

Hurricane Ian: Decision Support and Shared Experiences

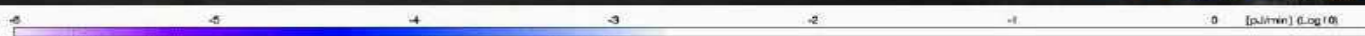


Matt Anderson

Science and Operations Officer









U.S. National Weather Service

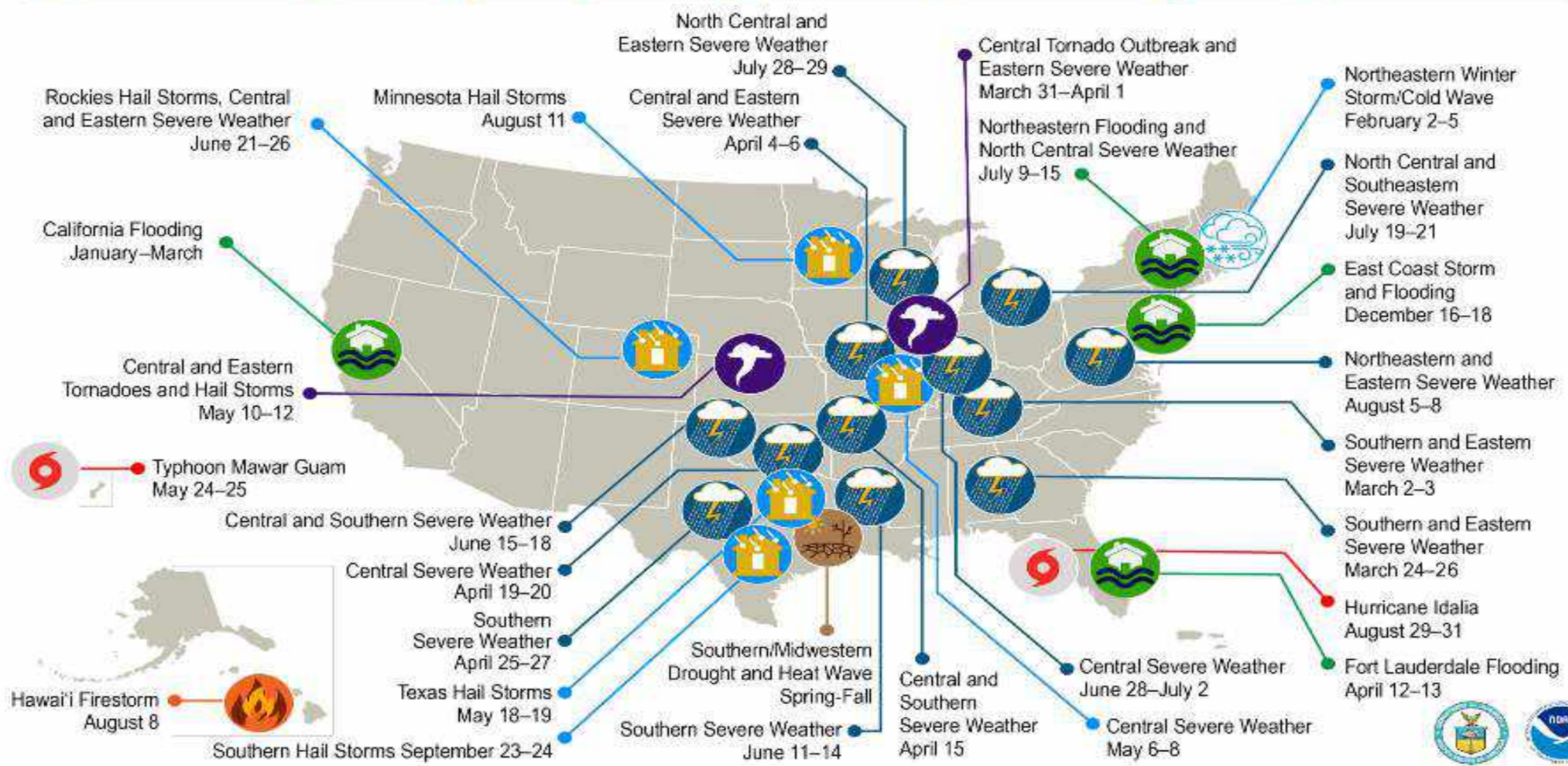
Tampa Bay Area/Ruskin, Florida



2023 Billion-Dollar Weather Disasters: 28 Disasters

U.S. 2023 Billion-Dollar Weather and Climate Disasters

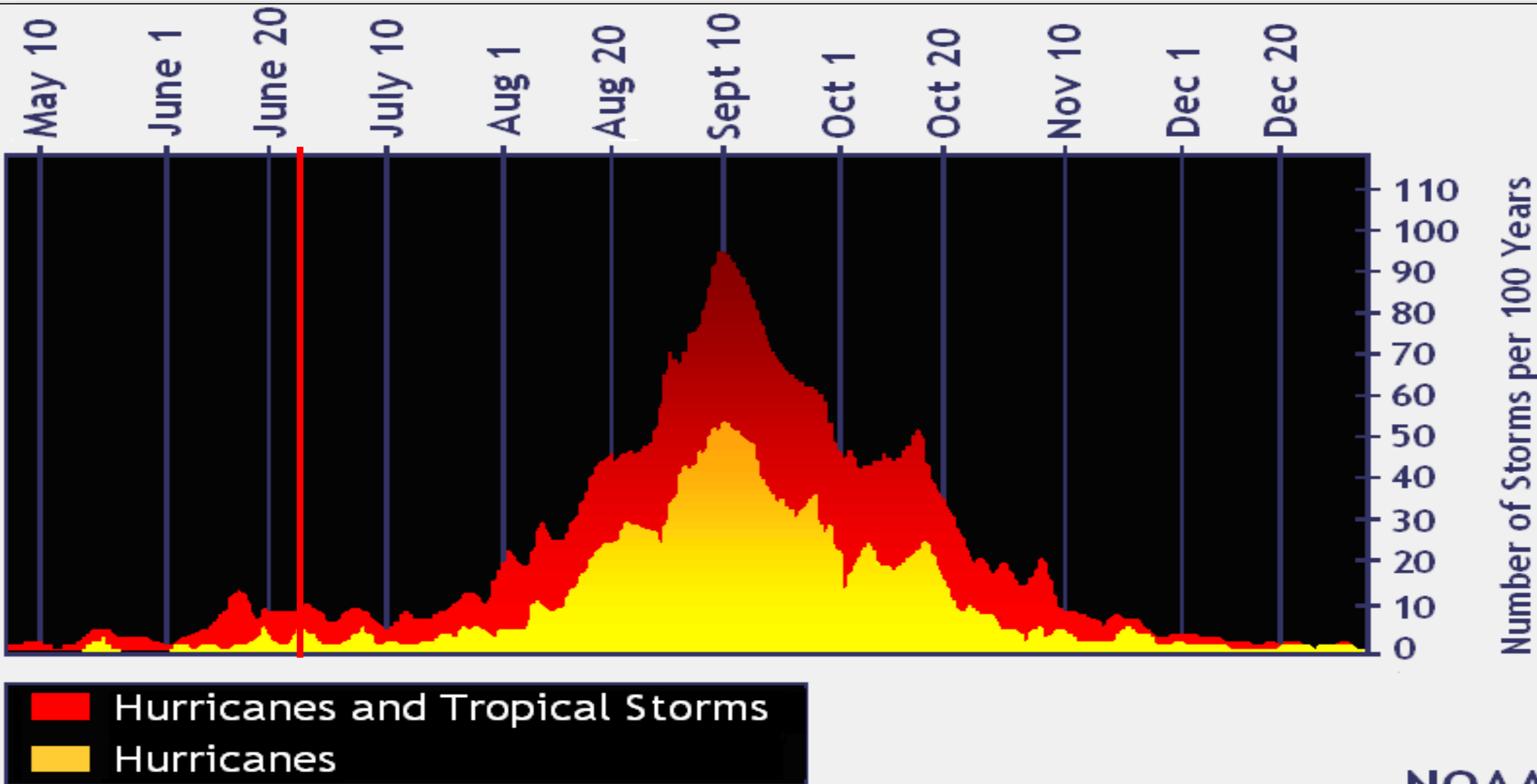
-  Drought/Heat Wave
-  Flooding
-  Hail
-  Hurricane
-  Severe Weather
-  Tornado Outbreak
-  Wildfire
-  Winter Storm/Cold Wave



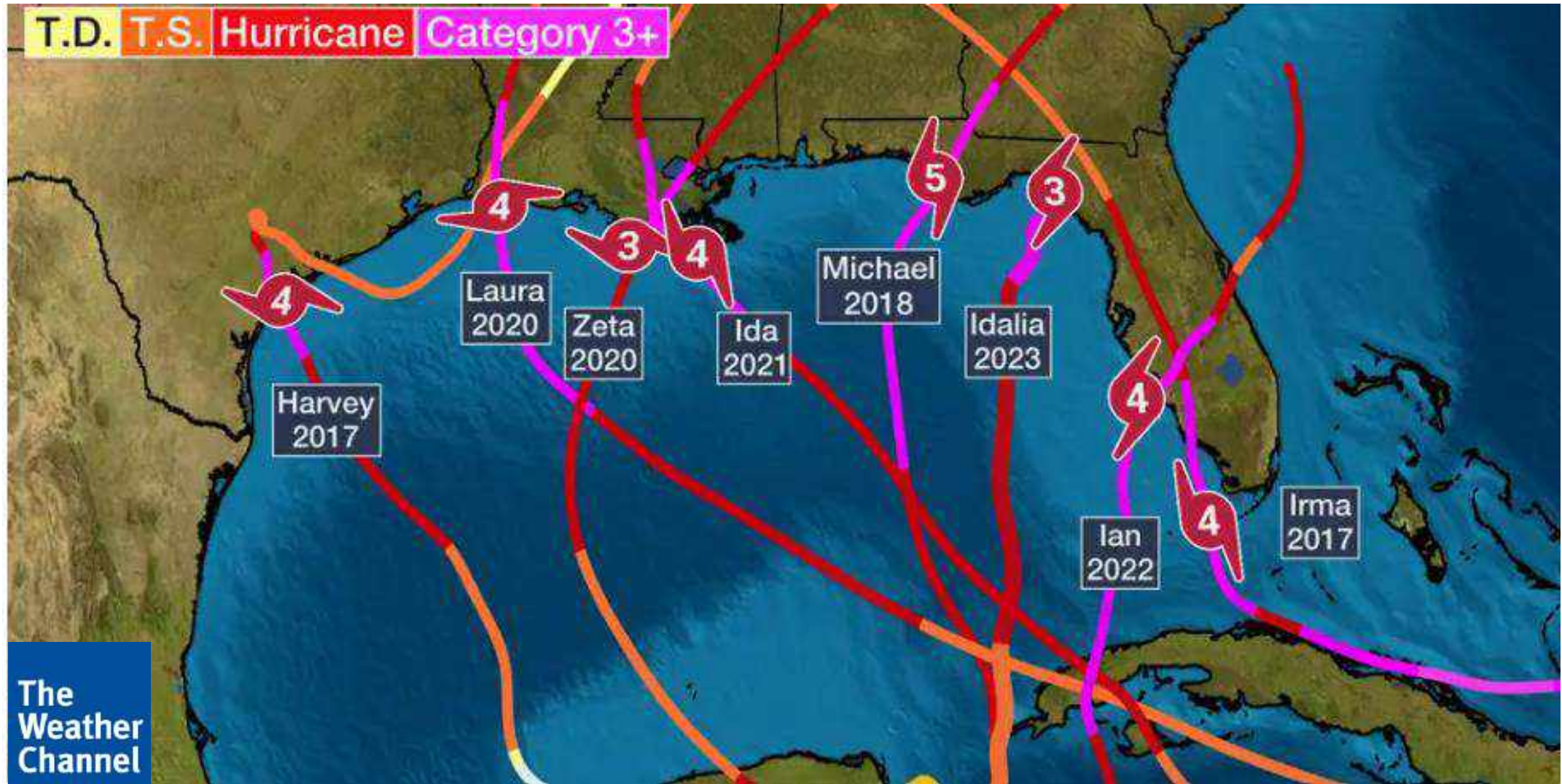
This map denotes the approximate location for each of the 28 separate billion-dollar weather and climate disasters that impacted the United States in 2023.



Hurricanes in the Atlantic Basin



Gulf of Mexico: Major (Cat. 3-5) Hurricanes 2017-2023



2023 Hurricane Season: **It only takes one!**



20 Named Storms (14) ^{4th} active

7 Hurricanes (7)

3 Major Hurricanes (3)

(Average 1991-2020 Season)

Season: Jun 1 – Nov 30

First Storm: May 30 (Arlene)

Last Storm: Oct 18 (Tammy)

Significant FL impacts from:
Hurricane **Idalia**



2024 Atlantic Tropical Cyclone Names

~~Alberto~~

Beryl

Chris

Debby

Ernesto

Francine

Gordon

Helene

Isaac

Joyce

Kirk

Leslie

Milton

Nadine

Oscar

Patty

Rafael

Sara

Tony

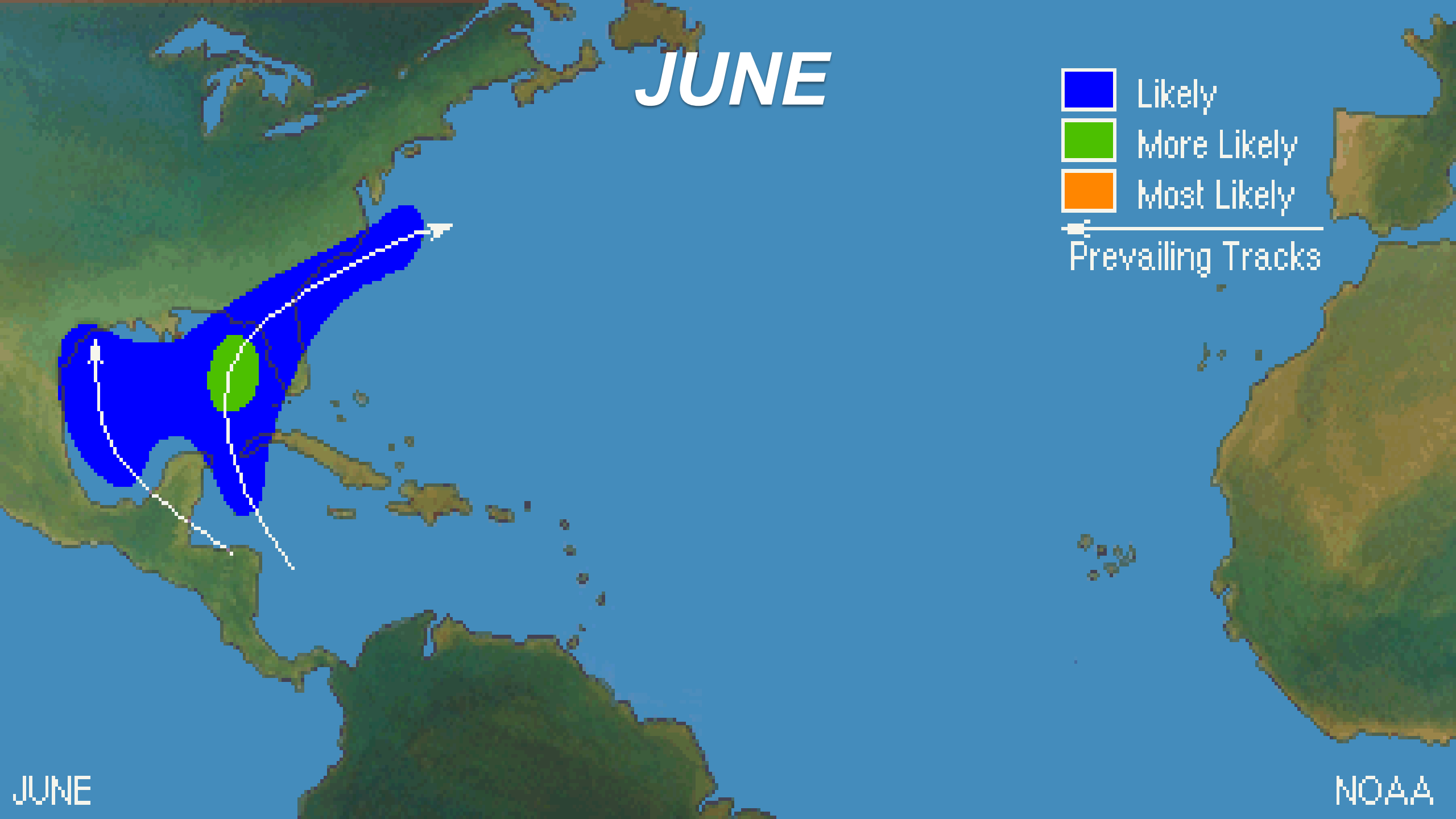
Valerie

William

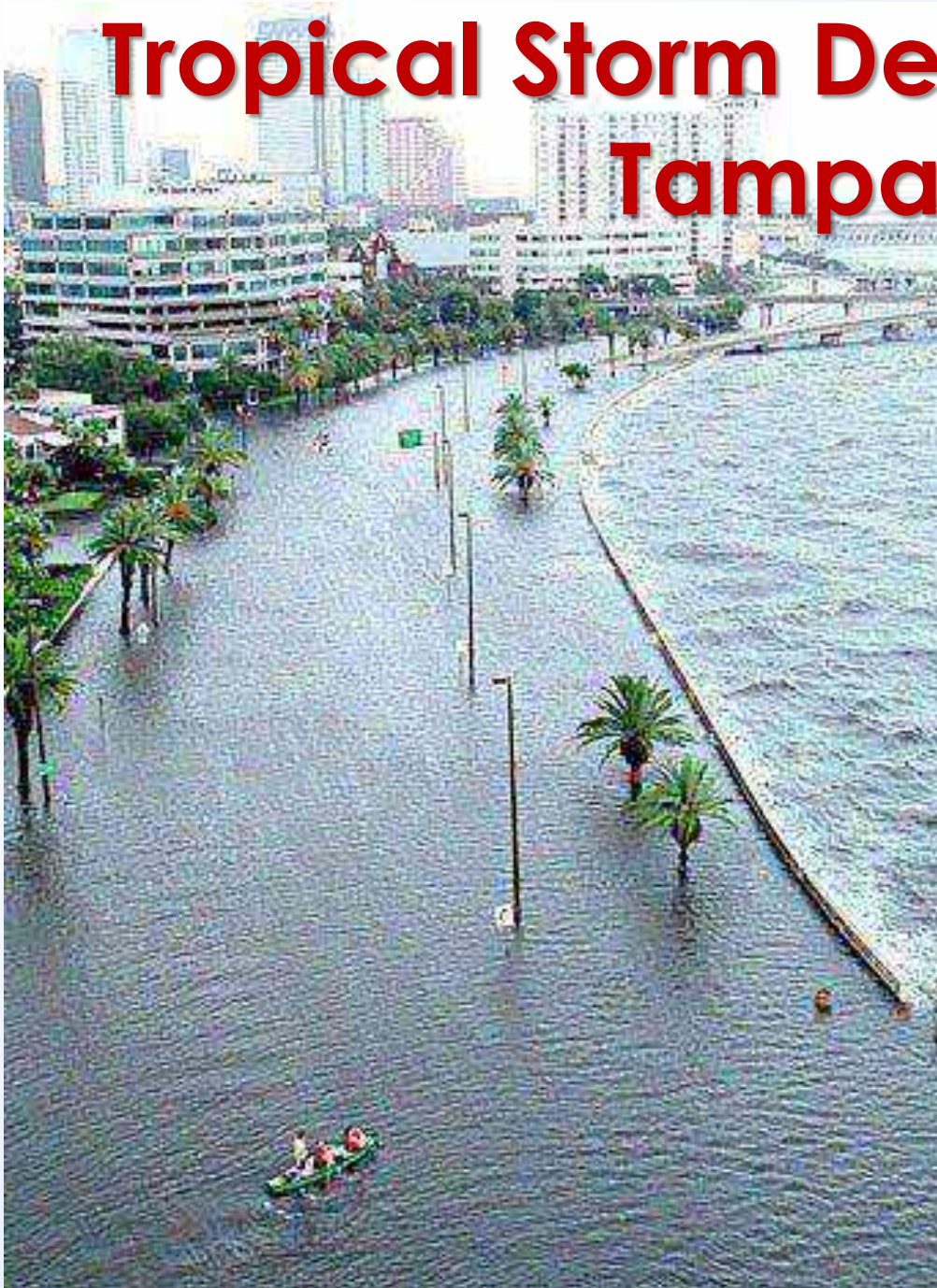
JUNE

- Likely
- More Likely
- Most Likely

←
Prevailing Tracks



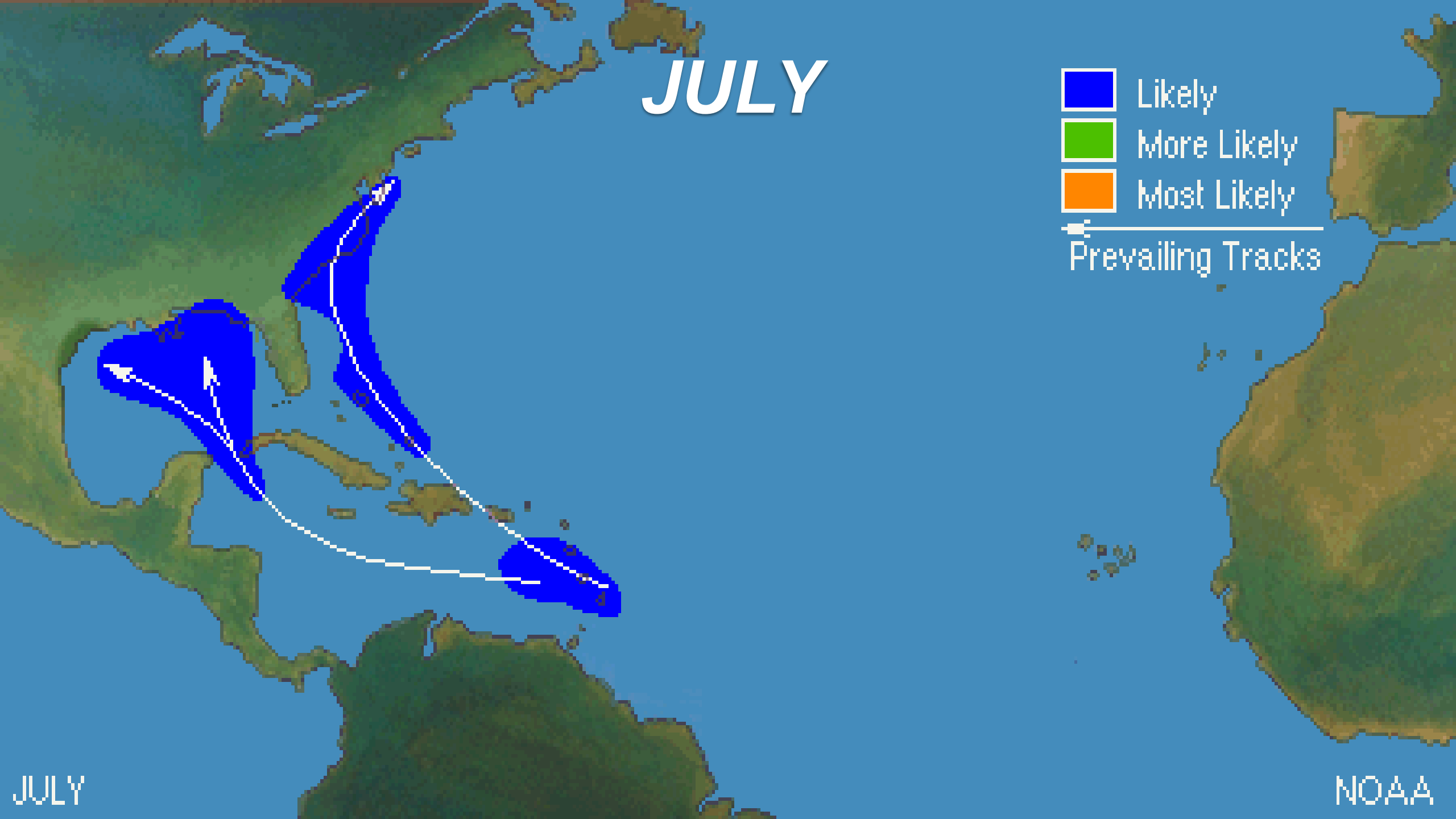
Tropical Storm Debby: June 2012 Tampa, Fla.



JULY

- Likely
- More Likely
- Most Likely

←
Prevailing Tracks



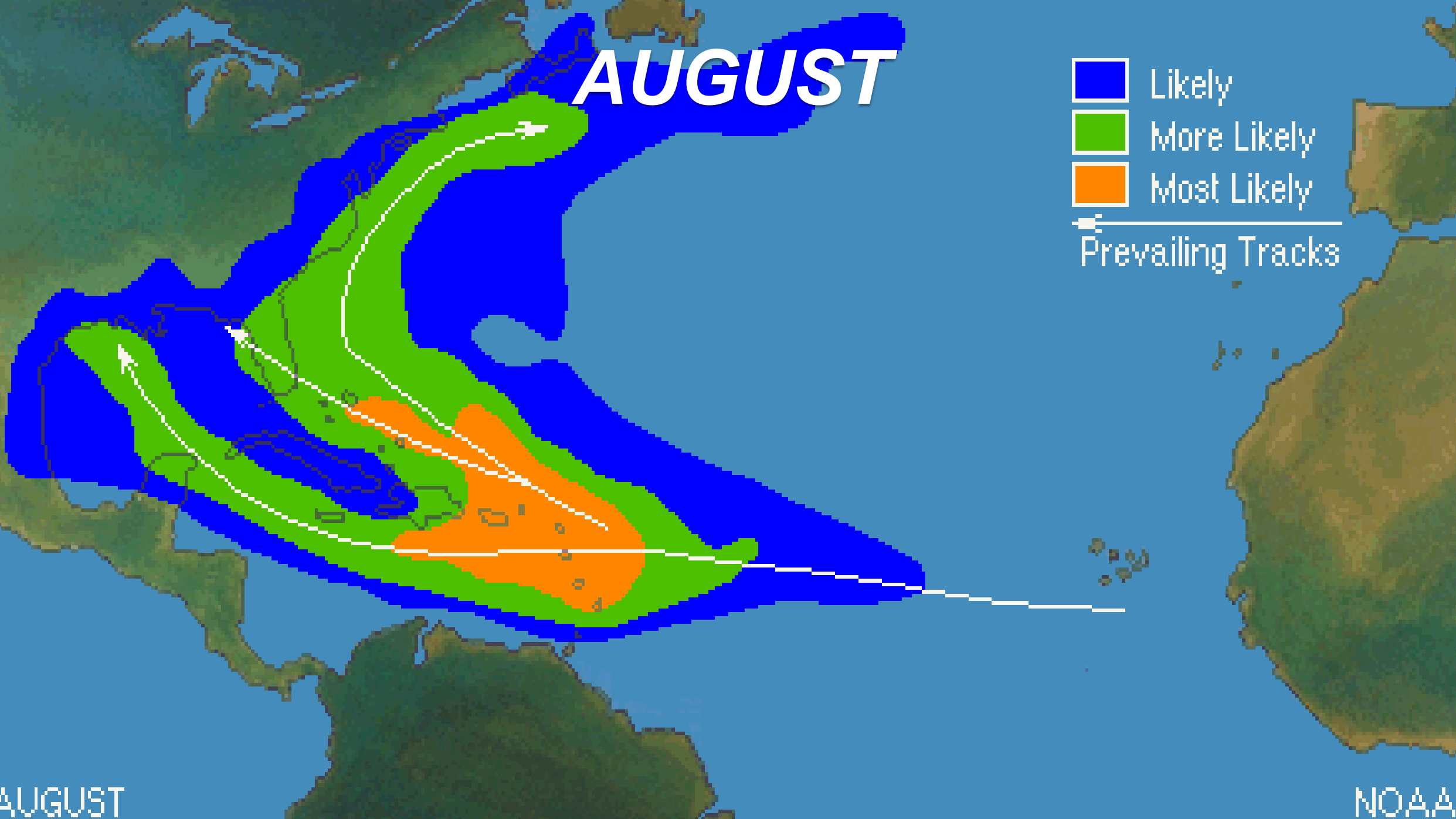
JULY

NOAA

AUGUST

- Likely
- More Likely
- Most Likely

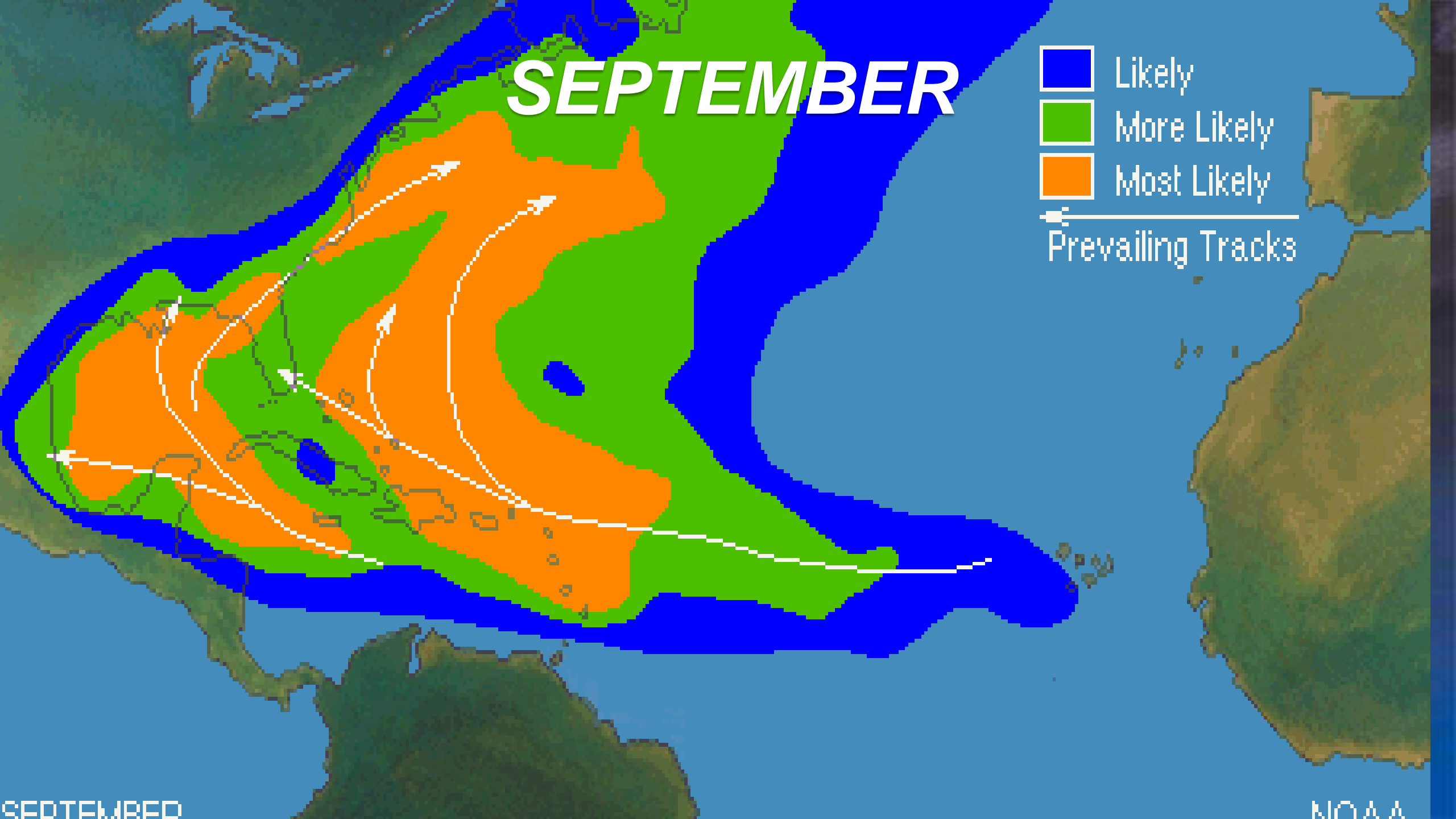
←
Prevailing Tracks





SEPTEMBER

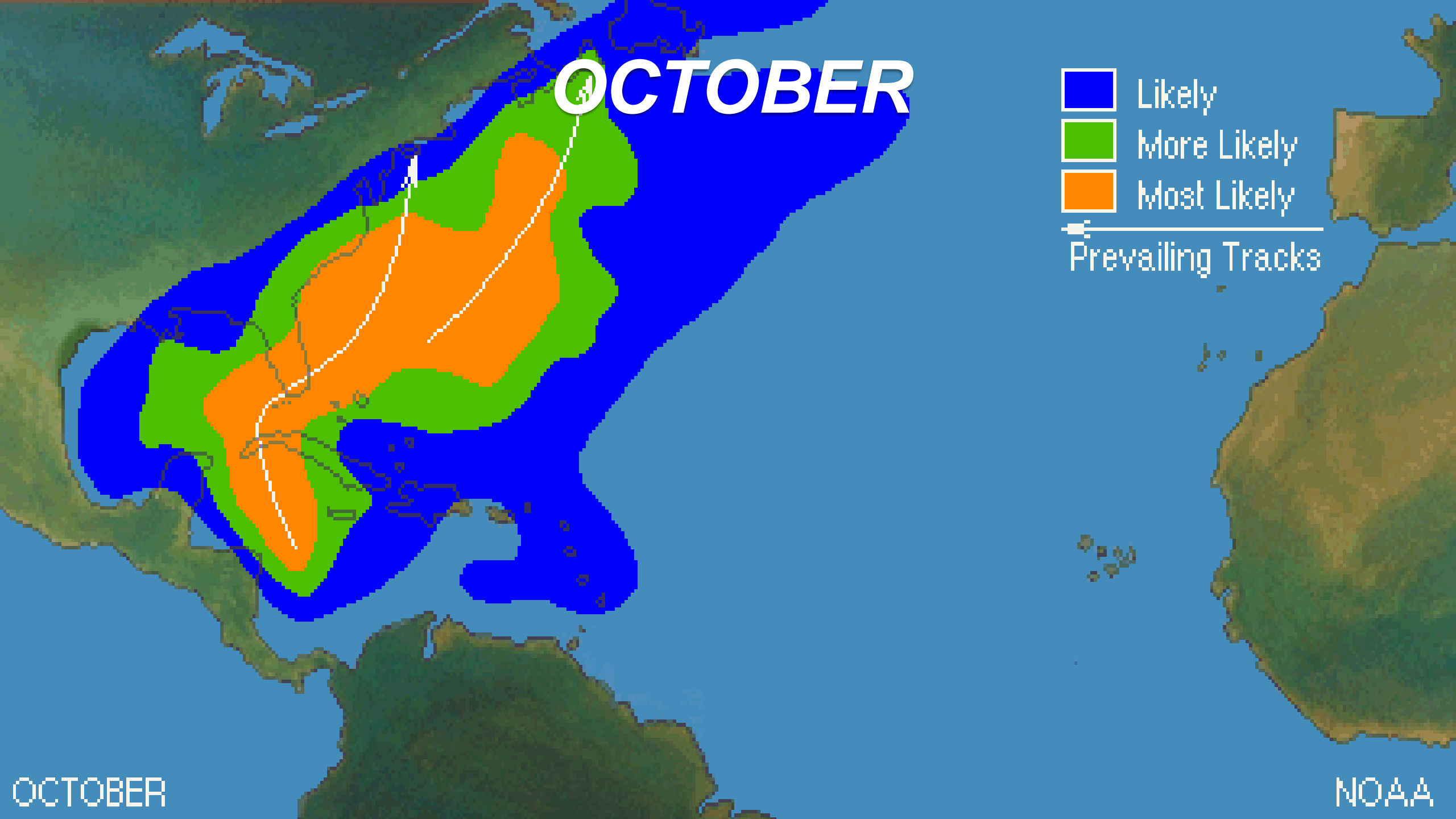
- Likely
- More Likely
- Most Likely
- ← Prevailing Tracks



OCTOBER

- Likely
- More Likely
- Most Likely

←
Prevailing Tracks



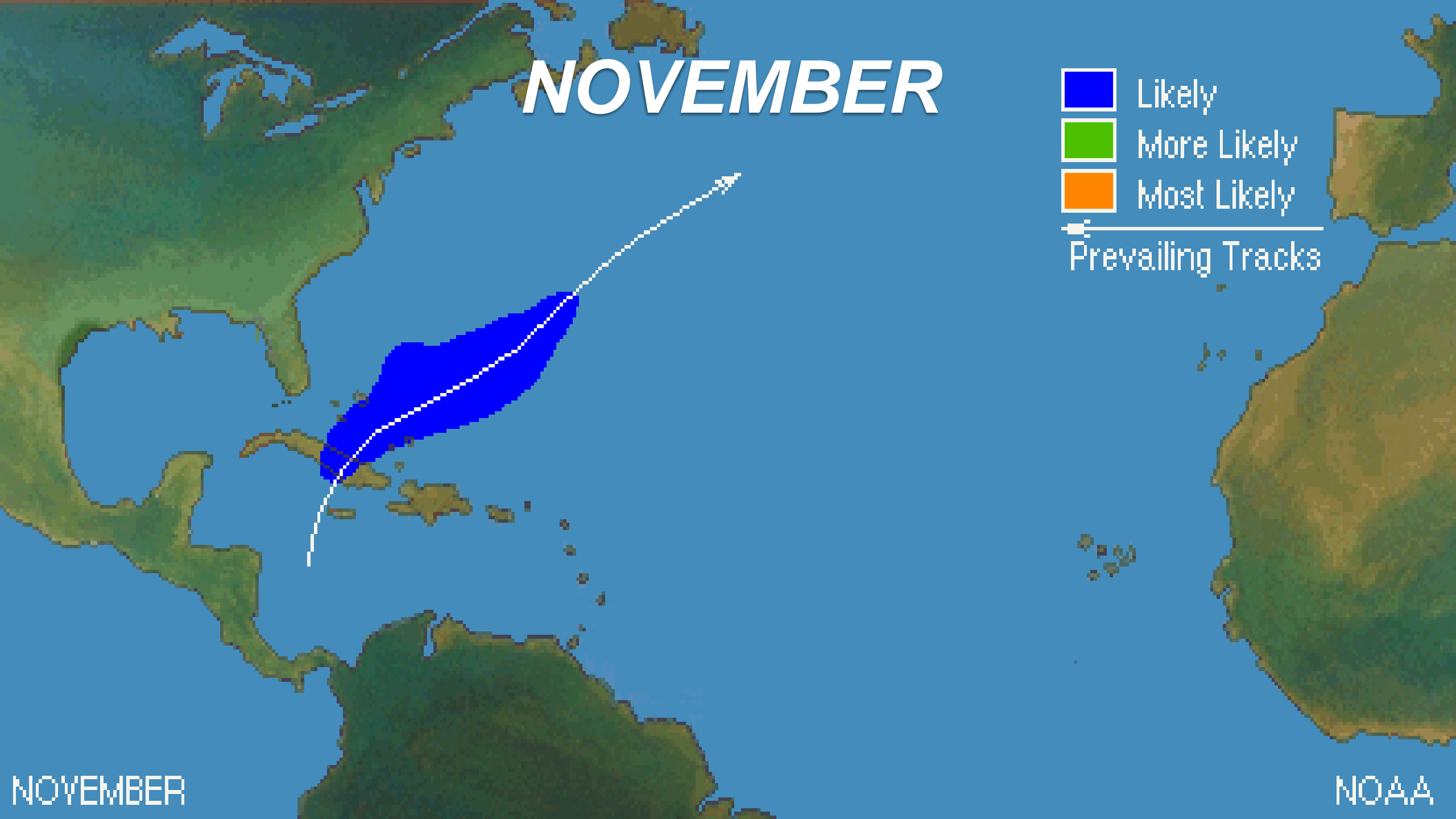
Tampa Bay Area "Tarpon Springs" Hurricane
October 25, 1921
Category 3



NOVEMBER

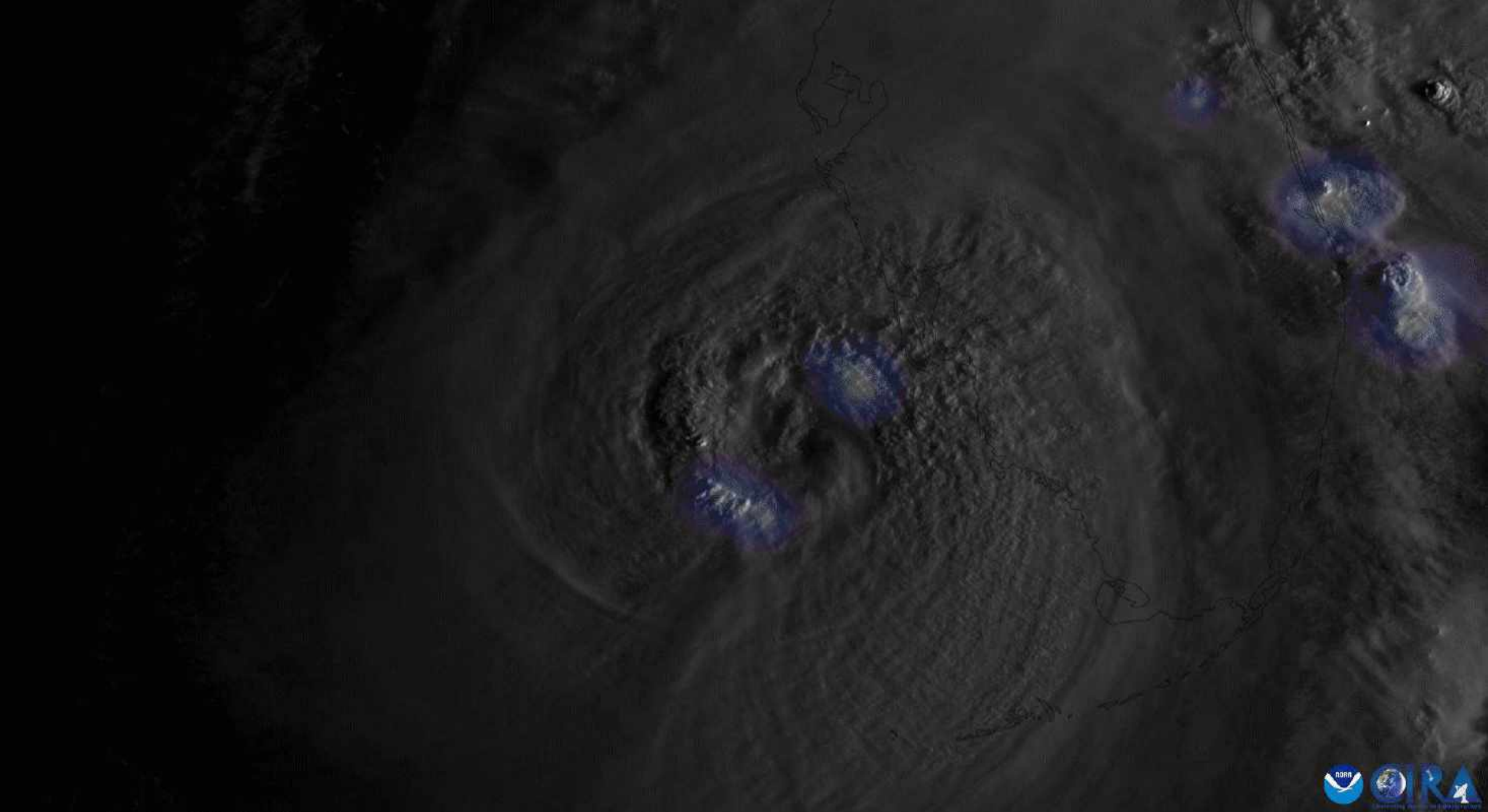
- Likely
- More Likely
- Most Likely

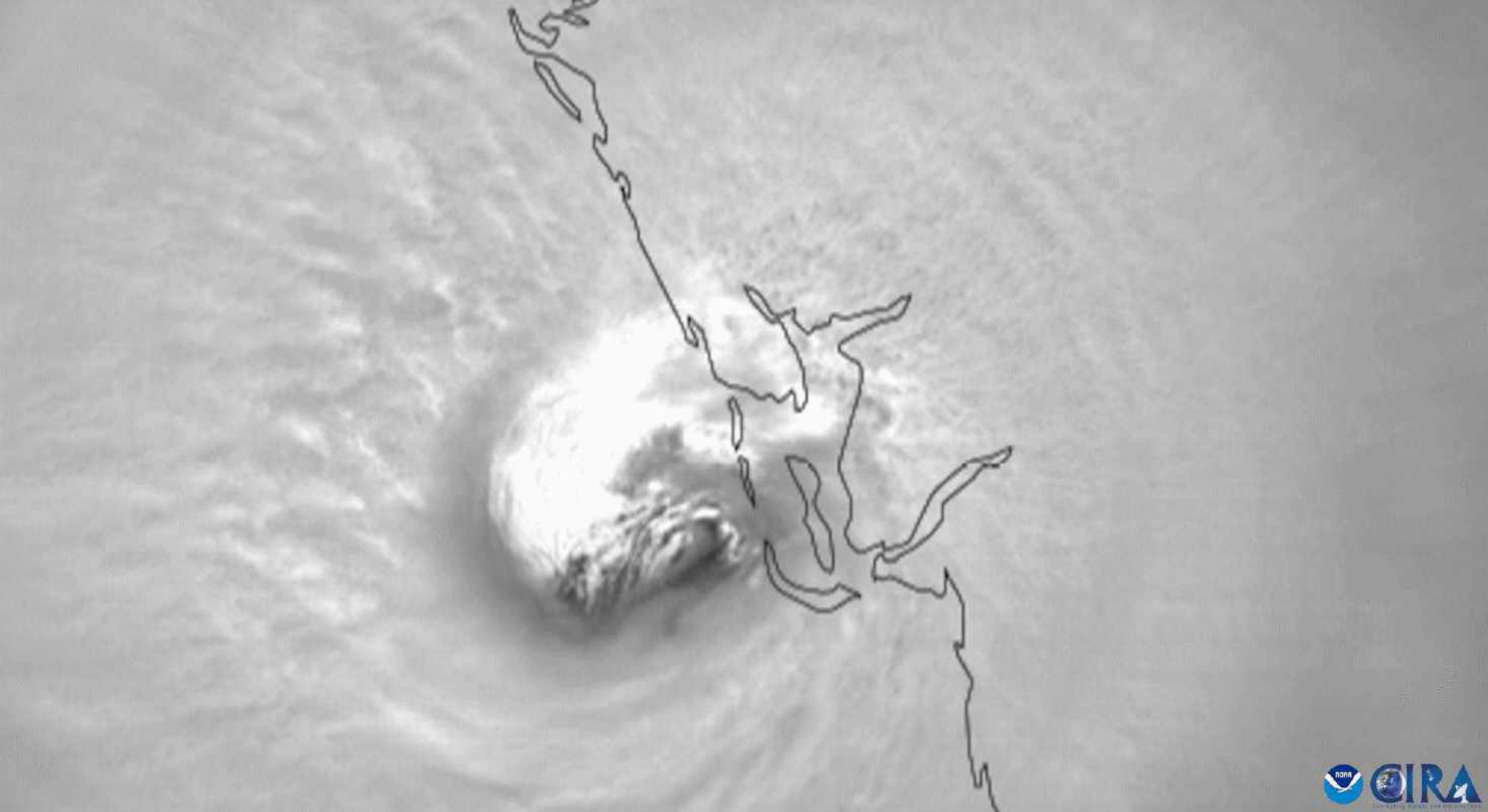
←
Prevailing Tracks



NOVEMBER

NOAA

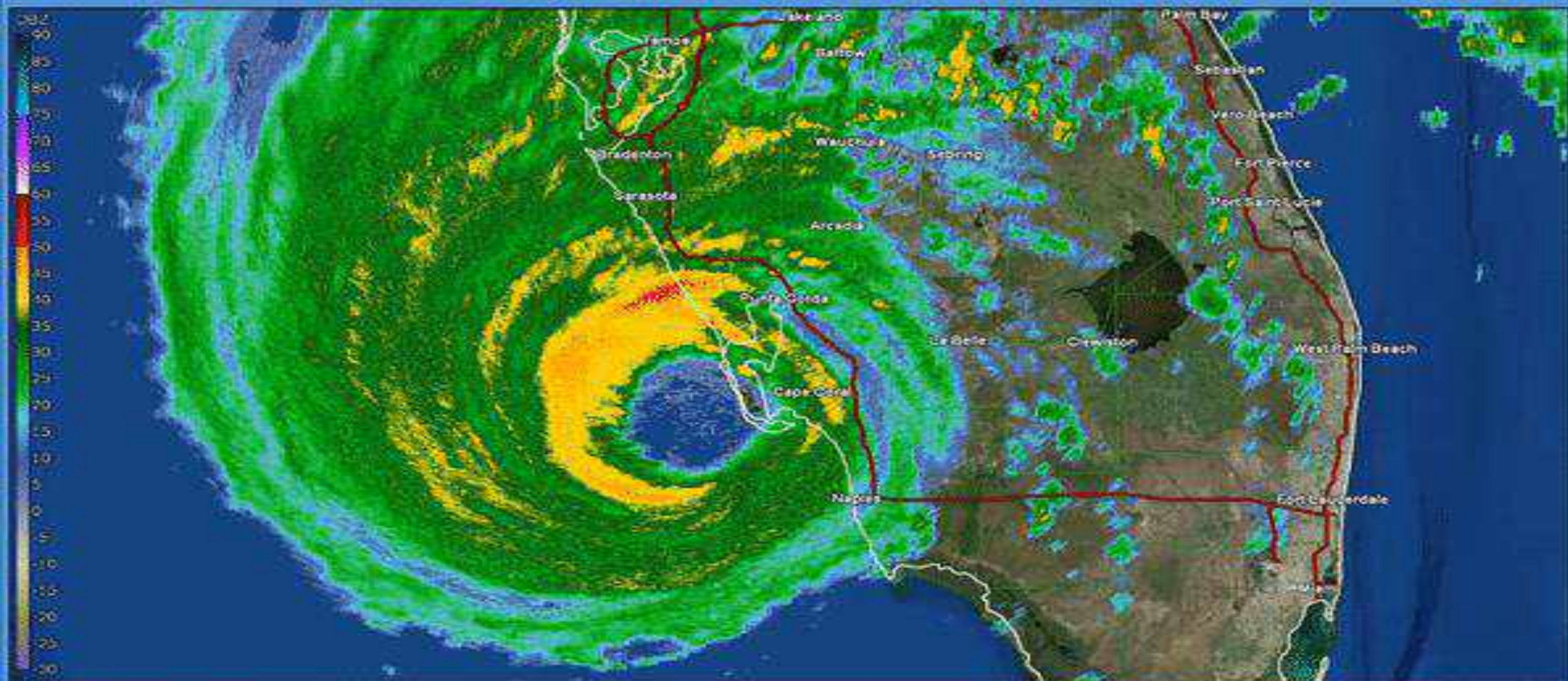






Hurricane Ian – 28 September 2022

1:30 – 4:00 PM EDT



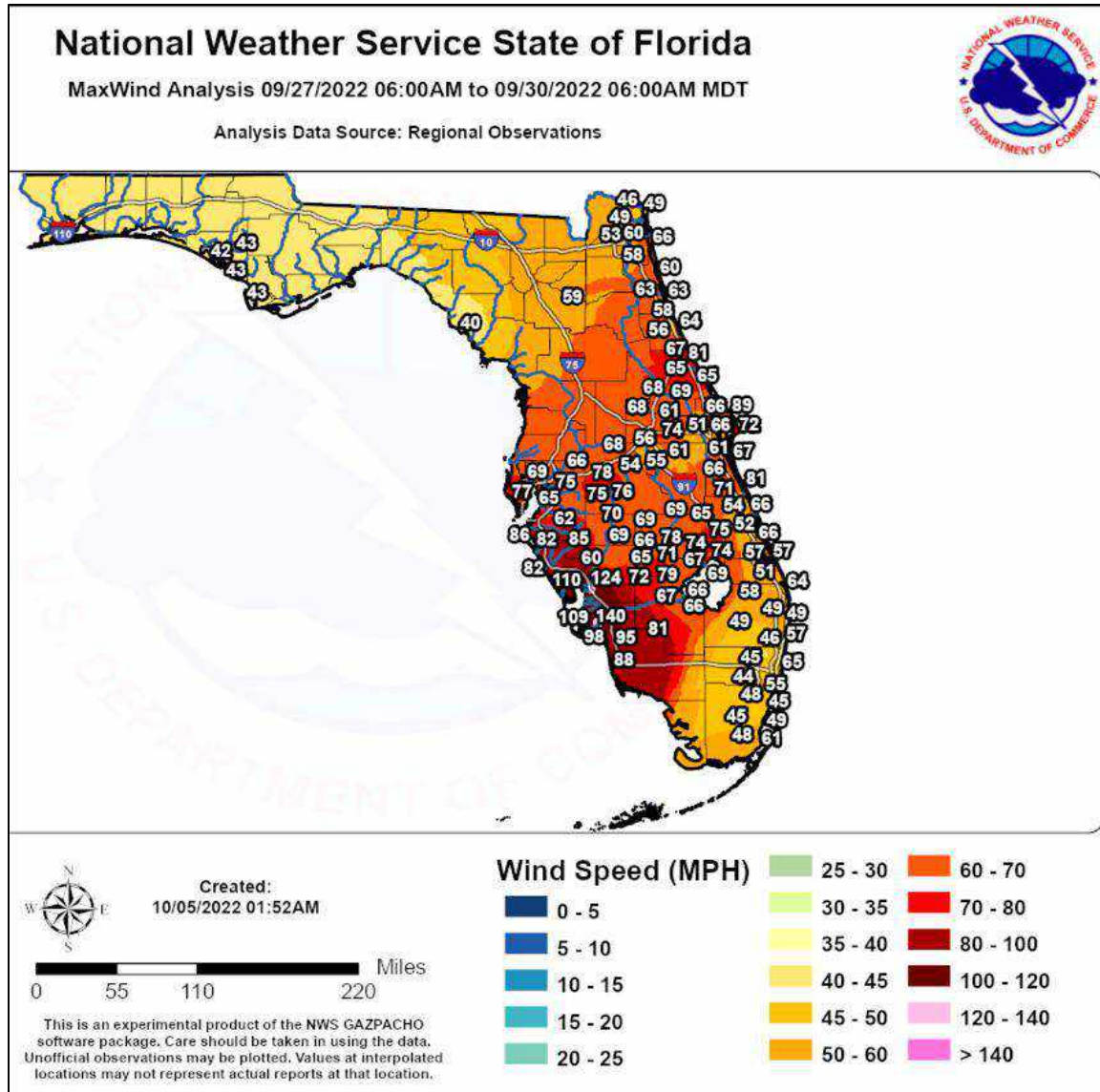
weather.gov/tampa

 [@NWSTampaBay](https://www.facebook.com/NWSTampaBay)



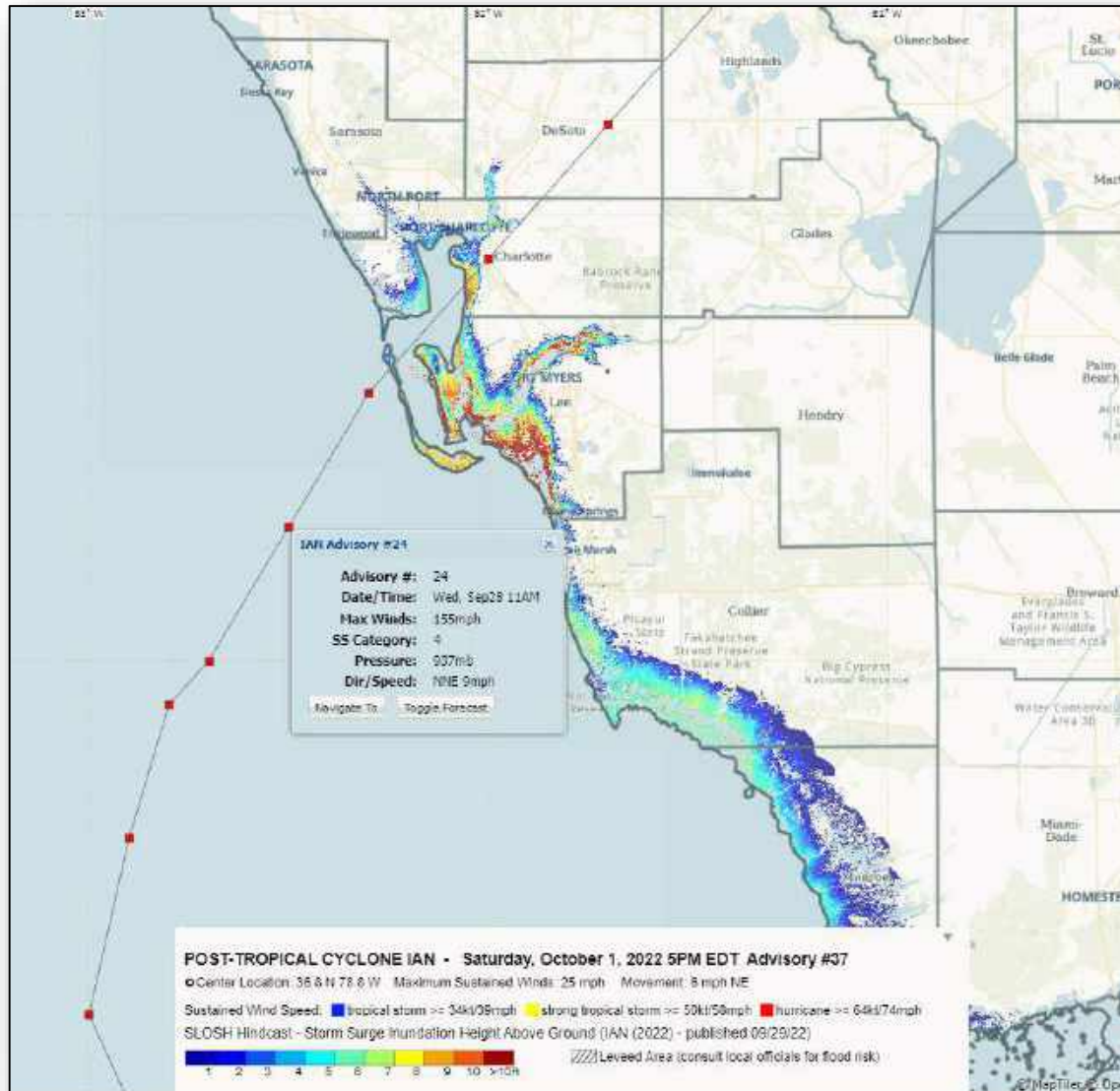
[@NWSTampaBay](https://www.twitter.com/NWSTampaBay)

2022 Major Hurricane Ian – Max Wind Gust



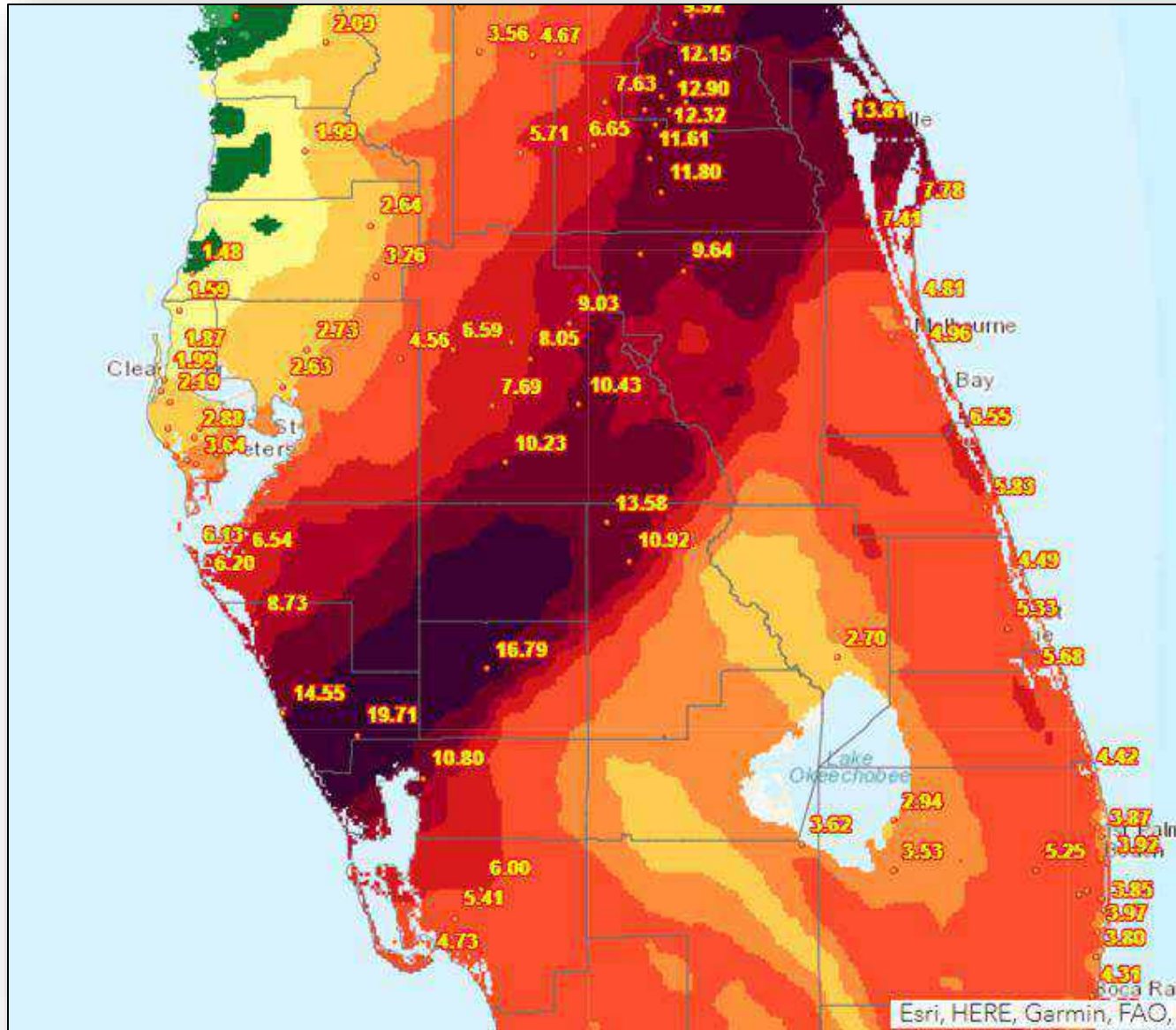
- Landfall is when the *center* of the eye wall crosses the beach
- Landfall at Cayo Costa - 305 PM ET Wed Sep 28, 2022
 - CAT 4, 150 mph, 940 mb
- Mainland Florida Landfall - Near Punta Gorda at Pirate Harbor
 - CAT 4, 435 pm Wed Sep 28, 145 mph, 942 mb
- Max Recorded Wind - 140 mph in Cape Coral

2022 Major Hurricane Ian - Storm Surge



- 6-10 feet water overtopped barrier islands
- Max surge 10 to 15 feet.
 - Structures washed off their foundation at locations where water was *flowing* over the barrier islands
 - Structures flooded with salt water on the inland side of the intercoastal
- Tides were 4-7 feet below normal north of the eye wall

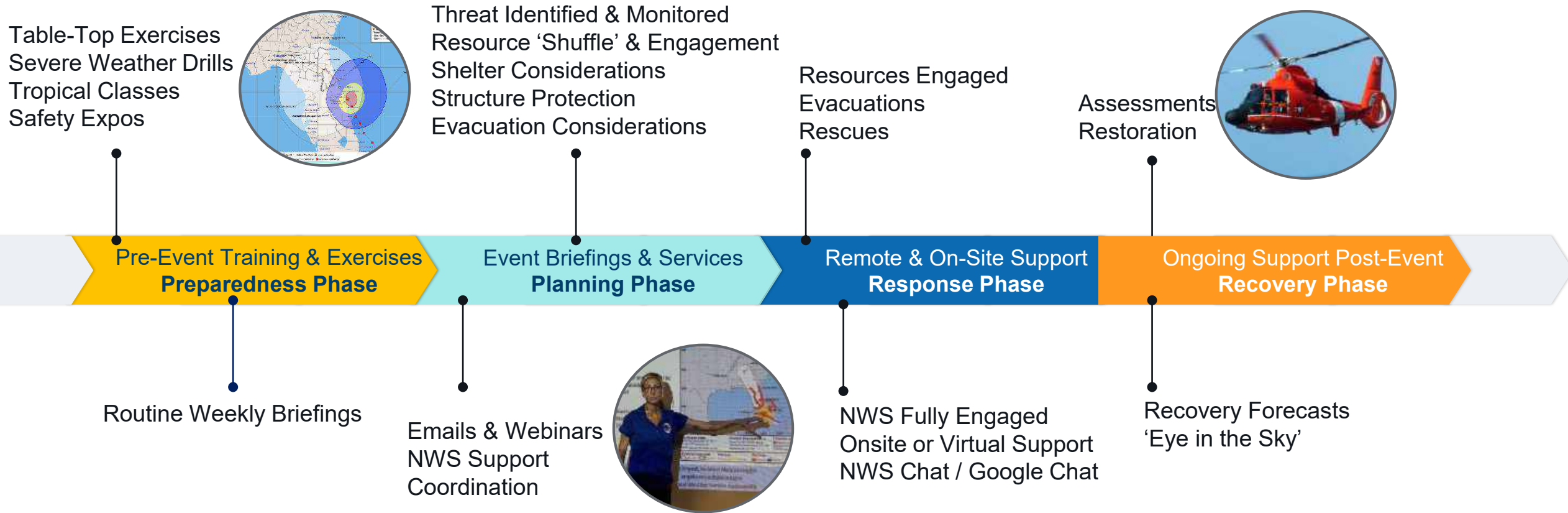
2022 Major Hurricane Ian - Rain



C. STORM TOTAL RAINFALL FROM 1200 UTC SEP 27 UNTIL 1200 UTC SEP 30

CITY/TOWN LAT LON DEG DECIMAL	COUNTY	ID	RAINFALL (IN)
1 NNW GROVE CITY 26.93 -82.33	CHARLOTTE	25056	26.95
1 NW CHARLOTTE BEACH 26.94 -82.22	CHARLOTTE	25218	22.97
3 NE NORTH PORT 27.08 -82.15	SARASOTA	25835	21.45
2 S ZOLFO SPRINGS 27.46 -81.80	HARDEE	25195	20.13
3 E ZOLFO SPRINGS 27.50 -81.75	HARDEE	25172	19.97
10 WSW PINE LEVEL 27.19 -82.13	SARASOTA	25603	19.83

Weather Decision Support Services



Partnerships with Emergency Management



3-5 Days Before Impact



National Weather Service

Major Hurricane Ian BRIEFING

1:00 PM ET
 Wednesday, January 11, 2023

What has changed: Surge threat increases for SW Florida

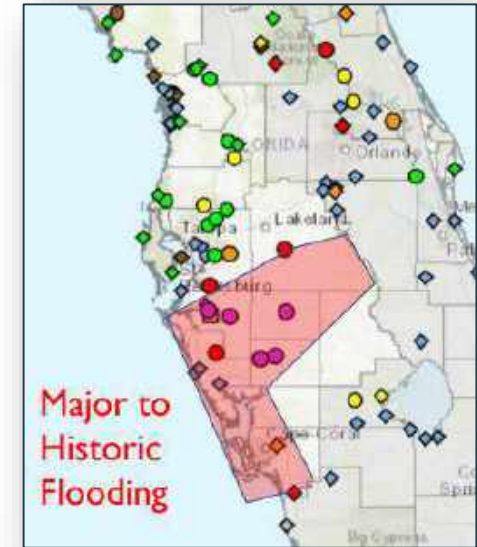
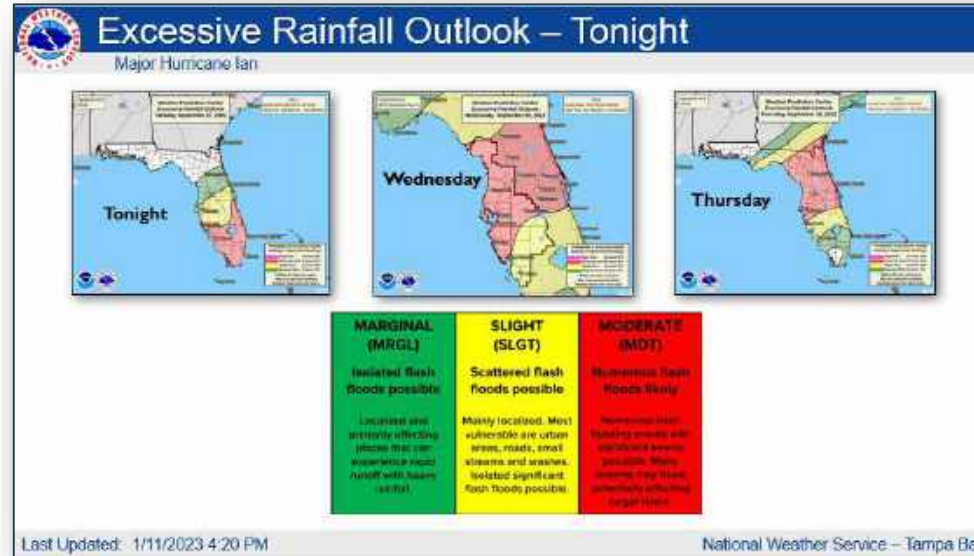
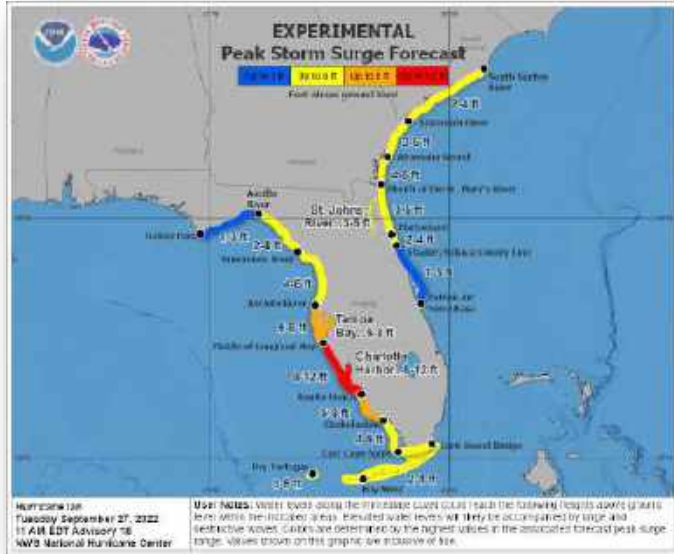
Next Briefing: Tuesday, September 27, at 7 PM ET

Disclaimer: The information contained within is time-sensitive. Do not use after 5pm EDT Tuesday

Tropical Email and/or Webinar briefings begin from NWS Tampa Bay (Ruskin) to both the local Media and Emergency Management

Briefing Times: 7 AM, 1 PM, 7 PM, 1 AM

1-2 Days Before Impact



National Weather Service

Major Hurricane Ian BRIEFING

1:00 PM ET
Wednesday, January 11, 2023

What has changed: Surge threat increases for SW Florida

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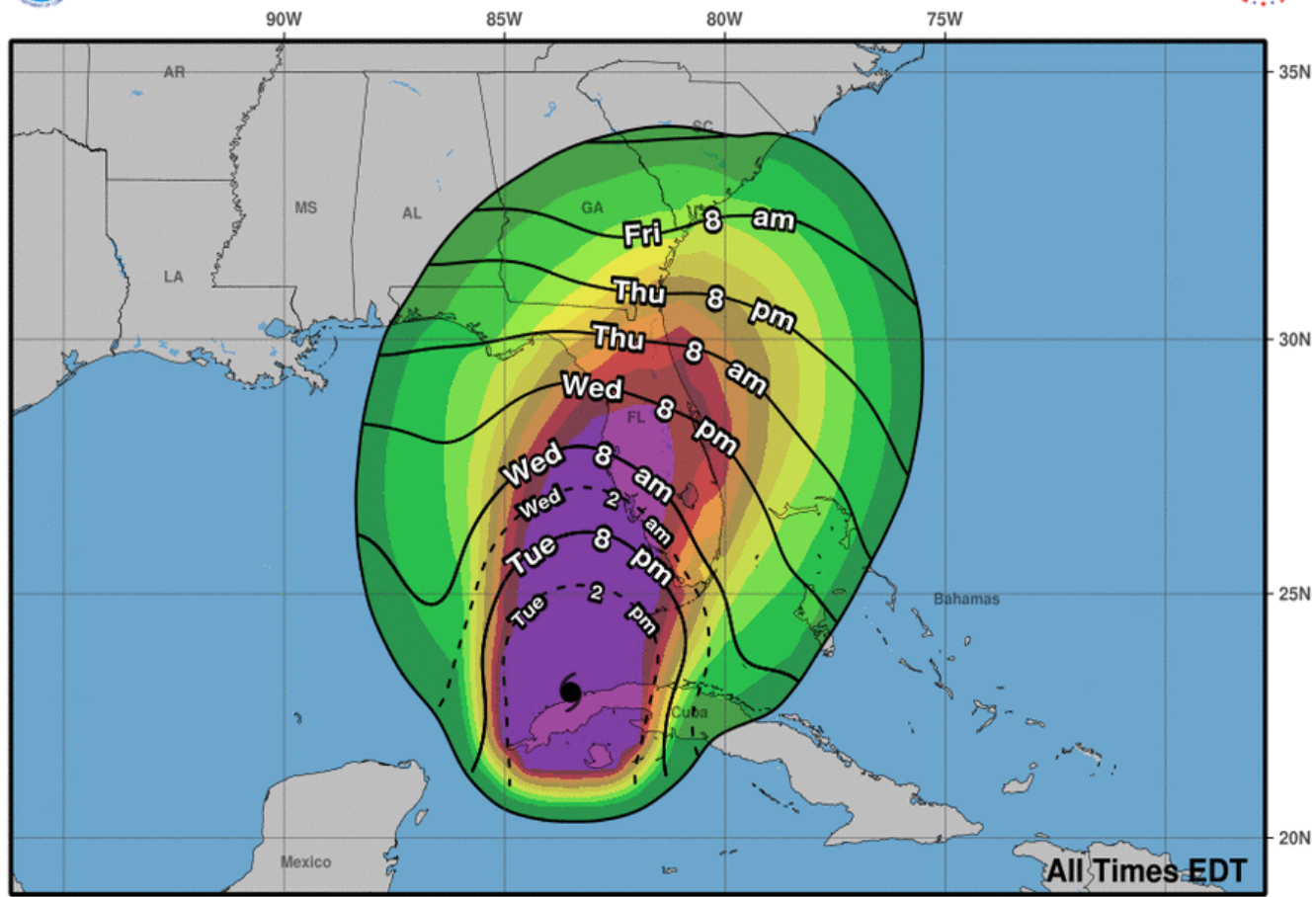


Time of Arrival of Tropical Storm Force Winds

Major Hurricane Ian



0-3 Day Most Likely Arrival Time of Tropical-Storm-Force Winds



Hurricane Ian
 Tue. Sep. 27, 2022 11 am EDT
 Advisory 18

Storm Location & Wind Speed
 ○ < 34 kt (39 mph)
 ○ 34-63 kt (39-73 mph)
 ● ≥ 64 kt (74 mph)

3-day chance of receiving sustained 34+ kt (39+ mph) winds
 5 10 20 30 40 50 60 70 80 90 100 %

County	Earliest Arrival	Most Likely
Lee	8 pm Tue	11 pm Tue
Charlotte	7 pm Tue	10 pm Tue
Sarasota	10 pm Tue	1 am Wed
DeSoto	1 am Wed	5 am Wed
Hardee	1 am Wed	5 am Wed
Highlands	3 am Wed	7 am Wed
Manatee	12 am Wed	4 am Wed
Pinellas	1 am Wed	6 am Wed
Pasco	2 am Wed	8 am Wed
Hillsborough	2 am Wed	8 am Wed
Polk	4 am Wed	8 am Wed
Sumter	5 am Wed	1 pm Wed
Hernando	3 am Wed	7 am Wed
Citrus	5 am Wed	11 am Wed
Levy	7 am Wed	3 pm Wed

HURRICANE WATCH

A Hurricane Watch is issued when **hurricane force winds are *possible* within 48 hours.**

Prepare by boarding up windows and moving loose items indoors. Have an emergency supply kit ready.

Hurricane Possible.

HURRICANE WARNING

A Hurricane Warning is issued when **hurricane force winds are *expected* within 36 hours.**

Seek shelter in a sturdy structure or evacuate if ordered.

Hurricane Expected!



Storm Surge Warning

There is a **danger of life-threatening inundation** from rising water moving inland from the shoreline generally **within 36 hours**.

Promptly follow evacuation and other instructions from local officials.

Storm Surge Watch

There is a **possibility of life-threatening inundation** from rising water moving inland from the shoreline generally **within 48 hours**.

Promptly follow evacuation and other instructions from local officials.



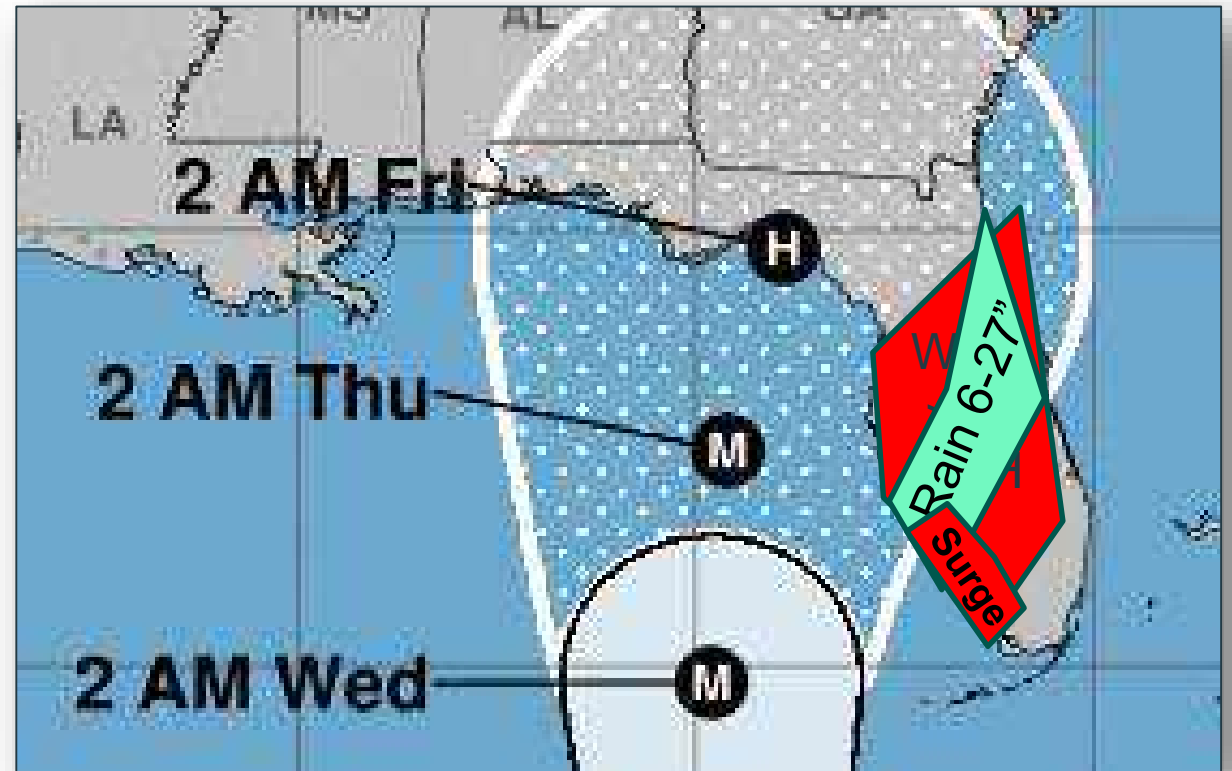
Be Careful with the Forecast Cone vs Impacts



The Cone of Uncertainty provides one piece to a much larger puzzle of threats and impacts.

Note how watches and warnings are in effect outside the Cone of Uncertainty.

Be Careful with the Forecast Cone vs Impacts

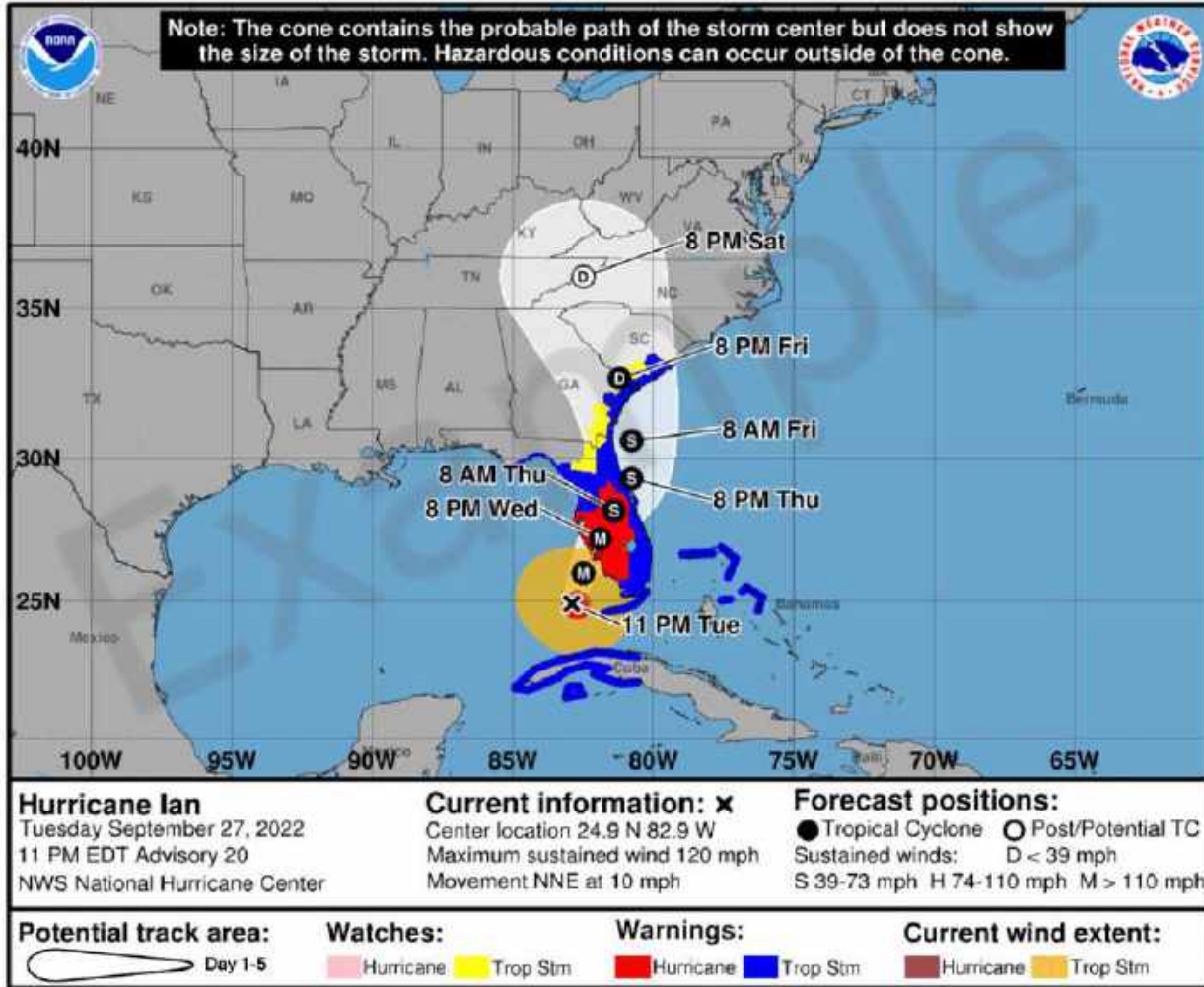


Small Shifts in the Track Can Have a Huge Impact on Landfall



Small track changes can have a large impact on the eventual landfall point (and subsequent impacts) across the West Coast of Florida

Cone Graphic with Inland Tropical Wind Watches/Warnings



New experimental cone graphic depicting inland U.S. tropical storm and hurricane watches and warnings will become available mid-season in 2024

Will help convey wind hazard risk over land

The 5-day cone will be depicted as all white instead of the current solid 1-3 day cone and hatched 4-5 day cone

Graphic may not be available as soon as the current cone graphic due to the time need to compile complete inland watch and warning information

Will be available beginning on or around **August 15, 2024**

Available at hurricanes.gov along with the current operational version of the cone graphic



Costliest U.S. Hurricanes

Year	Storm	Area	Damage in Billions
2005	Katrina	LA, MS	\$125
2017	Harvey	TX, LA	\$125
2022	Ian	SW Florida	\$113
2017	Maria	Puerto Rico	\$91.6
2017	Irma	Florida	\$77.2
2021	Ida	SE U.S.	\$75.2
2012	Sandy	US East Coast	\$68.7

https://en.wikipedia.org/wiki/List_of_costliest_tropical_cyclones

Hurricane Fatalities Caribbean and U.S.

Year	Storm	Area	# Fatalities
1900	Galveston	TX	6,000-12,000
1928	Lake Okeechobee	FL	4,075
2017	Maria	Puerto Rico	3,059
2004	Katrina	LA, MS	1,392
1926	Great Miami	S FL	539+
1960	Donna	Caribbean, FL	439
2022	Ian	FL	149
2017	Irma	FL	134
2004	Charley	FL	35

https://en.wikipedia.org/wiki/List_of_the_deadliest_tropical_cyclones

Hurricane Ian: The People and Their Stories



2022 Major Hurricane Ian - Impact



Casey Shannon

1d · 🌐

I took this earlier today, around 4:30. This is highway 70 looking south east over the train tracks coming into Arcadia. I took some video too but I don't have a battery big enough to upload it over a mobile Hotspot. This is the highest I've ever seen the river...



👍👍👍 6

2 shares

👍 Like

💬 Comment

➦ Share

Top National Weather Service meteorologists scour damage zone to improve future hurricane forecasts

WGCU | By [Tom Bayles](#)

Published October 6, 2022 at 1:08 PM EDT



Tom Bayles /

Brian LaMarre, left, who is the National Weather Service's chief meteorologist in the Tampa Bay region, talks with Pablo Santos, who is in charge of the NWS in Miami-South Florida, this week along hard-hit San Carlos Island while looking for subtle clues left behind by Hurricane Ian that might help improve the forecast during future tropical cyclones

Hurricane Ian: The People and Their Stories

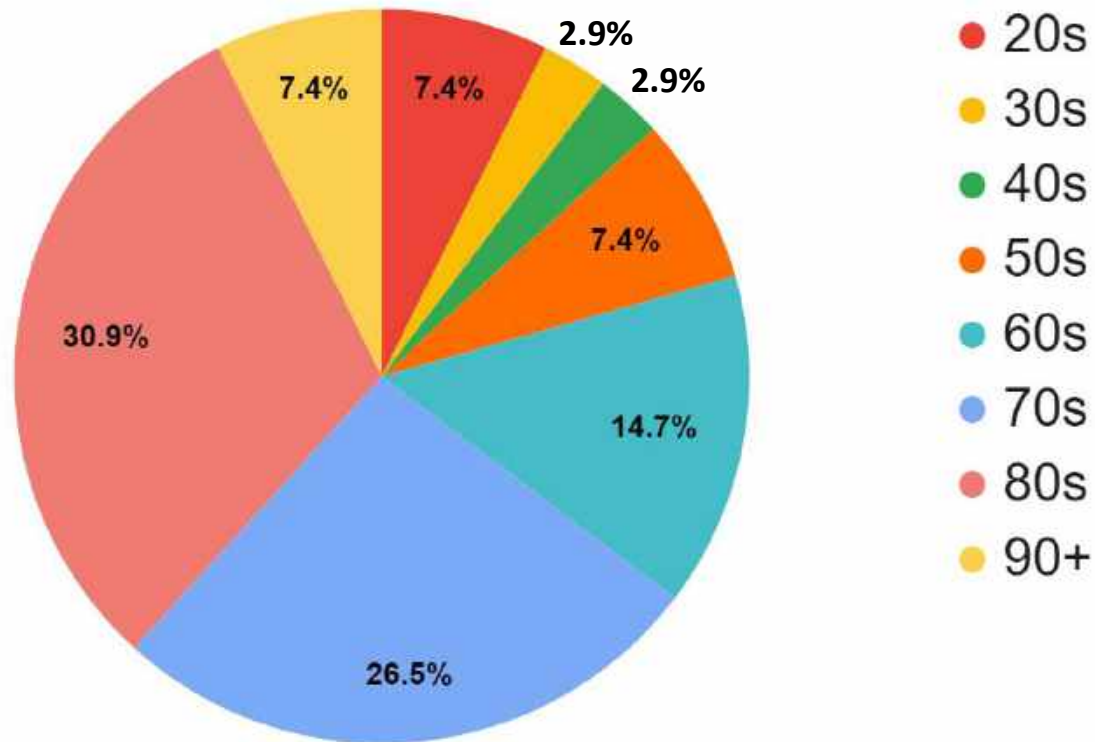




Ian Direct Fatalities

Demographics

74% of direct fatalities were 60+
52% were 70+

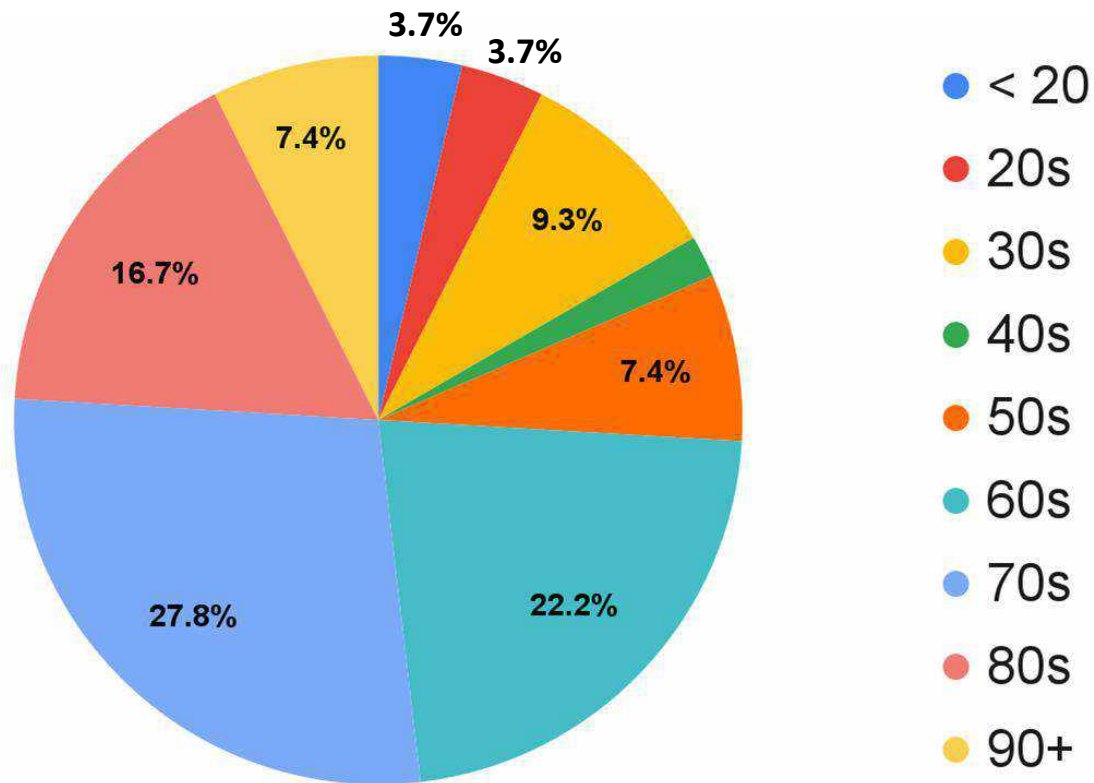


- Ian was responsible for 66 direct deaths - all in Florida
- Deadliest hurricane to affect the CONUS since Sandy (2012)
- Storm Surge: 41
- Freshwater Flooding: 12
- Marine: 8
- Wind: 4
- Surf: 1

Ian Indirect Fatalities

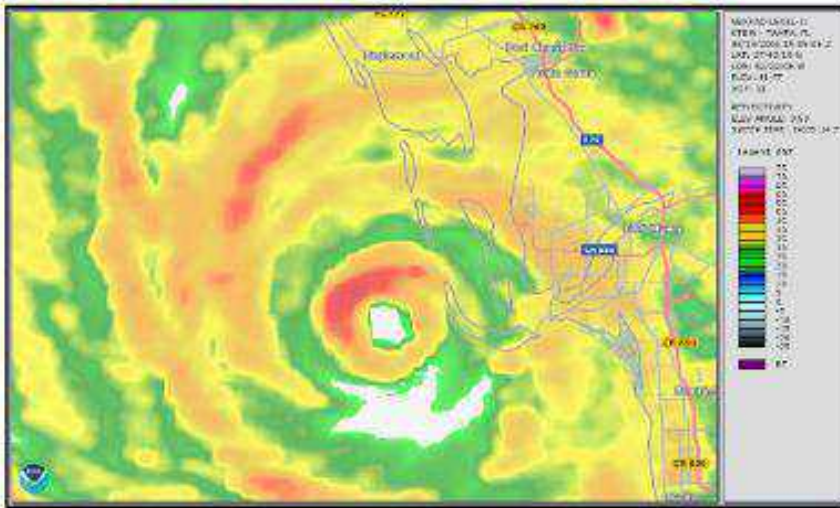
Demographics

80% of indirect fatalities were 60+
65% were 70+



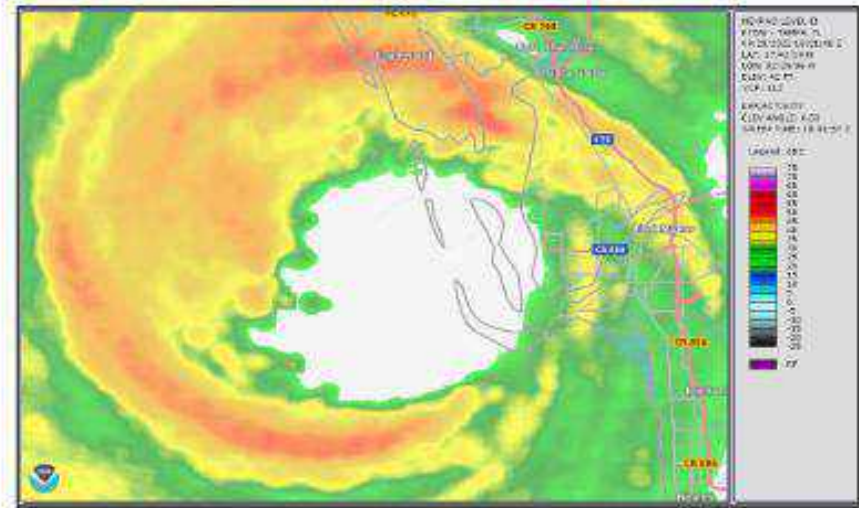
- Ian responsible for 90 indirect deaths
 - Florida: 84
 - North Carolina: 3
 - Virginia: 1
- Major Causes
 - Medical Care Related: 18
 - Cardiac: 16
 - Accidents: 16

Hurricane Comparison: Category – Size – Impacts



Hurricane Charley 2004

- Cat. 4 at landfall (141mph max wind)
- Landfall at Cayo Costa
- Eye was 10 miles wide
- Extreme winds were contained to within 10 miles of the eye
- Movement NNE at 21mph
- Minimum Central Pressure 940mb
- Max Storm Surge near **6ft** at Matanzas Pass FMB



Hurricane Ian 2022

- Cat. 4 at landfall (150mph max wind)
- Landfall at Cayo Costa
- Eye was 26 miles wide
- Extreme winds were contained to within 40 miles of the eye
- Movement NNE at 9mph
- Minimum Central Pressure 940mb
- Max Storm Surge near **15.5ft** at northern FMB

Social Science Research: Who Evacuates?

First Out 21%	Anxious and eager to leave if a hurricane is in the forecast
Constrained 14%	Aware of risks & willing to evacuate but face barriers
Optimists 16%	Doubt that a hurricane will occur but willing to evacuate
Reluctant 27%	Reluctant to evacuate but will leave if ordered to
Diehards 22%	Confident they can safely ride out hurricanes at home



Last Resort Safety Messaging

THE REALITIES OF STORM SURGE

- This is what surge can do to a home
- It is a constant onshore push of water, potentially for hours
- This is the main reason for evacuations. **Be sure to heed any evacuation orders from your county officials!**
- The water rises fast - like a tsunami. As a **last resort**, if caught in the surge, it is important to go vertical (example: second or third floor of the building you are sheltering in) instead of trying to evacuate in your vehicle once water has started to rise
- Be sure to include an axe or saw in your hurricane supply kit



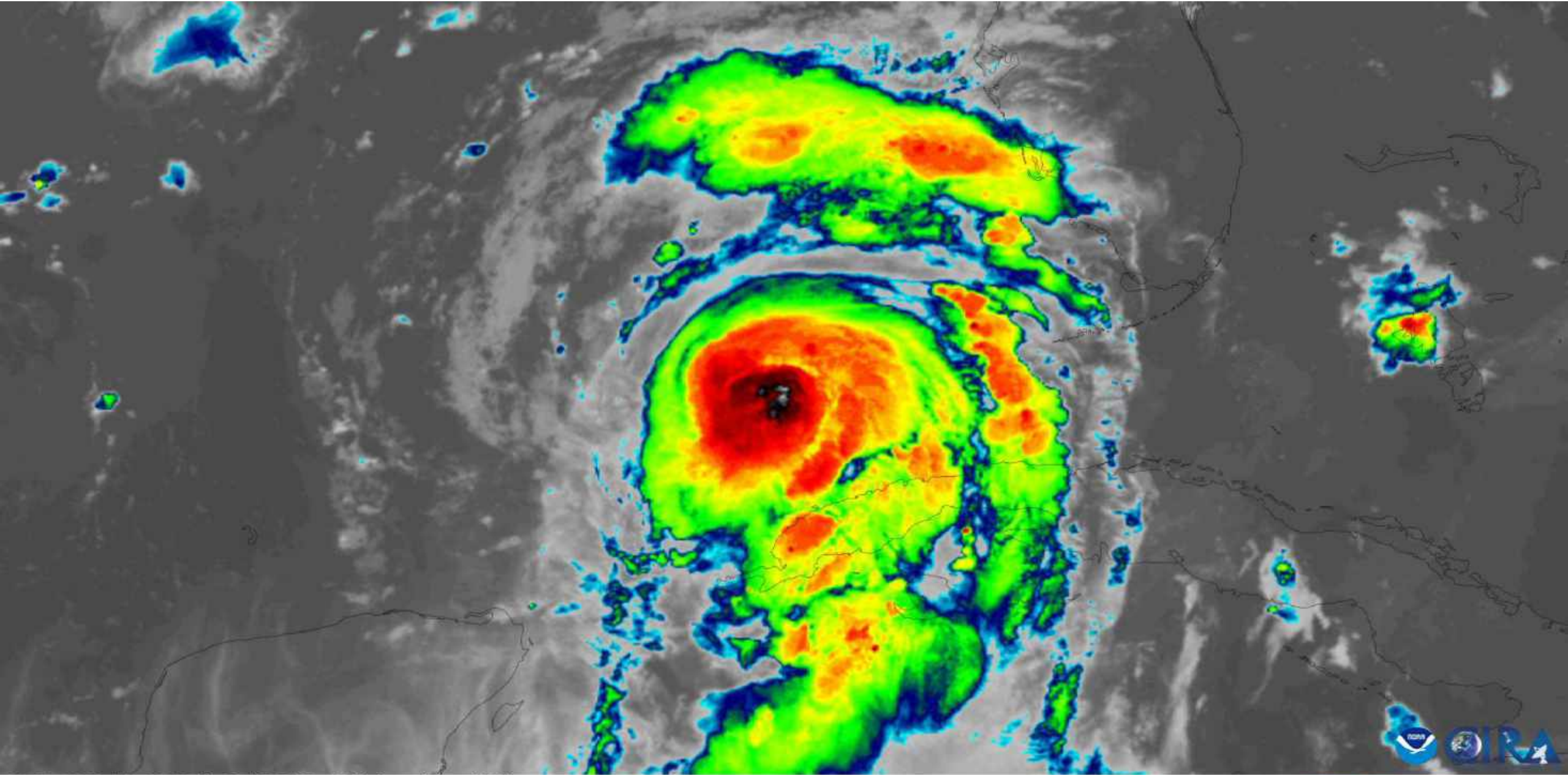
Hurricane Ian (Cat 4) 11.5 ft AGL storm surge in Fort Myers Beach, FL

Last Resort Safety Messaging

- Despite all of our best efforts, studies prove that some will choose to stay rather than evacuate - no matter what!
- We must therefore have some element of last resort safety within our messaging
- It should highlight going vertical rather than trying to escape in a vehicle
- Should also highlight having an axe or saw available if trapped



Hurricane Idalia: August 29-30, 2023



08-29-2023 | 11:56:17 UTC | GOES-16 | Infrared (band 13)

Temperature
-30 -20 -10 0 10 20 30 40 50 60 70 80 90



Storms Offshore can Cause Storm Surge Flooding

- Hurricane Idalia produced storm surge flooding all along the West Coast of Florida, even when over 100 miles from shore.
- Take evacuation orders seriously, even if a storm is not making landfall in your immediate area.

Highest NOAA Tide Gage Observations - MHHW
(numbers in red)

Distance between the "eye" and the Florida coastline
(numbers in black)

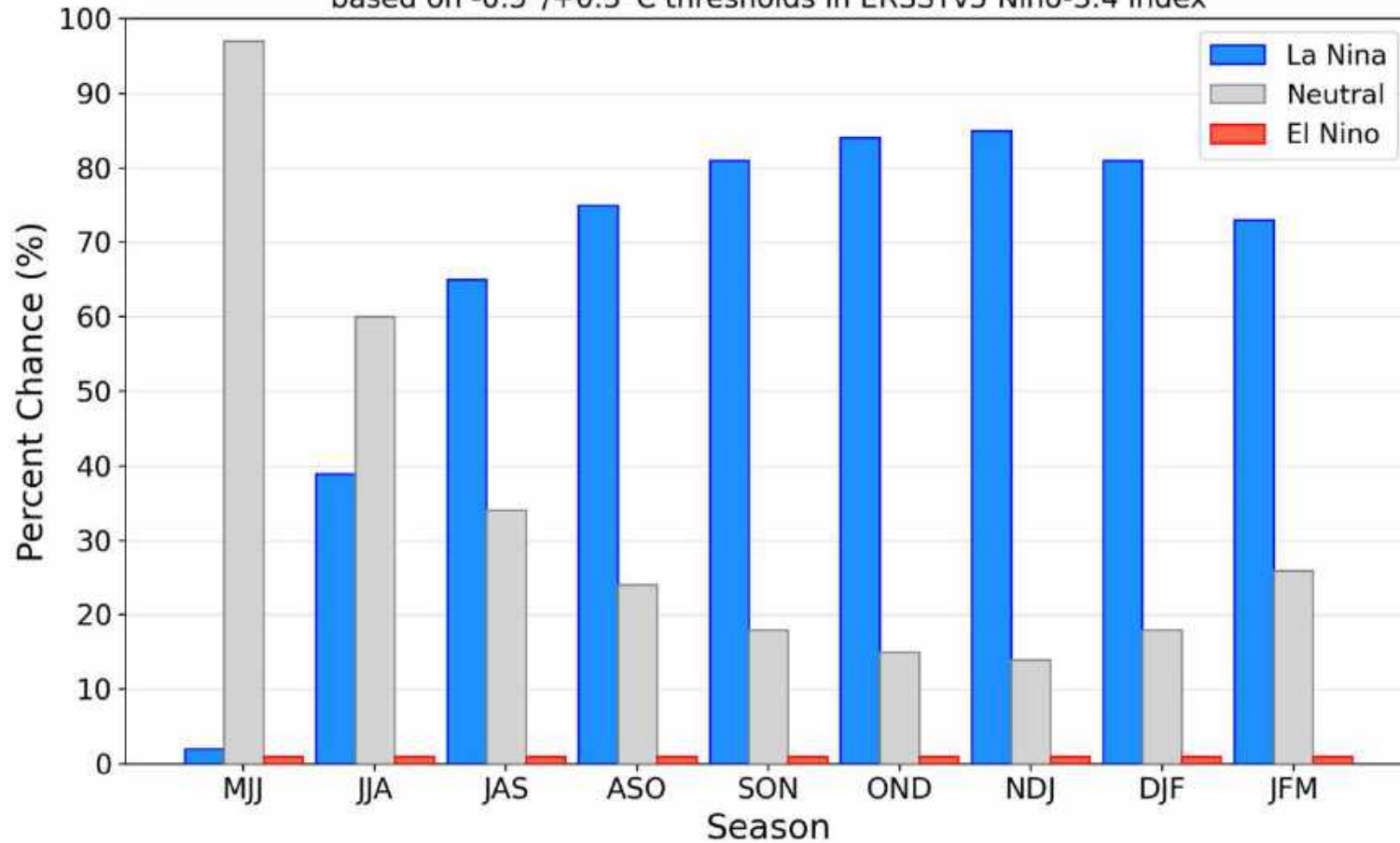


Distance of the "eye" of Idalia from the FL West Coast at preliminary NHC forecast points and Highest NOAA Tide Gage Observations

La Nina Returning

Official NOAA CPC ENSO Probabilities (issued June 2024)

based on $-0.5^{\circ}/+0.5^{\circ}\text{C}$ thresholds in ERSSTv5 Niño-3.4 index

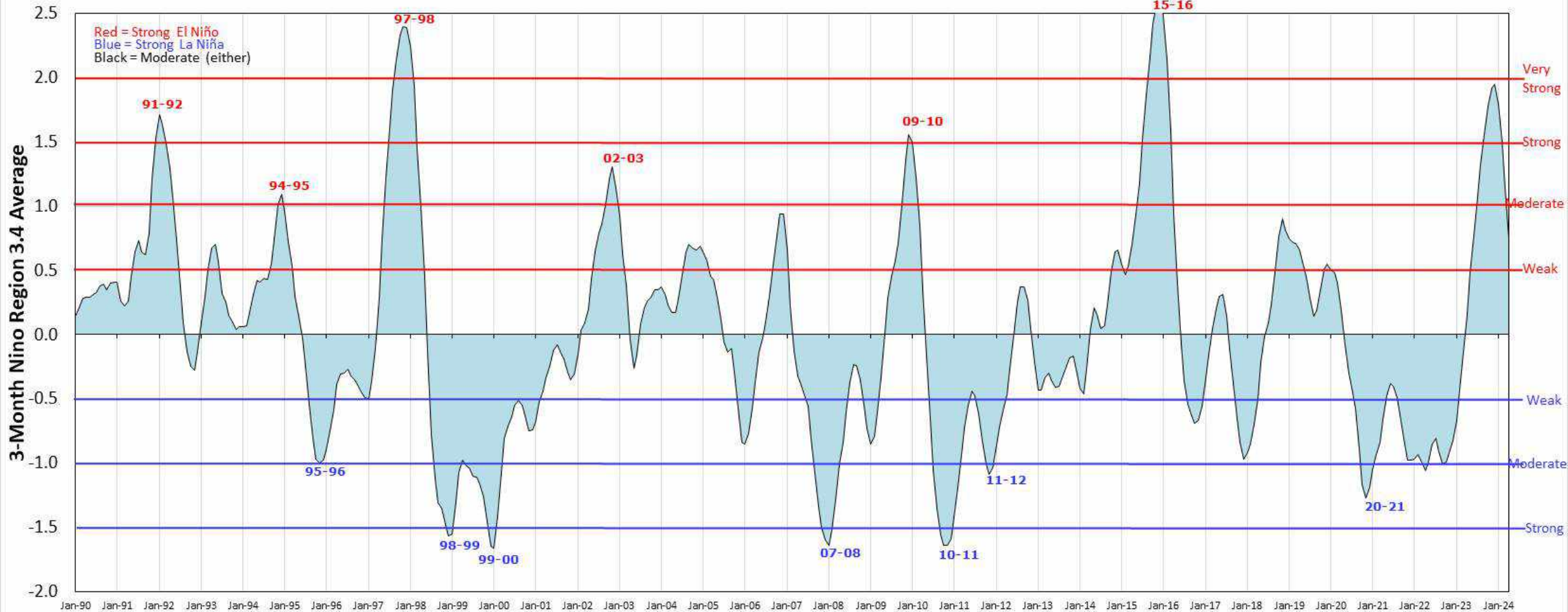


La Nina expected to return..

El Niño / La Niña Fluctuations

Oceanic Niño Index (ONI) - 1990-present

https://origin.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ONI_v5.php



La Niña Tropical Influence



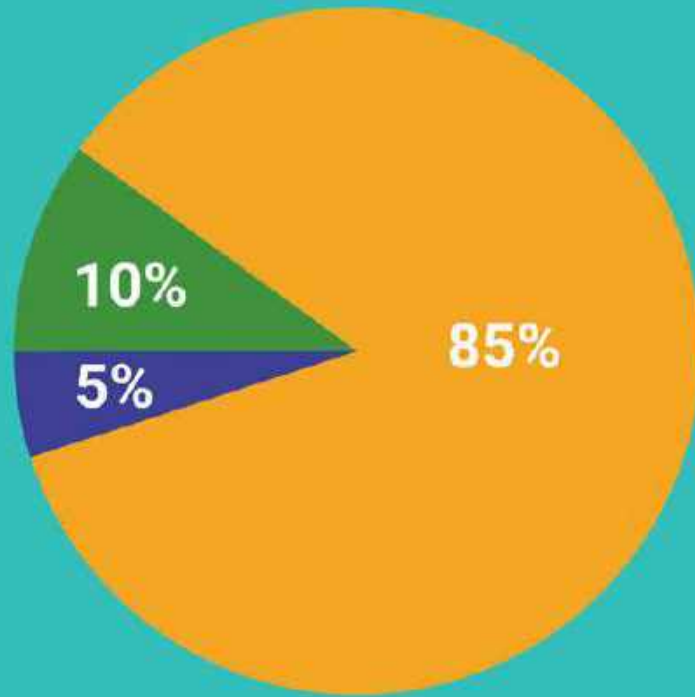
FEWER Hurricanes due to stronger vertical wind shear

MORE Hurricanes due to weaker vertical wind shear, weaker trade winds, and less atmospheric stability

Cool, Dry



2024 Atlantic Hurricane Season Outlook



■ Above normal ■ Near normal ■ Below normal

Season probability

Named storms

17 - 25

Hurricanes

8 - 13

Major hurricanes

4 - 7

Be prepared: Visit hurricanes.gov and follow @NWS and @NHC_Atlantic on X.

May 2024



2024 Hurricane Season Forecasts

	Average	Colorado State	The Weather Company	Accuweather
Named Storms	14	23	24	20-25
Hurricanes	7	11	11	8-12
Major Hurricanes	3	5	6	4-7



FEMA/NWS: Search for the **FREE** weather alert app



Get tips to survive natural disasters, customize your emergency checklist, and save meeting locations.



Receive alerts from the National Weather Service.



Locate open shelters and Disaster Recovery Centers, and apply for assistance.

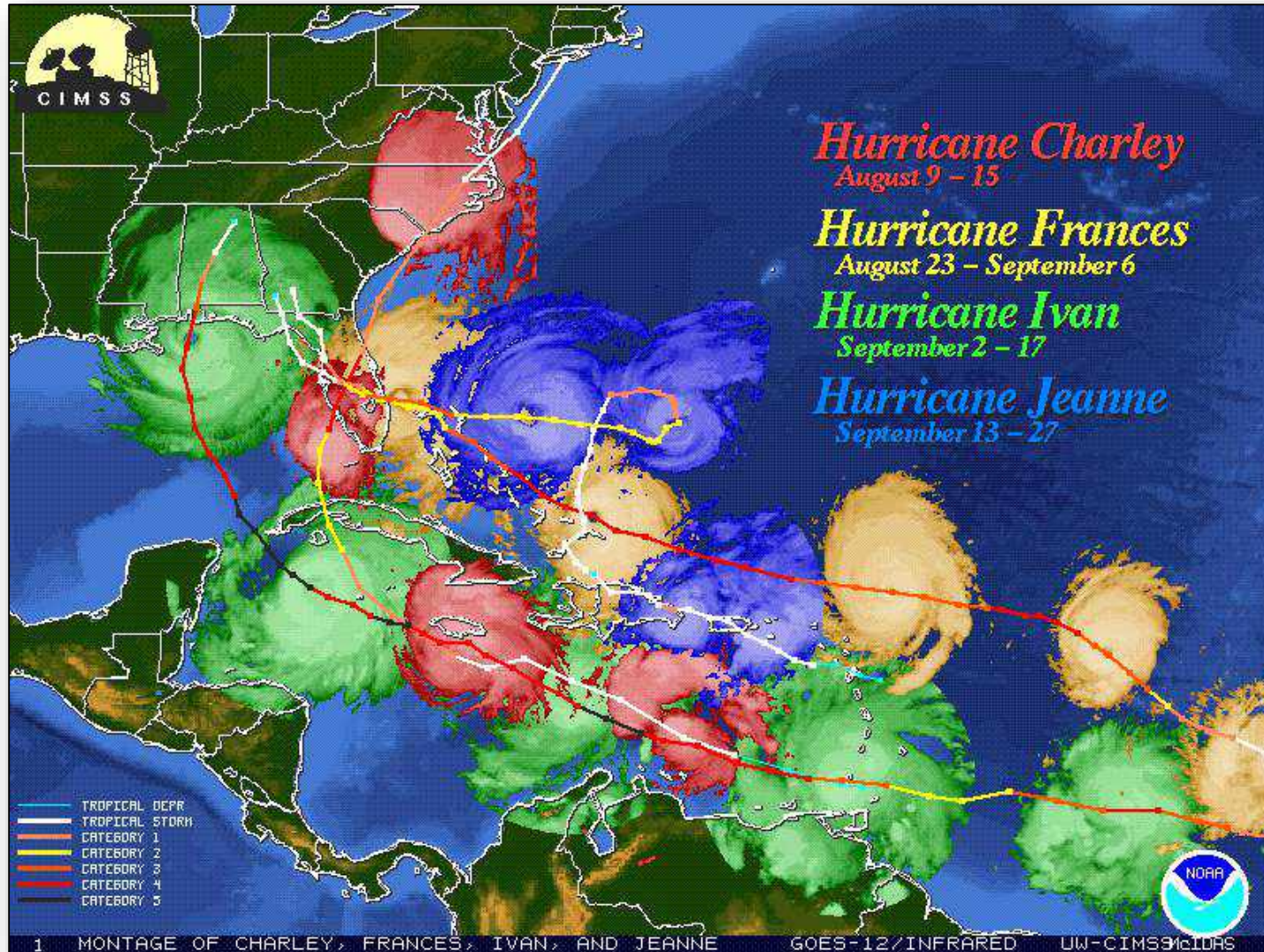


Upload and share your disaster photos.



Stay connected on social media and the FEMA blog.





<https://weather.gov/tampa>
<https://radar.weather.gov>
<https://weather.gov/forecastpoints>
<https://weather.gov/wrn>



NWSTampaBa
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