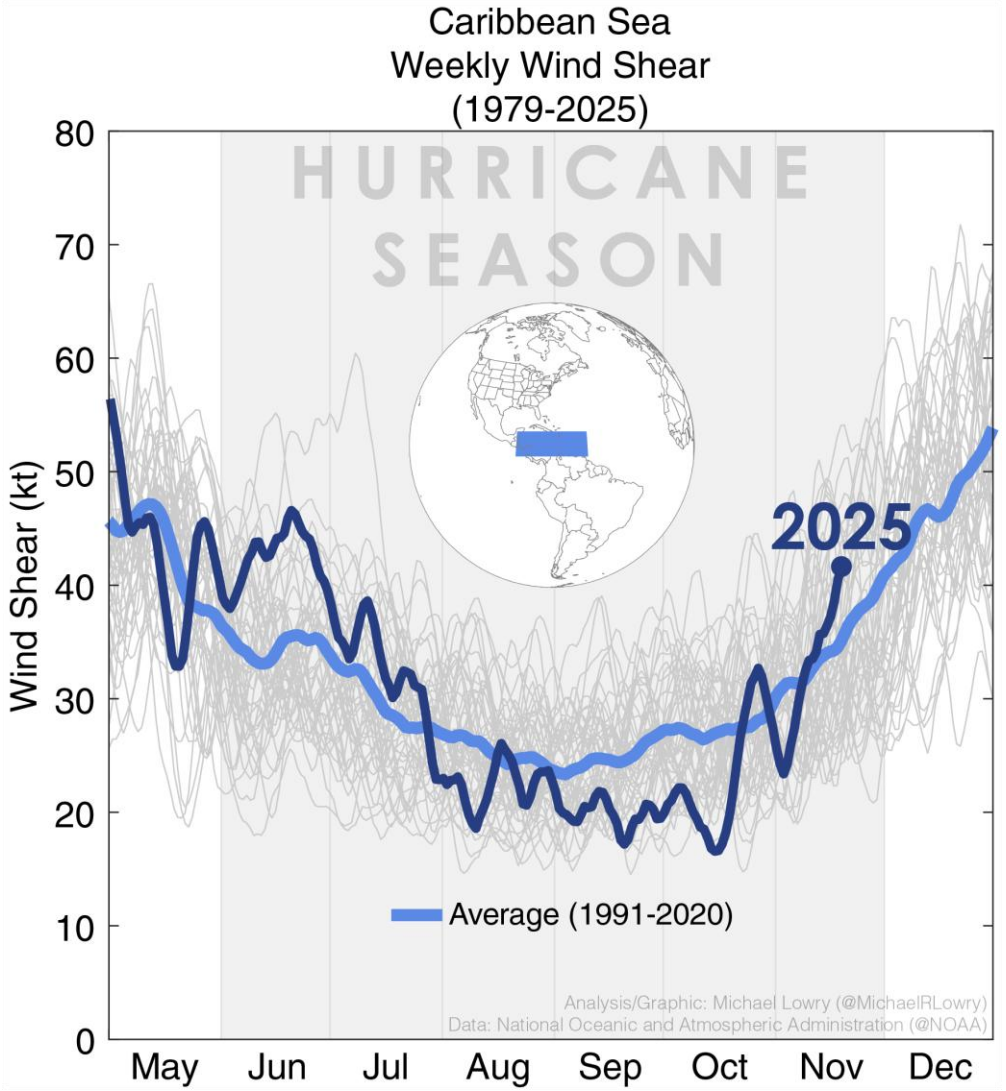
Impact on Tropical Cyclones

ENSO generally affects hurricane activity through changes to wind shear

In line with ENSO neutral conditions, wind shear in line with climatological mean







1. Shear diagram courtesy of Colorado State University
2. Wind shear graphic from Michael Lowry (@MichaelRLowry)

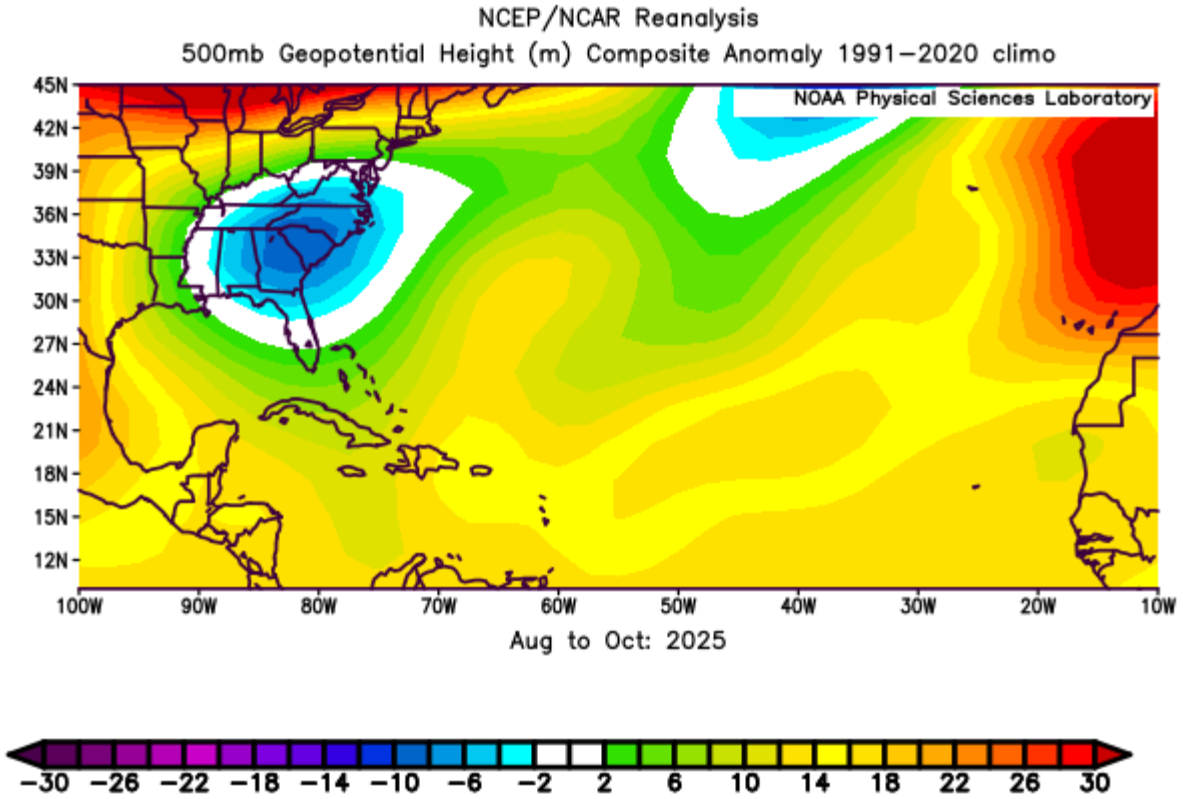
El Niño / Southern Oscillation (ENSO)

Persistent Trough

During peak of season, there was an anomalous trough over the southeast U.S.

Would tend to steer storms counter-clockwise around it to the Northeast

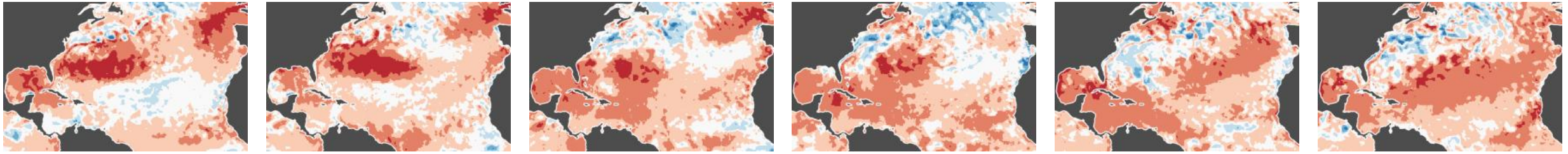
Began around the approach of Erin and lasted through Melissa's destructive track



North Atlantic Sea Surface Temperature (SST)

Synoptic History

June | July | August | September | October | November



Much warmer than average sea surface temperatures all season

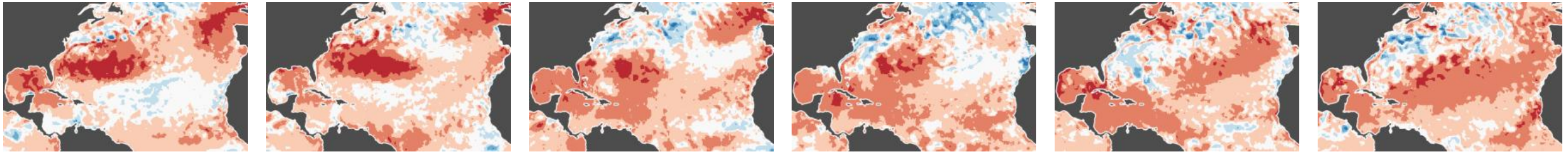
Particularly high across the Western Subtropical Atlantic in the early season and Caribbean / Gulf by late season

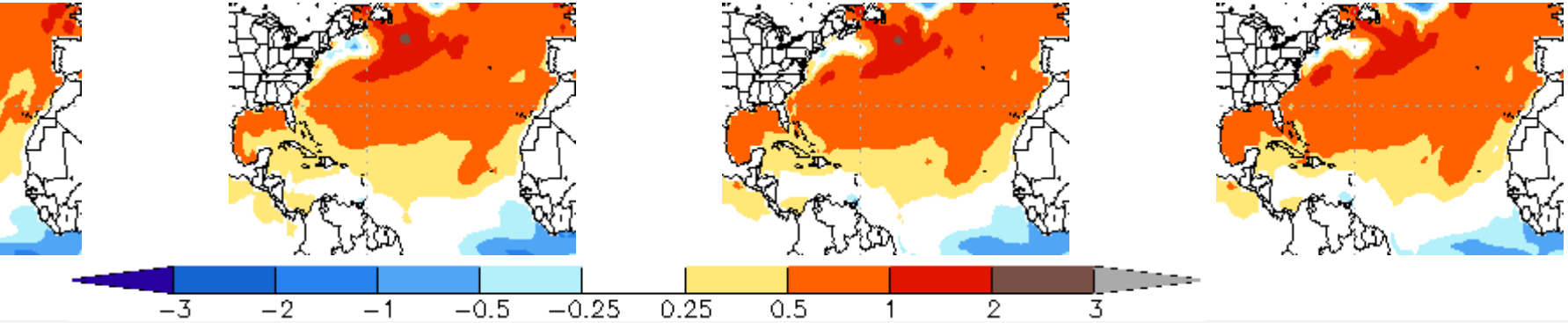
1. Sea surface temperature anomalies and extremes made available from Copernicus Climate Change Service

North Atlantic Sea Surface Temperature (SST)

Synoptic History

June | July | August | September | October | November





1. Sea surface temperature anomalies and extremes made available from Copernicus Climate Change Service

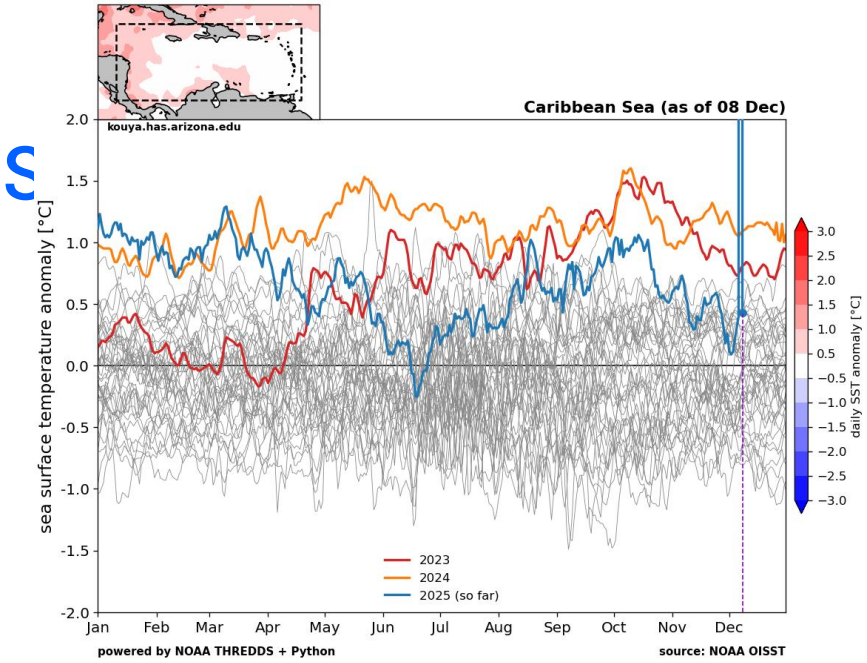
North Atlantic Sea Surface Temperature (SS

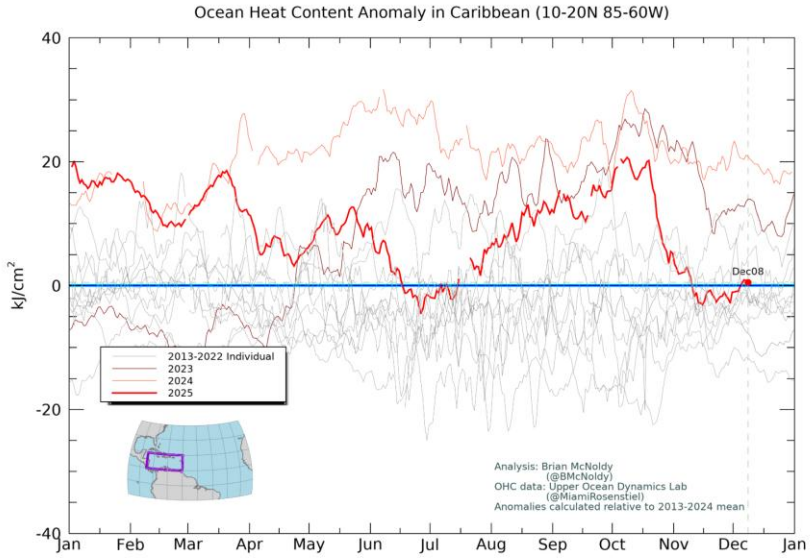
Oceanic Heat Content

Ocean heat content (OHC) integrates the depth of the warmth in the oceans

Not only were surface temperatures at or near record levels this season, but OHC was as well

This provides a steadier supply of energy to fuel storm development, especially for slow moving storms

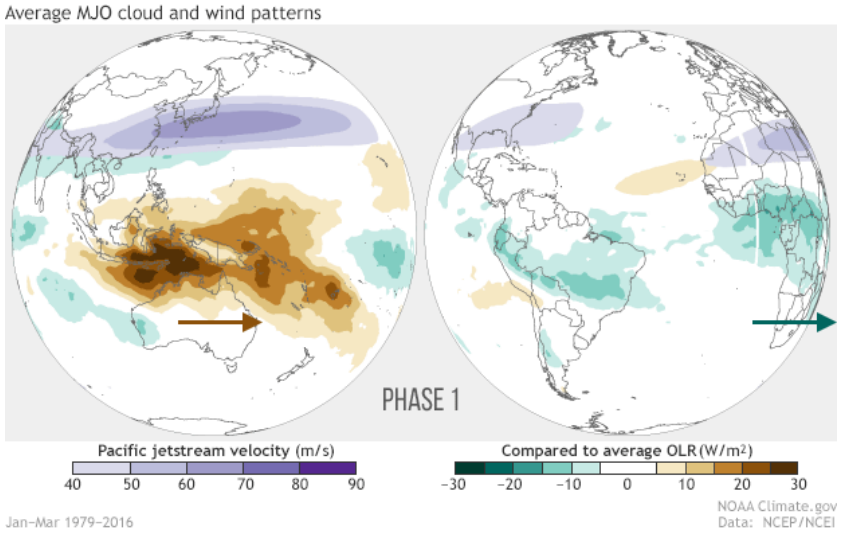




1. SST anomaly chart made available by Kim Wood
2. OHC anomaly chart made available by Brian McNoldy

Madden-Julian Oscillation (MJO)

Synoptic History & Impact on Tropical Cyclones

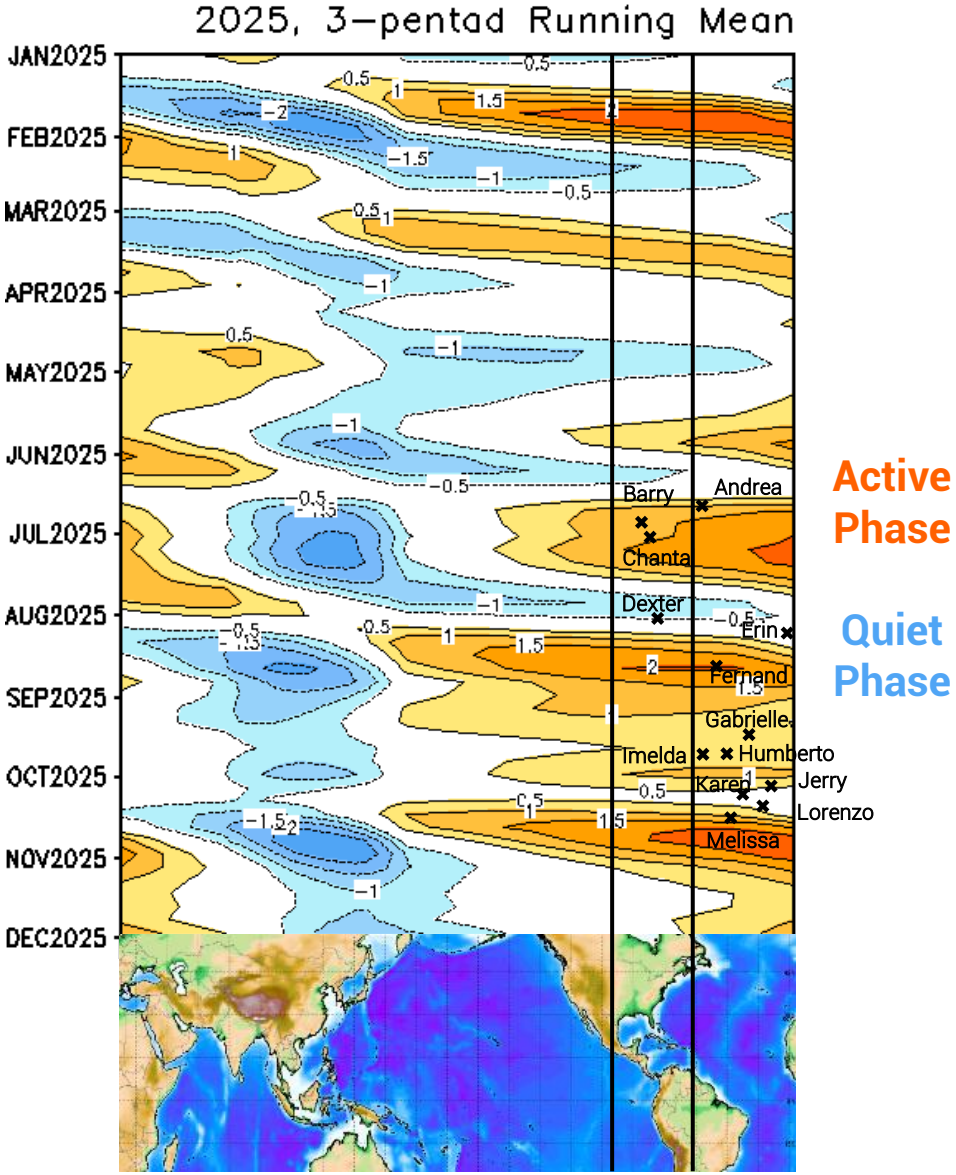


Active Phases

- Mid-June -> late July
- August -> October
- Mid-October

Strongest storms align with peak MJO

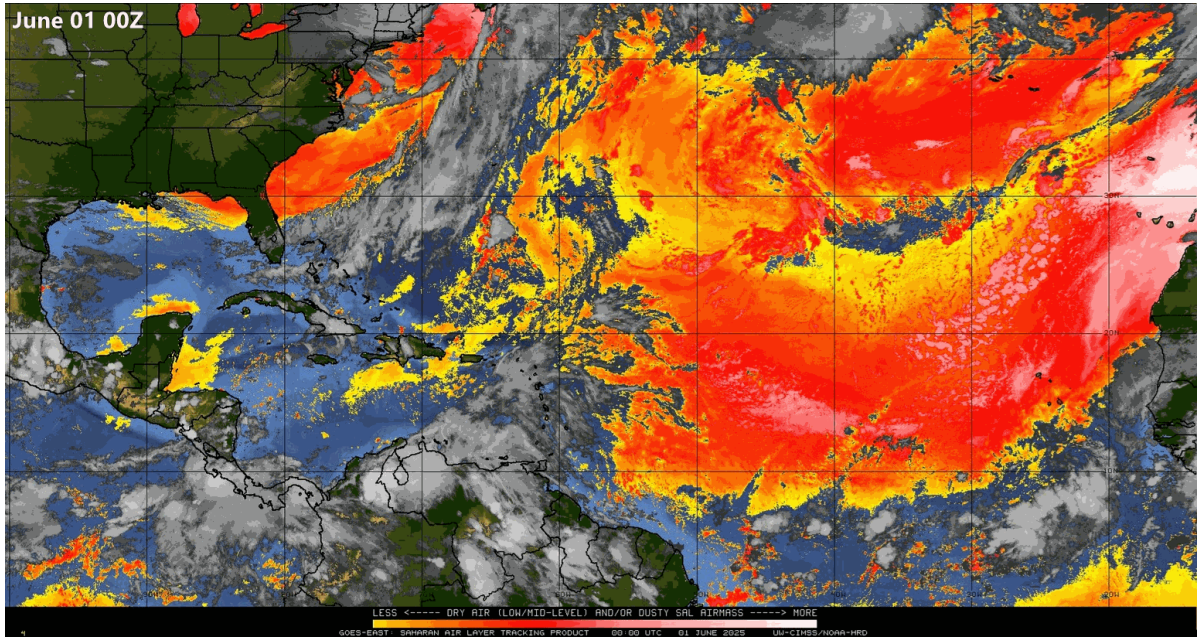
Weaker storms can occur off peak MJO

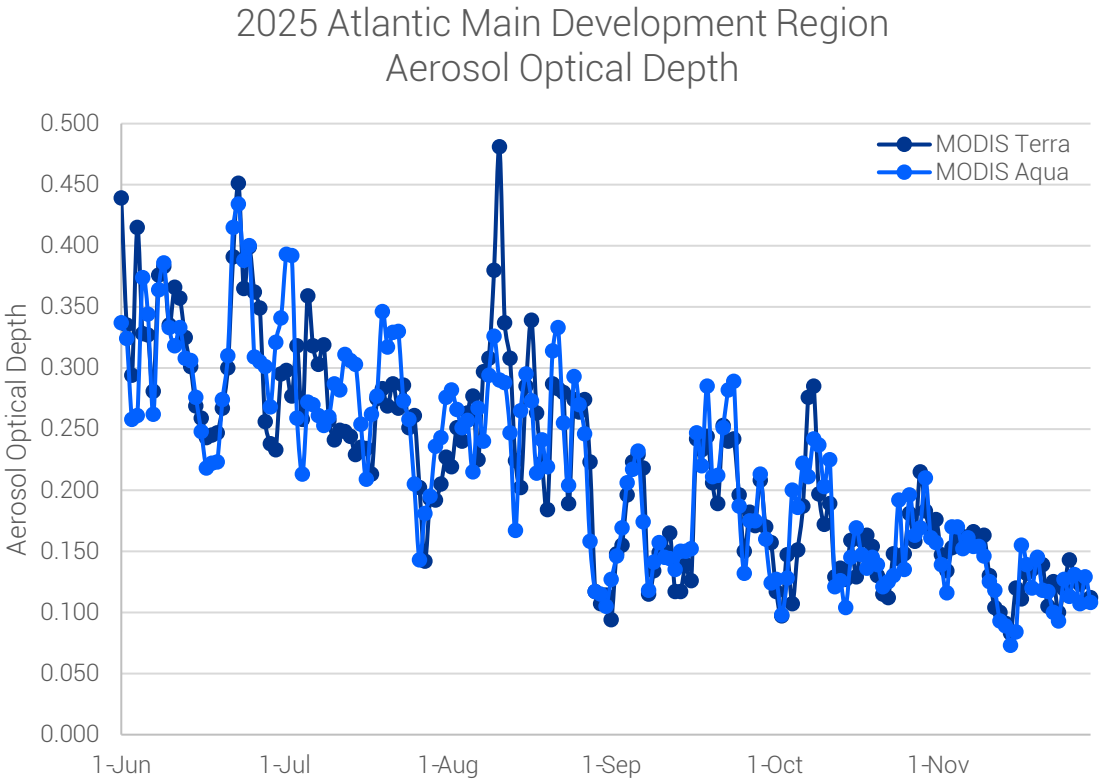


1. MJO monitoring data from NOAA's Climate Prediction Center

Saharan Air Layer (SAL)

Synoptic History & Impact on Tropical Cyclones



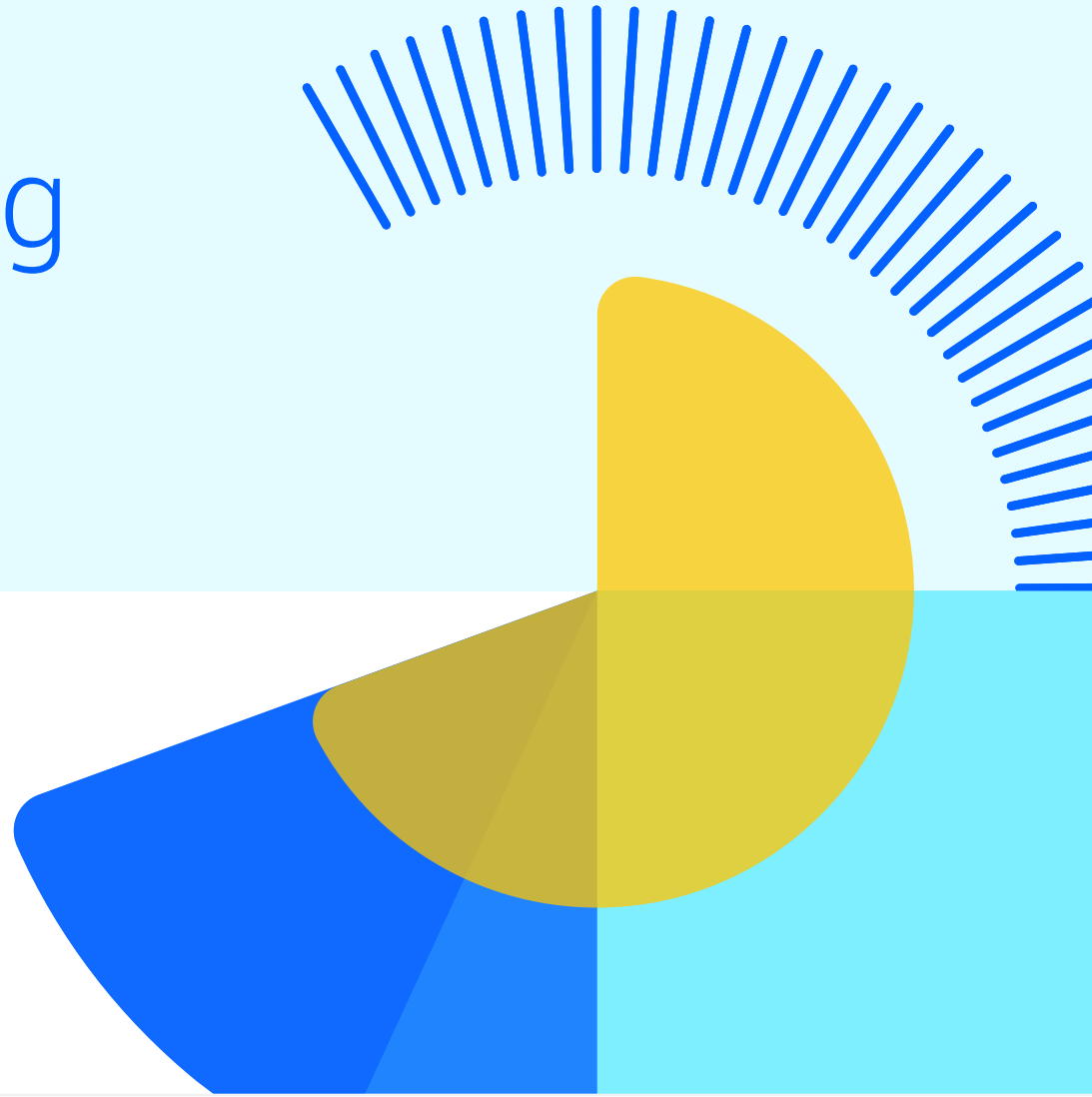


SAL more prominent at start of season with intermittent events mid-August

Dry air largely covers domain rest of season which disrupted storm development

1. GOES-EAST Split Window product of U.W. CIMSS
2. MODIS AOD made available through NASA WorldView

5 Verisk's Supporting Toolset

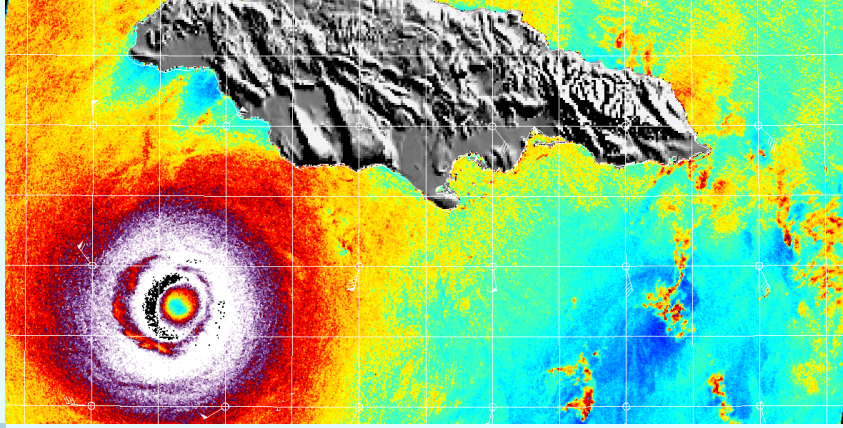


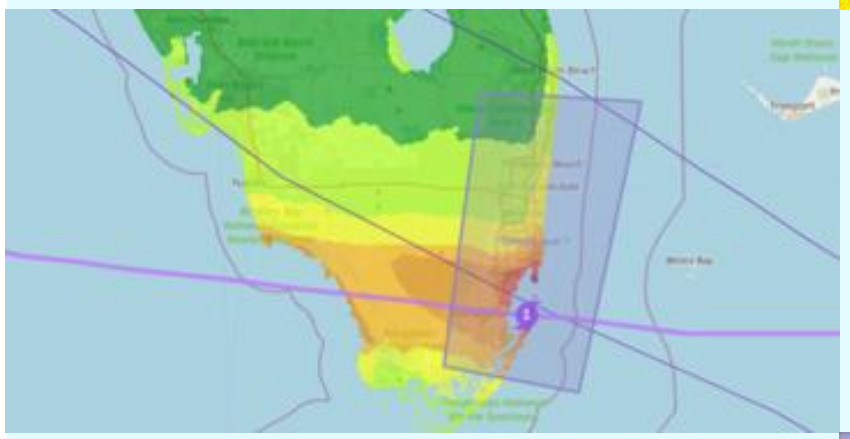
A complete set of solutions for an industry-leading view of risk

Research at Verisk

Verisk scientists are continually updating, evaluating, and improving our views of risk

Leveraging the latest available data and continually ingesting new observations





Developing a comprehensive and scientifically rigorous view of Atlantic hurricane risk

Learning from (and contributing to) cutting-edge research through peer-reviewed publications and professional conferences

Synthetic Aperture Radar (SAR) based winds through the STAR Water Surface Conditions Science Team's tropical cyclone winds program
https://www.star.nesdis.noaa.gov/socd/mecb/sar/sarwinds_tropical.php

Verisk Tropical Cyclone Model for the United States – Release in June 2026

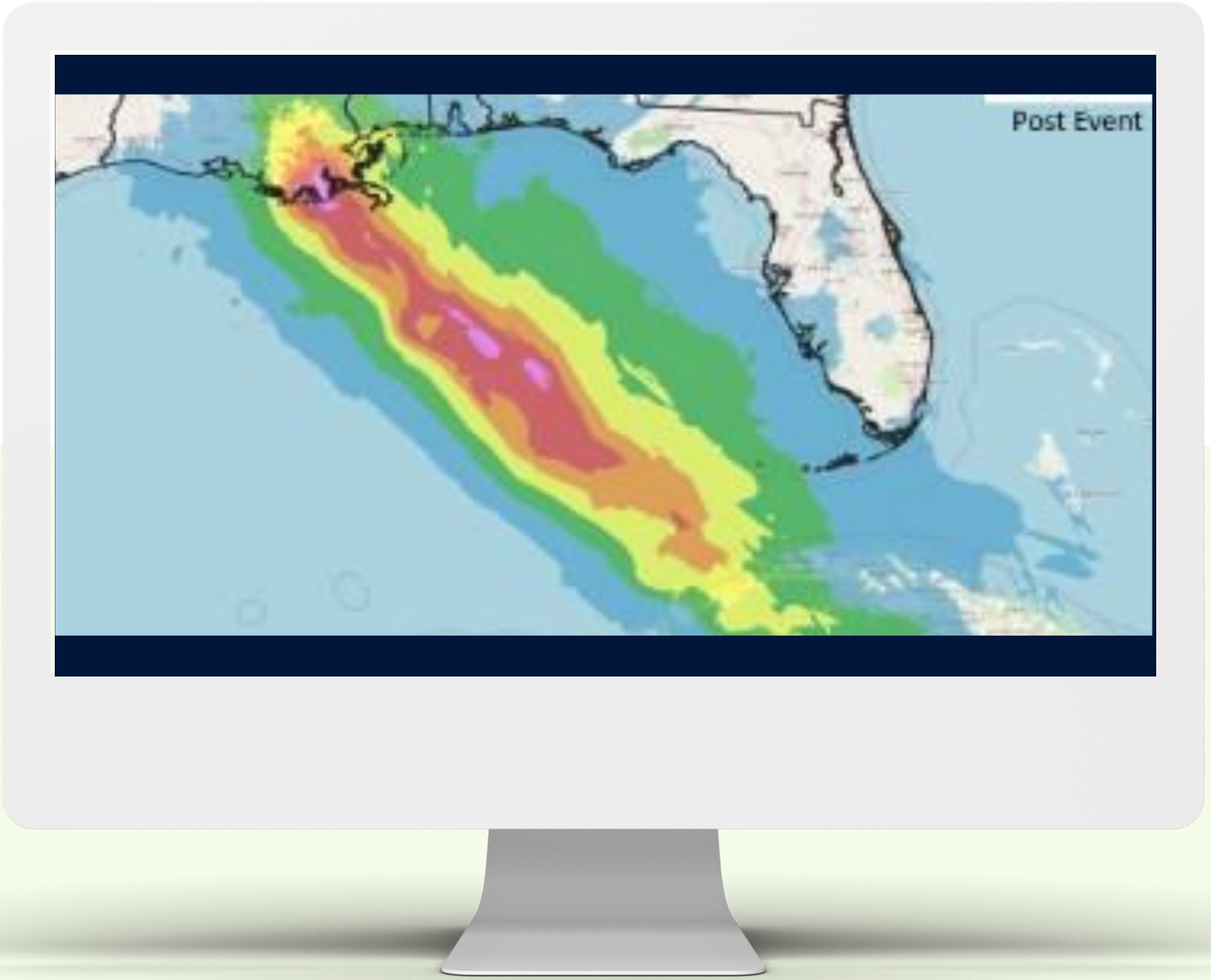
- Wind
- Storm Surge
- Inland Flooding
- Near - Present Climate

1. NASA Earth Observatory image of Hurricane Ian (2022) by Joshua Stevens, using Landsat data from the U.S. Geological Survey and roads from OpenStreetMap

Verisk Real-Time Solutions

Respond®

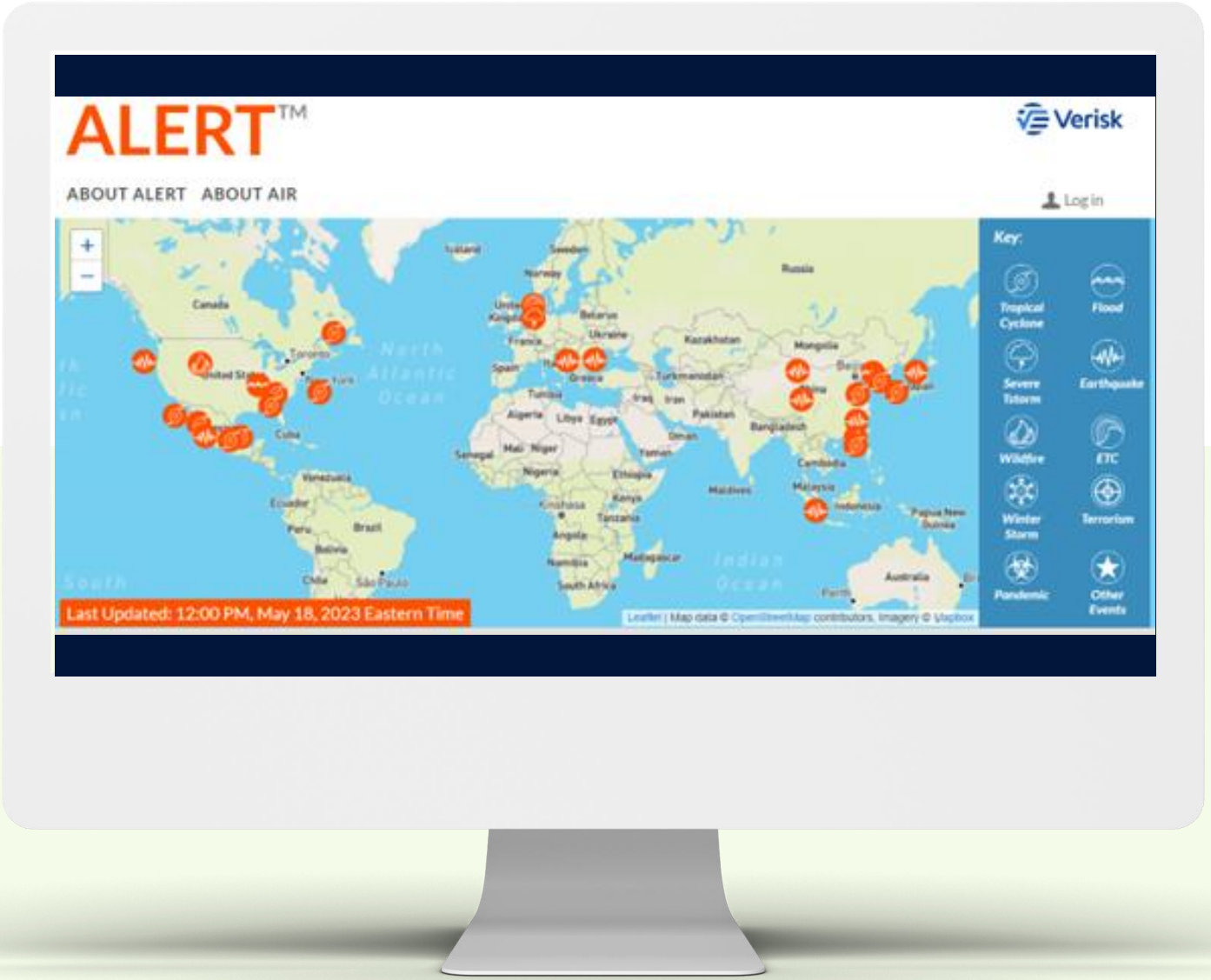
Automated near real-time, high-resolution weather event footprints



Verisk Real-Time Solutions

ALERT™

Real-time catastrophe reports with loss estimates and event sets

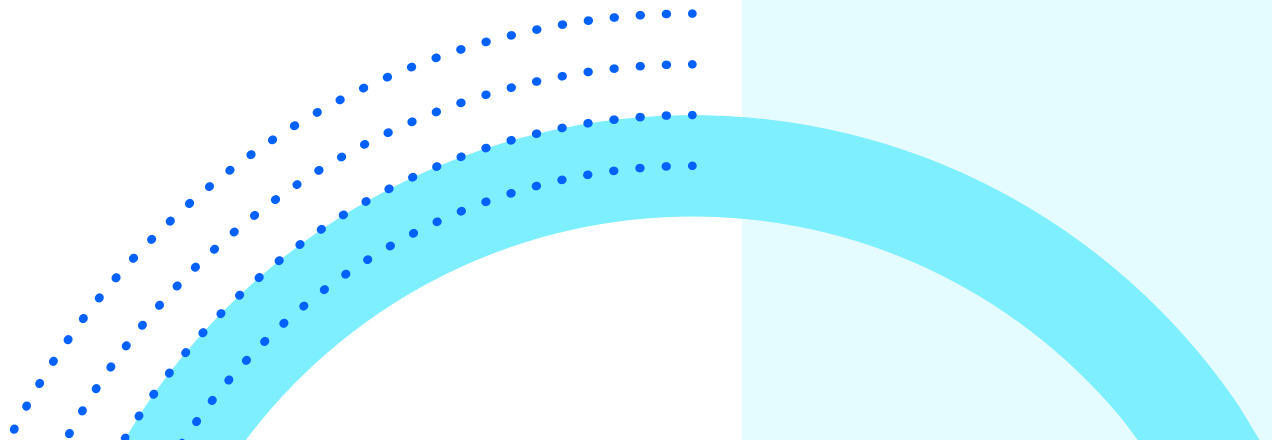


Thank you

While 2025 marked the end of a record streak of U.S. landfalling hurricanes, the continued rise in extreme rapid intensification means preparedness remains critical

Powering Better Insurance Decisions

Verisk connects the global insurance industry through proprietary data and technology to deliver the insights that real people depend on every day



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