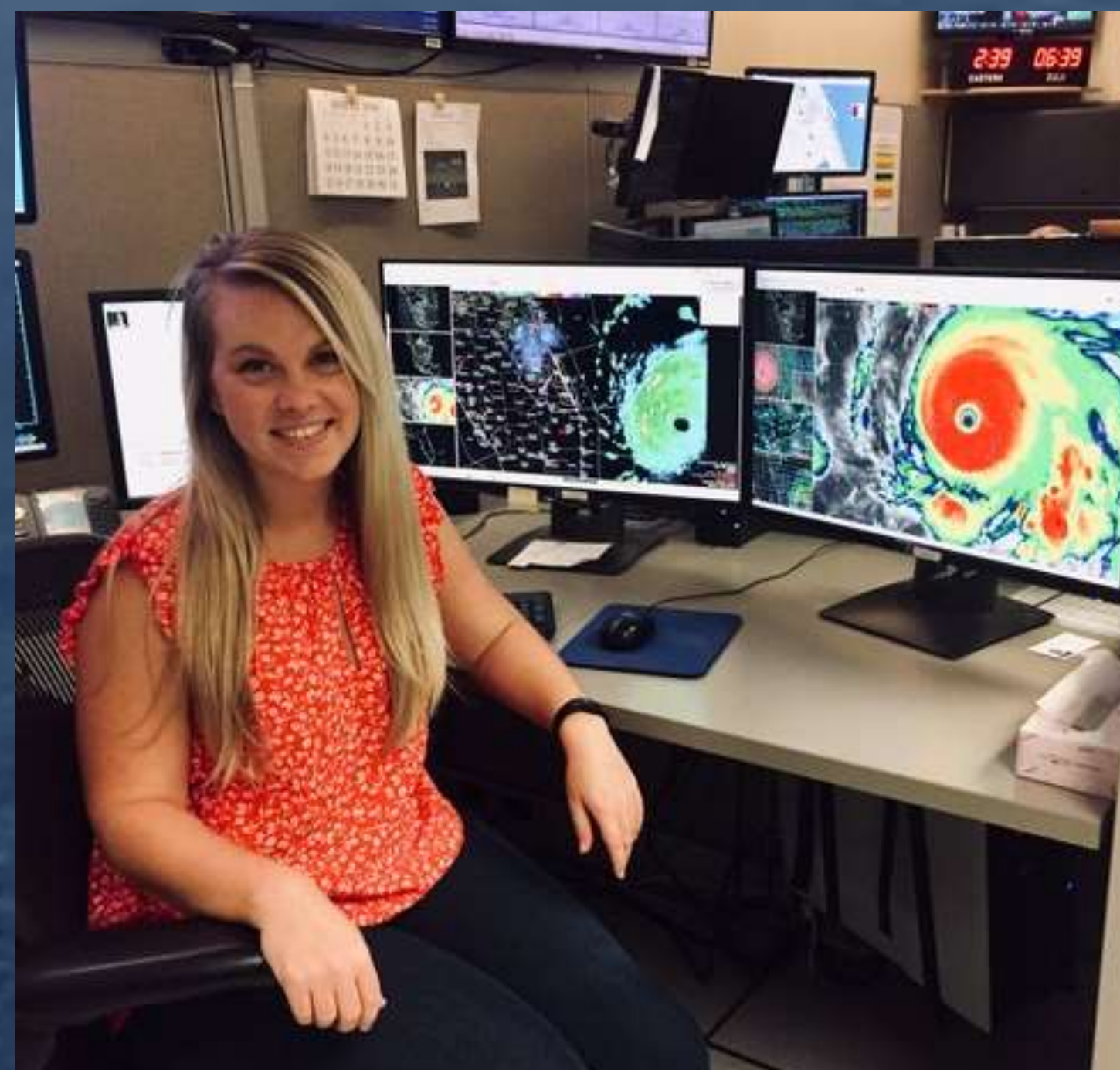




WEATHER 101

HURRICANES



JESSIE SCHAPER | METEOROLOGIST
National Weather Service – Melbourne, FL
jessica.schaper@noaa.gov



Poll Time

Have you ever
experienced direct
impacts from a tropical
system?

Today's Agenda

- ✓ Tropical Cyclone Basics
- ✓ Saffir-Simpson Wind Scale
- ✓ 5 Year Recap
- ✓ Inside the Office During a Storm
- ✓ The 4 Hazards
- ✓ Seasonal Forecasting & Collecting Data
- ✓ National Hurricane Center Products



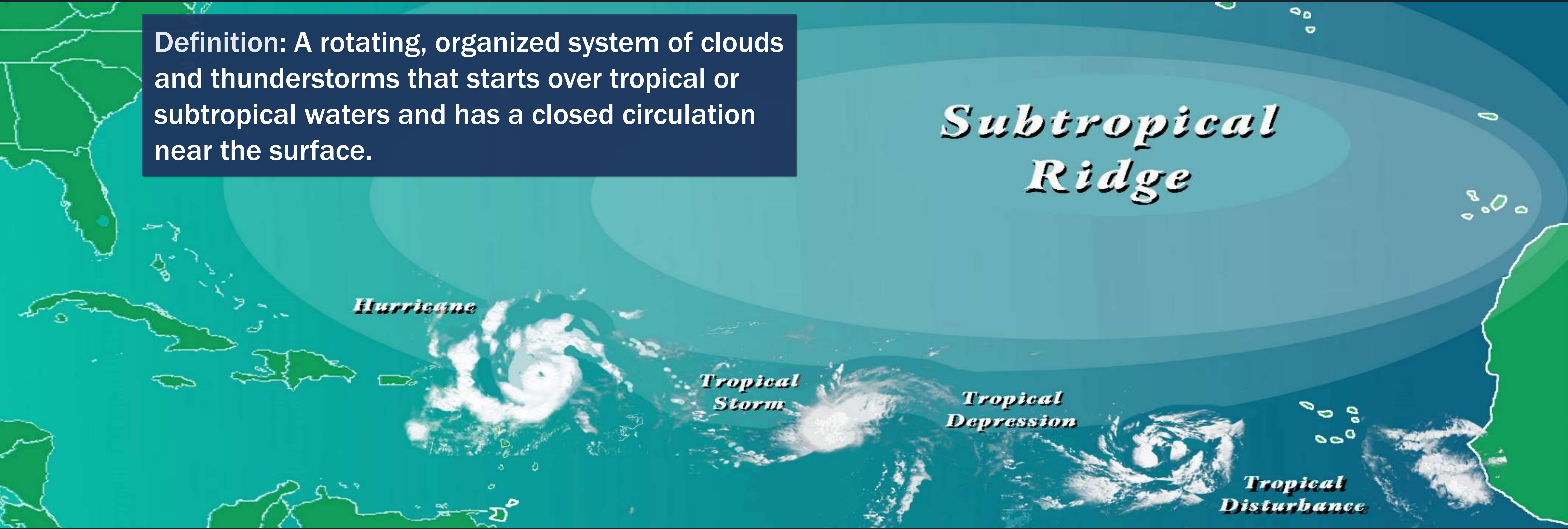


Tropical Cyclone Basics

Tropical Cyclones

Definition: A rotating, organized system of clouds and thunderstorms that starts over tropical or subtropical waters and has a closed circulation near the surface.

Subtropical Ridge

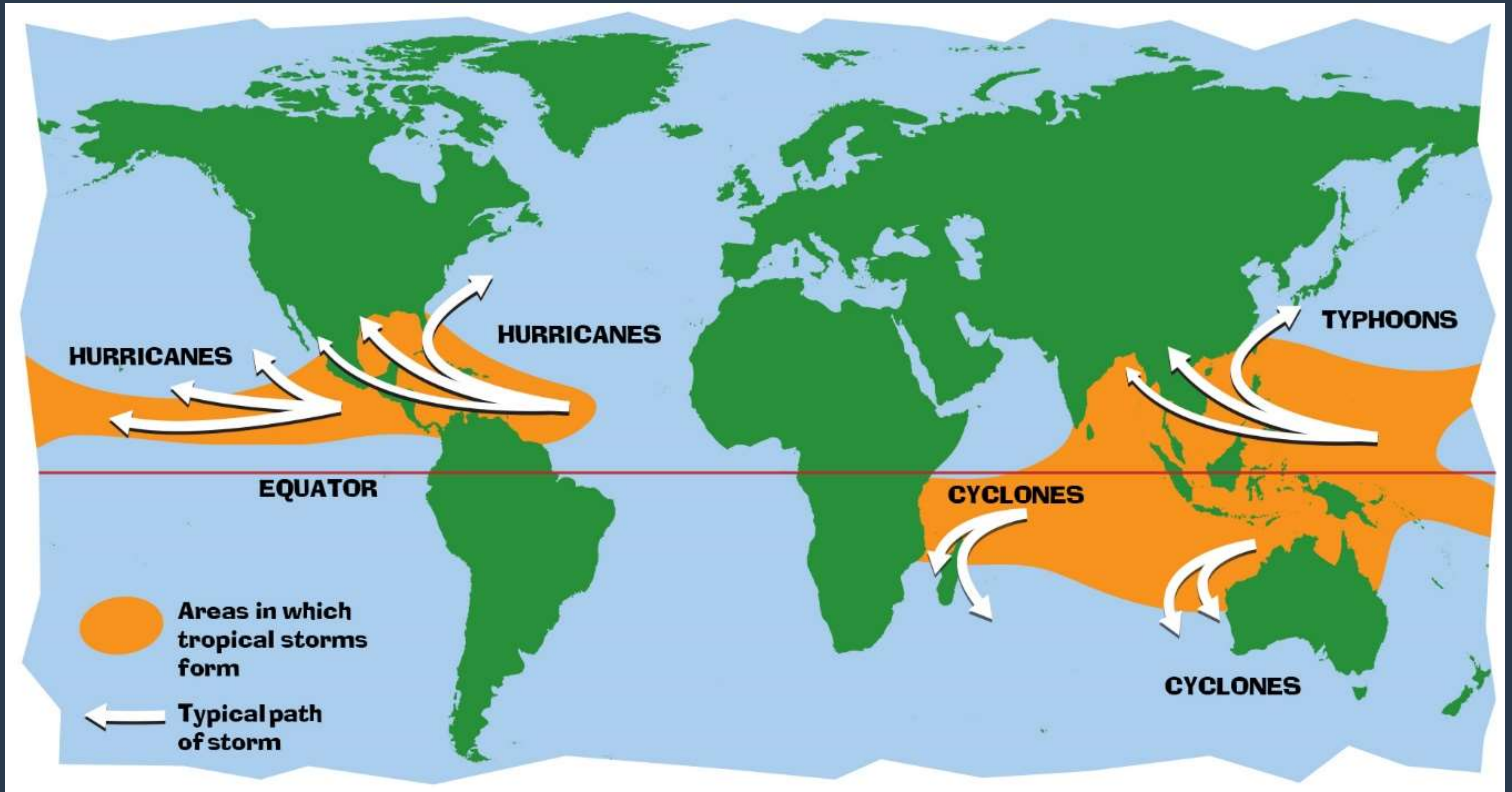


Storm Strength Classifications



Sources: Storm data provided by the National Hurricane Center, a division of the National Weather Service

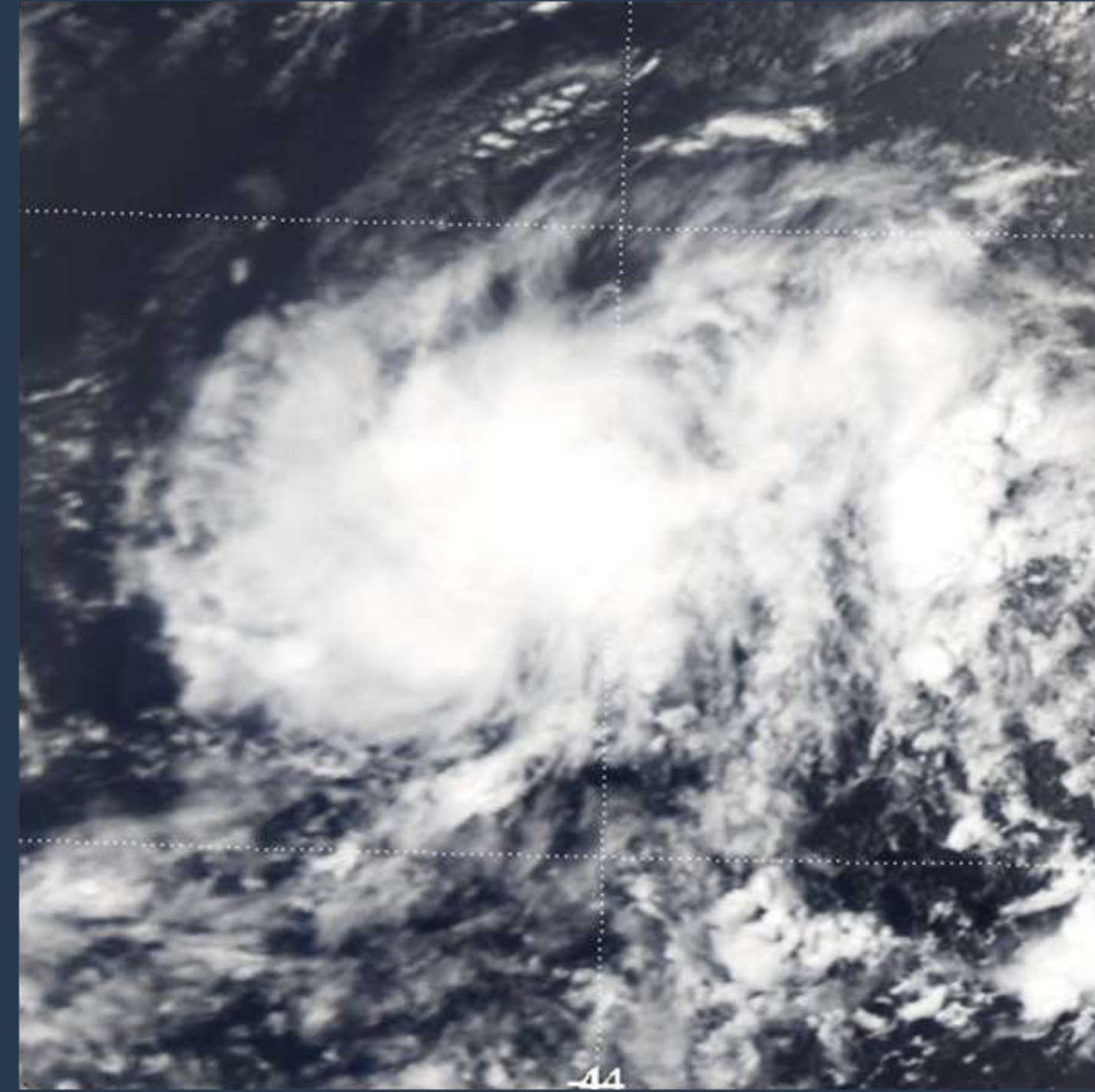
Tropical Cyclones



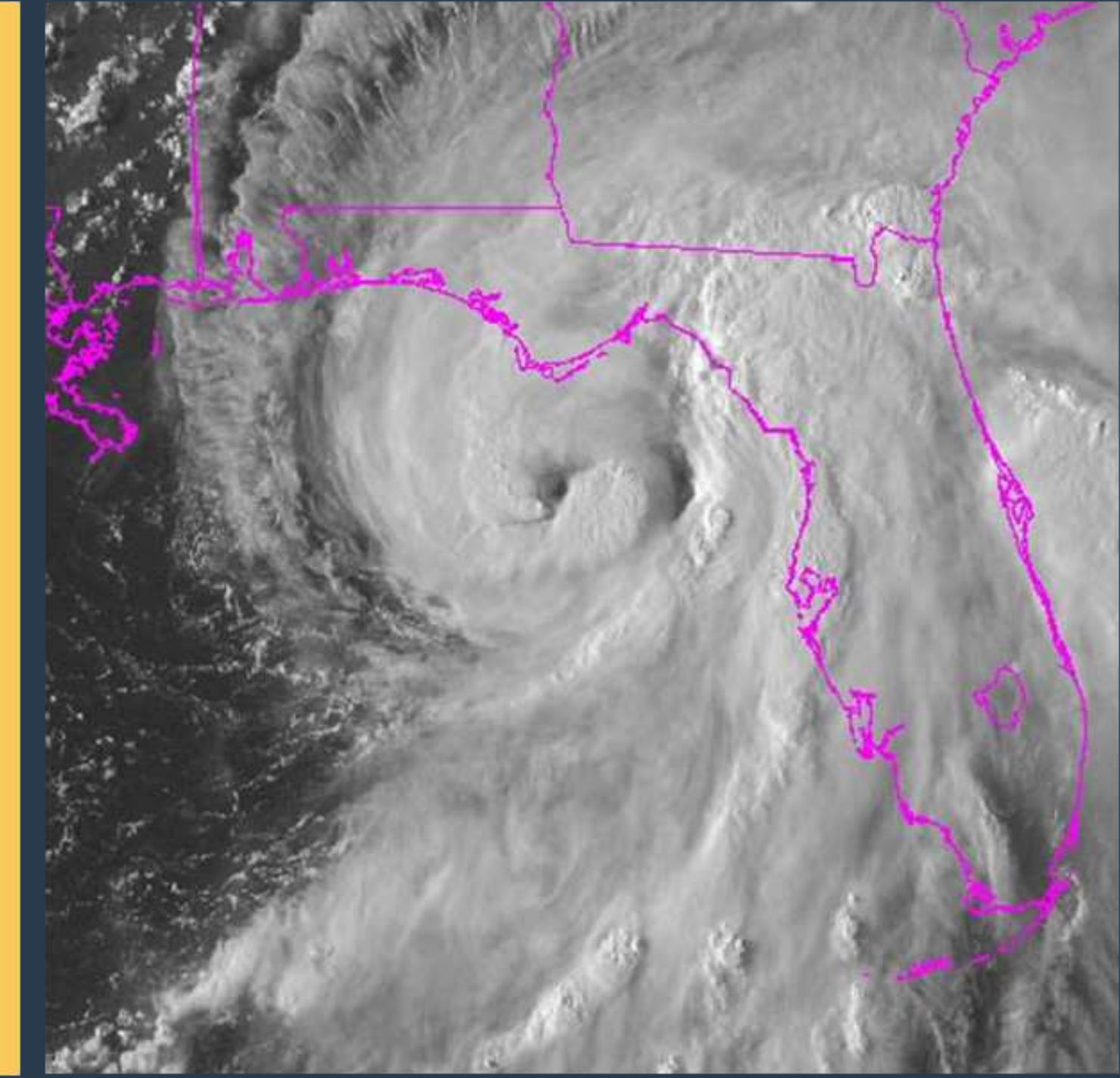
Tropical Cyclones

Tropical Cyclone Come in All Shapes & Sizes!

Tropical Depression
(winds at or below 38 mph)



Hurricane
(winds at or above 74 mph)



Tropical Storm
(winds between 39 – 73 mph)



Major Hurricane
(winds at or above 111 mph)



Tropical Cyclones

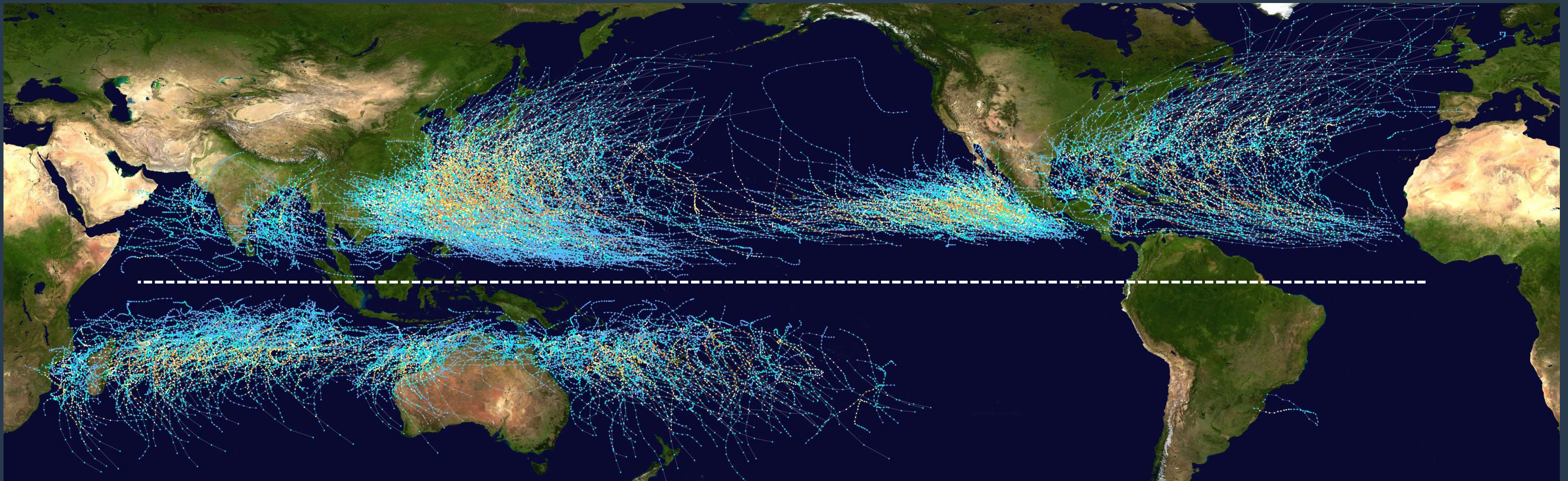
Tropical Cyclone Come in All Shapes & Sizes!



Tropical Cyclones

INGREDIENTS

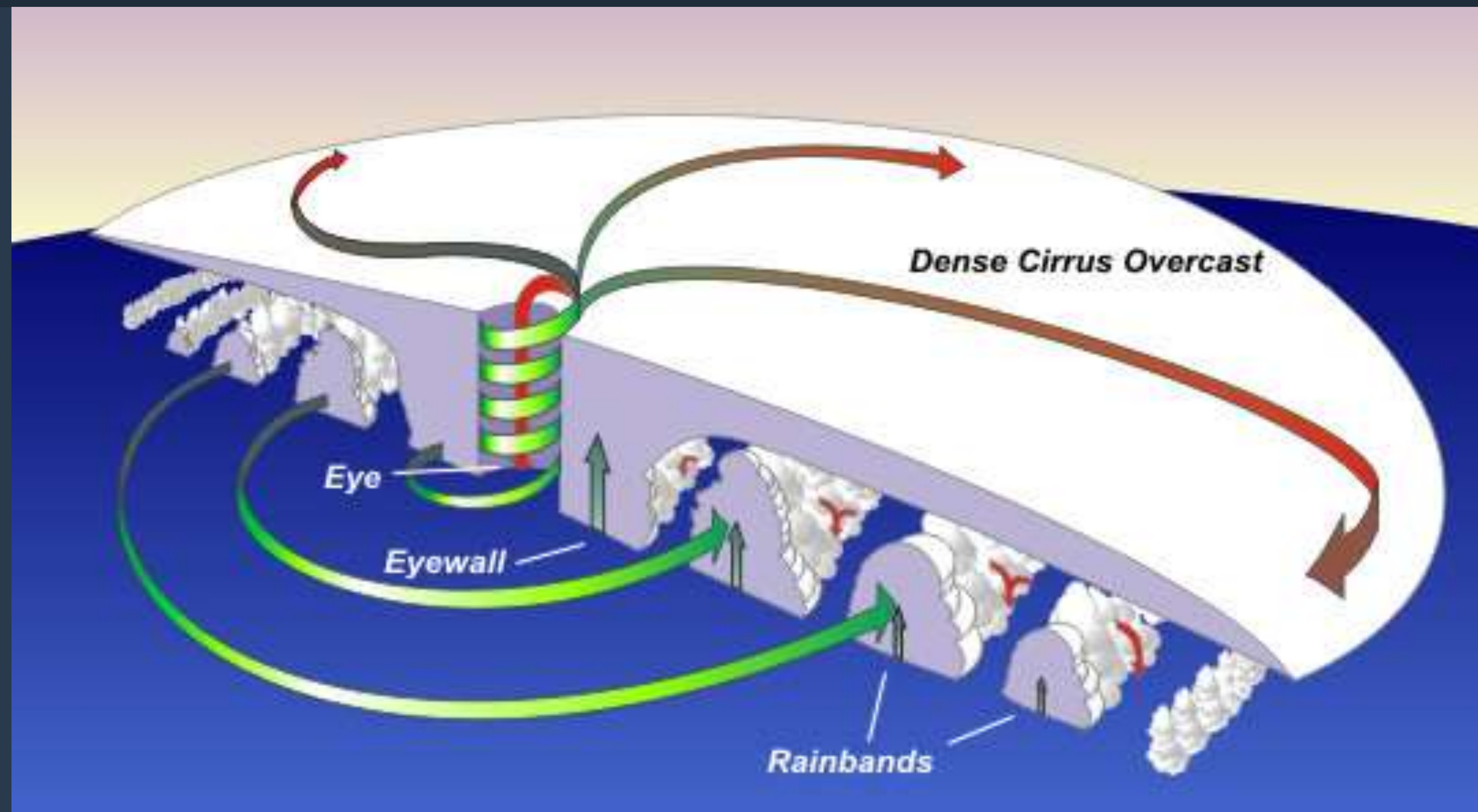
- Warm ocean water through a deep layer
- Unstable atmosphere with sufficient moisture
- Low vertical wind shear
- Pre-existing disturbance near the surface (away from equator)

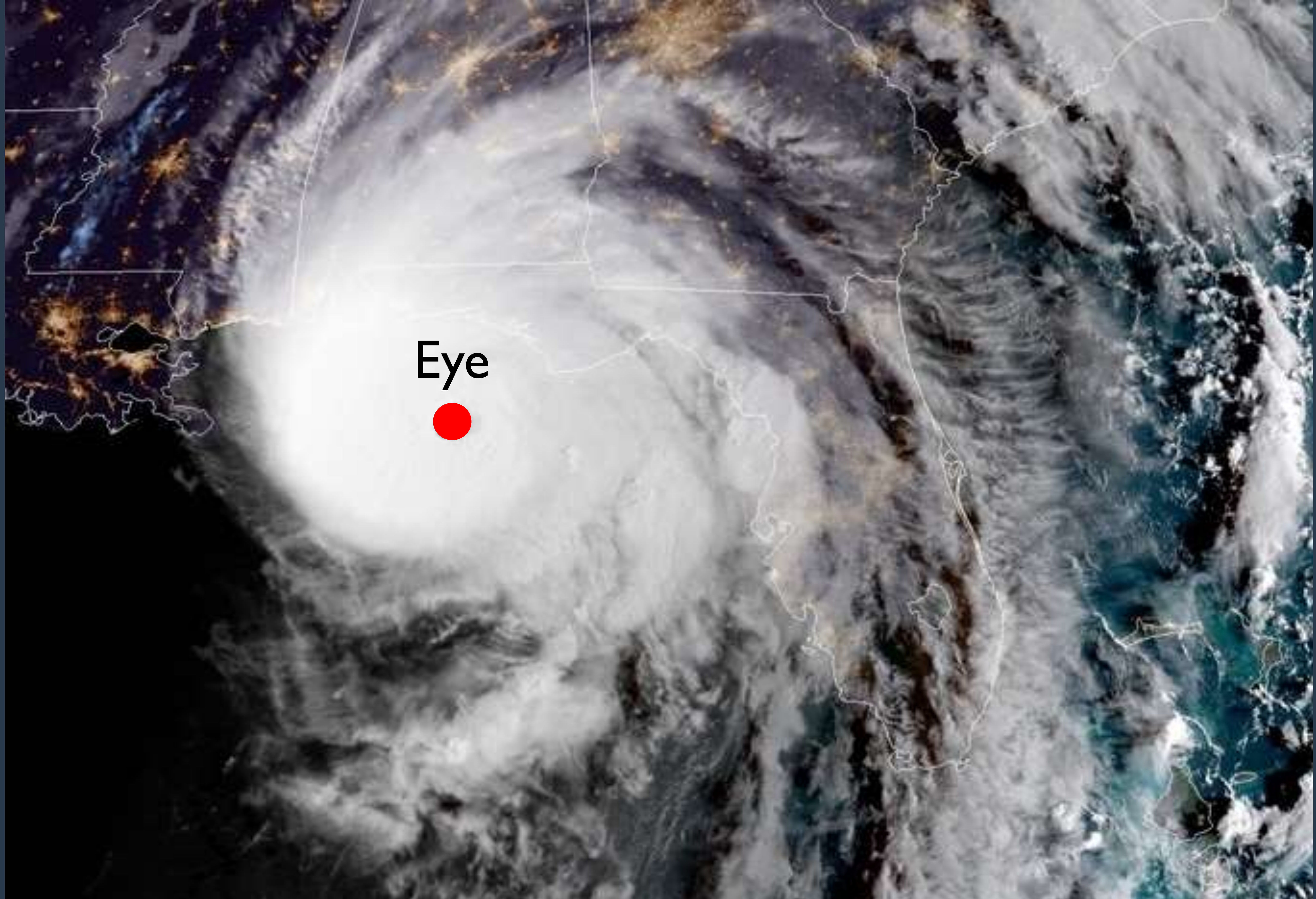


Tropical Cyclones

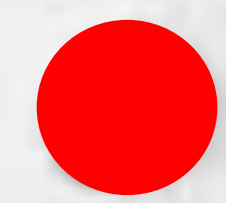
STRUCTURE

- **Eye:** center of the storm, relatively calm & sinking air
- **Eyewall:** strongest winds located here; indicates storm intensity
- **Rain Bands:** curved bands of heavy rain that spiral away from the eyewall; tornadoes possible





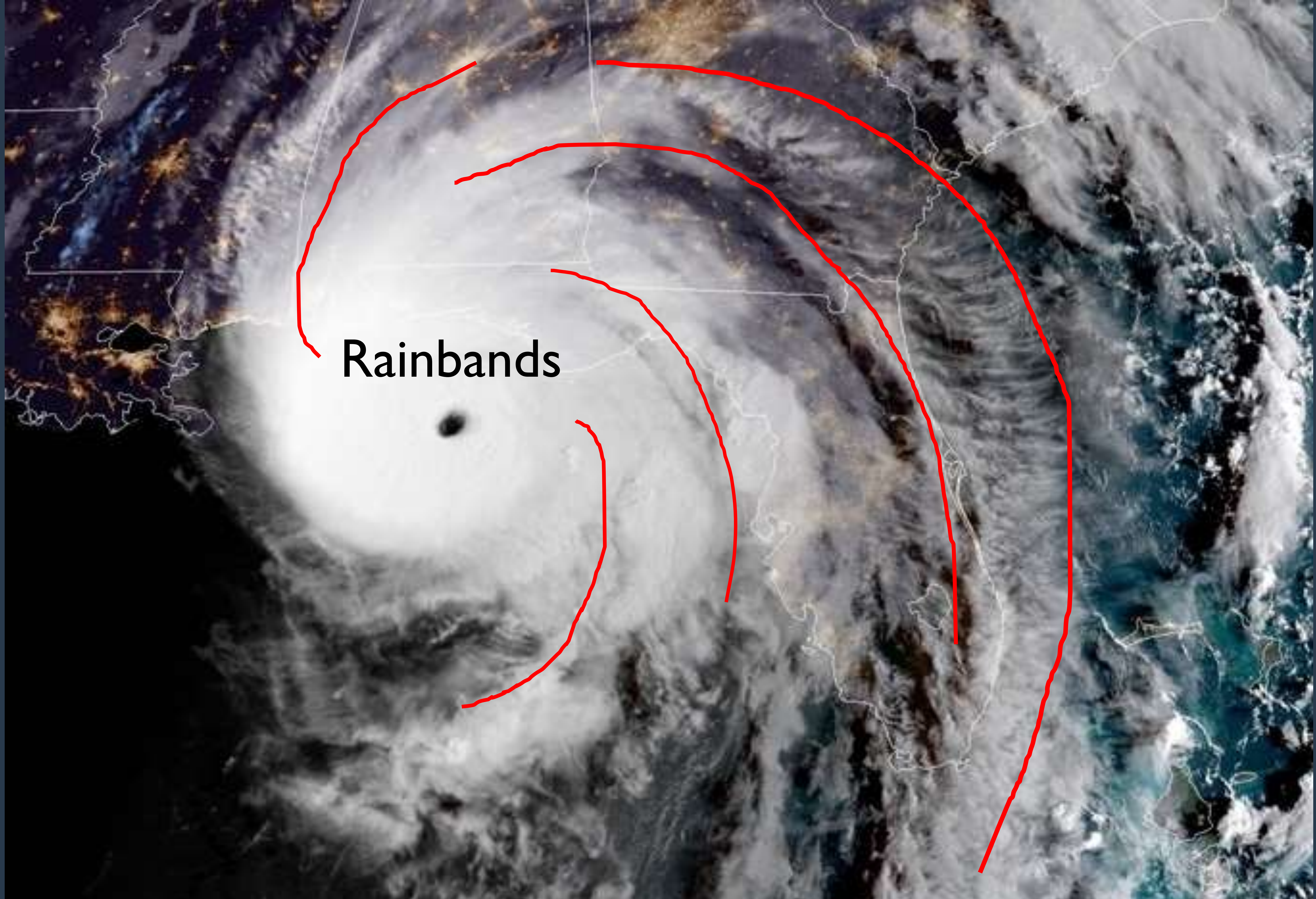
Eye



A satellite image of a hurricane, showing a distinct eye and a surrounding eyewall. The eyewall is the innermost ring of clouds, appearing as a bright white circle. The eye is the center of the storm, appearing as a dark, clear area. The surrounding clouds are shown in various shades of gray and white, indicating different cloud heights and densities. The image is overlaid with a map of the United States, showing the hurricane's position over the Gulf of Mexico. The word "Eyewall" is written in black text above a red circle that marks the center of the eyewall.

Eyewall





Rainbands

Tropical Cyclones

Saffir-Simpson Hurricane Wind Scale



WIND: 74-95 mph

DAMAGE: Very dangerous winds will produce some damage



WIND: 96-110 mph

DAMAGE: Extremely dangerous winds will cause extensive damage



WIND: 111-129 mph

DAMAGE: Devastating damage will occur



WIND: 130-156 mph

DAMAGE: Catastrophic damage will occur

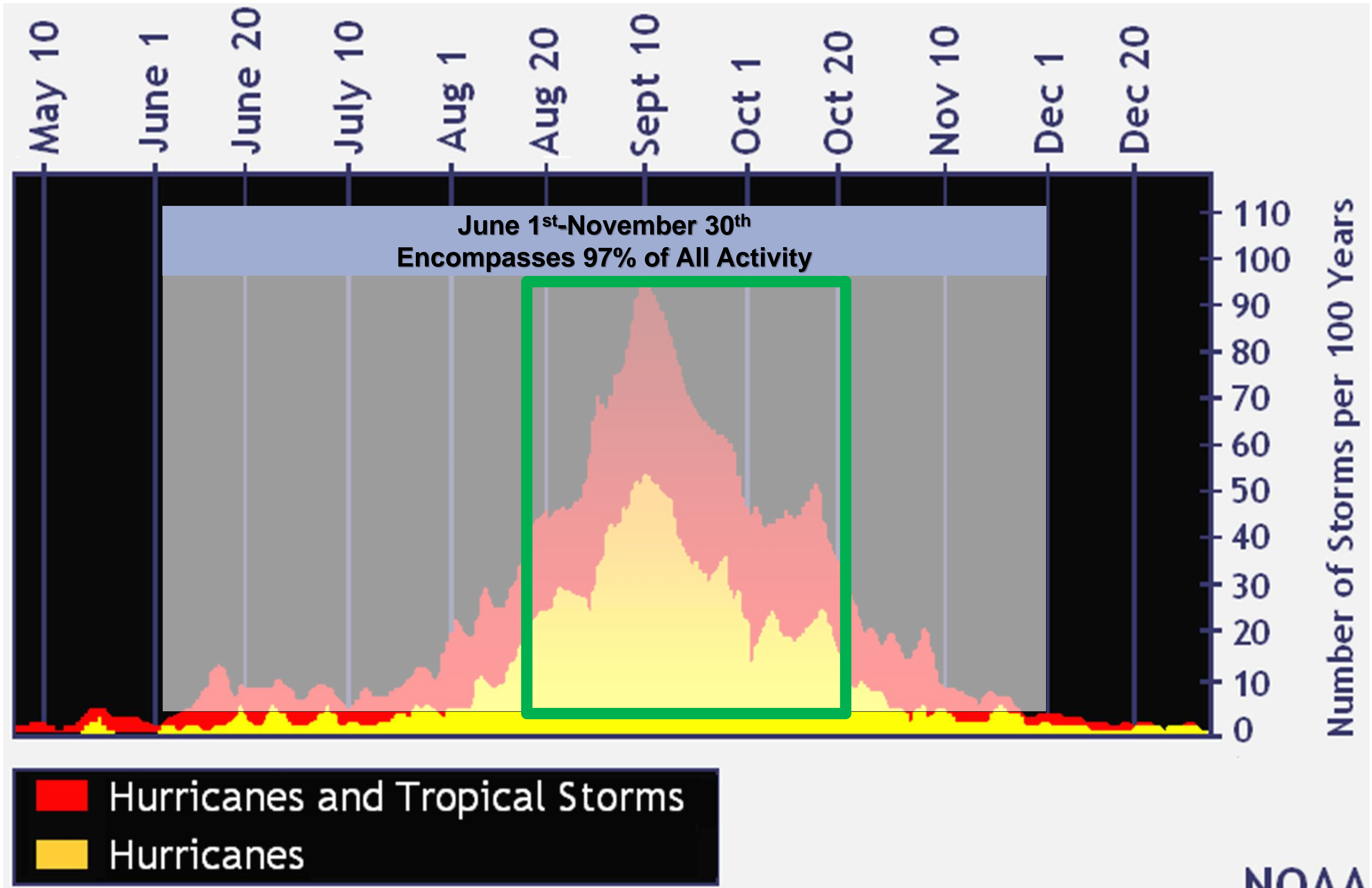


WIND: 157 mph or higher

DAMAGE: Catastrophic damage will occur

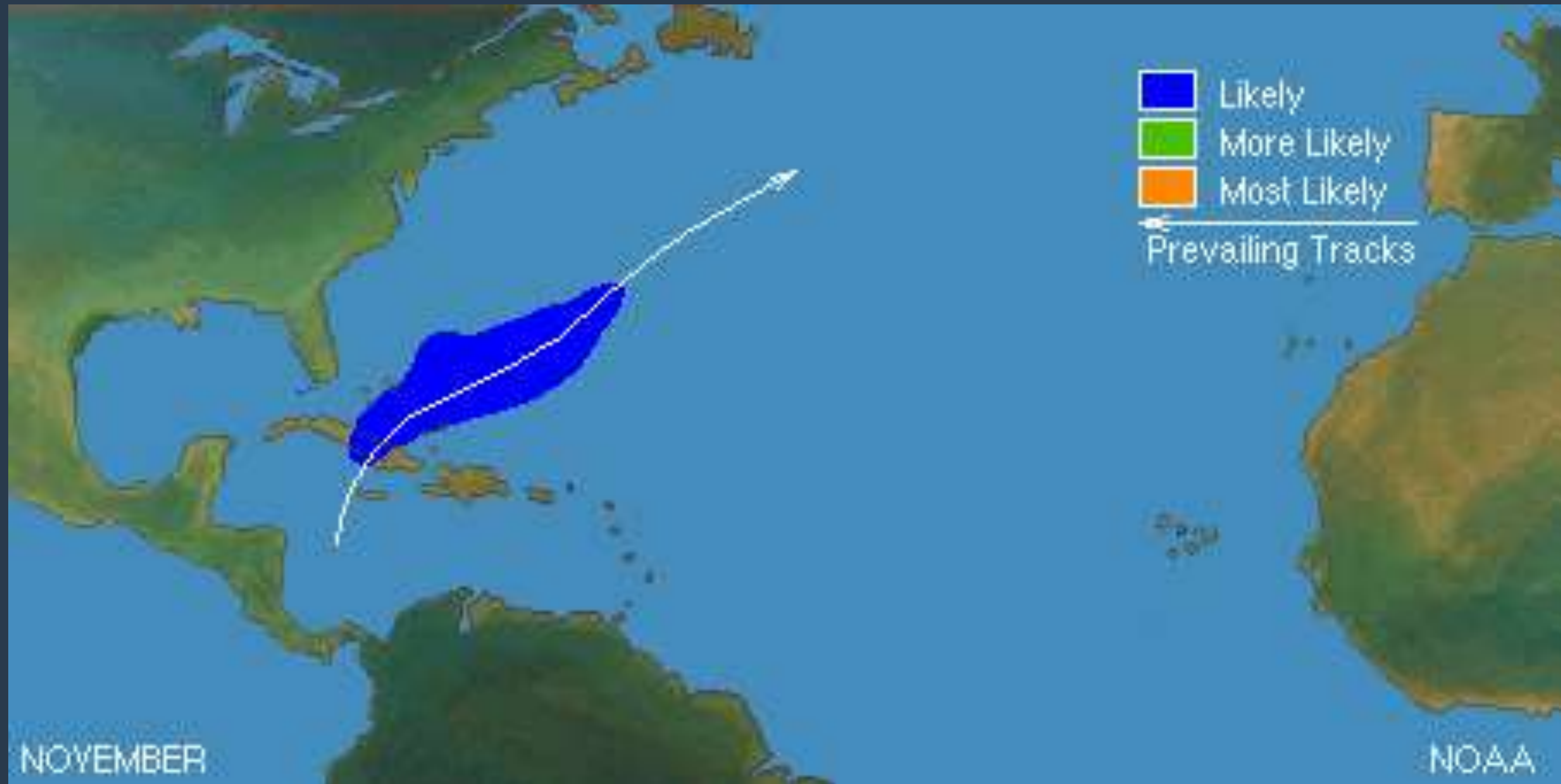


Tropical Cyclones



■ Hurricanes and Tropical Storms
■ Hurricanes

Tropical Cyclones





Pop Quiz!

Where are the strongest winds in a hurricane located?



Pop Quiz!

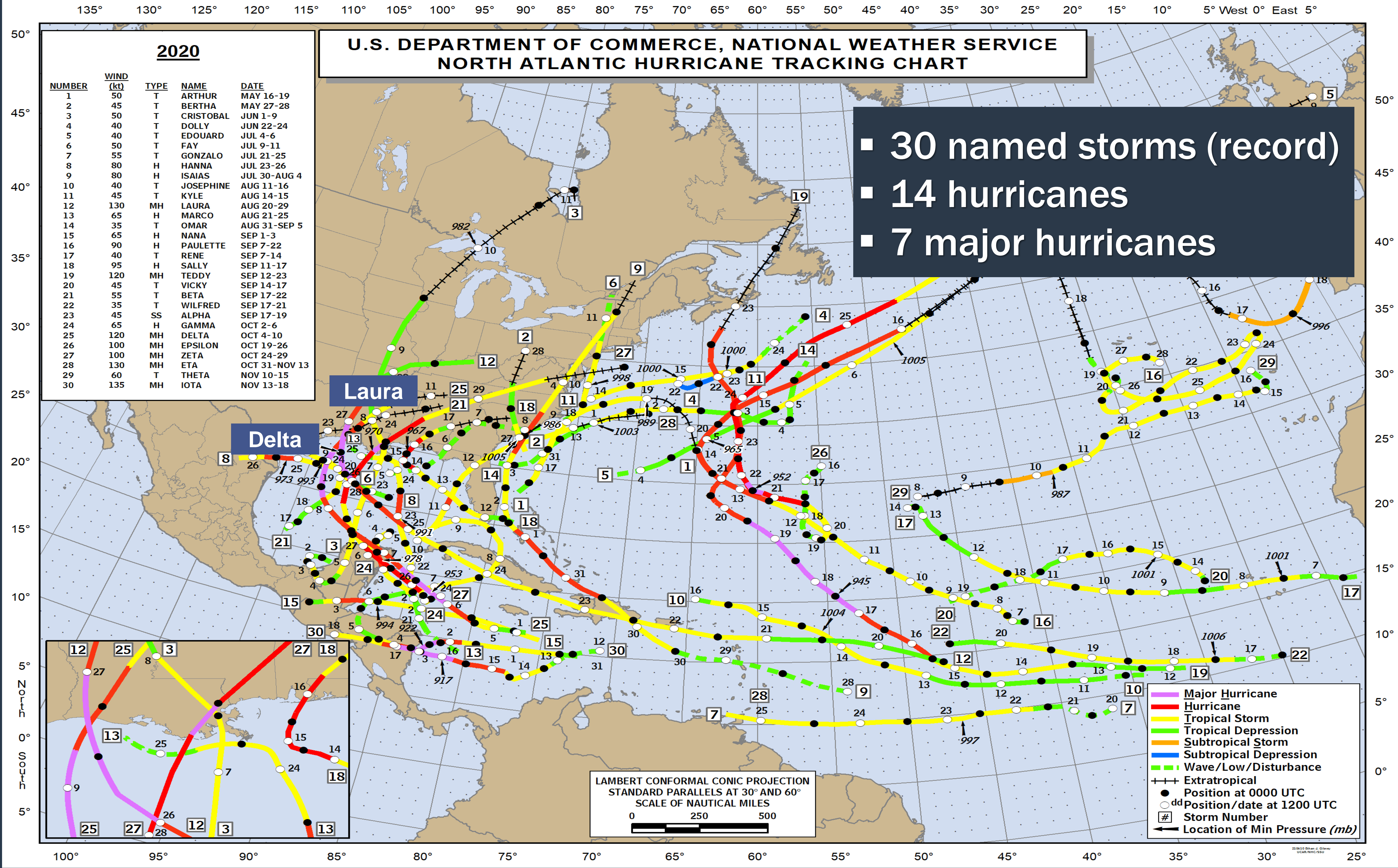
TRUE or FALSE

The Saffir-Simpson Scale only considers wind speed when defining a system's category.



**5 Year Season
Summary**

2020 Hurricane Season

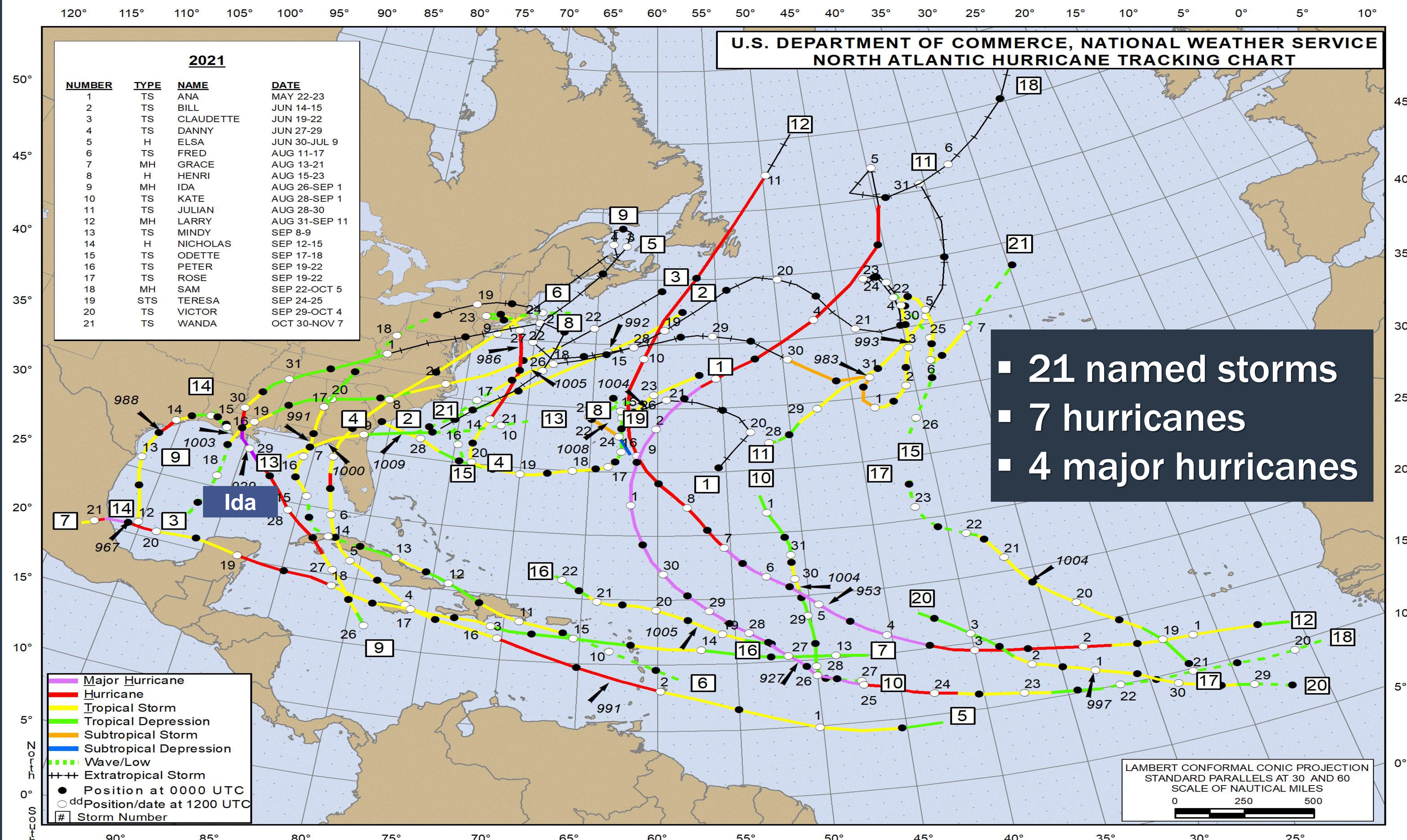


- 30 named storms (record)
- 14 hurricanes
- 7 major hurricanes

Delta

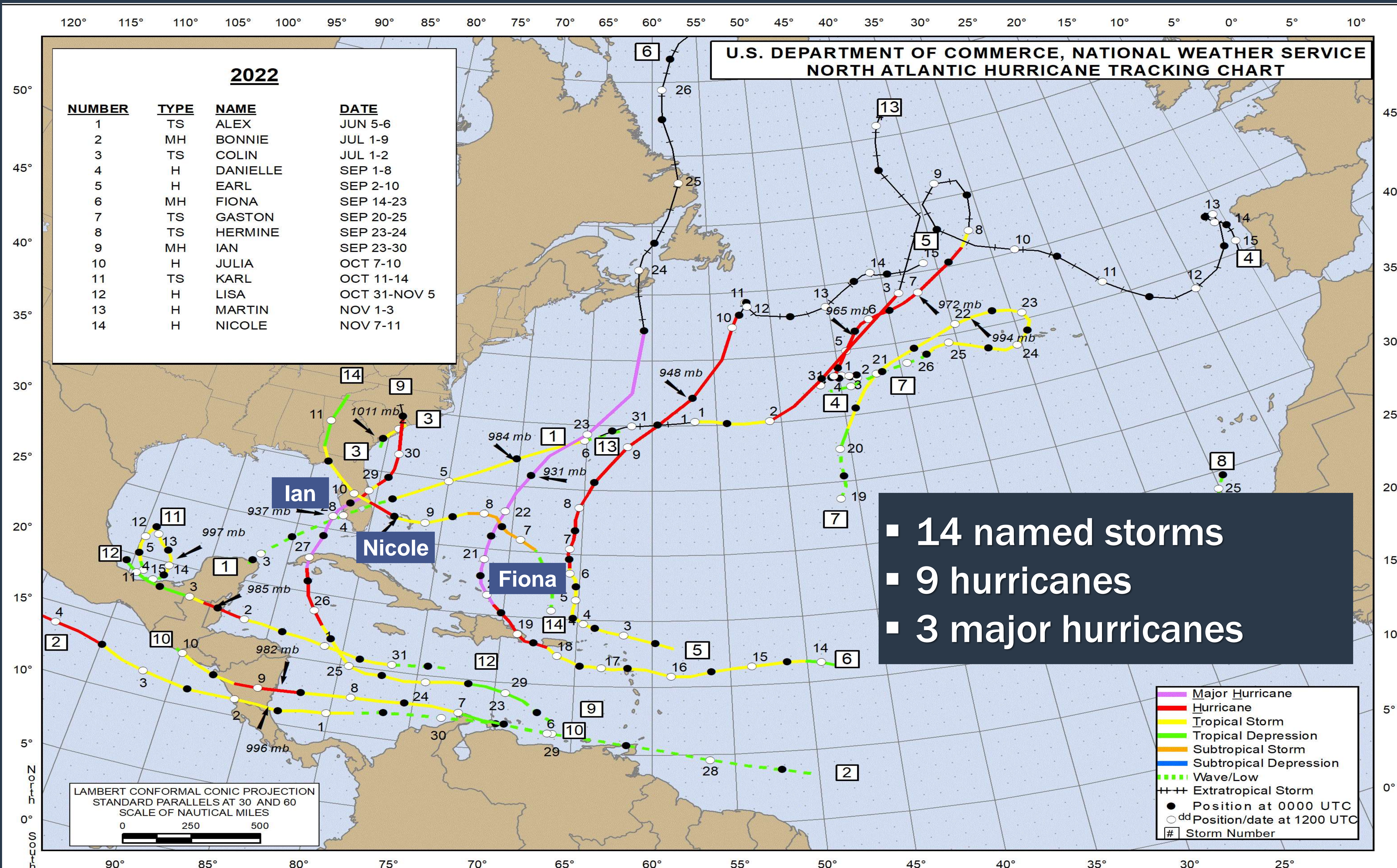
Laura

2021 Hurricane Season



- 21 named storms
- 7 hurricanes
- 4 major hurricanes

2022 Hurricane Season

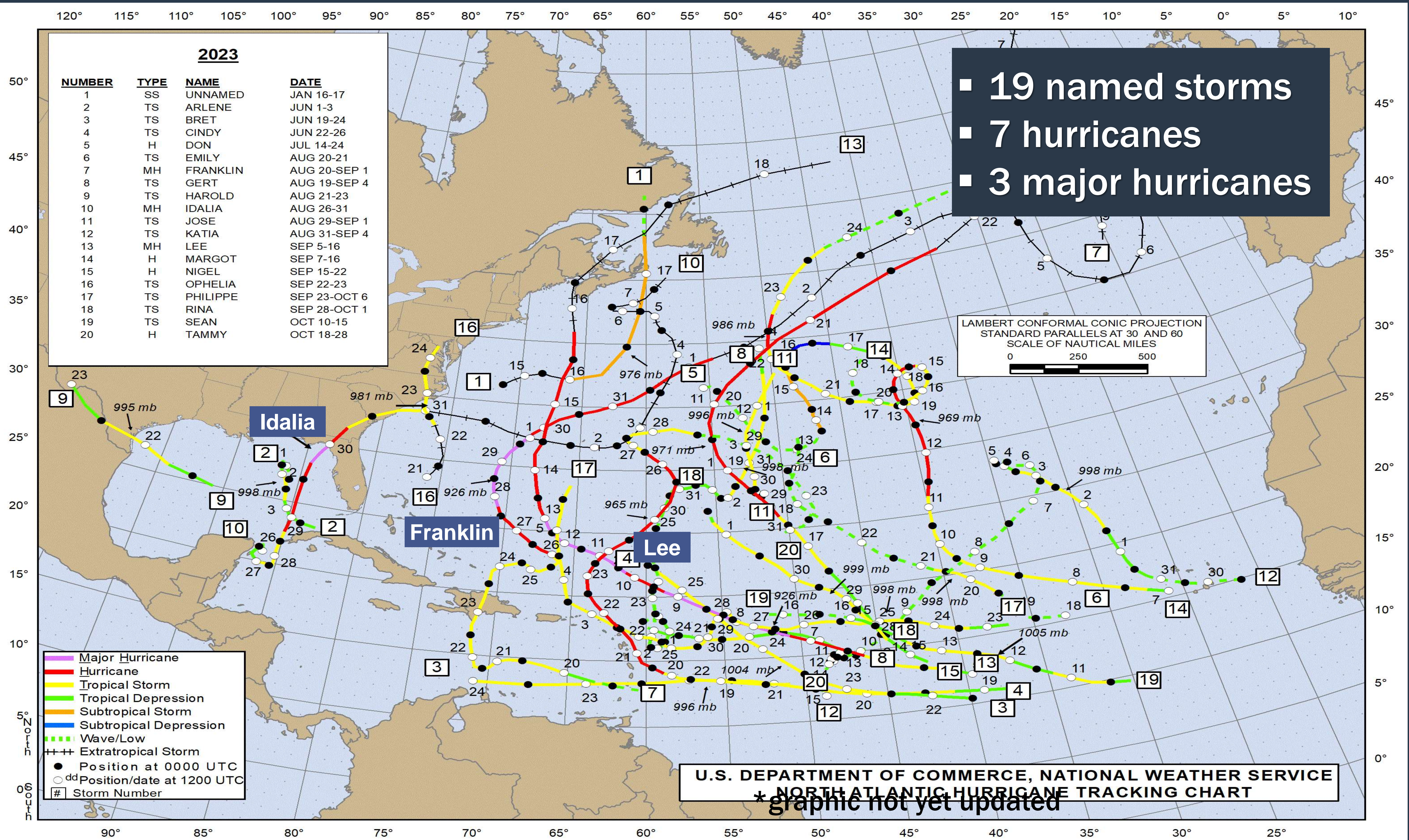


- 14 named storms
- 9 hurricanes
- 3 major hurricanes

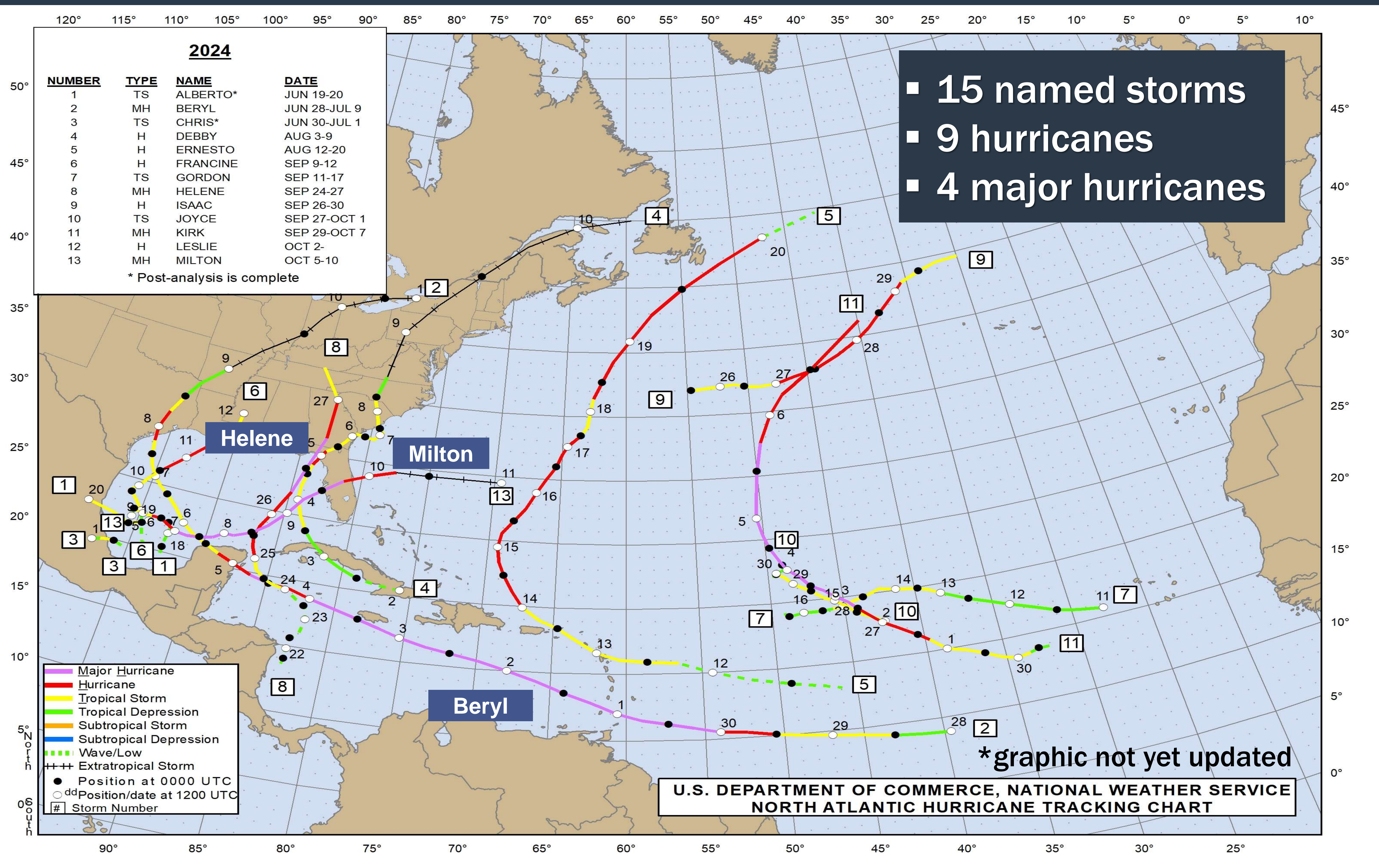
— Major Hurricane
— Hurricane
— Tropical Storm
— Tropical Depression
— Subtropical Storm
— Subtropical Depression
- - - Wave/Low
+ + + Extratropical Storm
● Position at 0000 UTC
○ Position/date at 1200 UTC
Storm Number

LAMBERT CONFORMAL CONIC PROJECTION
 STANDARD PARALLELS AT 30 AND 60
 SCALE OF NAUTICAL MILES
 0 250 500

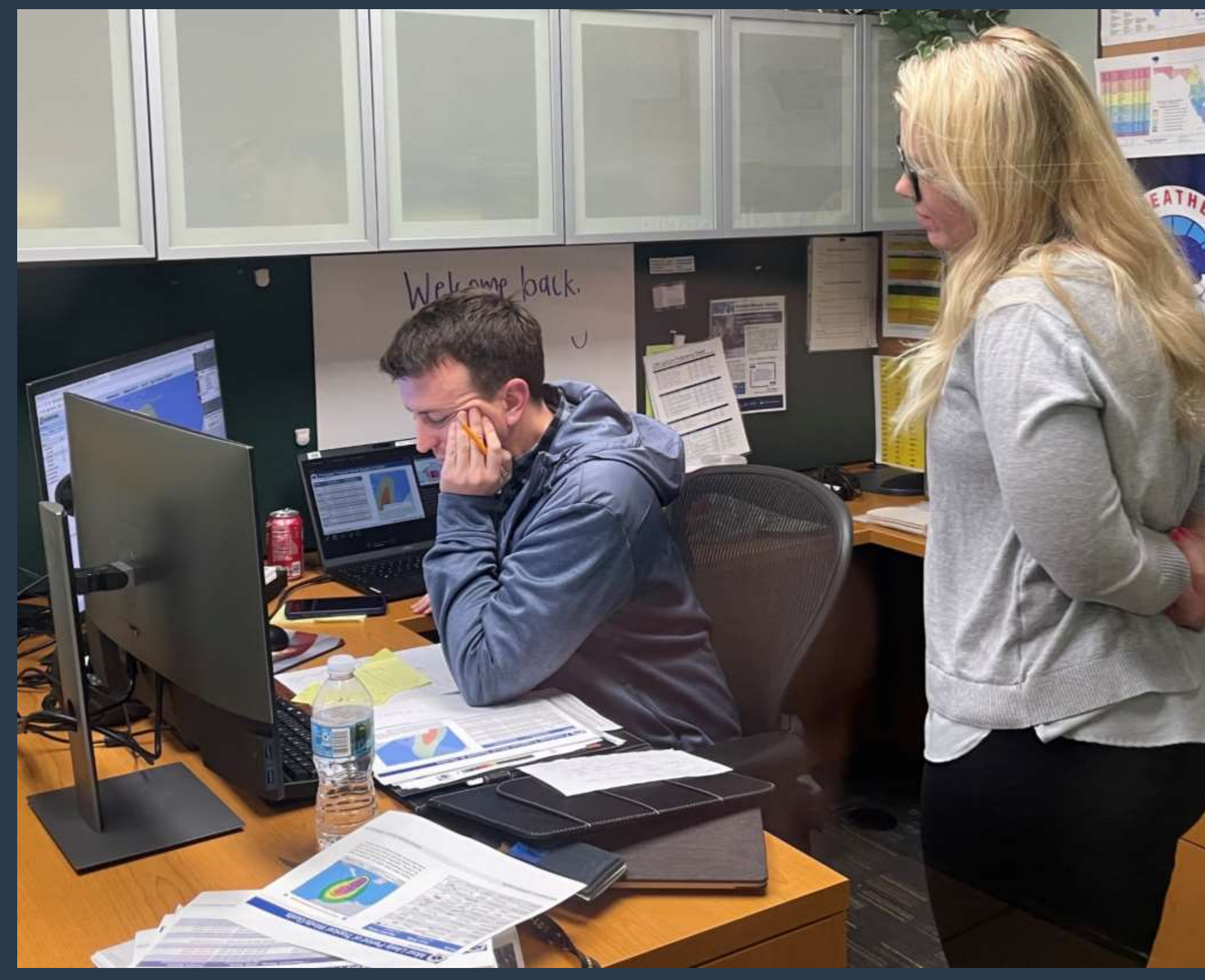
2023 Hurricane Season



2024 Hurricane Season (So Far)



Hurricane Operations – All Hands On Deck



2020 Hurricane Season Names



2020 Atlantic Tropical Cyclone Names*

~~Arthur~~
Bertha
Cristobal
Dolly
Edouard
Fay
Gonzalo

Hanna
~~Isaias~~
Josephine
Kyle
Laura
Marco
Nana

Omar
Paulette
Rene
Sally
Teddy
Vicky
Wilfred

*Names provided by the World Meteorological Organization

2020 Hurricane Season Names

A Alpha	B Beta	Γ Gamma	Δ Delta	E Epsilon	Z Zeta
H Eta	Θ Theta	I Iota	K Kappa	Λ Lambda	M Mu
N Nu	Ξ Xi	Ο Omicron	Π Pi	Ρ Rho	Σ Sigma
Τ Tau	Υ Upsilon	Φ Phi	Χ Chi	Ψ Psi	Ω Omega

2005 Made
it Here

Goodbye Greek Names...

Adria

Braylen

Caridad

Deshawn

Emery

Foster

Gemma

Heath

Isla

Jacobus

Kenzie

Lucio

Makayla

Nolan

Orlanda

Pax

Ronin

Sophie

Tayshaun

Viviana

Will

*Names provided by the World Meteorological Organization

2024 Atlantic Season Names

~~Alberto~~

~~Beryl~~

~~Chris~~

~~Debby~~

~~Ernesto~~

~~Francine~~

~~Gordon~~

~~Helene~~

~~Isaac~~

~~Joyce~~

~~Kirk~~

~~Leslie~~

~~Milton~~

~~Nadine~~

~~Oscar~~

Patty

Rafael

Sara

Tony

Valerie

William

*Names provided by the World Meteorological Organization

A Few “Retired” Names

Dora (1964)
Camille (1969)
Hugo (1989)
Andrew (1992)
Floyd (1999)
Charley (2004)
Frances (2004)
Ivan (2004)
Jeanne (2004)

The “I” name is
the most common
to be retired

Dennis (2005)
Katrina (2005)
Rita (2005)
Stan (2005)
Wilma (2005)
Sandy (2012)
Matthew (2016)
Harvey (2017)
Irma (2017)
Maria (2017)

Michael (2018)
Dorian (2019)
Laura (2020)
Eta (2020)
Iota (2020)
Ida (2021)
Fiona (2022)
Ian (2022)



Pop Quiz!

What was the most active Atlantic hurricane season on record?



Pop Quiz!

What organization is responsible for choosing the list of hurricane names?

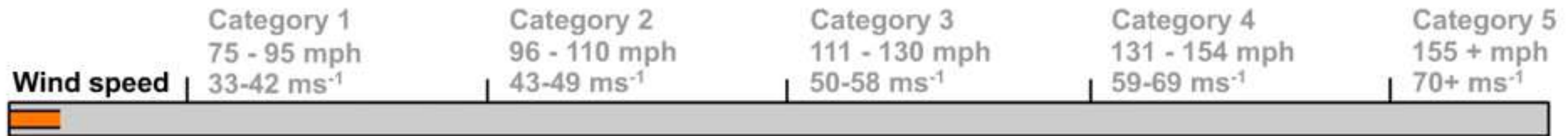
A banner for "Weather 101" from NWS Nashville. On the left is the National Weather Service logo. To its right, the text "NWS Nashville Presents" is written in white. The main title "Weather 101" is in a large, blue, serif font with a white outline, set against a background of white clouds against a blue sky.

NWS Nashville Presents
Weather 101

Hurricane Hazards

Hurricane Hazards

Hurricane Intensity Scale (Wind Damage)



Hurricane Hazards

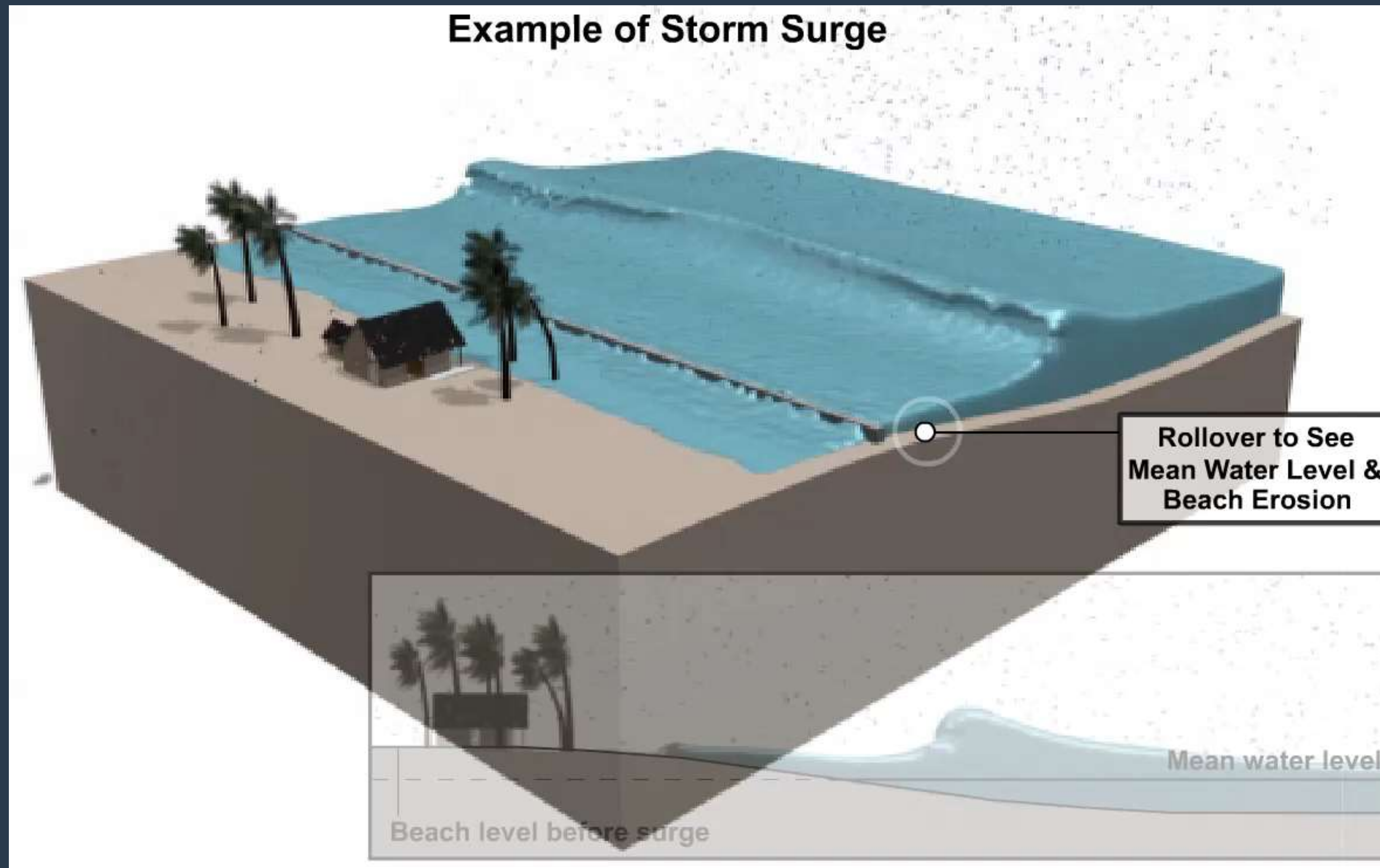
Copyright 2004 Jim Edds

ExtremeStorms.com

- Strongest winds near the center of the storm
- Causes dangerous flying debris

- Strong Winds
- Storm Surge
- Flooding
- Tornadoes

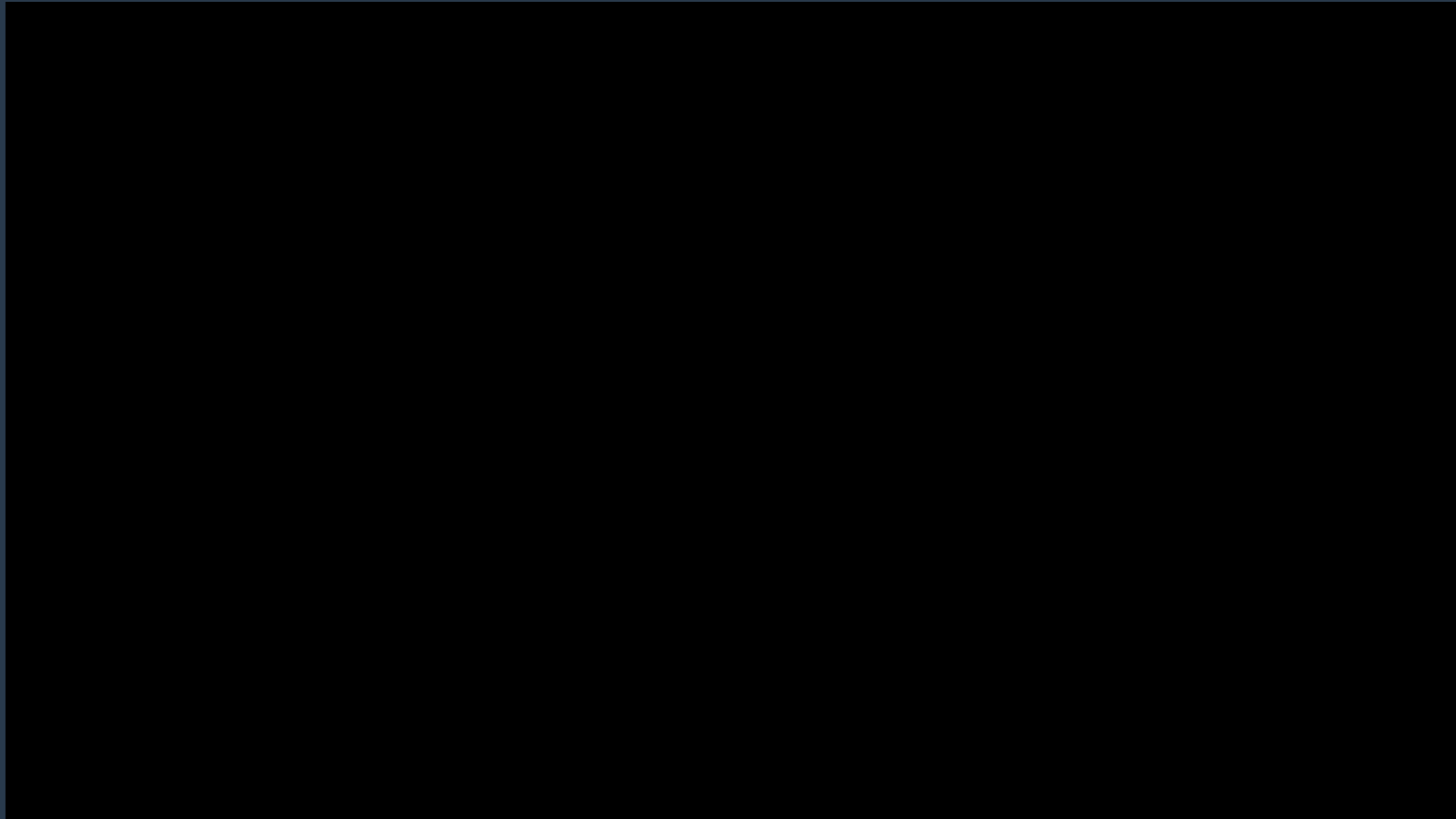
Hurricane Hazards



- Rise of water due to a storm
- Most dangerous to people!

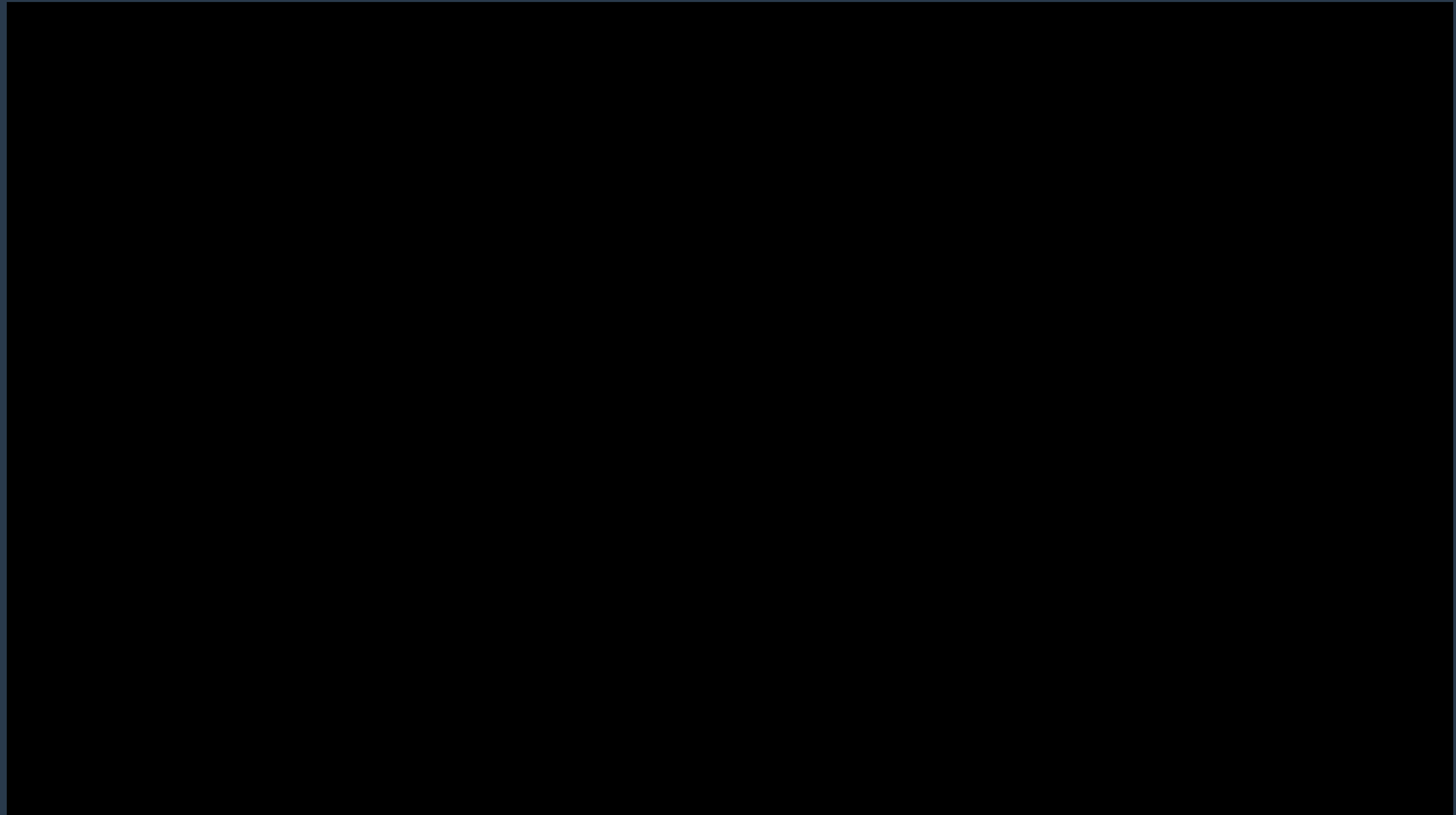
- Strong Winds
- Storm Surge
- Flooding
- Tornadoes

Hurricane Hazards – Storm Surge



Surge in Ft Myers

Hurricane Hazards – Storm Surge



[Ian Peak Surge](#)

Hurricane Hazards – Reverse Surge



USA Today Photo



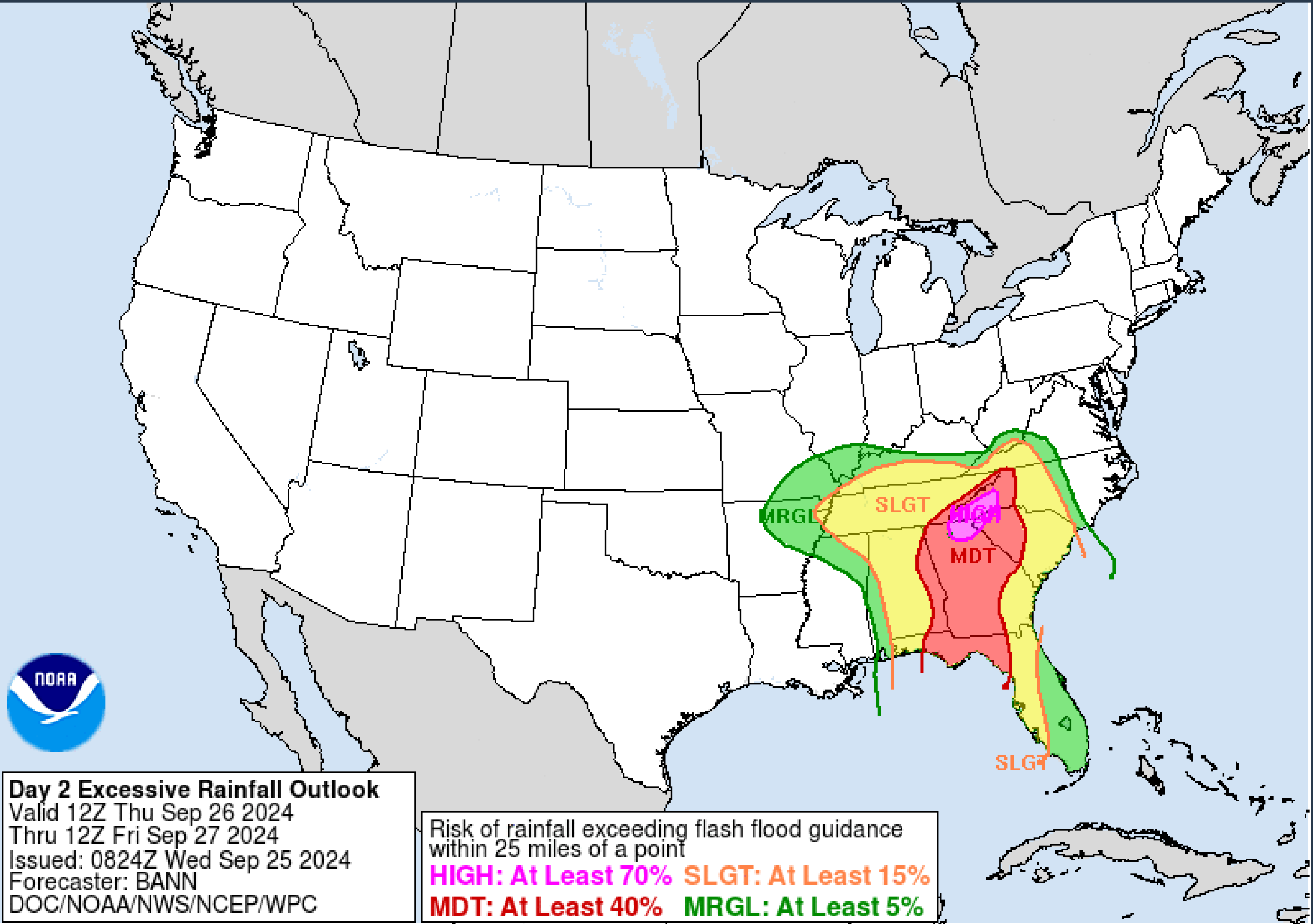
Hurricane Hazards



- Heavy rain often leads to flooding
- Can take place no matter how strong a storm is & well inland

- Strong Winds
- Storm Surge
- **Flooding**
- Tornadoes

Hurricane Hazards – Helene Flooding



Photos courtesy of Carolina Public Press



Hurricane Helene

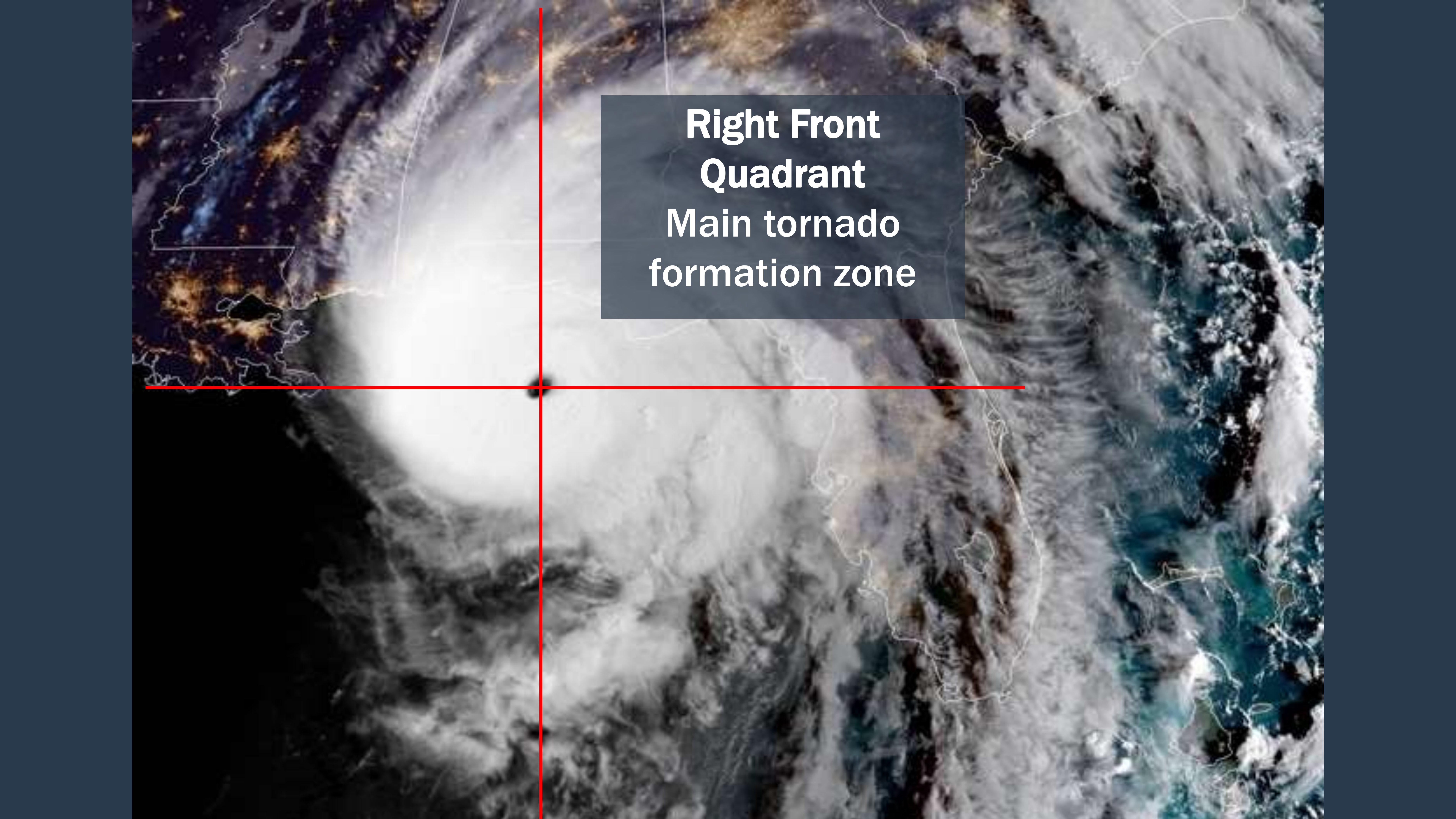


Hurricane Hazards



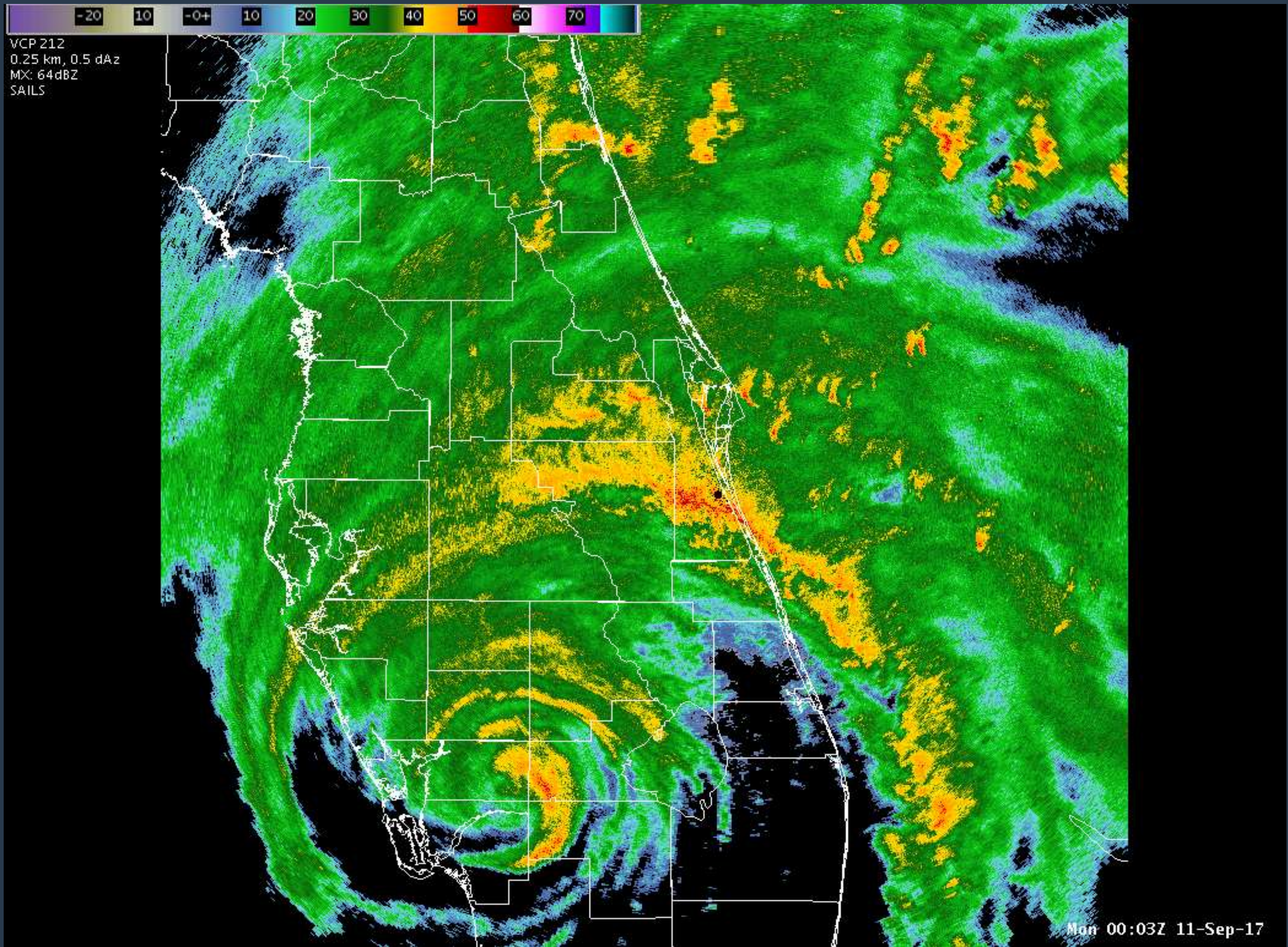
- Often occurs well ahead of a storm!
- Can affect preparation and evacuation activities

- Strong Winds
- Storm Surge
- Flooding
- Tornadoes

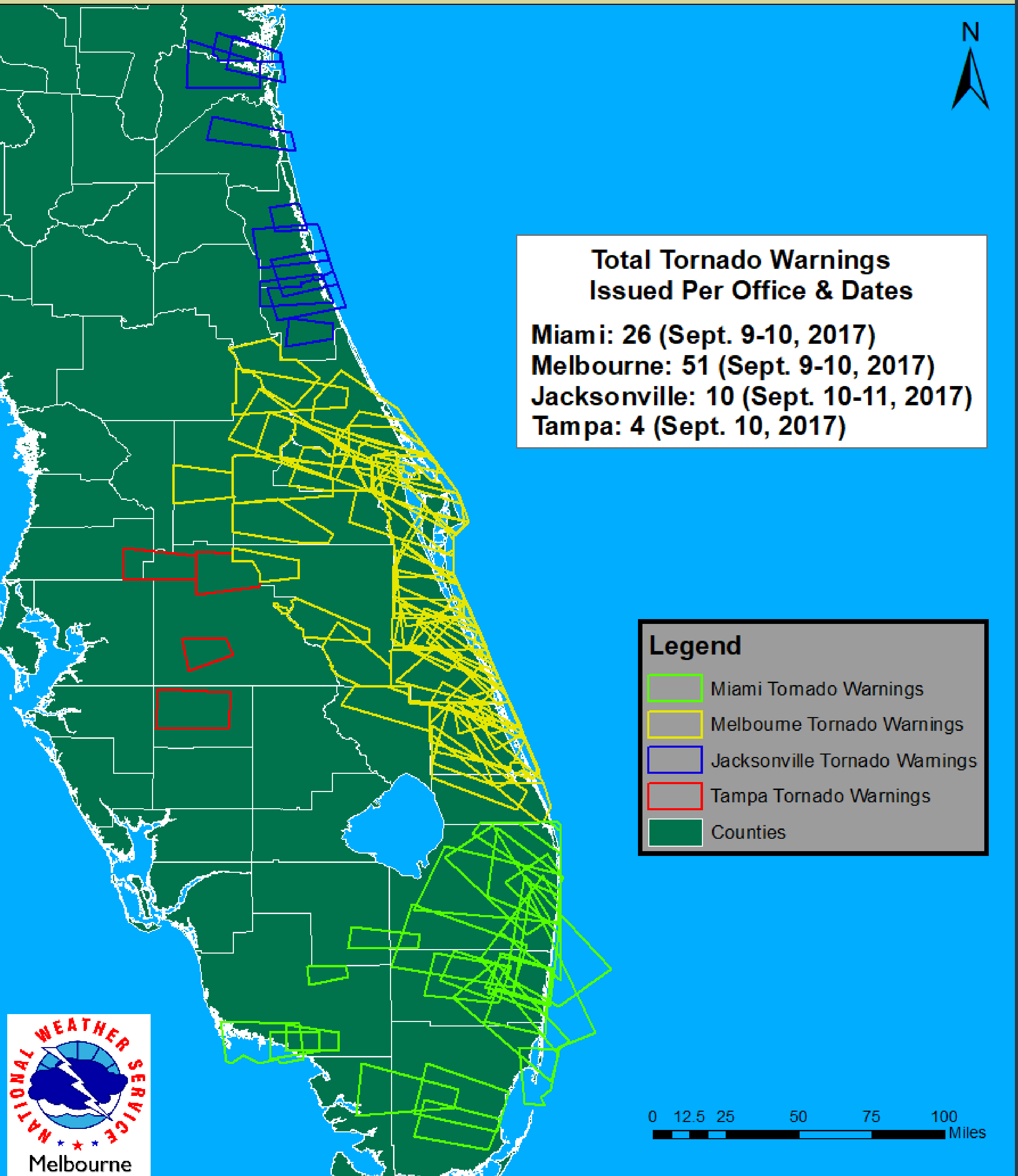
A satellite image of a storm system, likely a supercell, showing a bright, dense cloud mass on the left side. The image is overlaid with a red crosshair. A dark grey rectangular box is positioned in the upper right quadrant, containing white text. The background shows the storm's structure over a geographical area, with some landmasses visible on the right side.

**Right Front
Quadrant
Main tornado
formation zone**

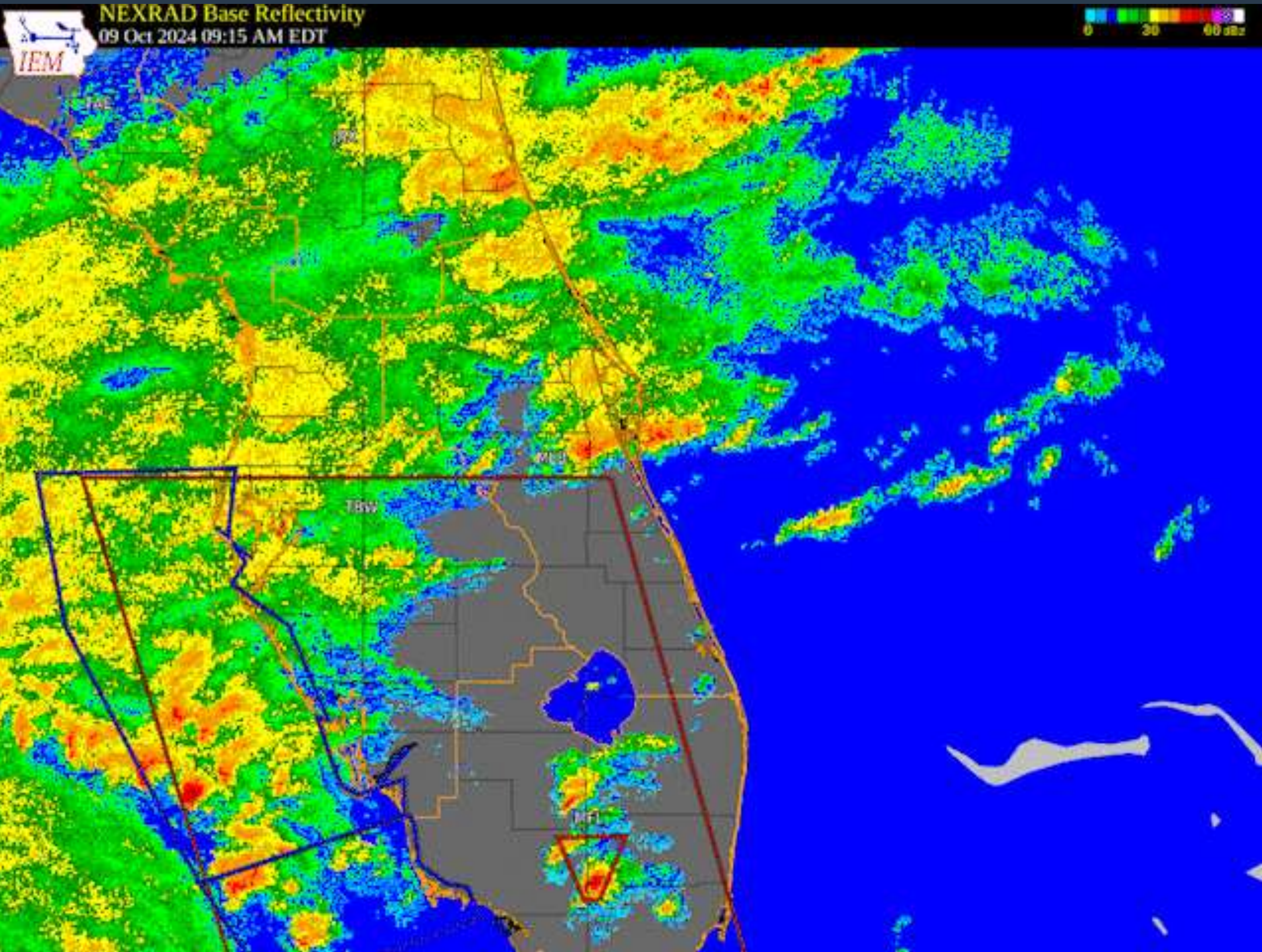
Hurricane Irma (2017)



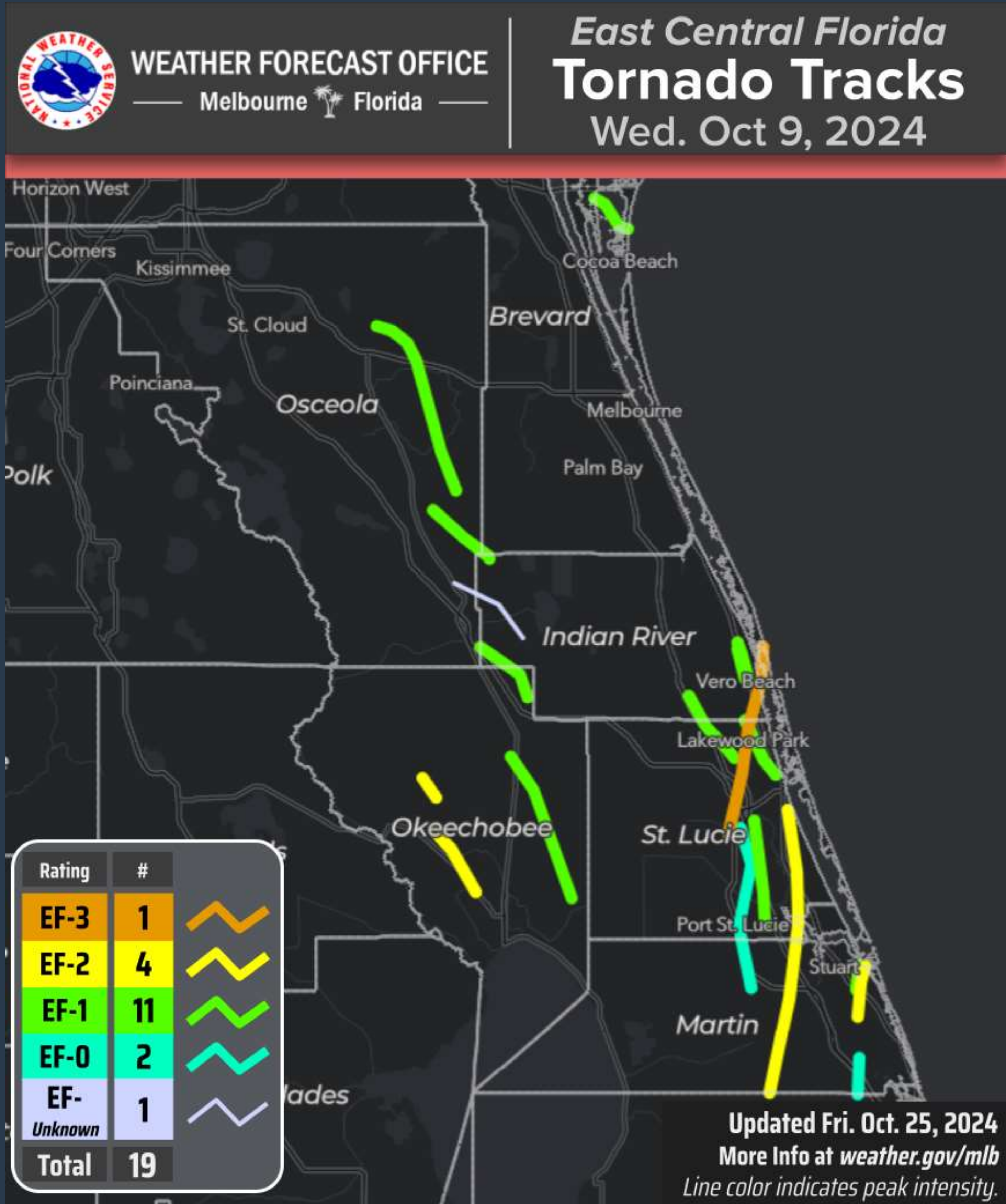
Hurricane Irma Tornado Warnings Issued By Florida Weather Forecast Offices



Hurricane Milton (2024)



19 confirmed tornadoes in ECFL with 6 fatalities in Fort Pierce from EF-3



Hurricane Milton (2024)



Debunking the Myth

Hurricanes vs Tornadoes

Wait, they aren't the same?



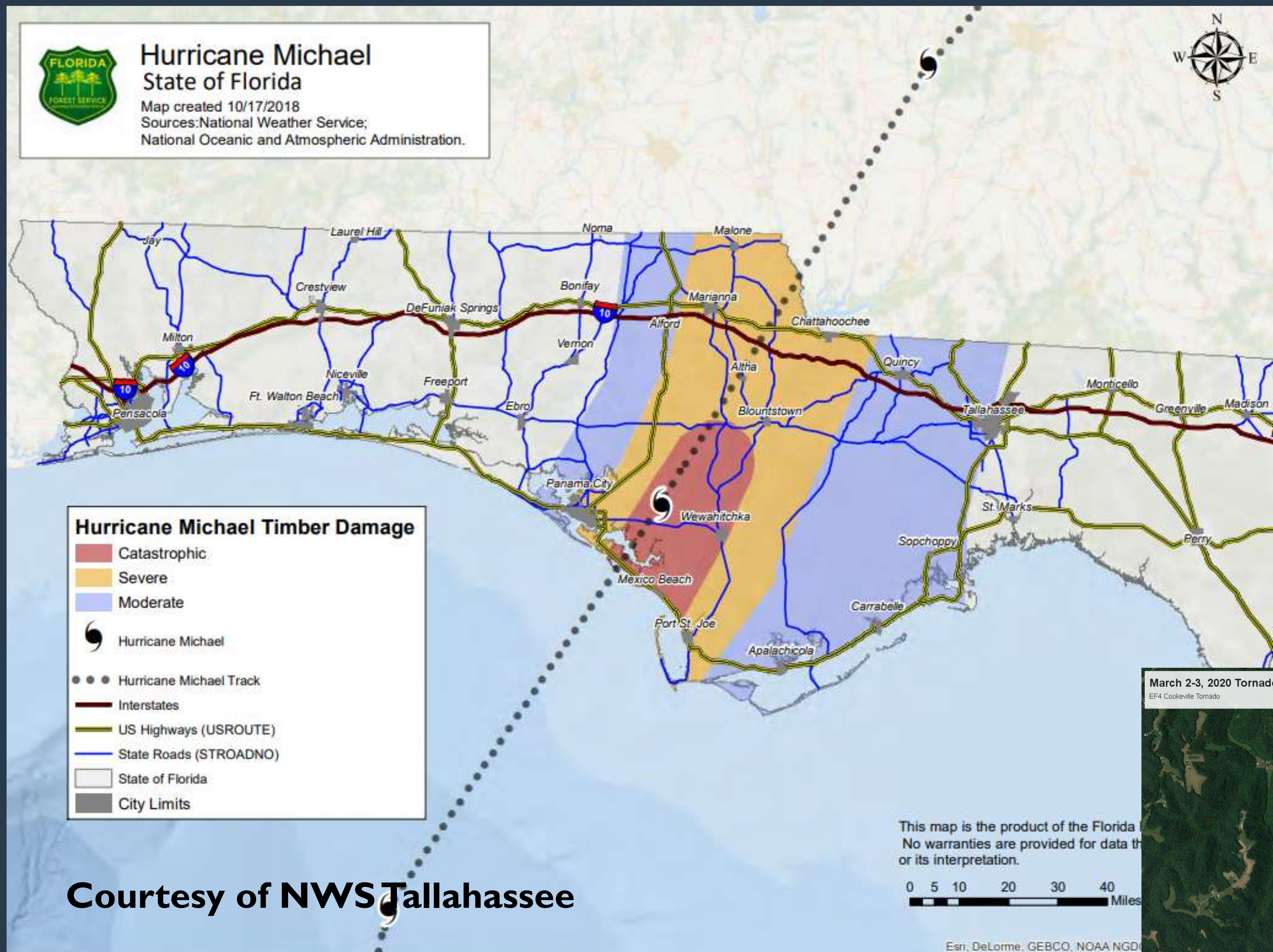
Debunking the Myth

Hurricanes vs Tornadoes

Wait, they aren't the same?

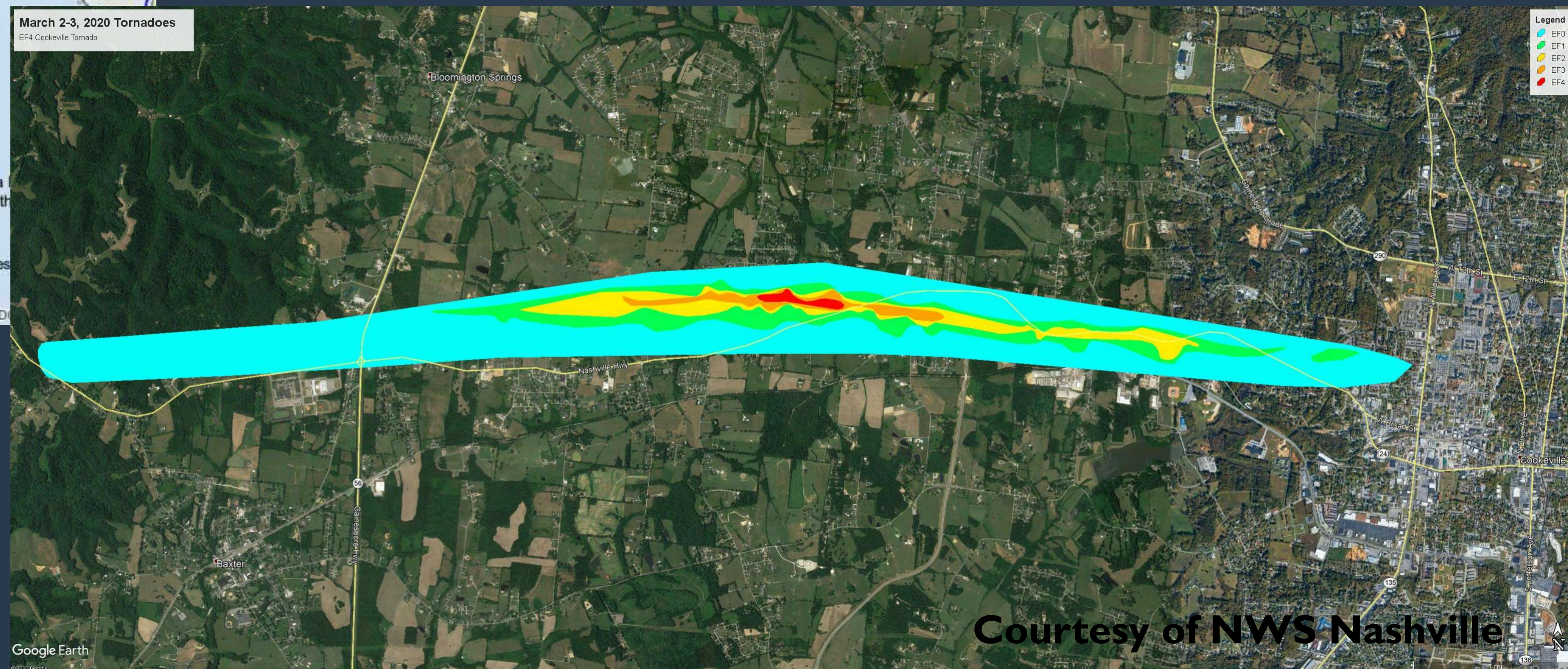


Debunking the Myth



Hurricane Michael
Max Winds 161 mph
Duration (in FL): 5.5 hours

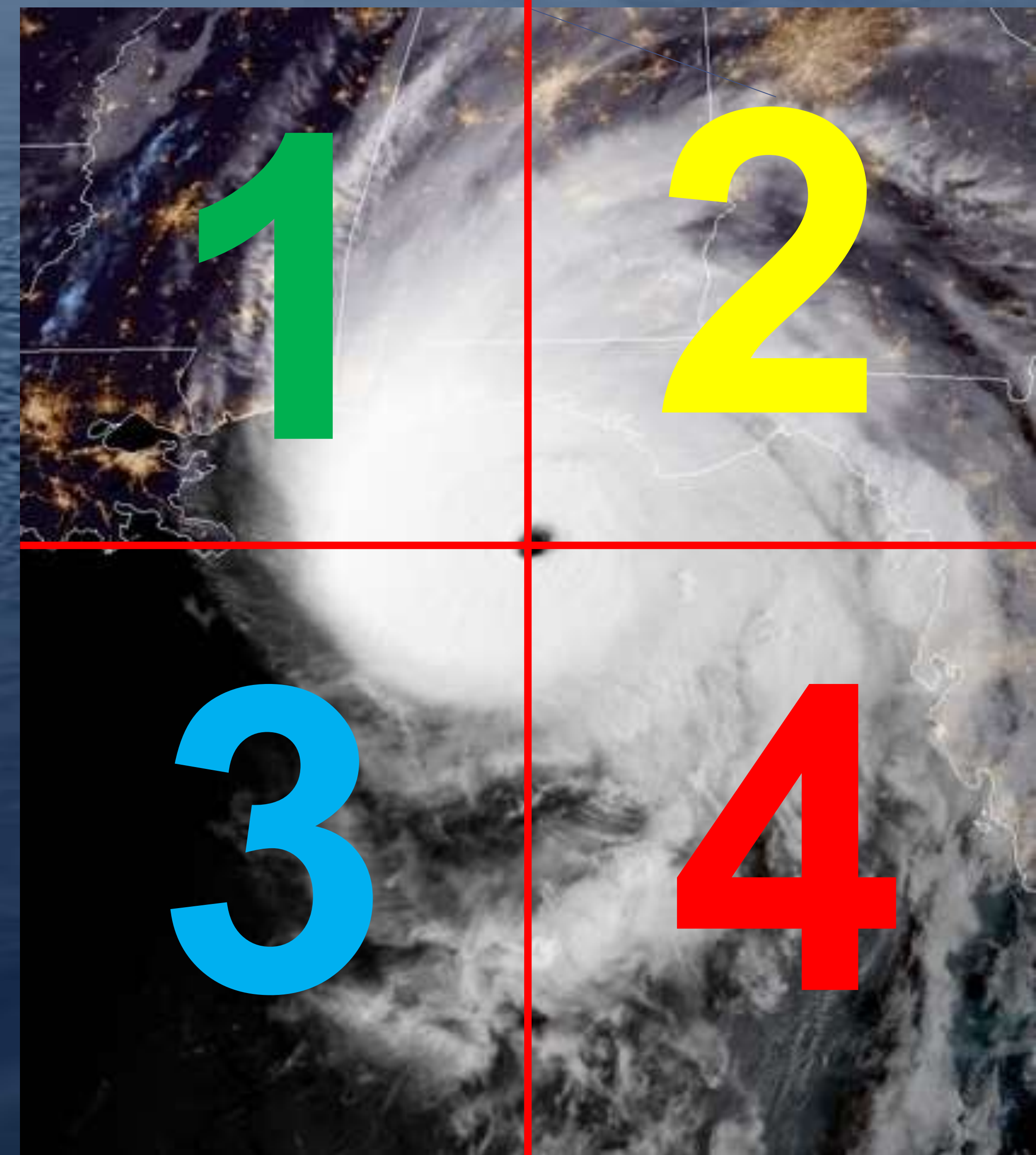
Cookeville Tornado
Max Winds 175 mph
Duration: 8 mins





Pop Quiz!

Where is the most favorable area for tornado formation in a hurricane?





Pop Quiz!

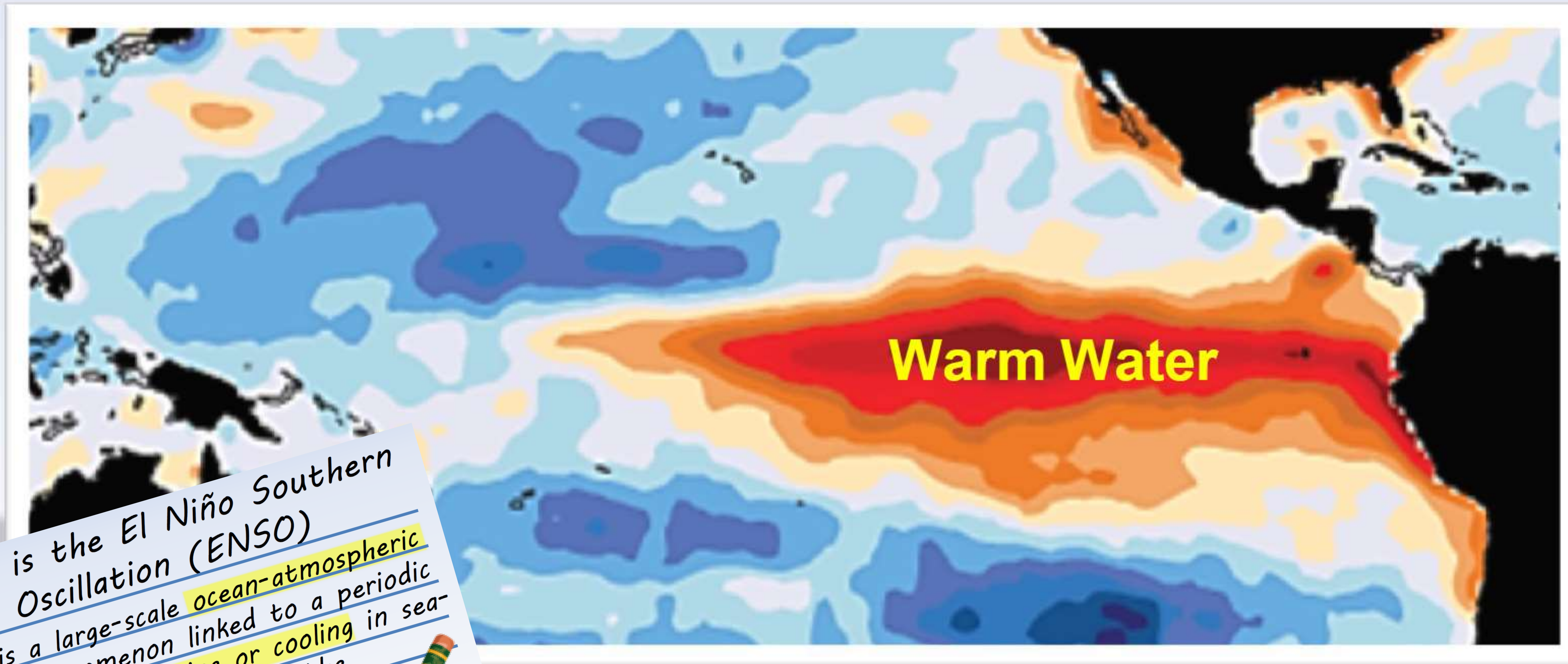
TRUE or FALSE

**A Tropical Depression would
NOT cause flooding rain.**



Seasonal Forecasting & Data Collection

What is El Niño?

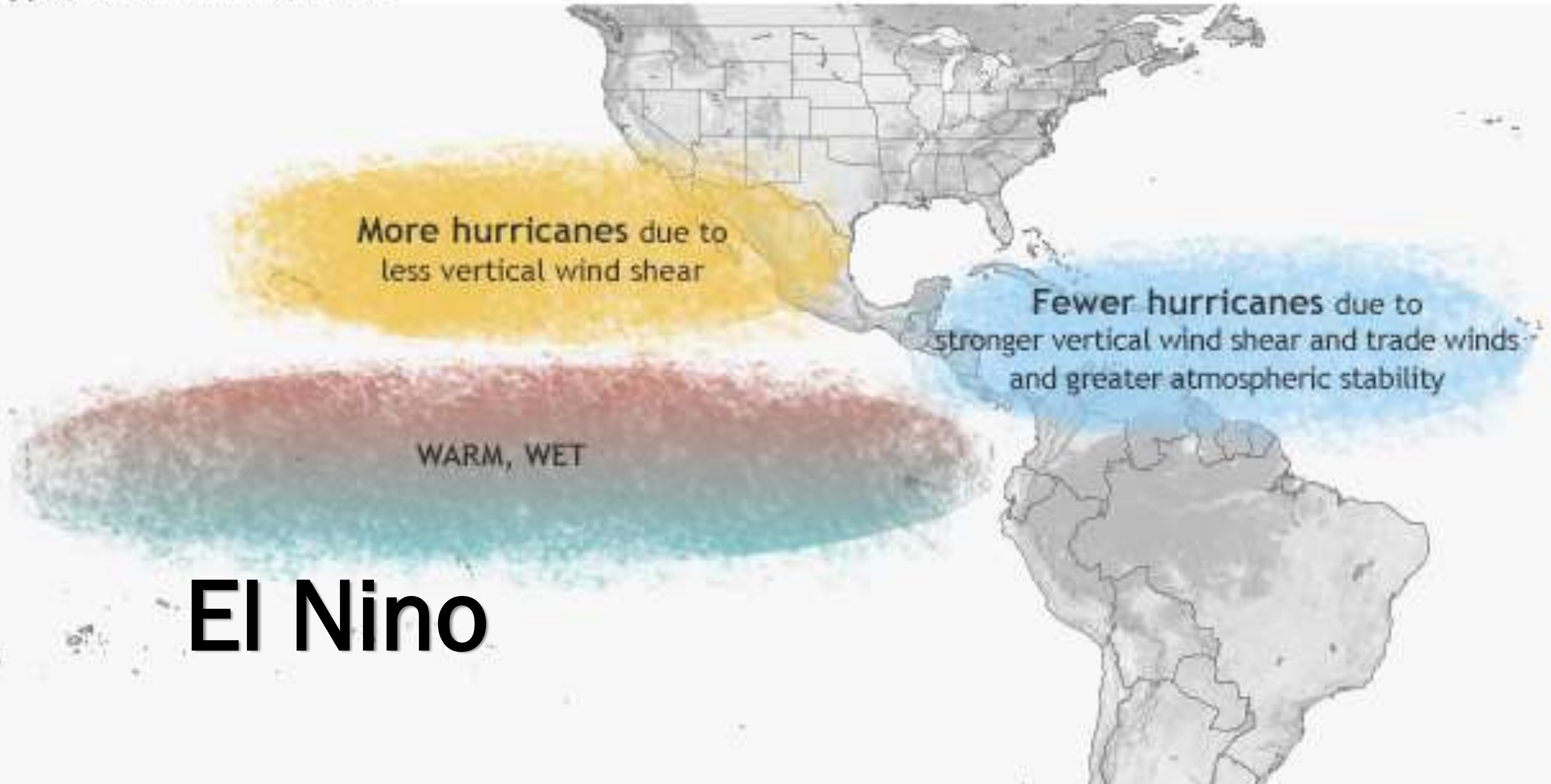


What is the El Niño Southern Oscillation (ENSO)
ENSO is a large-scale ocean-atmospheric
(2 - 7 years) warming or cooling in sea-
surface temperatures across the
equatorial Pacific.

Only ONE of the large-scale
oscillations, but very influential

Influence on Tropical Activity

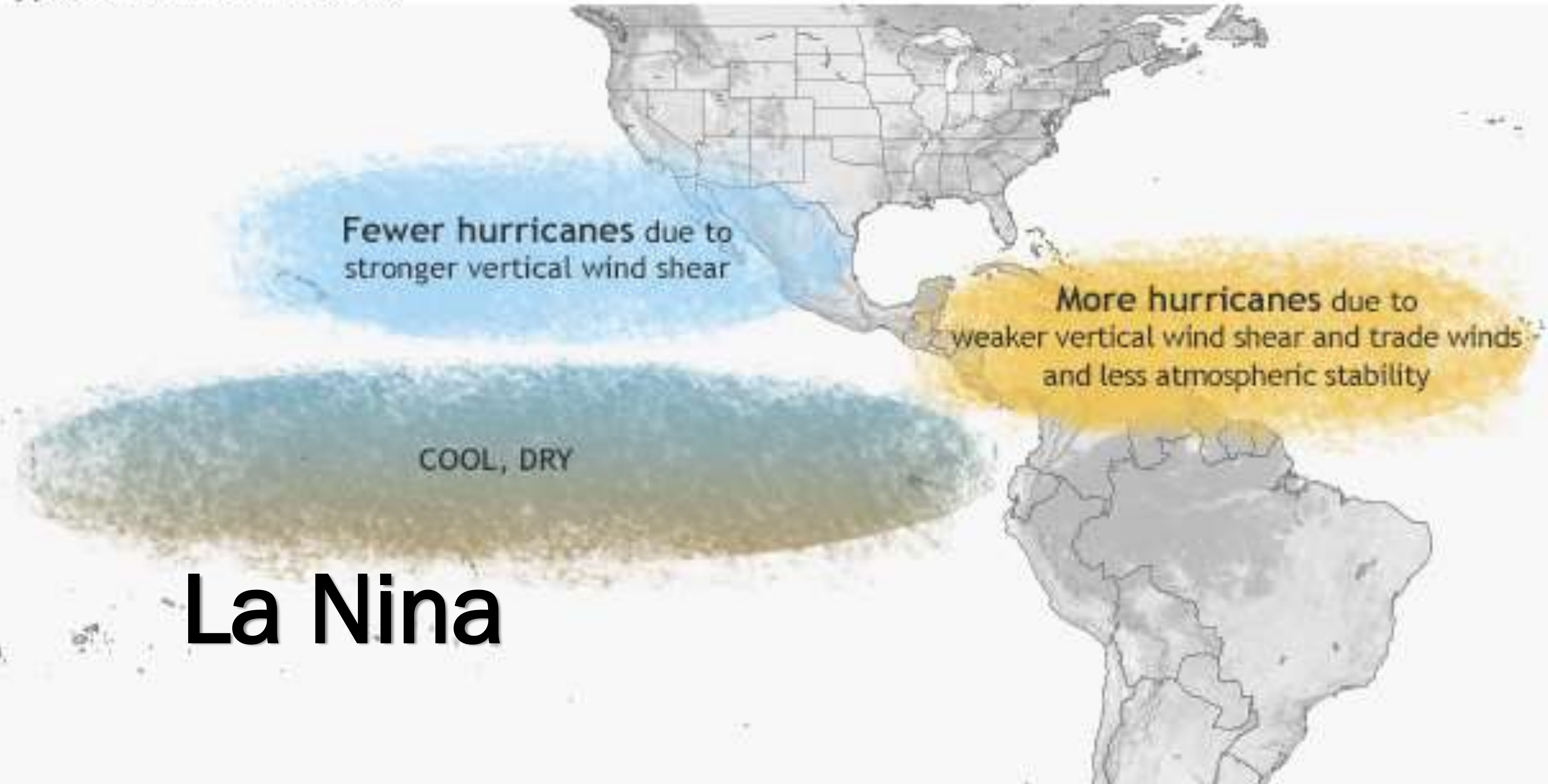
Typical El Niño influence



El Niño

Influence on Tropical Activity

Typical La Niña influence



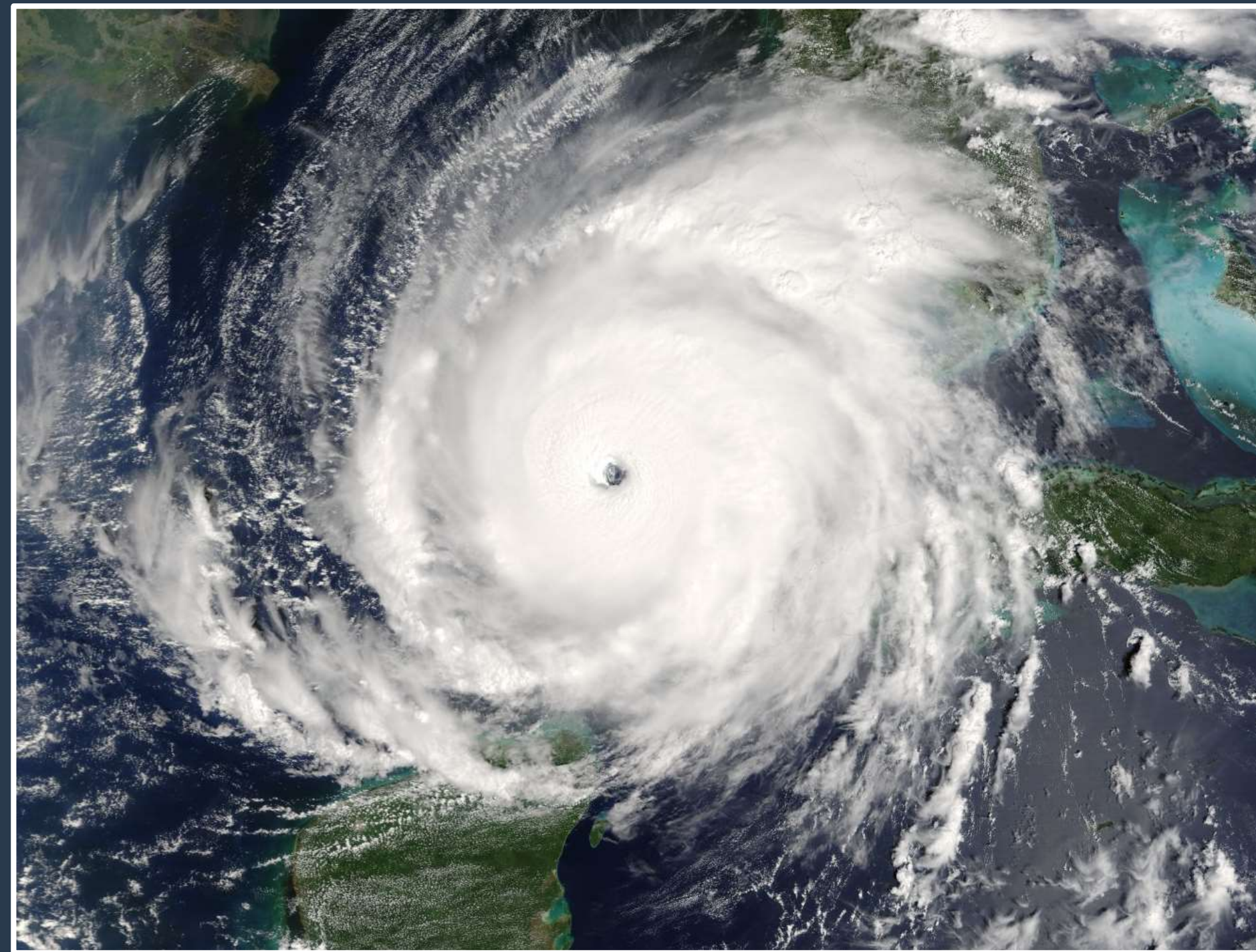
Fewer hurricanes due to stronger vertical wind shear

More hurricanes due to weaker vertical wind shear and trade winds and less atmospheric stability

COOL, DRY

La Nina

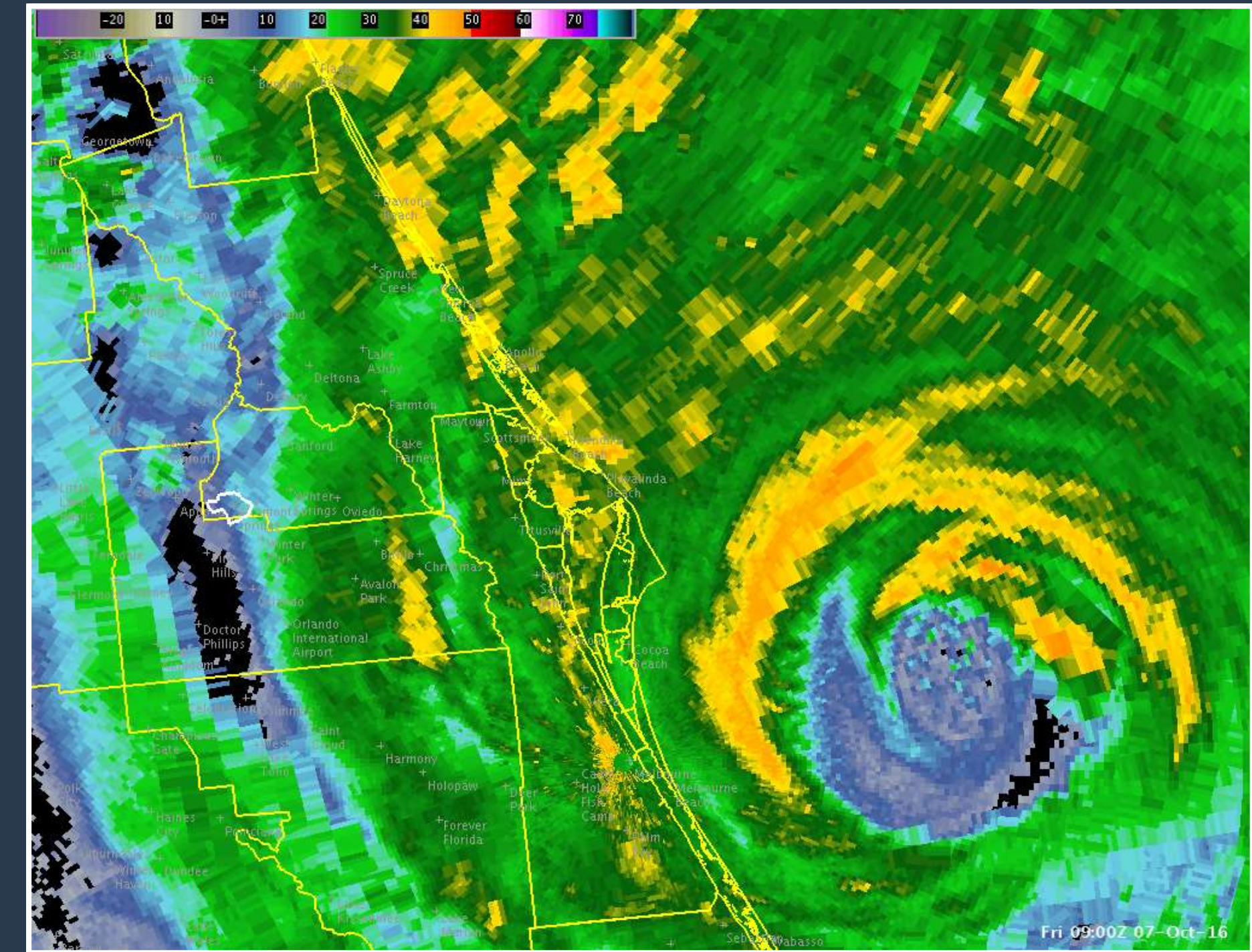
Monitoring Tropical Cyclones



GOES Satellites (Space)



Hurricane Hunters (Air)

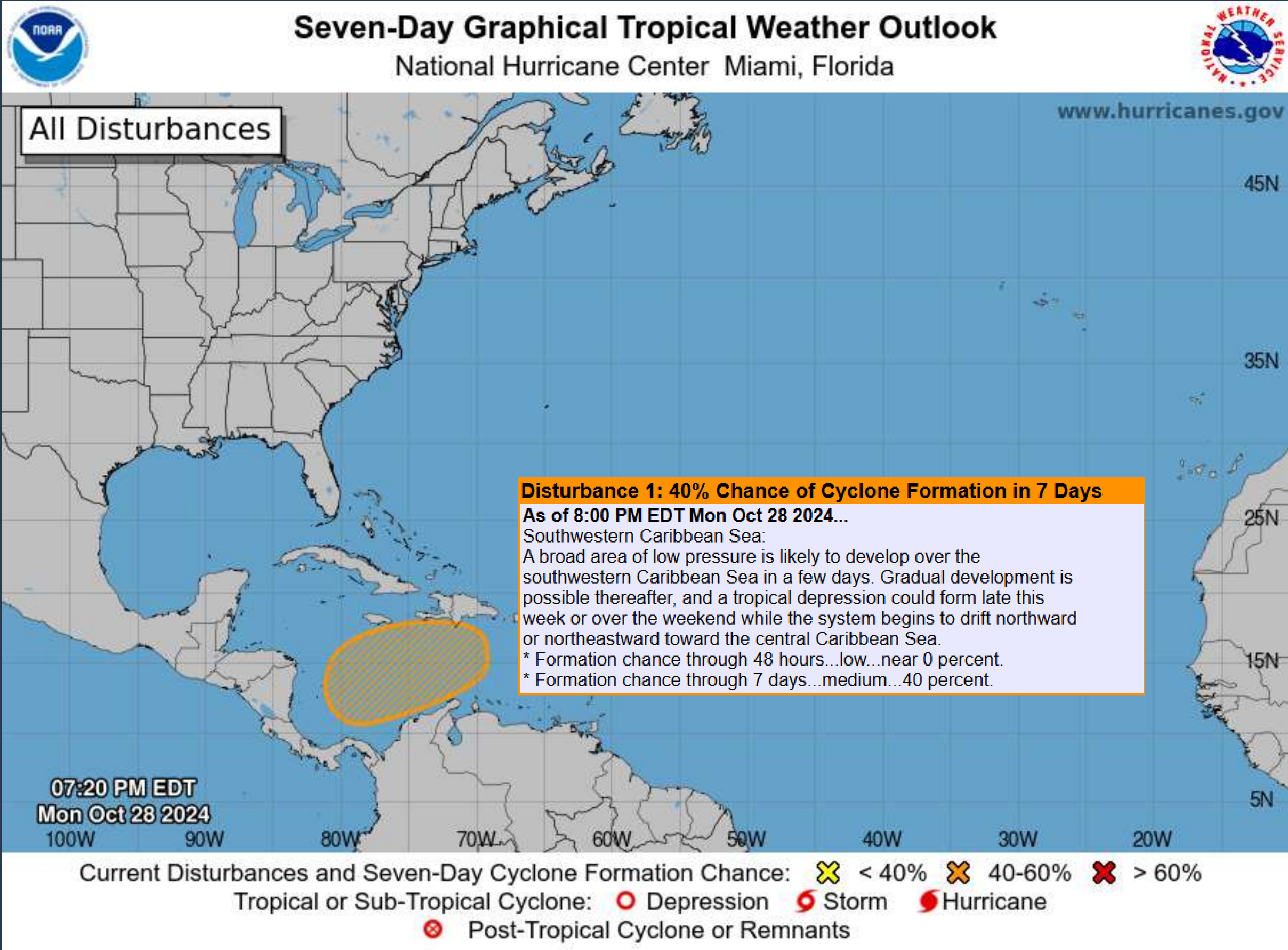


Doppler Radar (Ground)



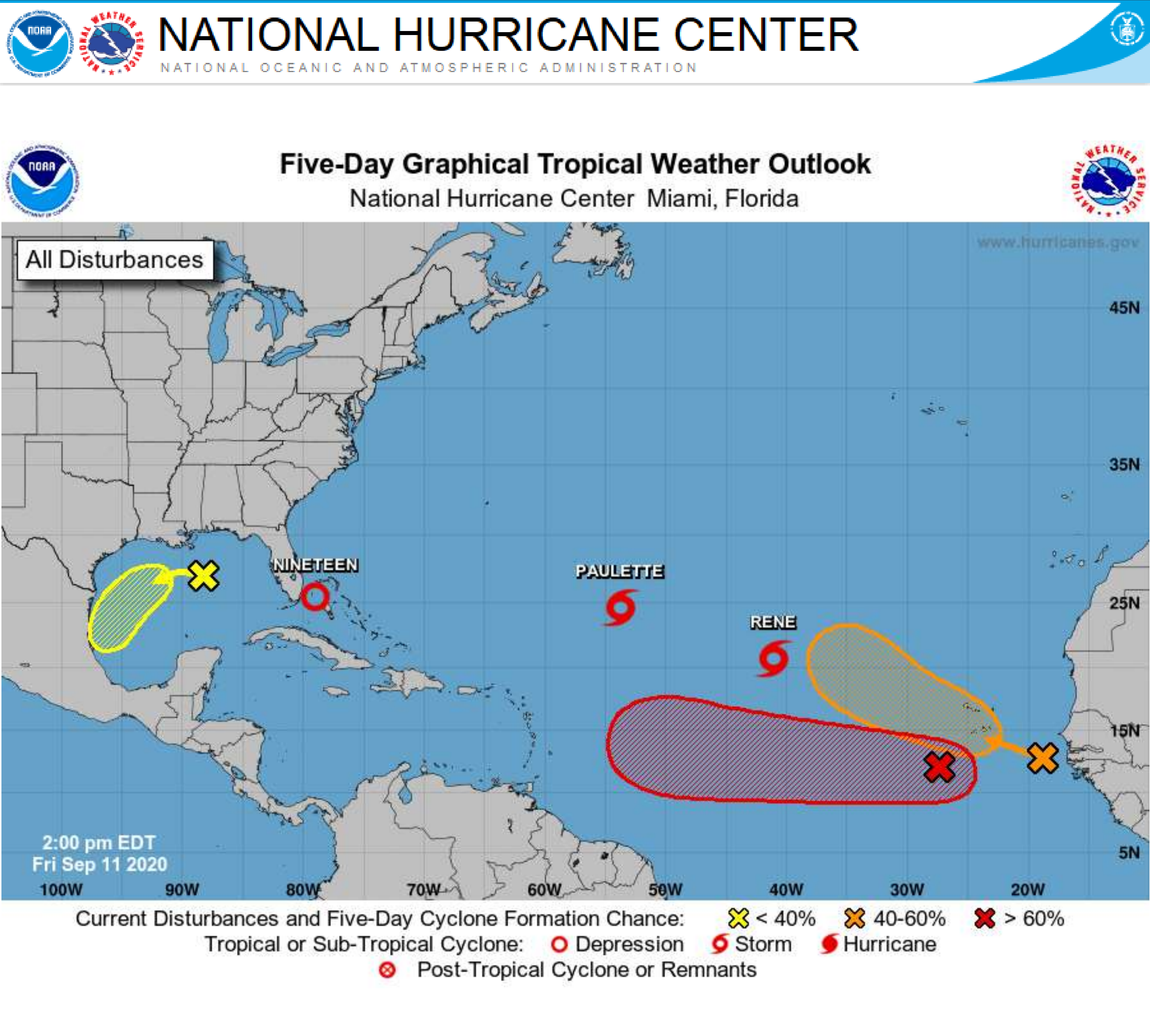
**National Hurricane Center
Products & Verification**

Tropical Weather Outlook (2 Day & 7 Day)

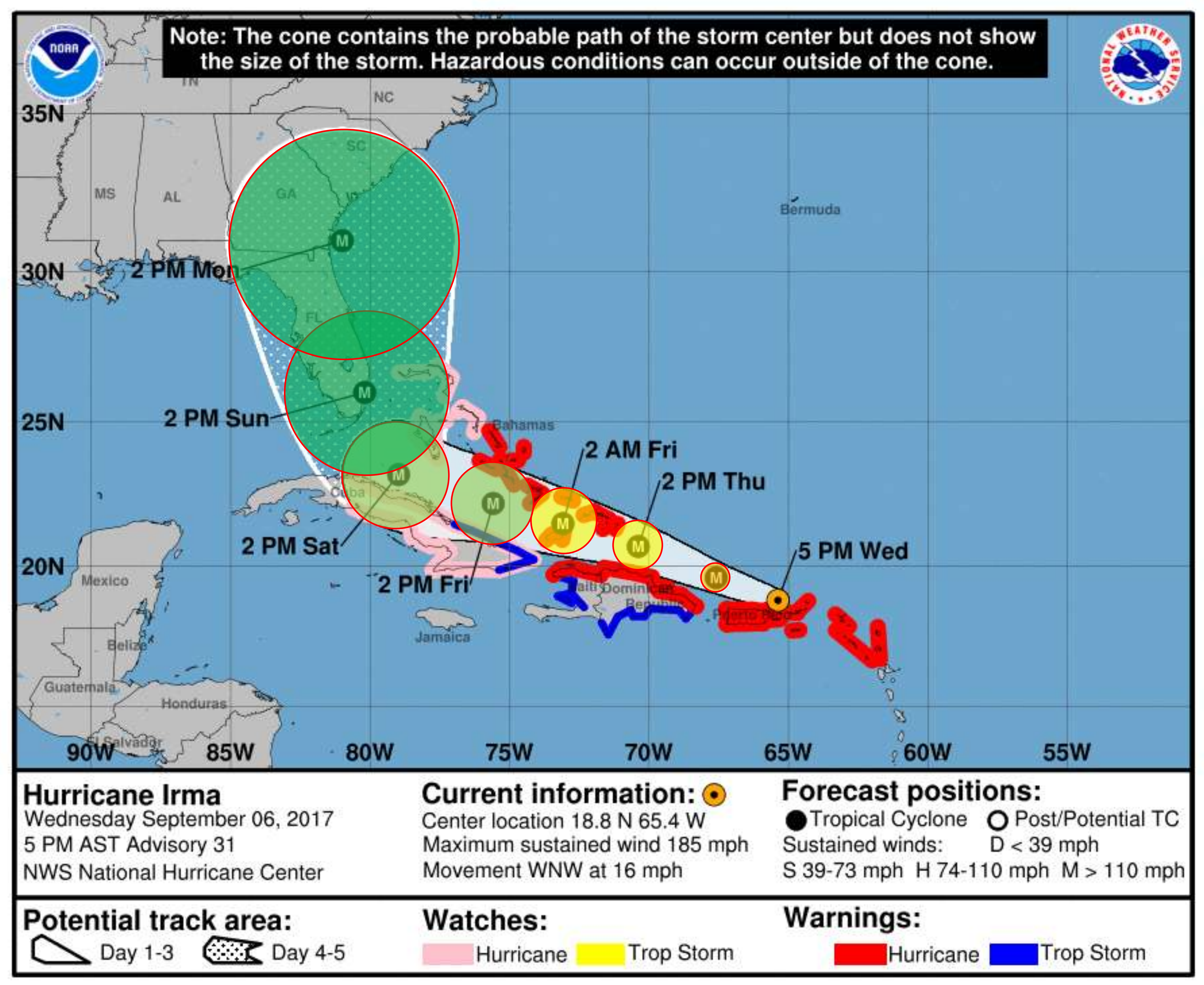


<https://www.hurricanes.gov>

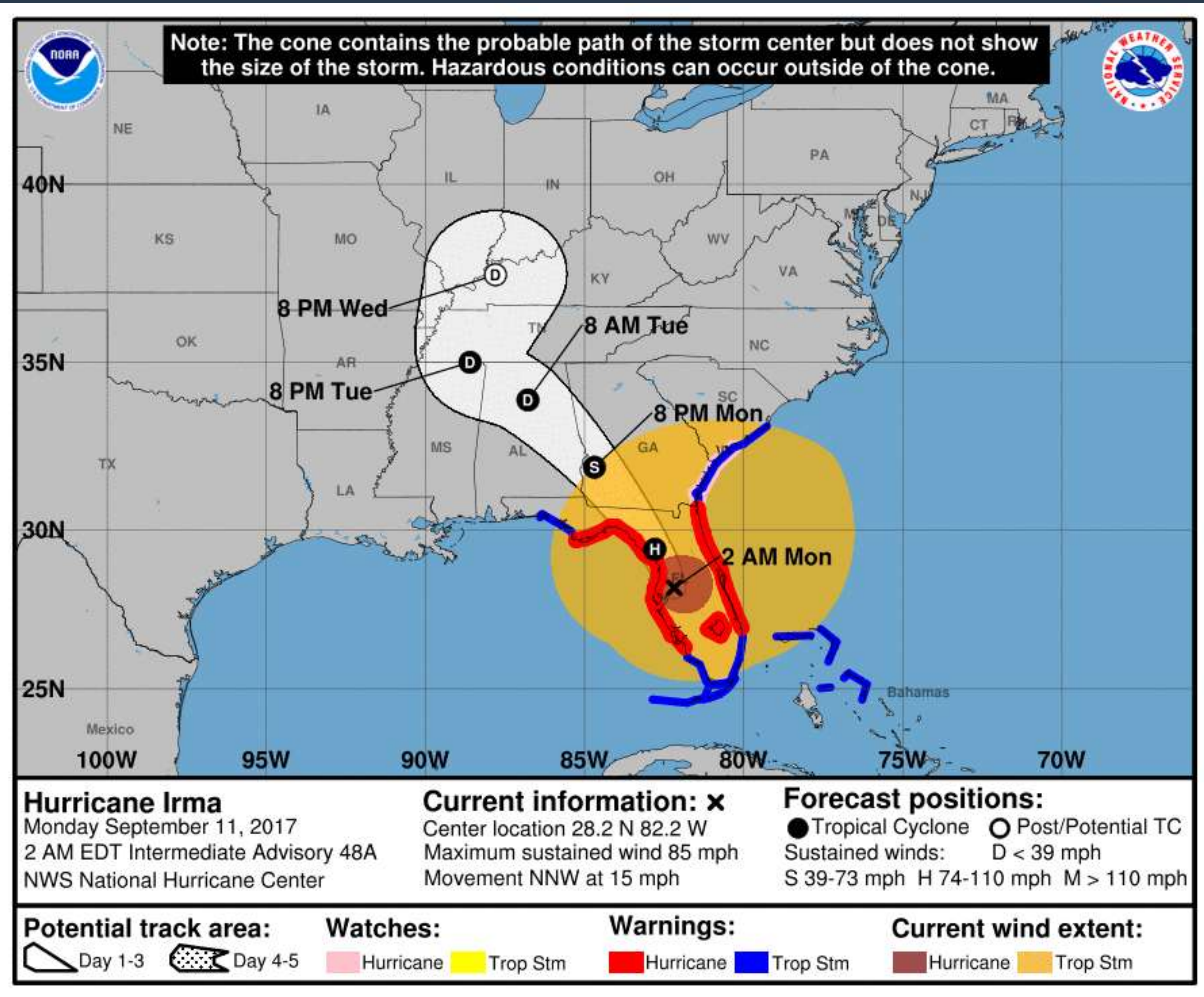
National Hurricane Center Products



National Hurricane Center Products



National Hurricane Center Products



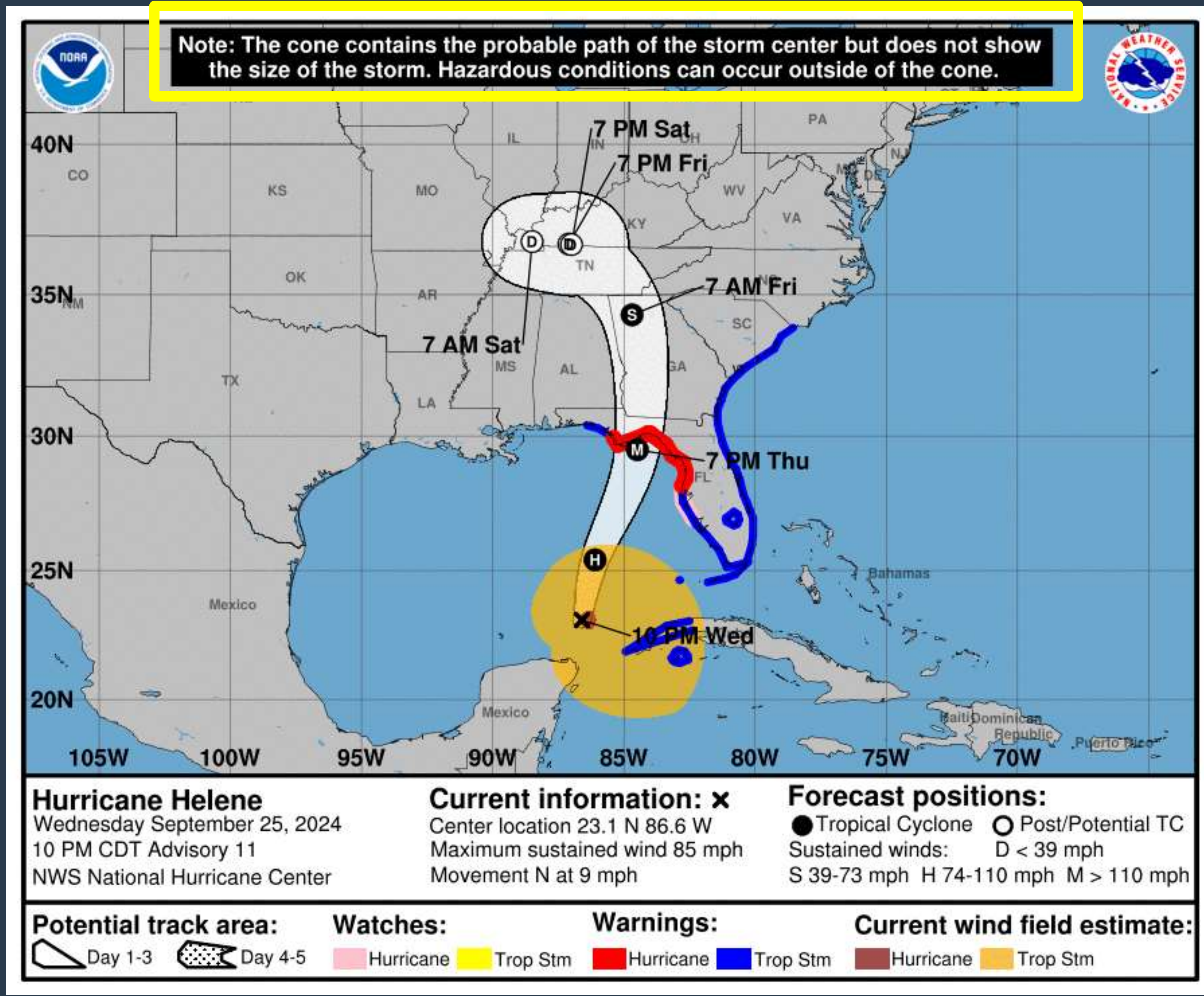
What the Cone Is and Is Not

The Cone Is:

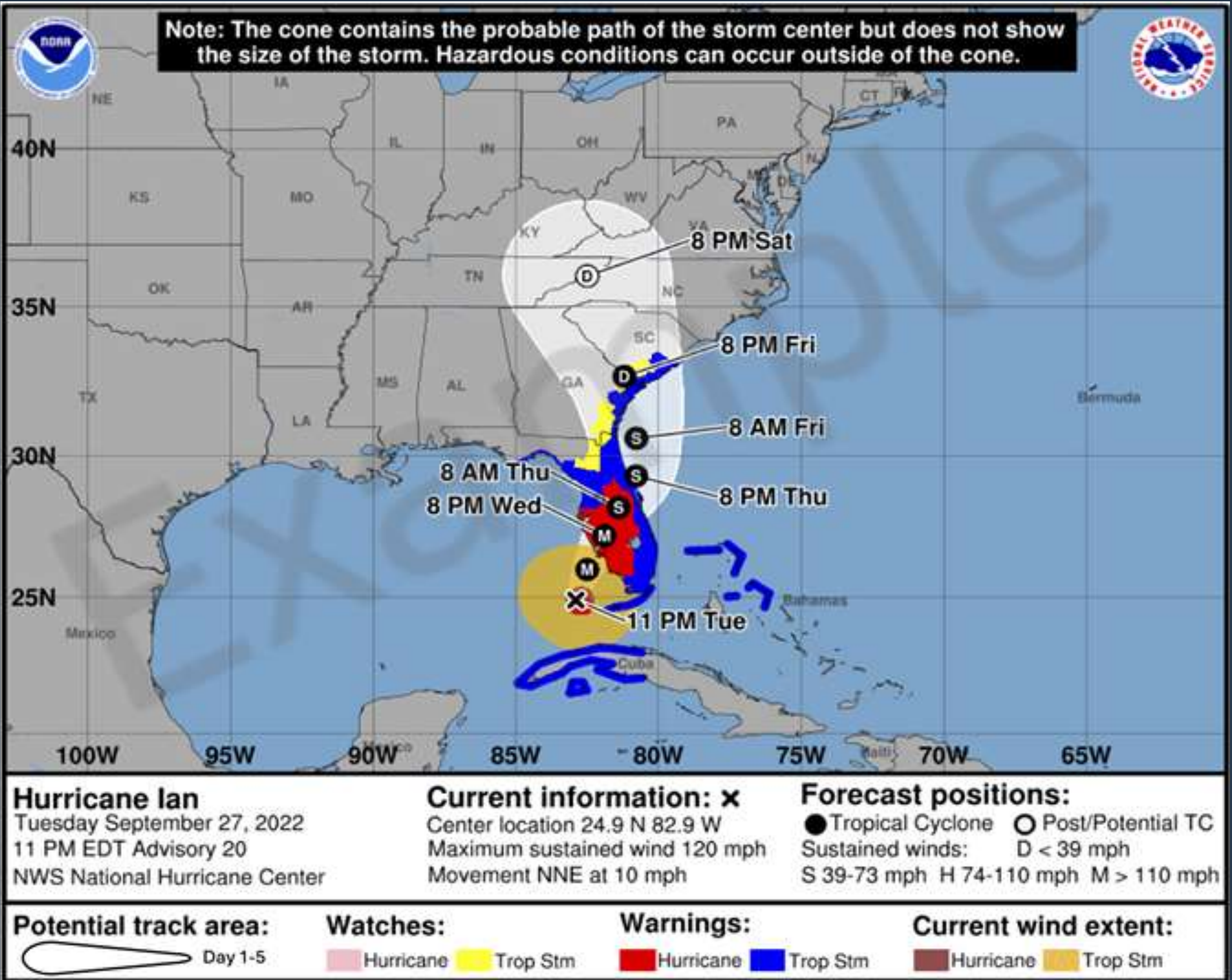
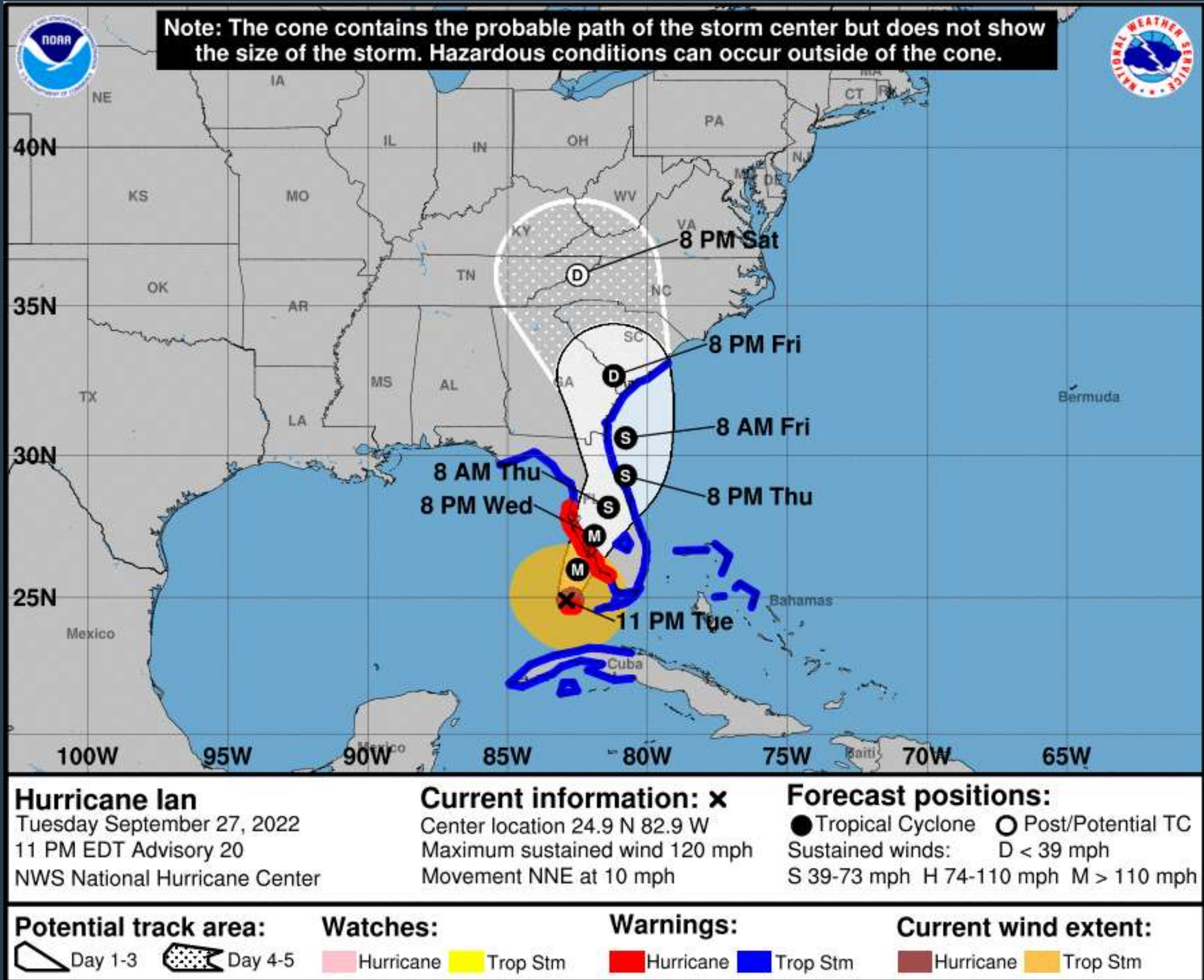
The Cone Is Not:

A forecast of where the center of the storm will track 66% of the time

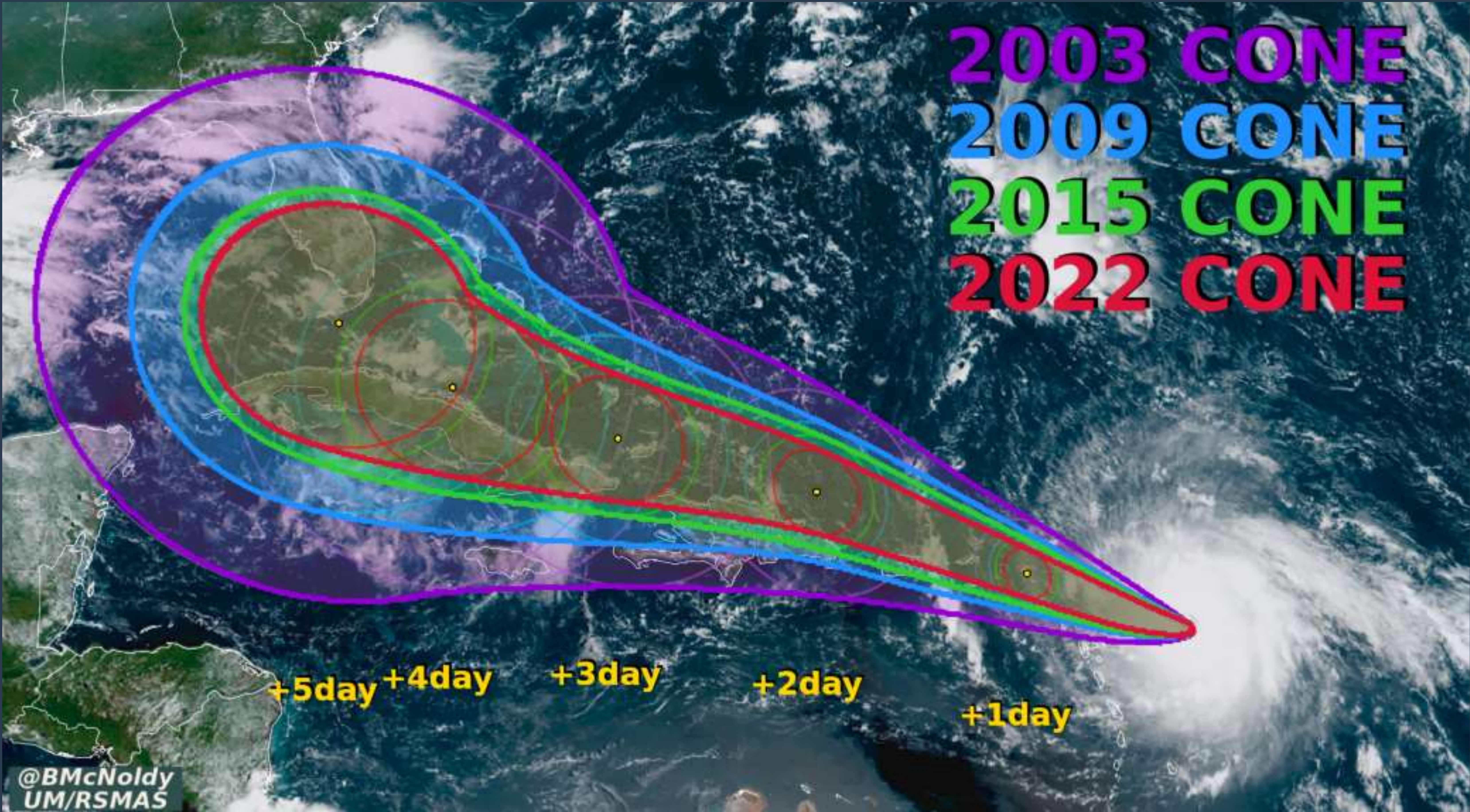
A depiction of who will and will not receive impacts



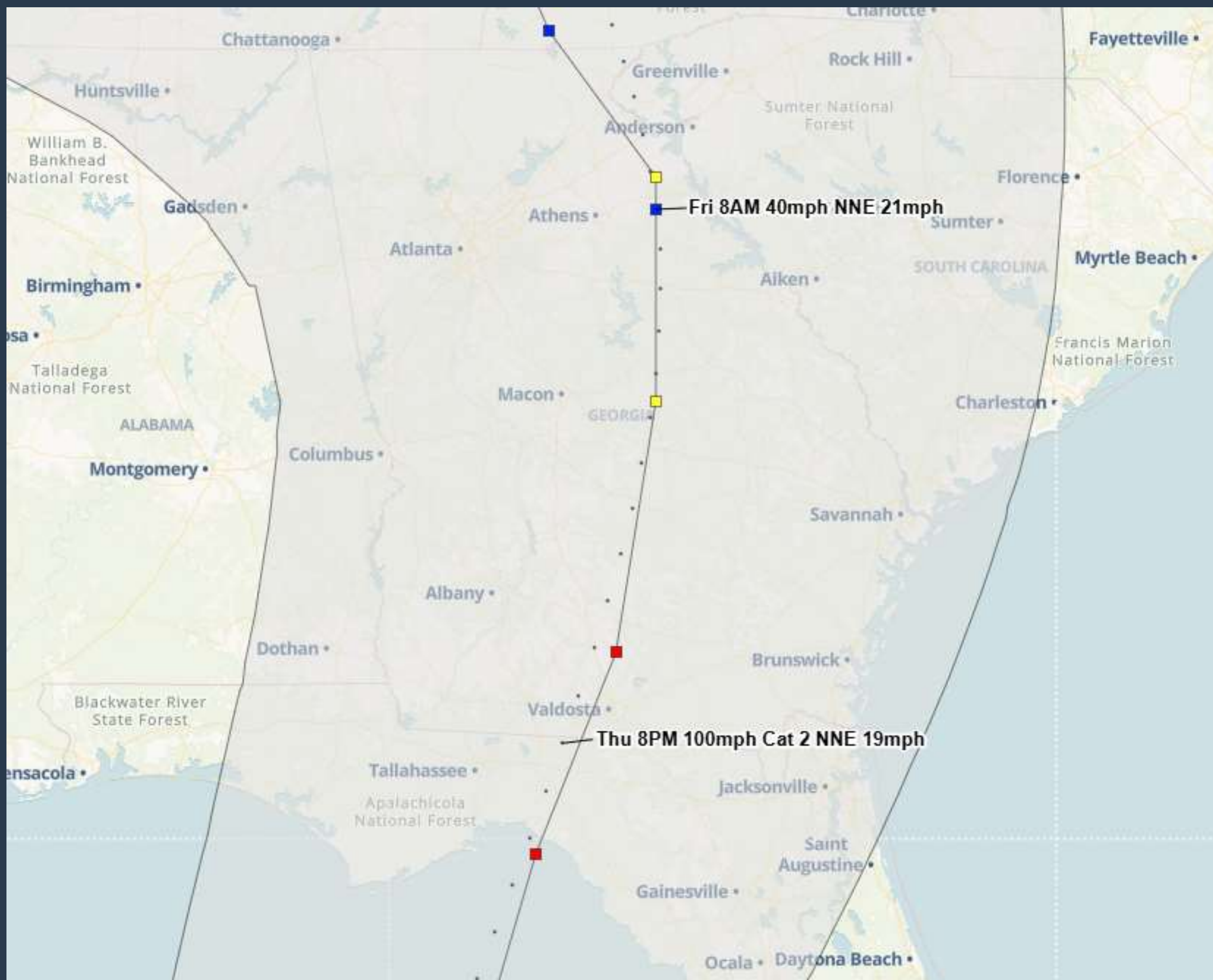
New for 2024!



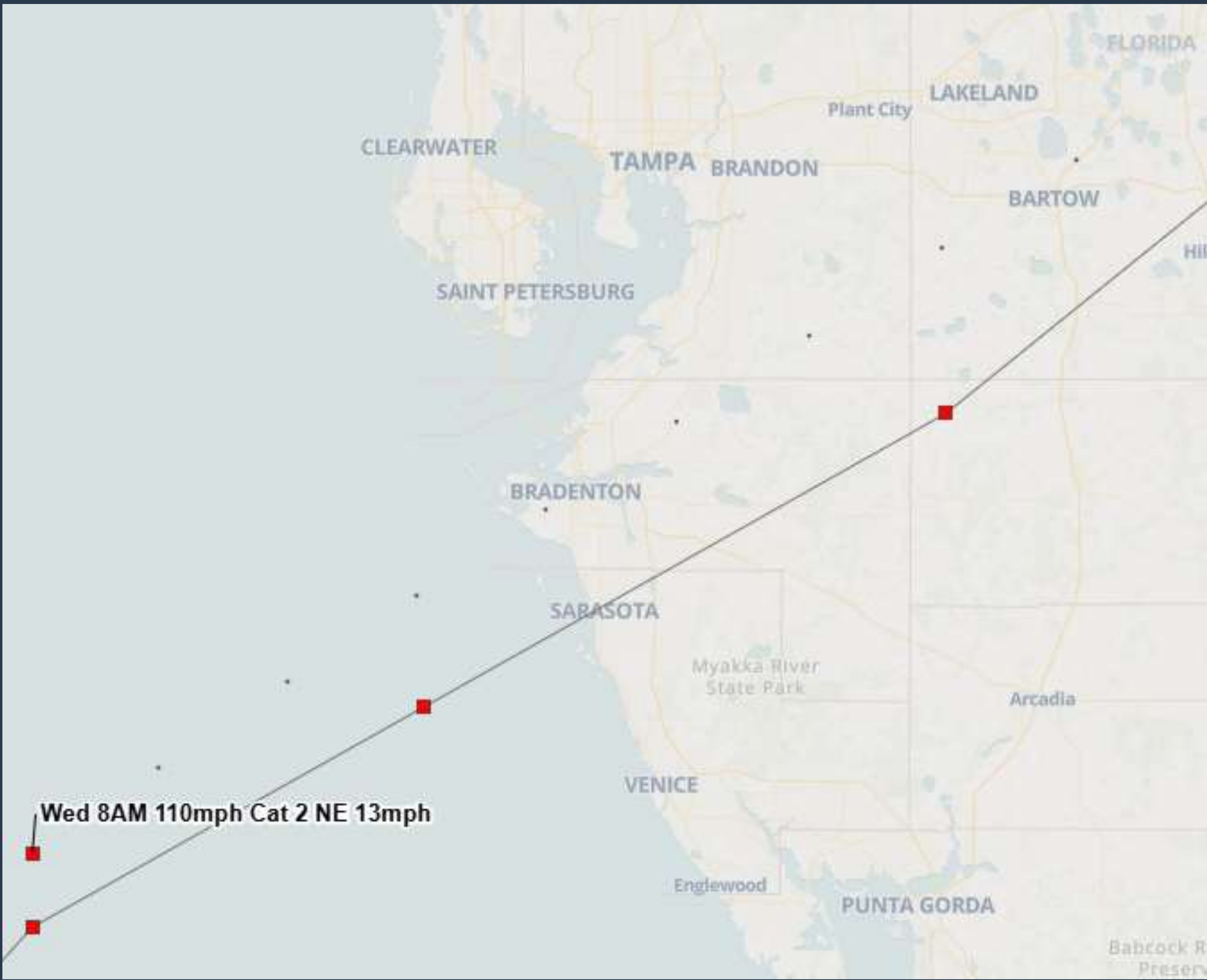
National Hurricane Center Products



Forecast Verification - Helene

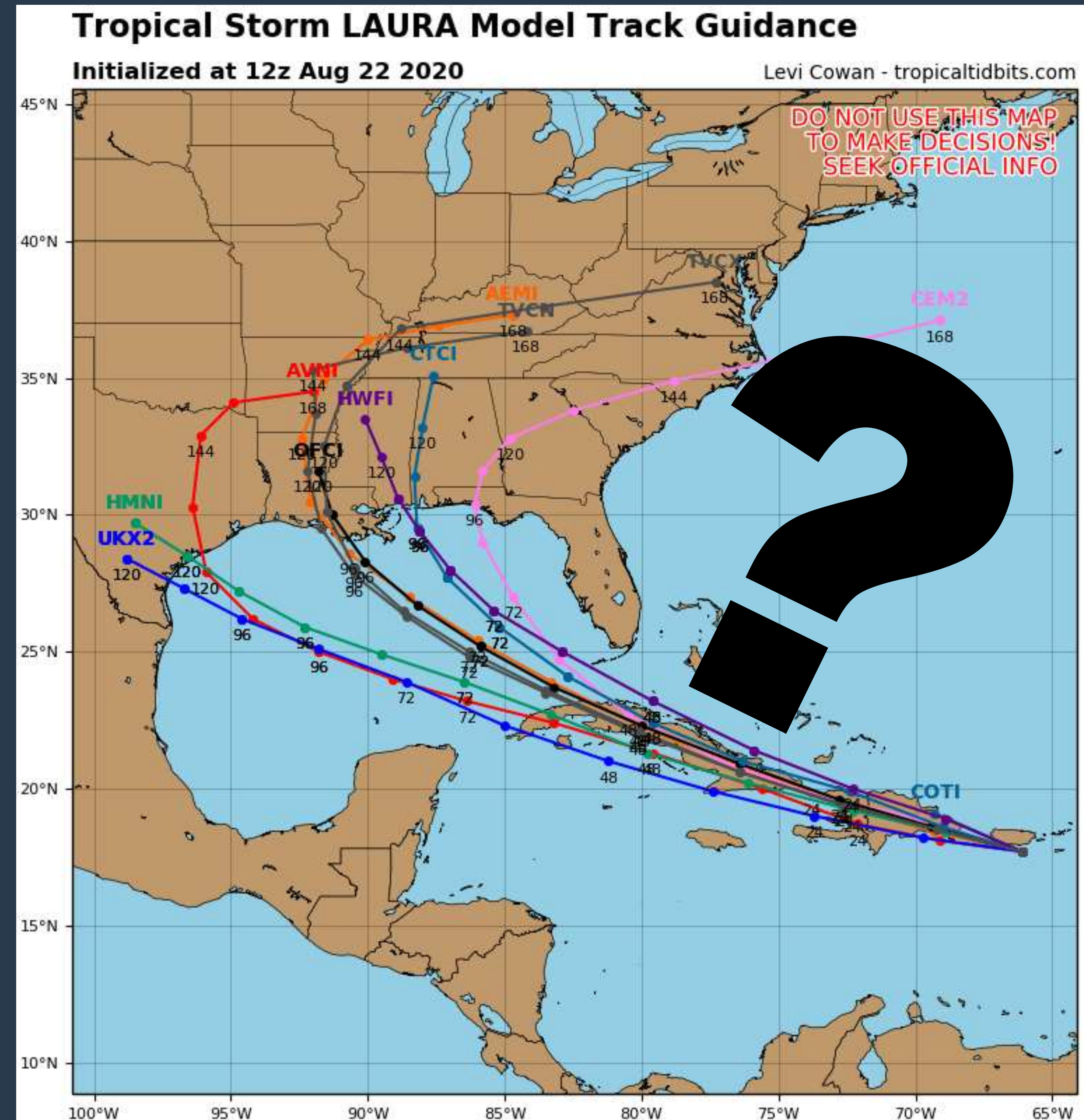


Forecast Verification - Milton



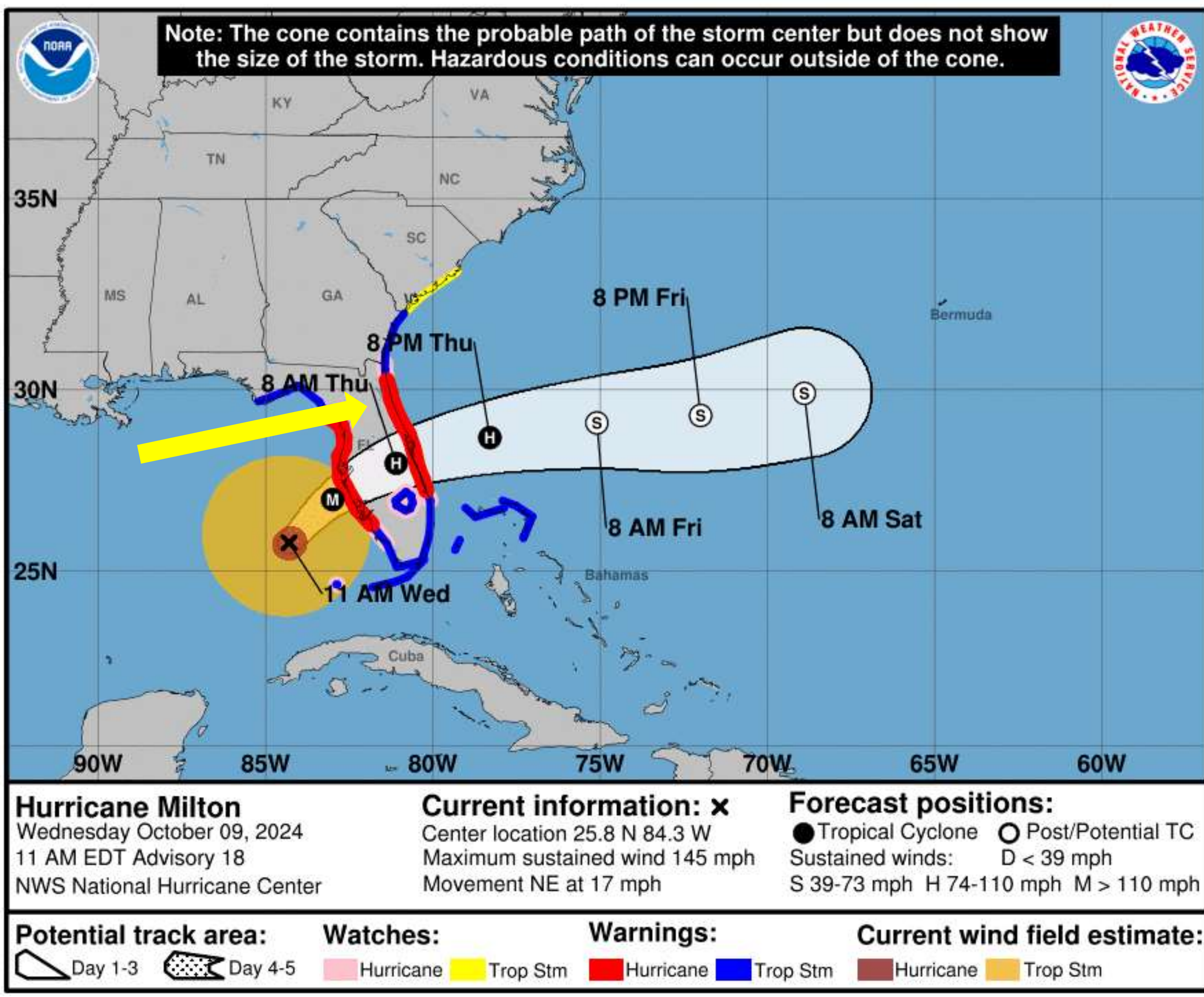
Avoid the Hype!

- Hurricane forecasting has vastly improved, however there is still much to be learned. Uncertainty can be **HIGH!**
- Tropical cyclones are not single points & produce significant impacts regardless of size or strength (impacts outside the cone will occur)
- Stay informed through reliable sources and avoid the hype!





Pop Quiz!



You live at the tip of the yellow arrow. Your neighbor says “We have nothing to worry about, we aren’t in the cone”. Is he correct?



Pop Quiz!

Hurricane Harry is about to make landfall. Where would you go to receive updates on the storm?
(check all that apply)



NEXT CLASS

**TUESDAY, OCTOBER 29
10 AM CDT / 11 AM EDT
NWS STORM SURVEYS**



QUESTIONS?

JESSIE SCHAPER | METEOROLOGIST
National Weather Service – Melbourne, FL
jessica.schaper@noaa.gov