



UNITED STATES DEPARTMENT OF COMMERCE  
NATIONAL OCEANIC AND  
ATMOSPHERIC ADMINISTRATION



# Record Breaking Hurricane Season 2020 and What's New for 2021

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NOAA/National Weather Service  
National Hurricane Center

2021 Florida Tropical Training



# Just a Few of the 2020 Records (Preliminary)

**\*\*\*6th straight year with at least one named storm prior to the official start of the Atlantic hurricane season**

**\*\*\*Most named storms in a 170 years of record keeping with 30, 14 hurricanes (7 major), and 22 storms had watches/warnings for land areas or made landfall**

**\*\*\*Most U.S. landfalls with 11, surpasses 9 back in 1916**

**5 tropical storms (Bertha, Cristobal, Fay, Beta, Eta (2)**

**6 hurricanes (Hanna, Isaias, Laura, Sally, Delta, Zeta)**

**4 landfalls in Louisiana (TS Cristobal, H Laura, H Delta, H Zeta)**

**8 landfalls along the Gulf Coast (Cristobal, Hanna, Laura, Sally, Beta, Delta, Zeta, Eta)**

**\*\*\*Only the second time on record having 5 or more tropical cyclones at the same time**

**\*\*\*Tied with 1886 and 1985 for the most hurricane landfalls in season for the U.S.**

**\*\*\*\*13 International landfalls, two CAT4 landfalls in Nicaragua two weeks and 15 miles apart with Eta and Iota. Subtropical Storm Alpha made landfall in Portugal.**



# Just a Few of the 2020 Records

(Preliminary)

**\*\*\*One of the highest storm surge events for Louisiana during Hurricane Laura, around 18 ft (5.49 m)**

**\*\*\*Third most hours flown for the USAF 53<sup>rd</sup> hurricane hunters, only 1985 and 2005 were higher. NOAA AOC highest ever, 681.3 hours, over 110% higher than average and more than 10% higher than the previous bench mark in 2005**

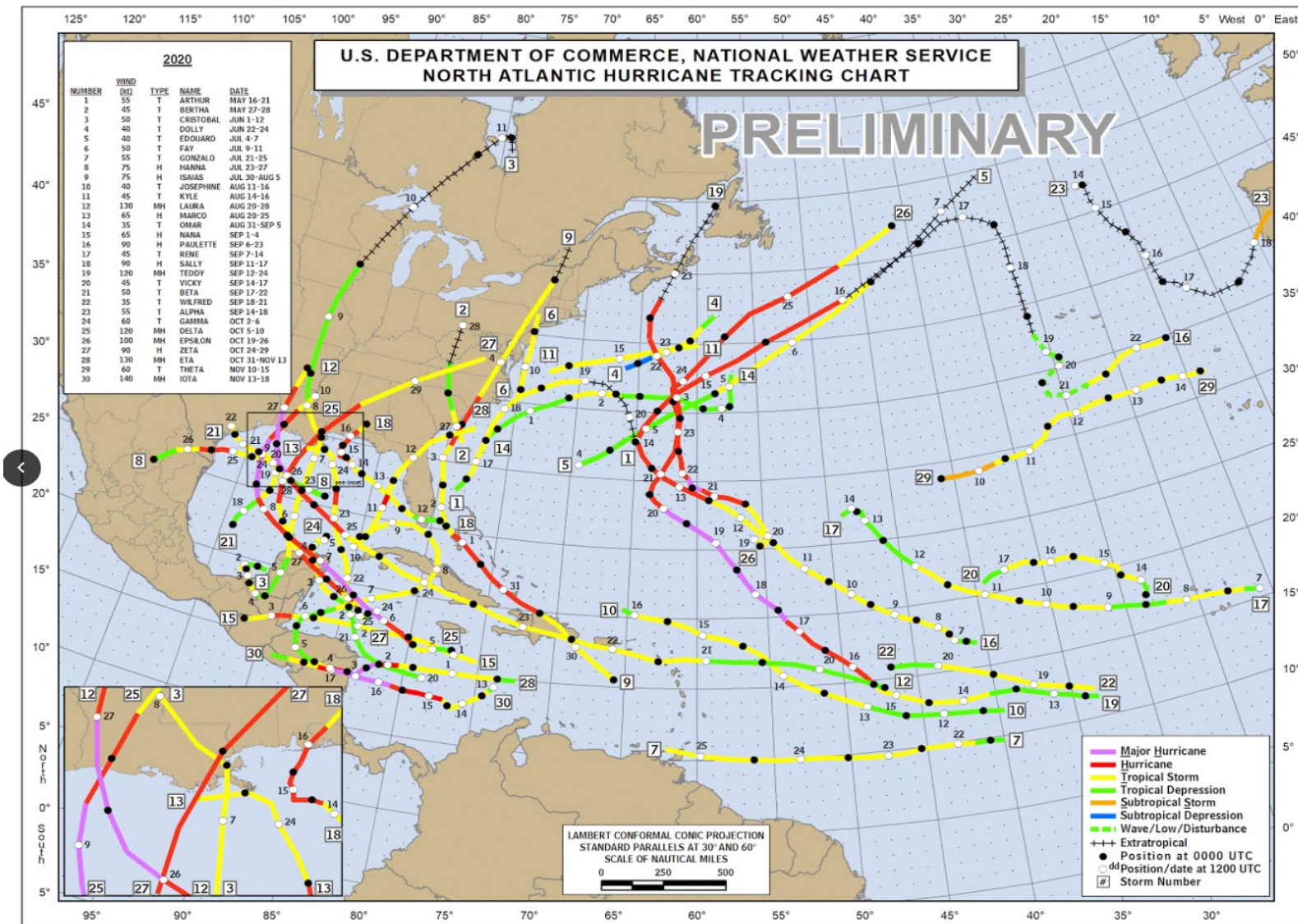
**\*\*\*639 advisory packages in the Atlantic only, for the season, average is 322**

**\*\*\*First time with two major hurricanes in November**

**\*\*\*Latest CAT5 on record**



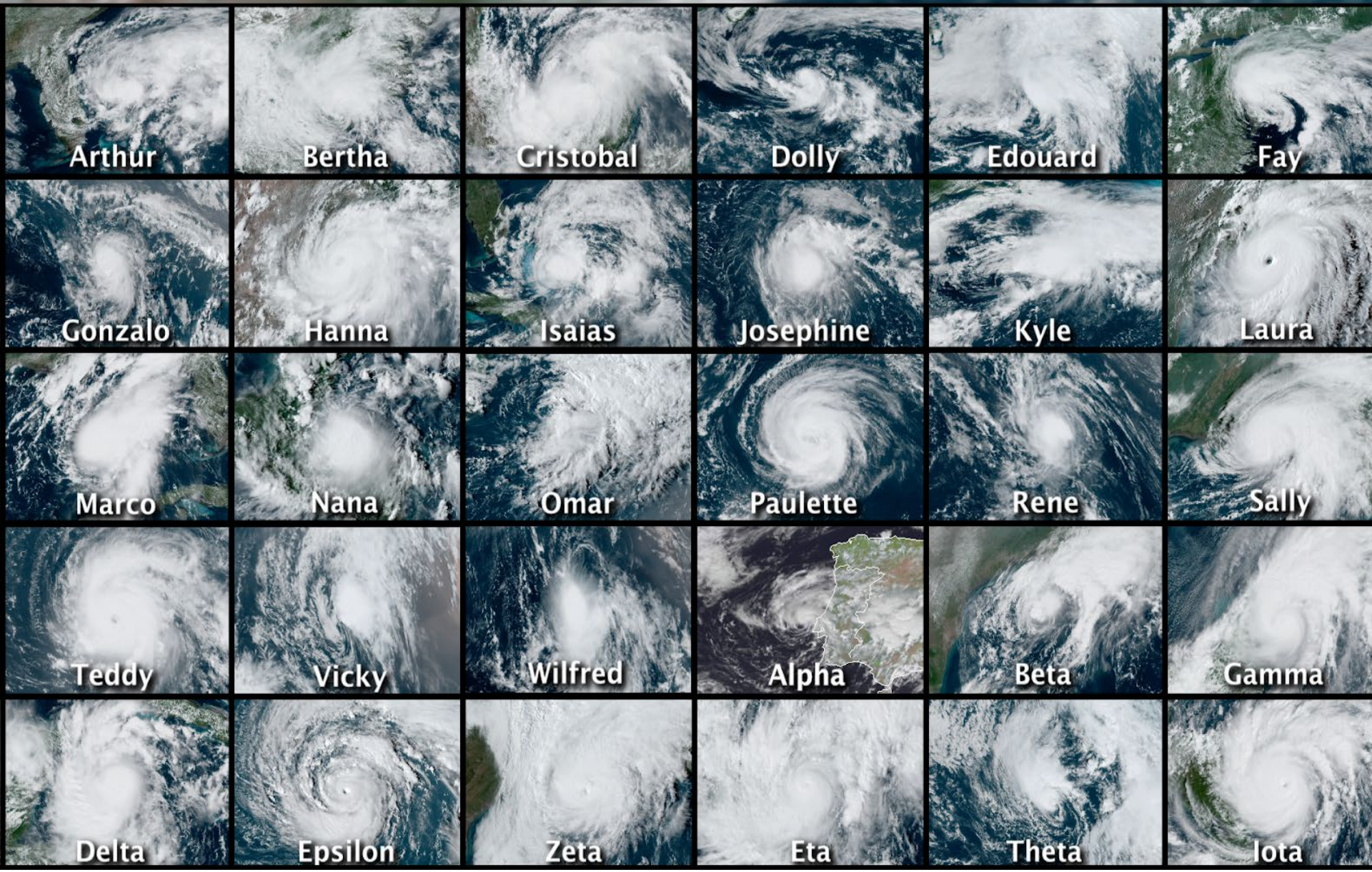
# Deep Into Two Alphabets







# The 2020 Atlantic Hurricane Season







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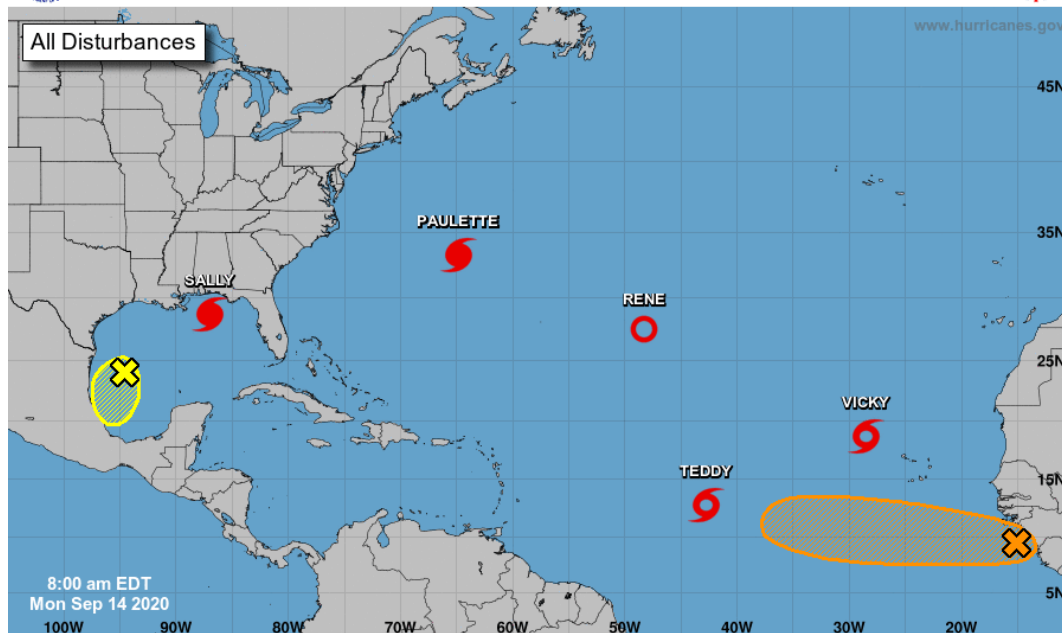
# 10 Named Storms Formed in September

5 active Atlantic TCs  
on 14-15 September  
(Paulette, Rene,  
Sally, Teddy, Vicky)



## Five-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida

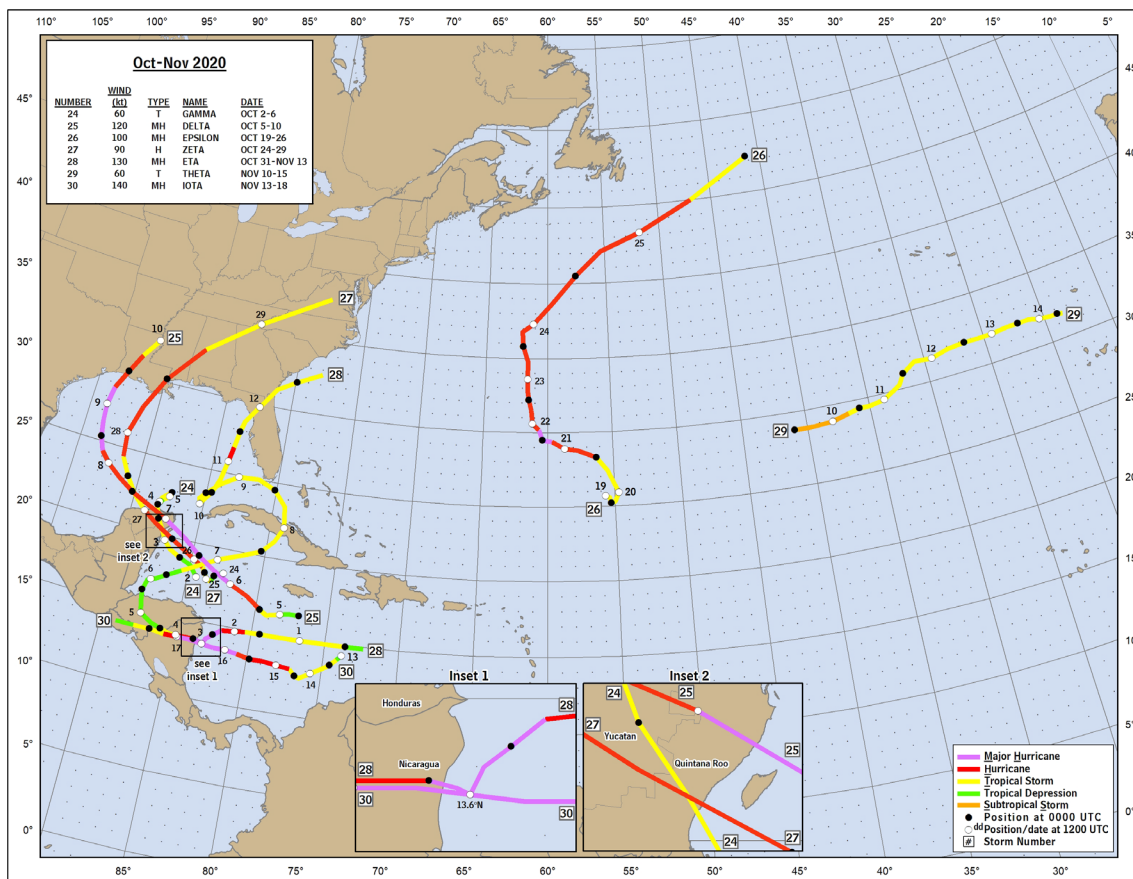


Current Disturbances and Five-Day Cyclone Formation Chance: < 40% 40-60% > 60%  
Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane  
 Post-Tropical Cyclone or Remnants



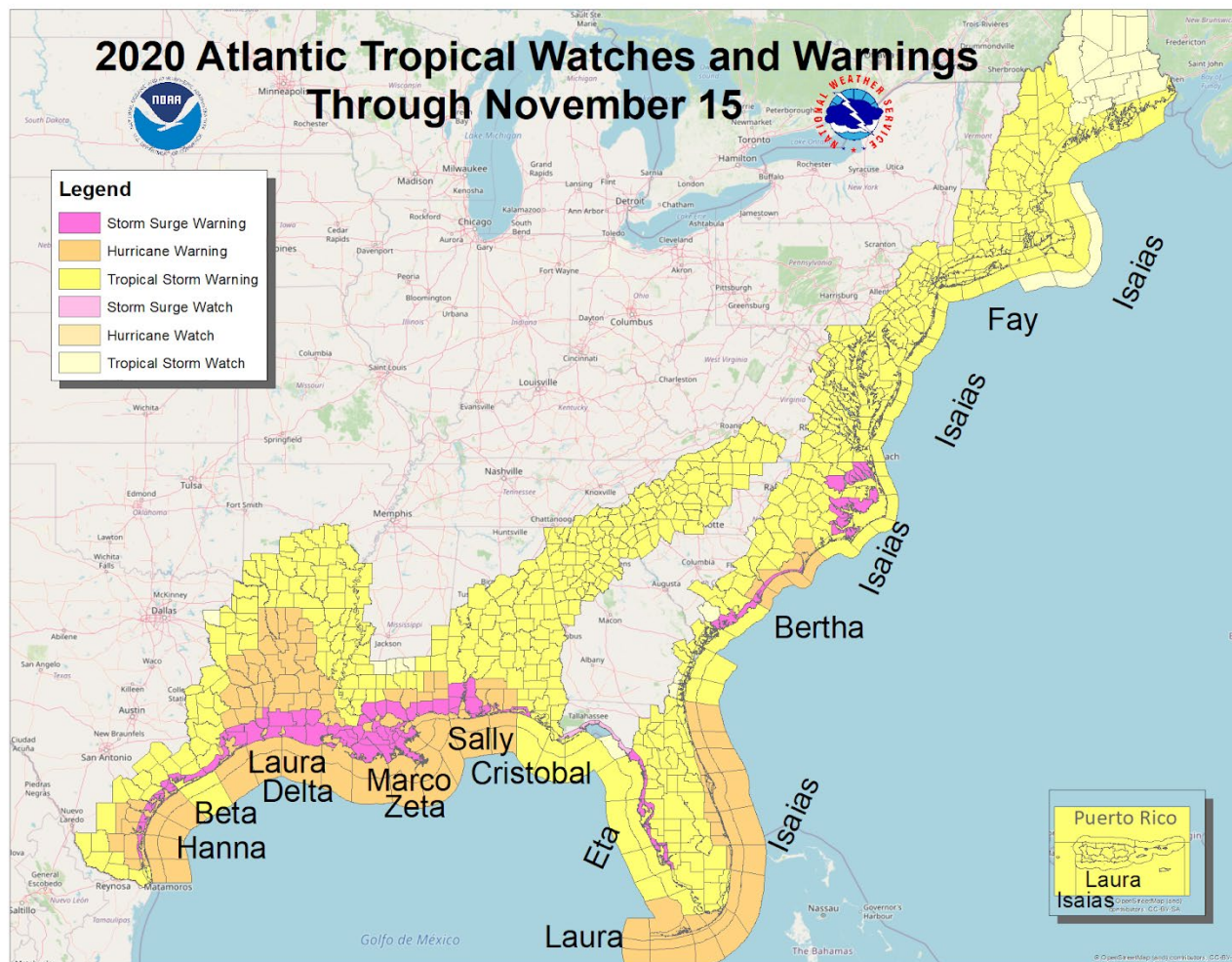
# 7 Named Storms Formed in October and November

7 active Atlantic TCs in October and November  
(Gamma, Delta, Epsilon, Zeta, Eta, Theta, Iota)





# A Whole Team Effort



- Atlantic U.S. coastal hurricane warnings in effect: **378 hours (15.75 days)**

- Coastal watches and warnings in effect for Louisiana: **474 hours (19.75 days)**

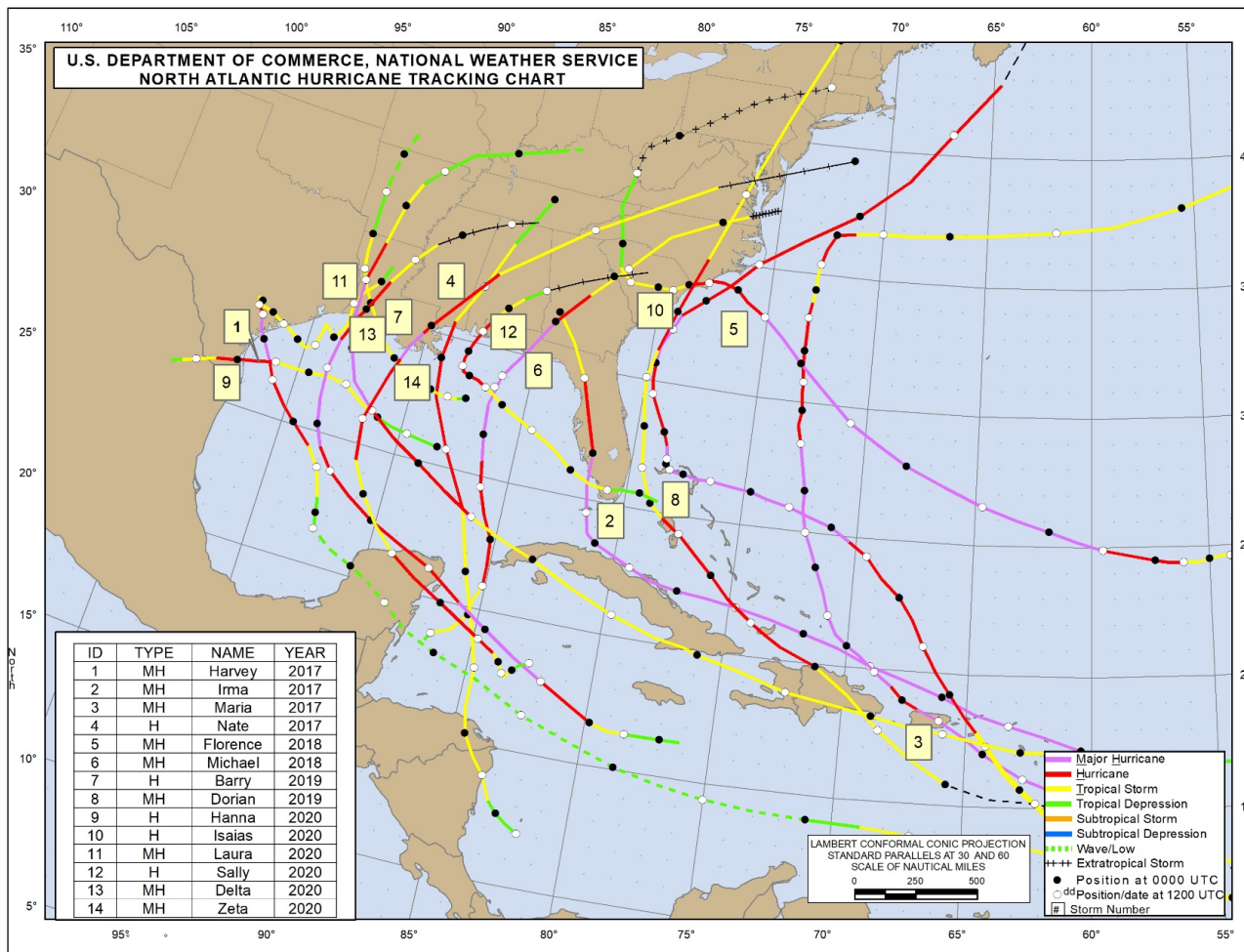
- 14 systems required issuance of watches or warnings on first advisory

Image courtesy Penny (Zabel) Harness, WFO Corpus Christi





# Yes, it has been active

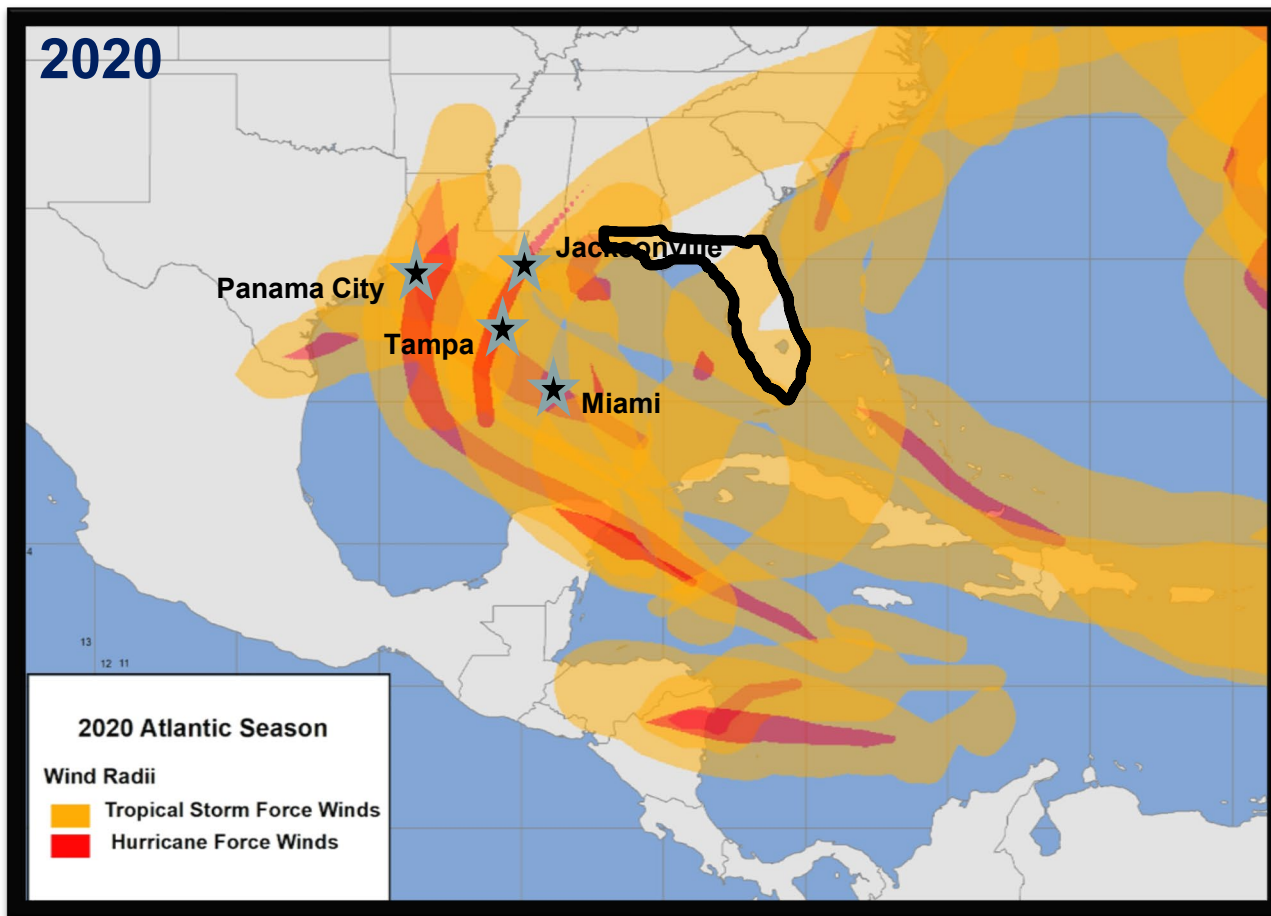


• **14 hurricanes have made landfall in the U.S. since 2017 (6 were major)**

- Total U.S. Damage:
  - **\$353 Billion**
- Number billion dollar storms:
  - **12**
- Number 10 billion dollar storms:
  - **6**



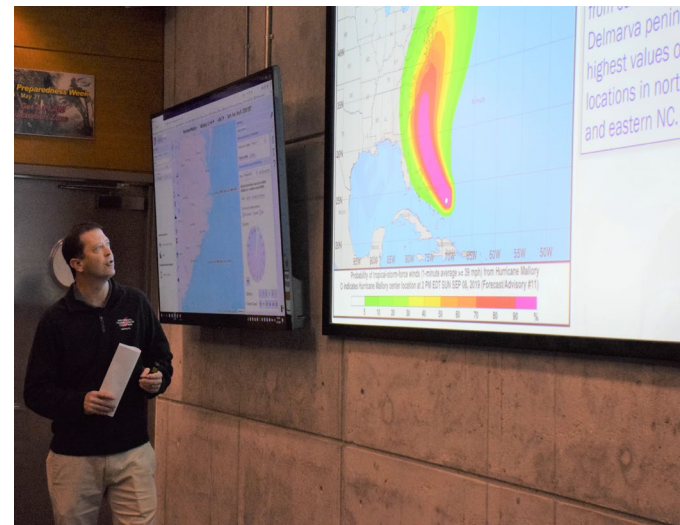
# Florida, what if?







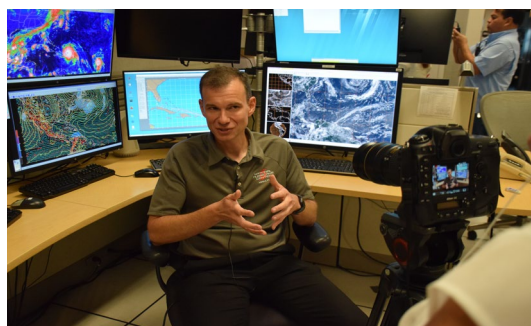
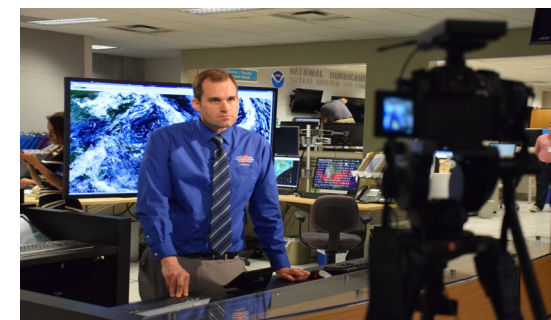
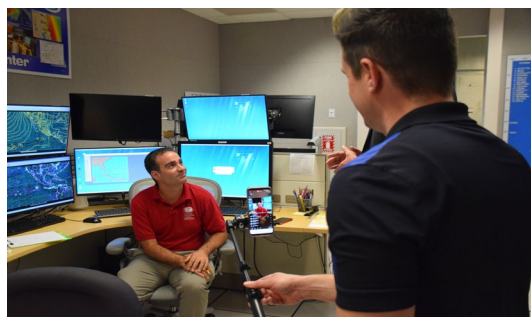
# Normal Pre-Season







# Normal Pre-Season







# Normal Pre-Season





# Pandemic Season



IVEGABAJ2  
@VegaBajaWx

NWSSanJuan: "¡Gracias a todos lo que participaron en el webinar de hoy!



Pendientes al 2do webinar en español que será este miércoles.

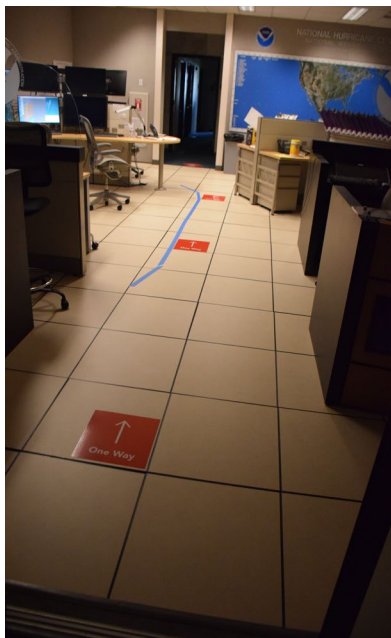
Registrate: [register.gotowebinar.com/register/63014...](https://register.gotowebinar.com/register/63014...)

#HurricanesAtHome NWSNHC"

Translate Tweet



**NHC Gone Virtual with Hurricanes at Home and New Tools to Collaborate – Keeping us safe so we can keep the public safe!**



Tonya  
@tvrivers

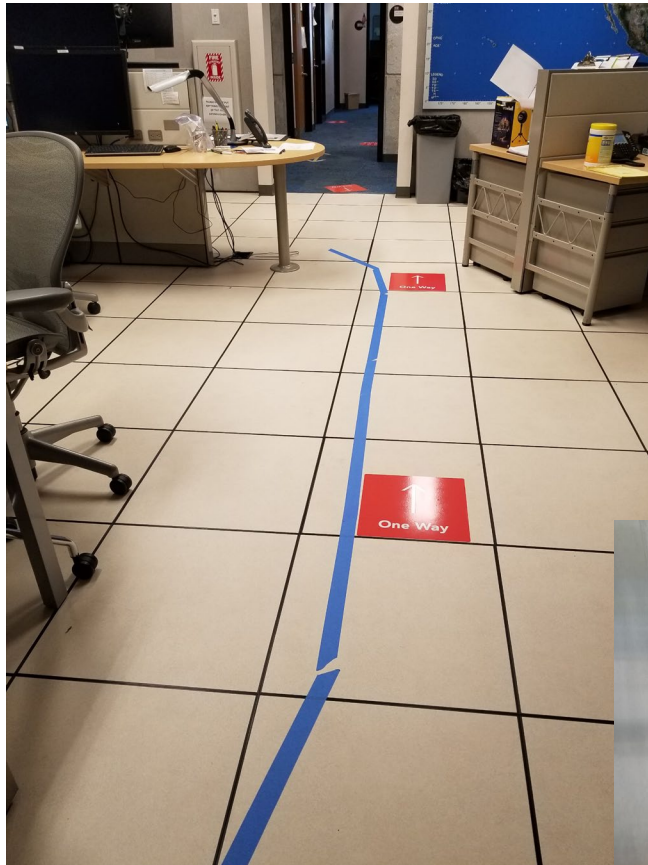
Watching the Hurricanes at Home Webinar. Thanks @NHC\_Atlantic and @NWSWakefieldVA for doing this for our students. 🌊





# Pandemic Season

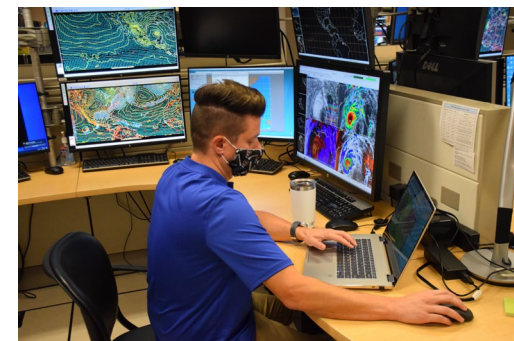
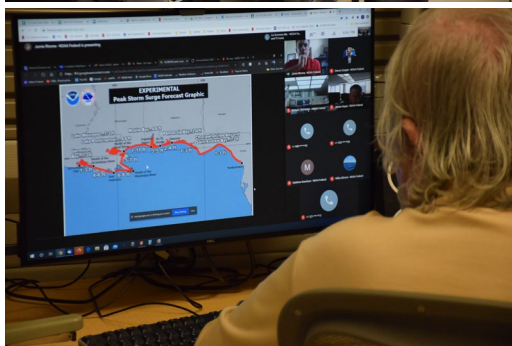
- 1) Moved Workstations
- 2) Cohort Schedule
- 3) Limit those in the building
- 4) Safety plan
- 5) Distancing at all times
- 6) Masks and PPE
- 7) Combination of office and telework
- 8) COOP planning and testing
- 9) Virtual shift change
- 10) Video collaboration







# Keeping us safe, so we can keep the public safe!







# Pre-Deployment COOP



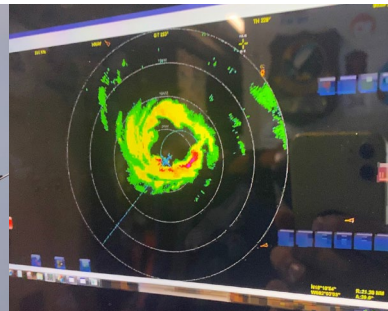
NHC pre-COOP College Park, MD



# Challenging Aircraft Coordination

- Aircraft reconnaissance

- Huge workload with systems near land and numerous simultaneous systems
- Forward deployment limitations, staffing and maintenance challenges with the pandemic
- Multiple evacuations of Keesler AFB by 53RD WRS complicated their operations
- Overflight clearances





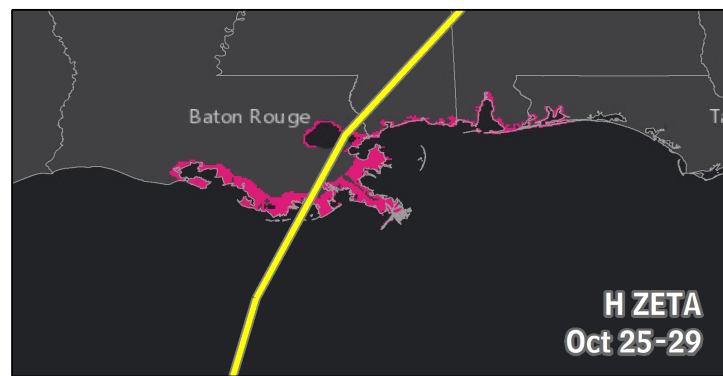
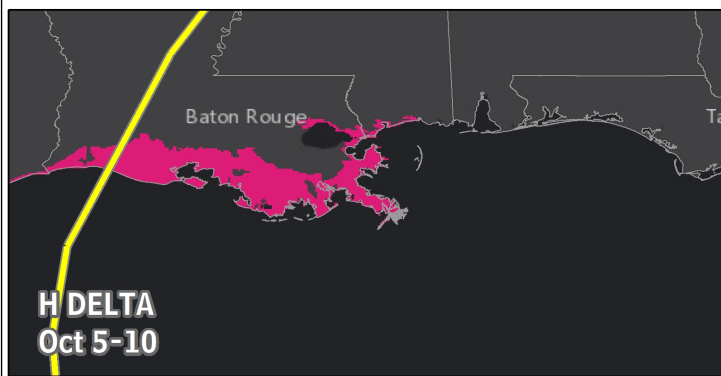
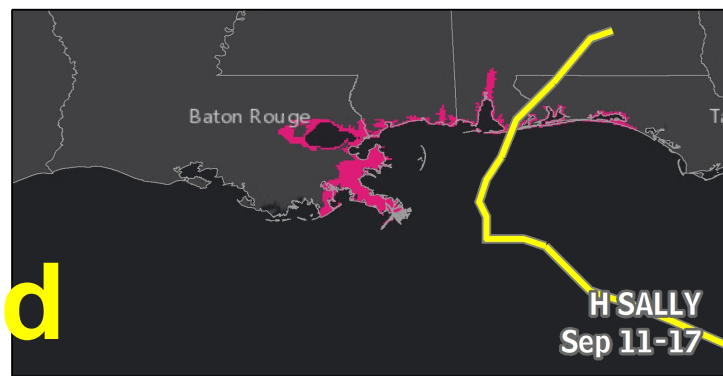
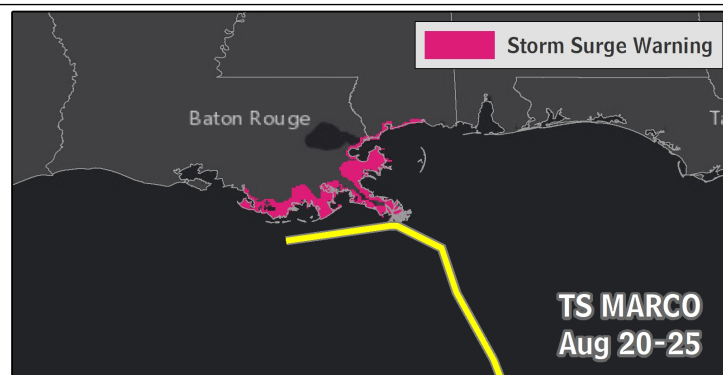
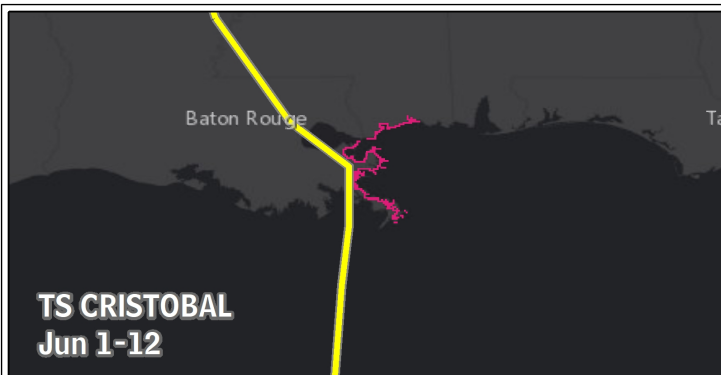
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# A Few Thoughts Going Forward



# 1. Words Matter

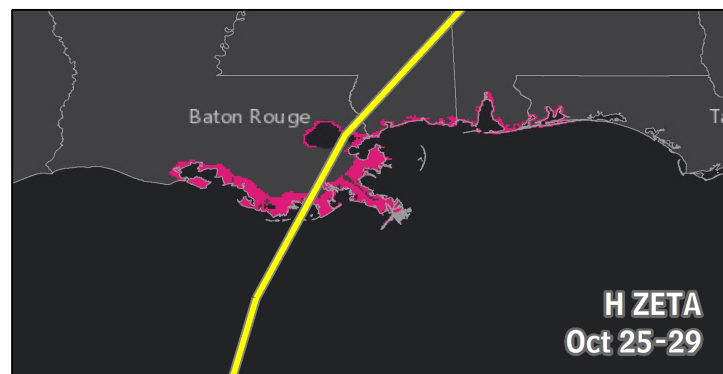
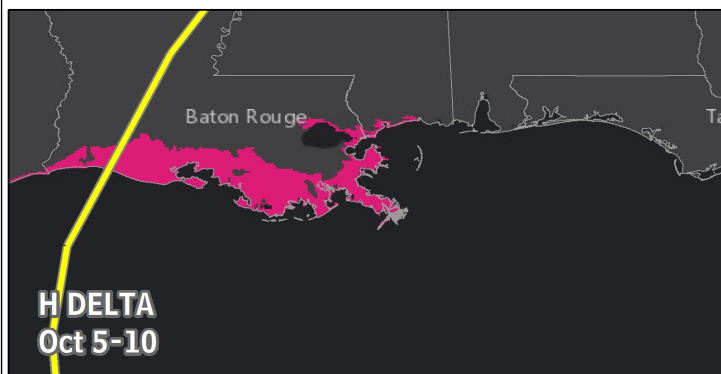
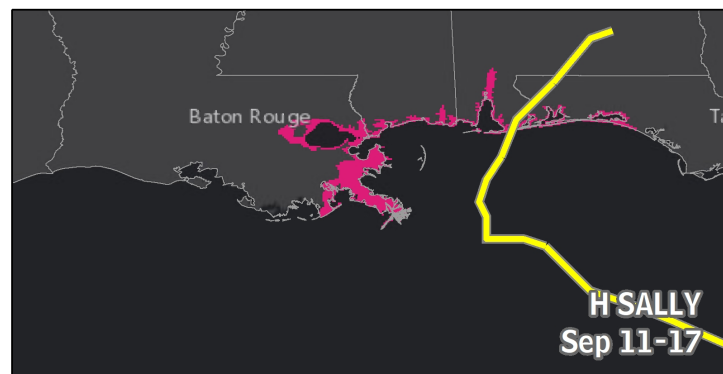
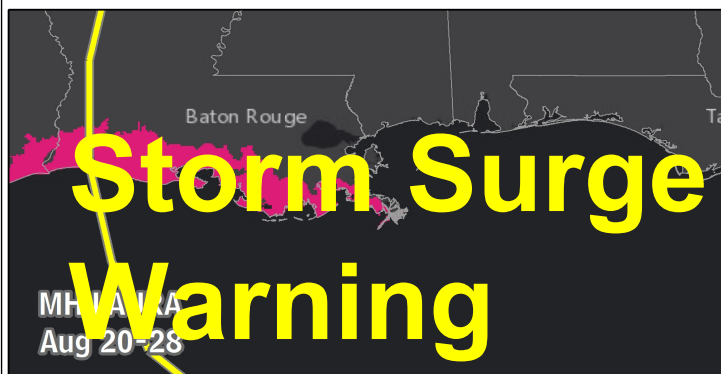
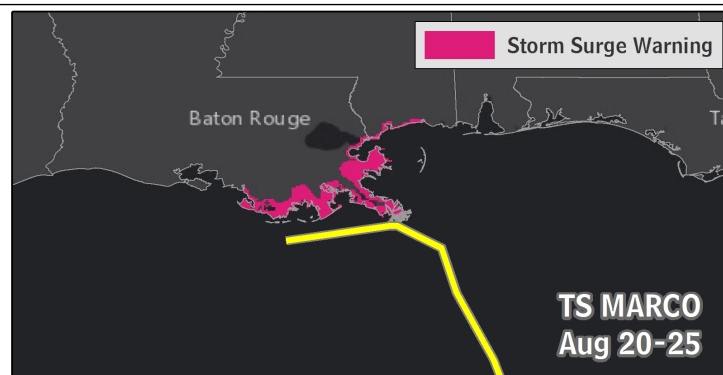
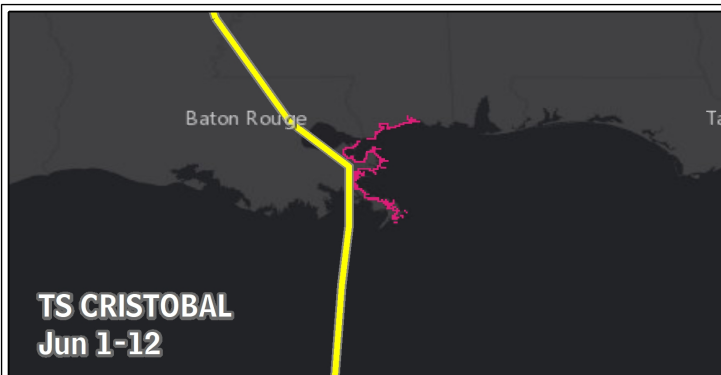


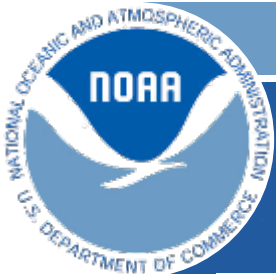
15 to 20 feet  
Above Ground



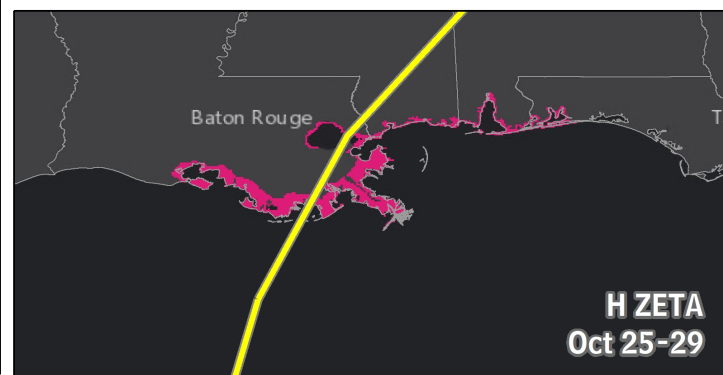
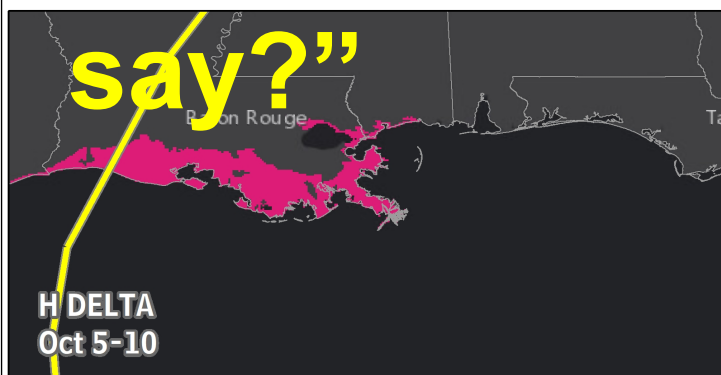
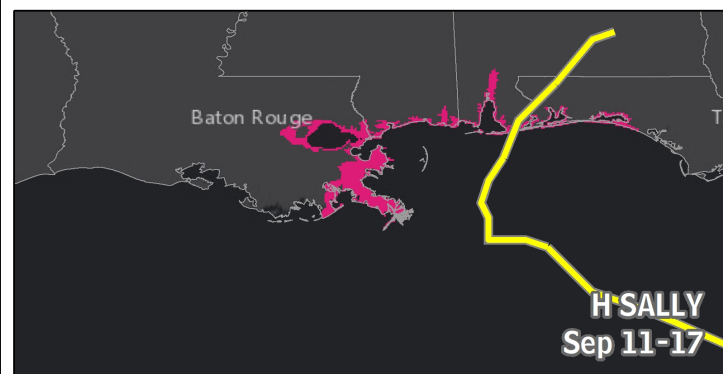
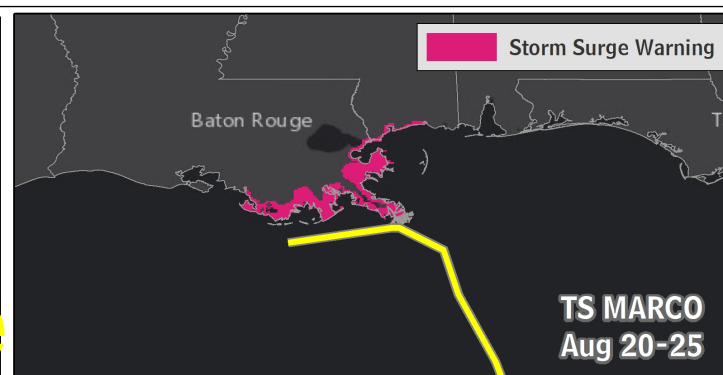


# 1. Words Matter





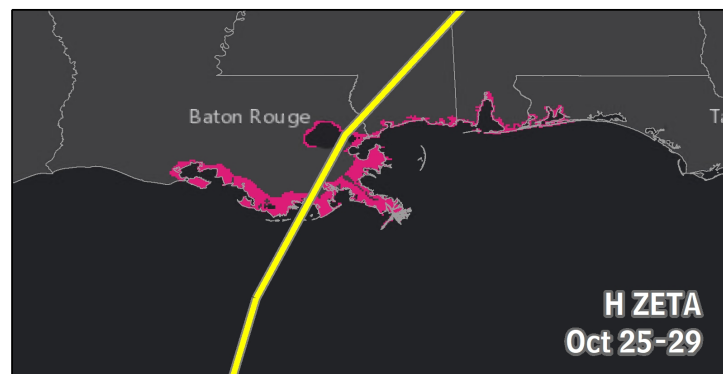
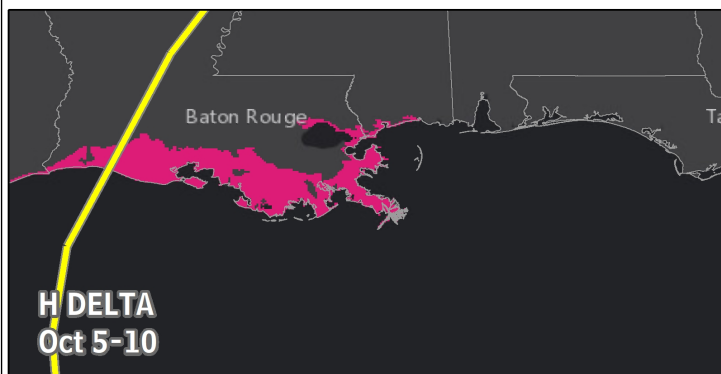
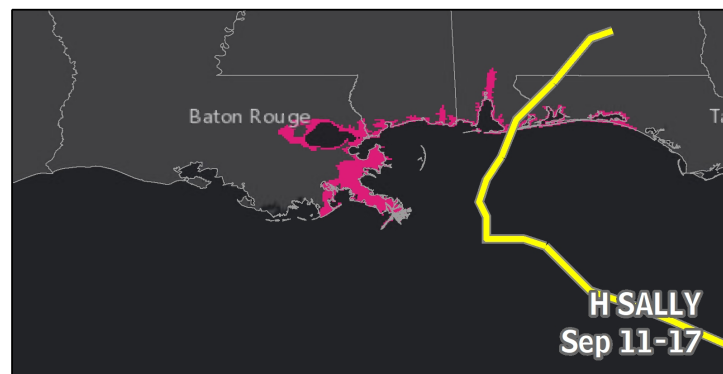
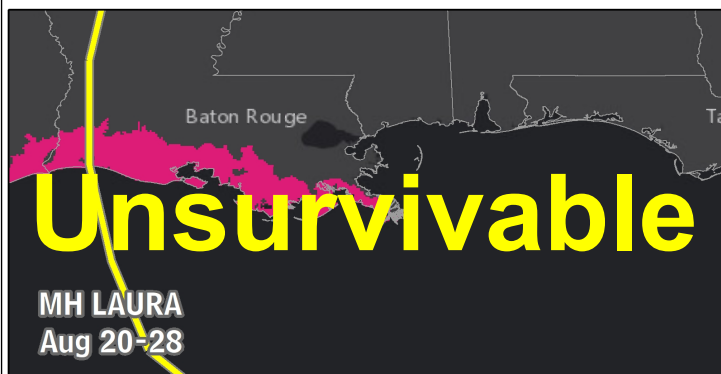
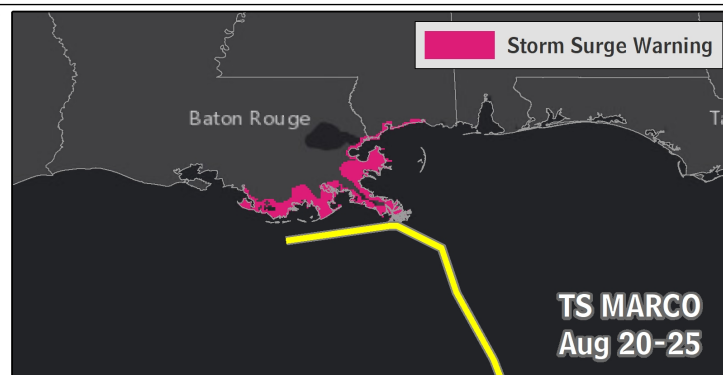
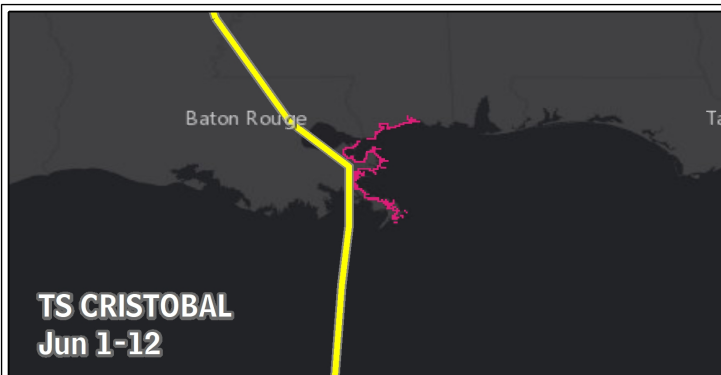
# 1. Words Matter



**“We still have  
people not  
evacuating,  
what can we  
say?”**

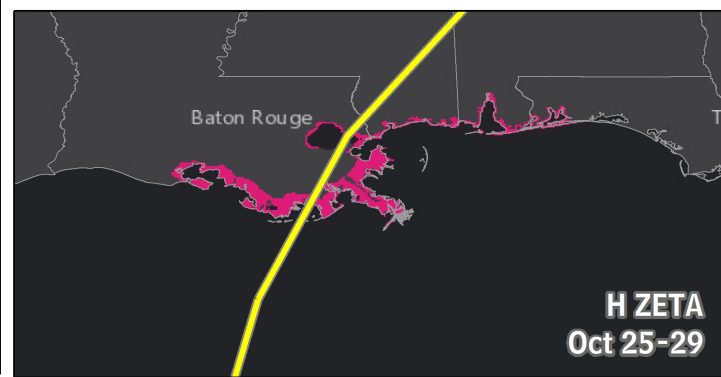
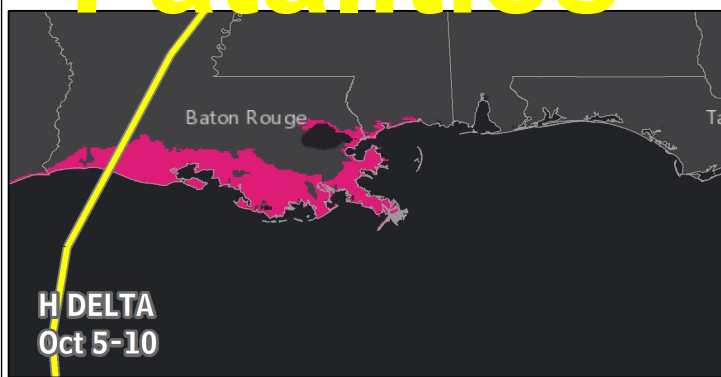
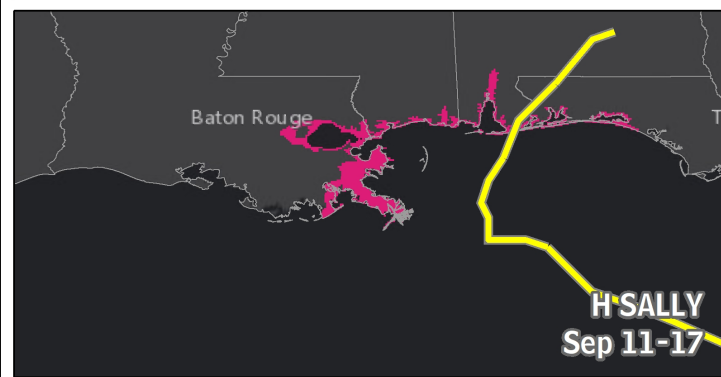
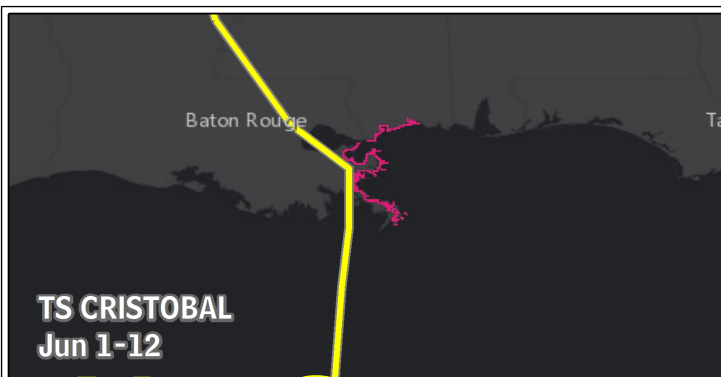


# 1. Words Matter





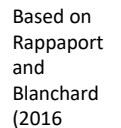
# 1. Words Matter



**No Storm  
Surge  
Fatalities**



1963-2012  
indirect  
deaths (heart  
attacks,  
power  
problems  
(e.g., no A/C,  
lights,  
medical  
equipment),  
etc.).  
Outnumber  
direct deaths  
in some  
storms.



A pie chart illustrating the distribution of age groups. The chart is divided into three segments: a large red segment representing the '>60' group at 58%, a medium gray segment representing the '31-60' group at 28%, and a small gray segment representing the '0-30' group at 14%.

Age Group	Percentage
0-30	14%
31-60	28%
>60	58%

8 **times** as many victims age over 60 as under 21 years old





## 2. Indirect Fatalities

Hurricane Laura:	7 Direct Fatalities (Wind 5, 2 Rip Current) 34 Indirect Fatalities (16 from carbon monoxide)
Since 2017:	14 Hurricane Landfalls, 6 Were Major Hurricanes 7 Storm Surge Fatalities
Preliminary 2020:	46 Direct Fatalities (Rip Currents 16, Wind 14, Freshwater 9, Marine 3, Surge 2, Tornado 2) 51 Indirect, with at least 19 carbon monoxide.

Historically, storm surge is the leading cause of fatalities in tropical systems.

In the last 4 years, we've lost more people to carbon monoxide poisoning after a storm than we have storm surge.



# 3. Little Wiggles Matter

## Hurricane Laura

— Laura Actual Track

... Simulated Track Shifted West

**How Might Storm Surge Inundation Have Been Different Had Hurricane Laura Made Landfall 20 Miles Farther West?**

3 to 5 feet lower

1 to 3 feet lower

No Significant Difference

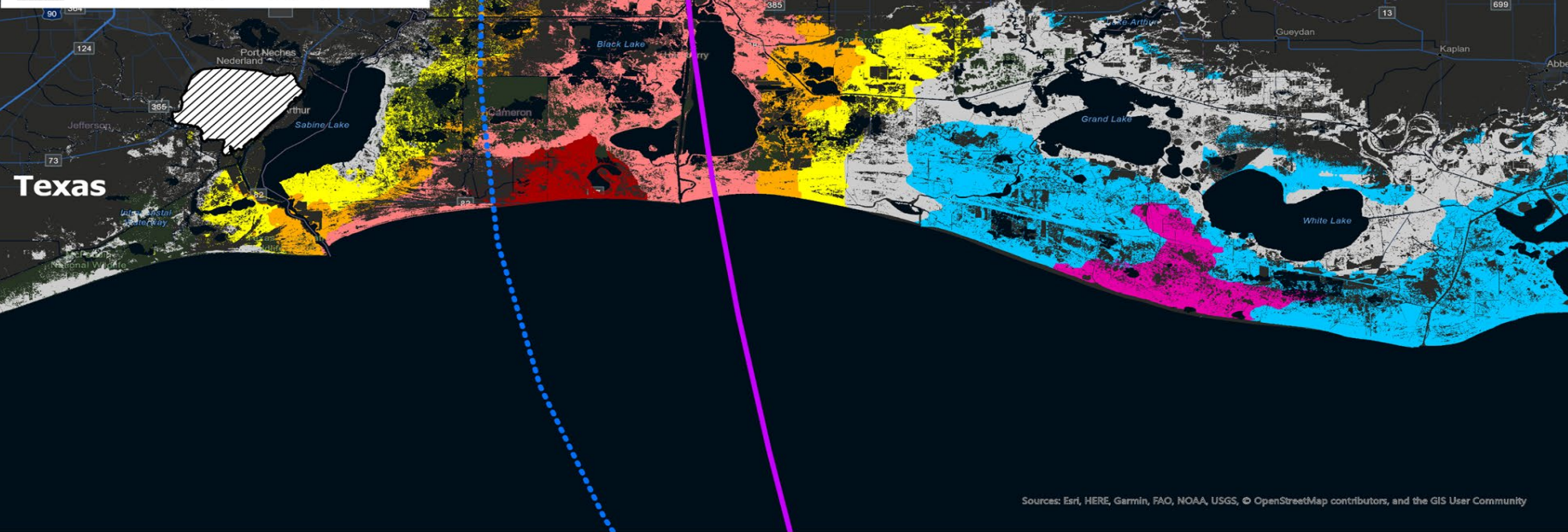
1 to 3 feet higher

3 to 5 feet higher

5 to 10 feet higher

10 to 15 feet higher

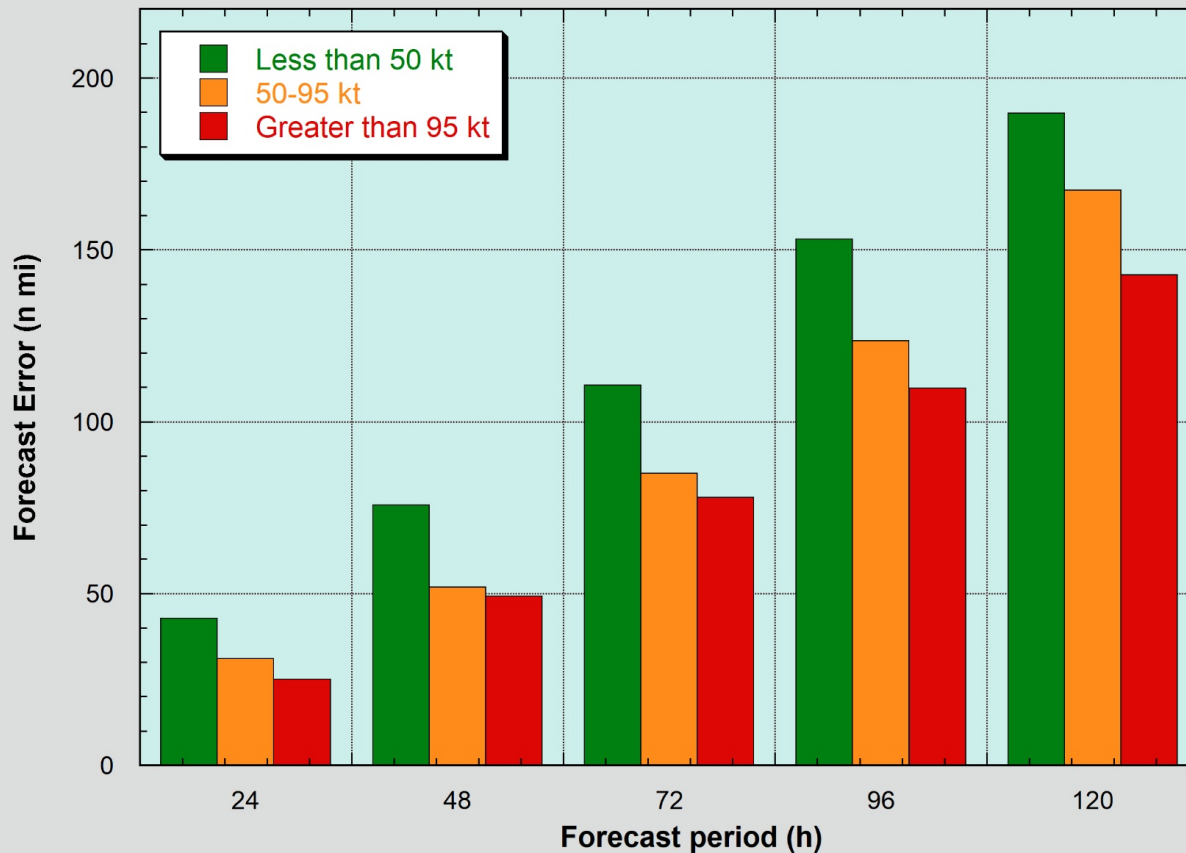
Inundation not mapped for levee area



Sources: Esri, HERE, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

## 4. Every Storm Is Different

**NHC Official Track Forecast Errors by Intensity  
2015-19 Atlantic Basin**

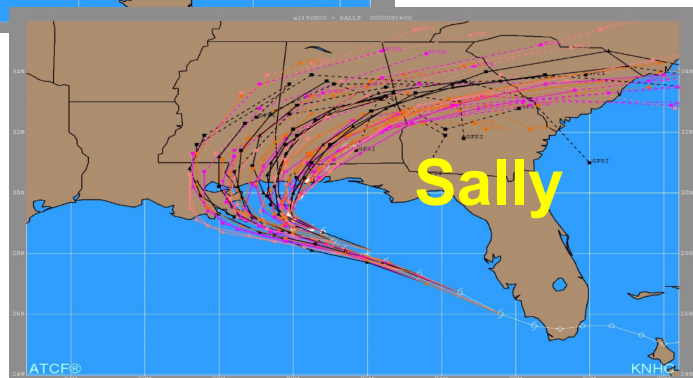
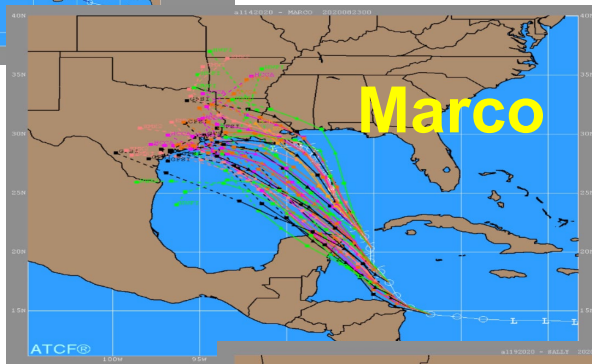
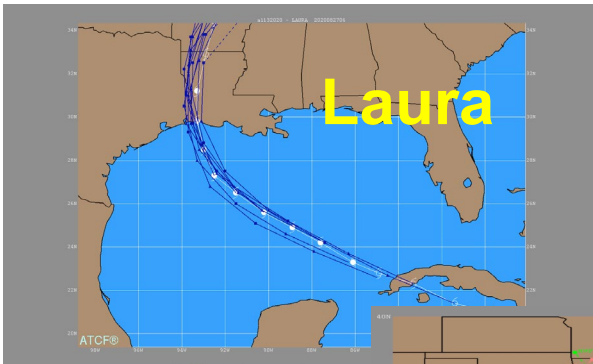


**As the initial intensity of the storm increases, NHC average track error gets smaller!**



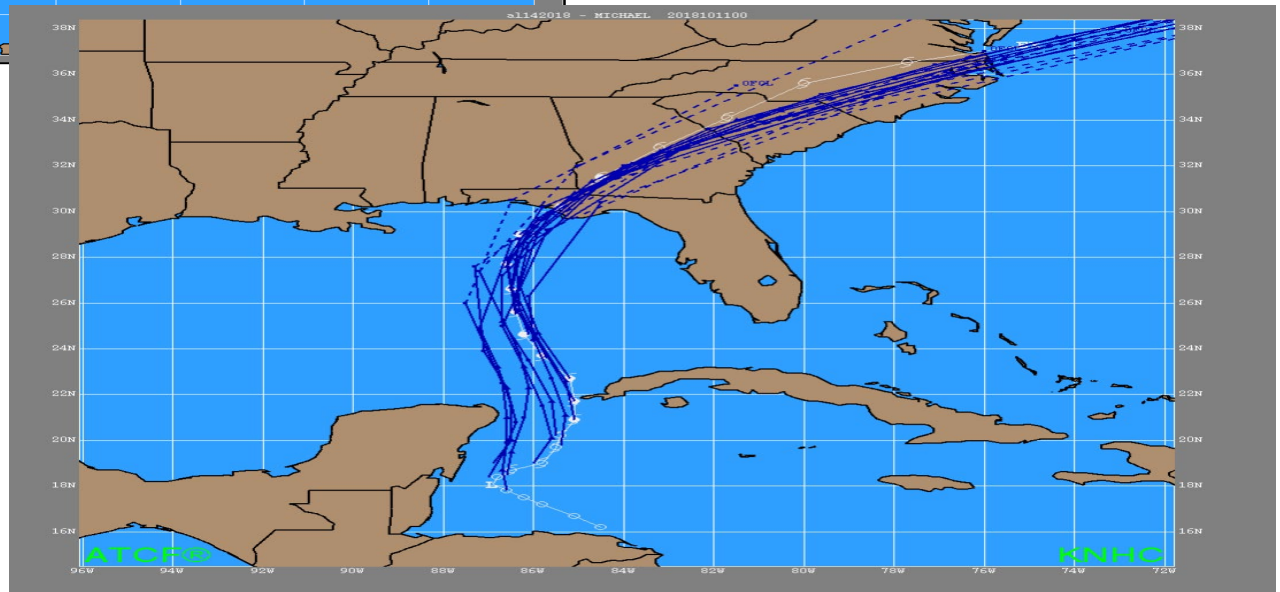
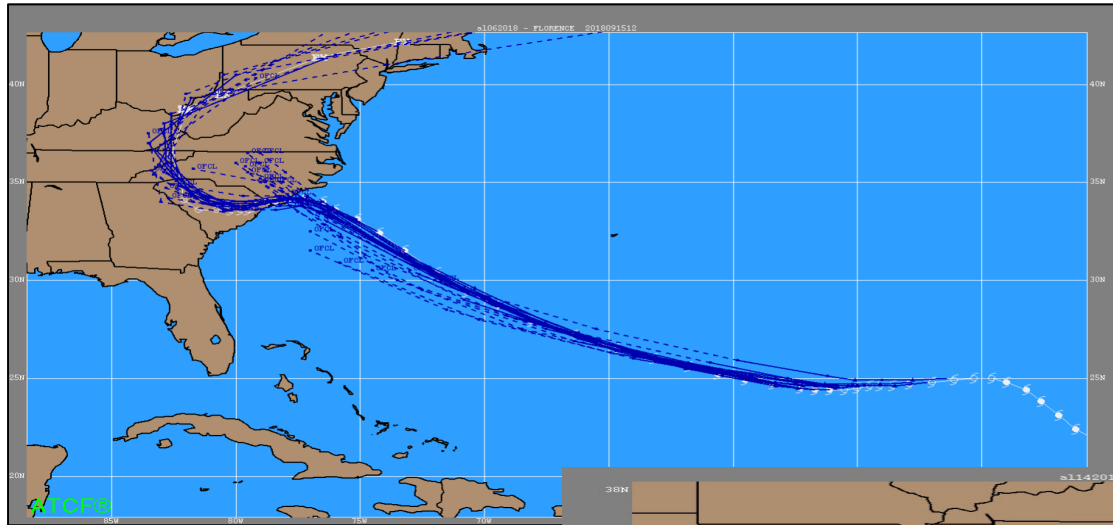
## 4. Every Storm Is Different

**Other factors  
come into play;  
interaction with  
other storms,  
forward speed,  
wind shear,  
eyewall structure,  
and confidence in  
weather patterns**





# 5. Hurricanes Don't Care About Your Timelines



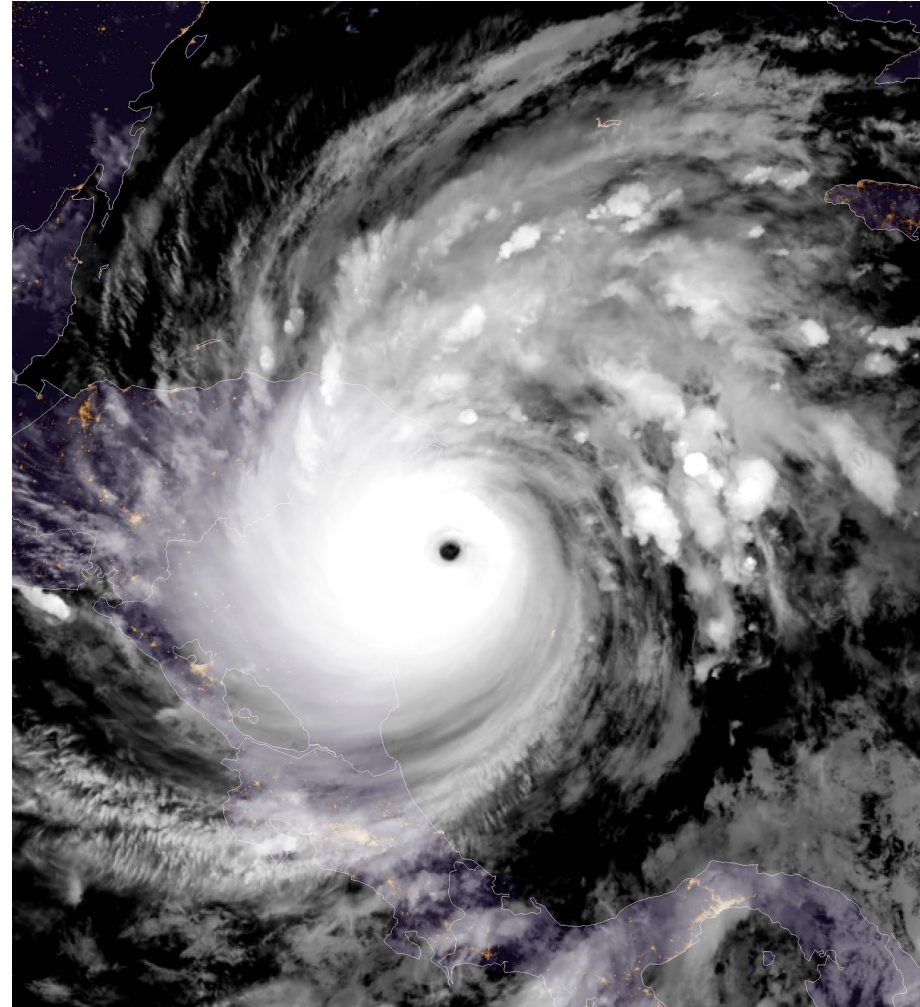


# 5. Hurricanes Don't Care About Your Timelines

9 Atlantic TCs in 2020 underwent RI, **several just before landfall and several rapidly weakened and/or fluctuated**

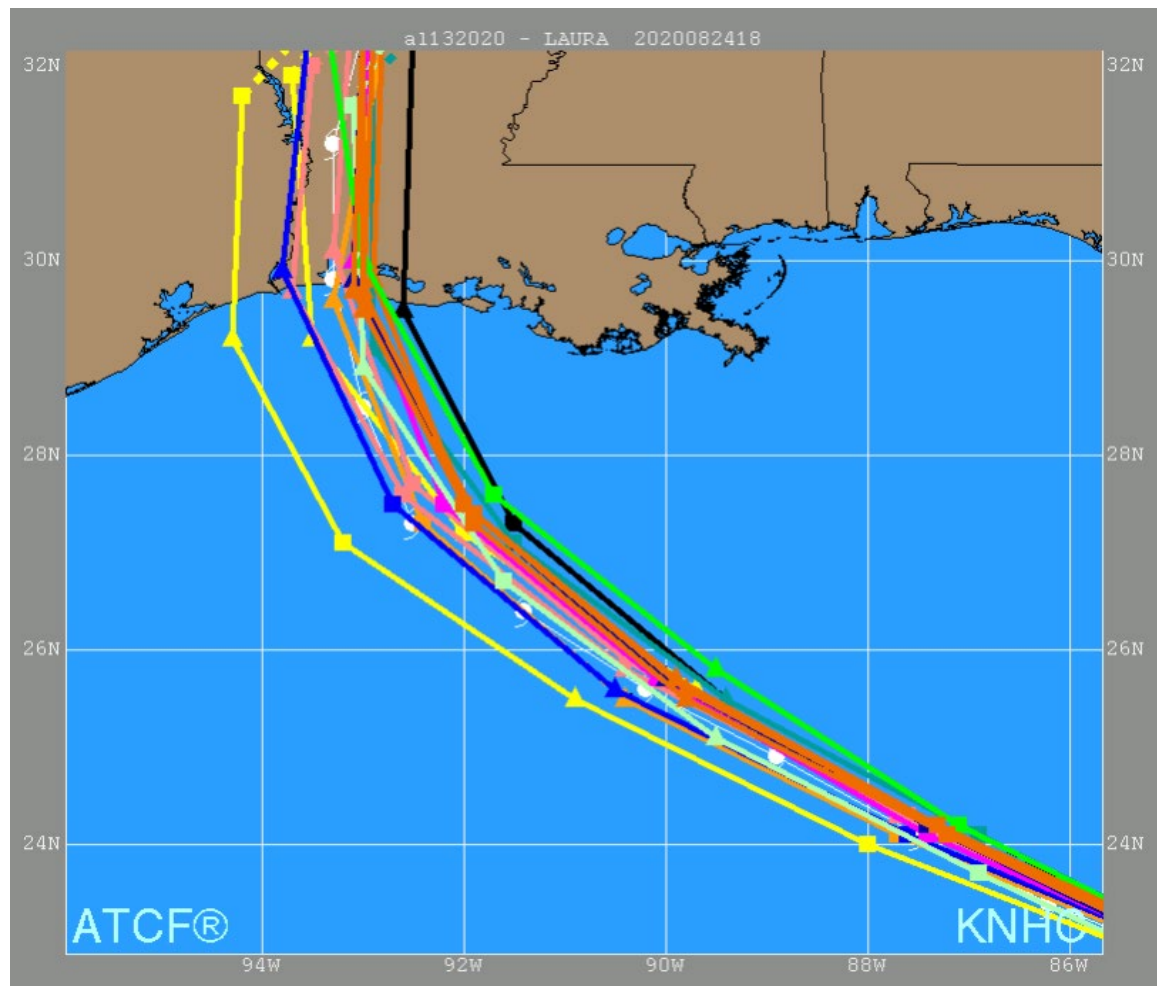
Largest 24-h intensity change:

- Hanna: 30 kt (50 -> 80 kt)
- Laura: 40 kt (90 -> 130 kt)
- Sally: 20 kt in 12 h (70 -> 90 kt)
- Teddy: 35 kt (85 -> 120 kt)
- Delta: 65 kt (55 -> 120 kt)
- Epsilon: 45 kt (55 -> 100 kt)
- Zeta: 40 kt (55 -> 95 kt)
- Eta: 70 kt (60 -> 130 kt)
- Iota: 70 kt (70 -> 140 kt)



## 6. Deterministic Concerns

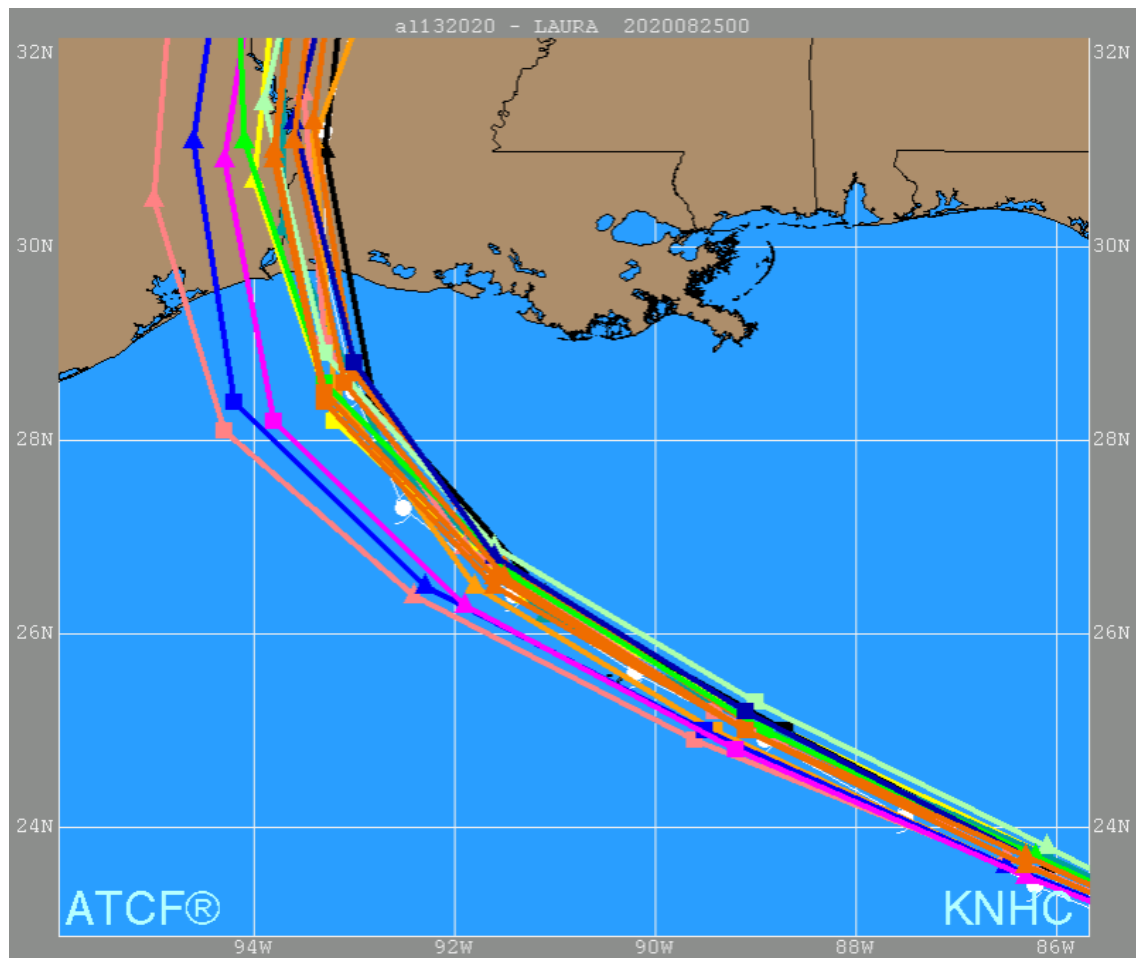
Hurricane  
Laura -  
Guidance  
1800 UTC  
August 24





## 6. Deterministic Concerns

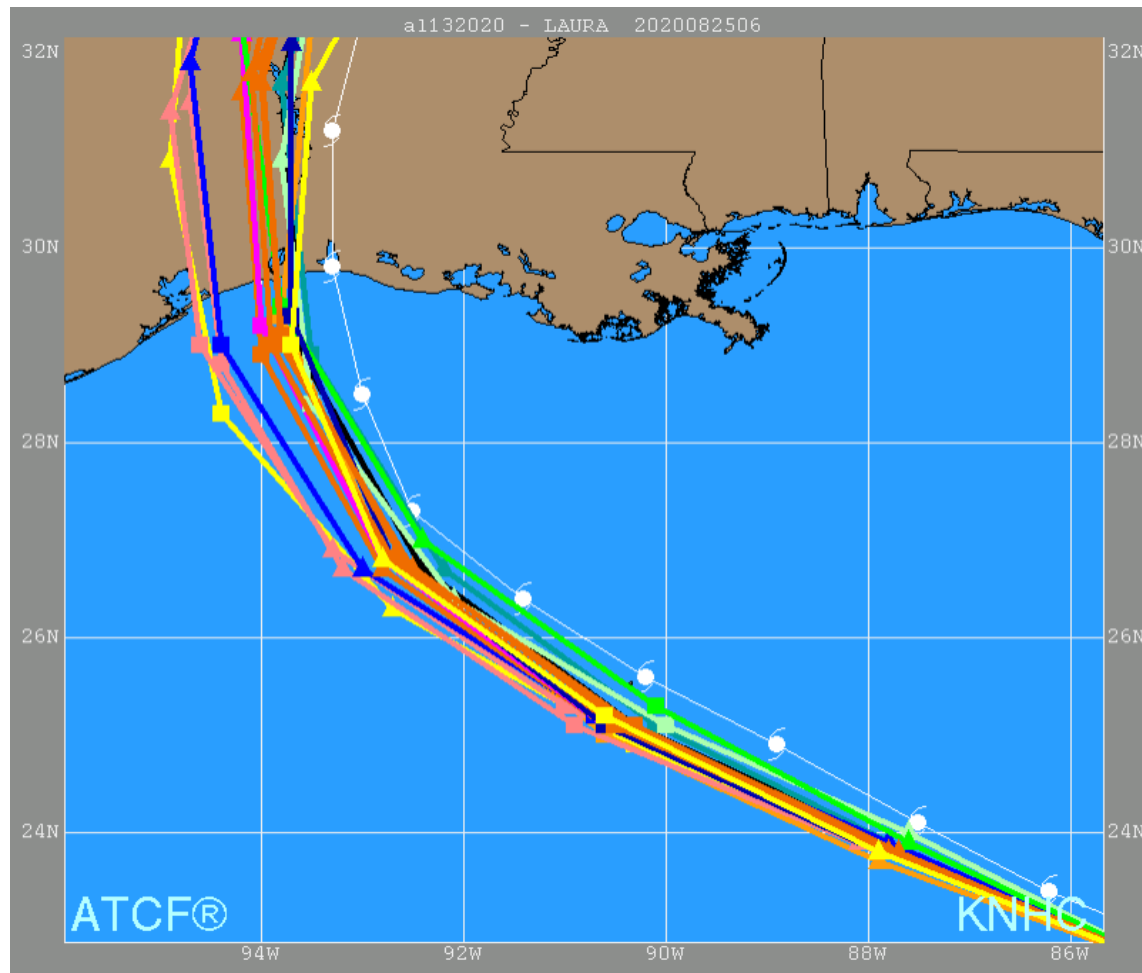
Hurricane  
Laura -  
Guidance  
0000 UTC  
August 25



## 6. Deterministic Concerns

Hurricane  
Laura -  
Guidance

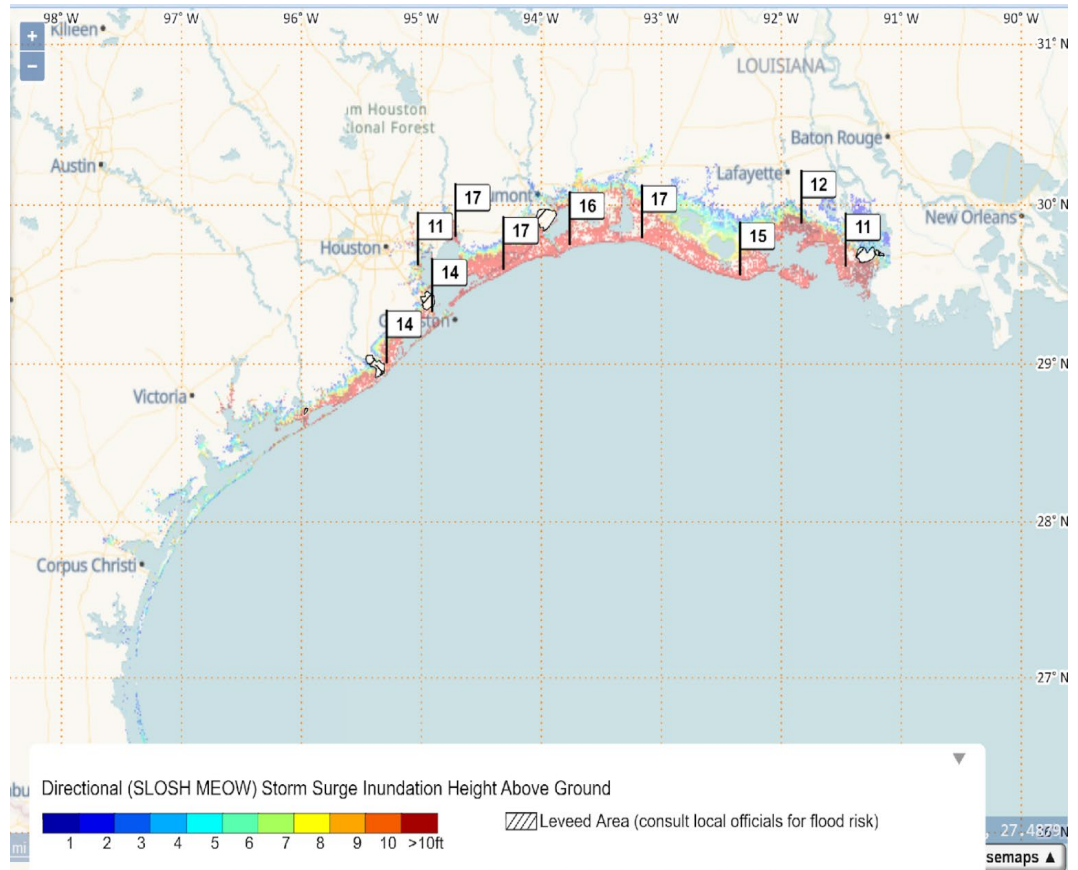
0600 UTC  
August 25



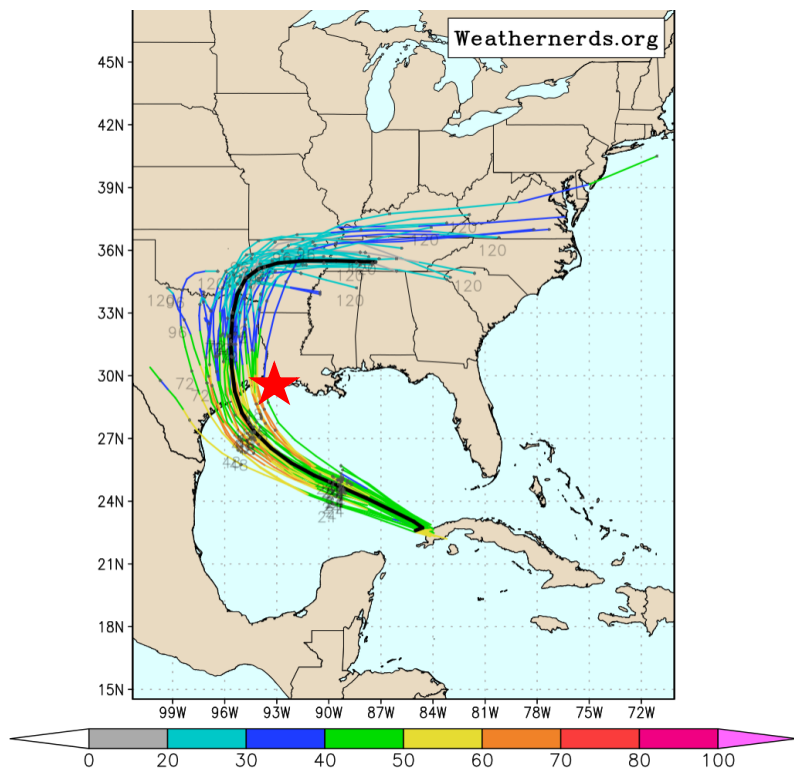


## 6. Deterministic Concerns

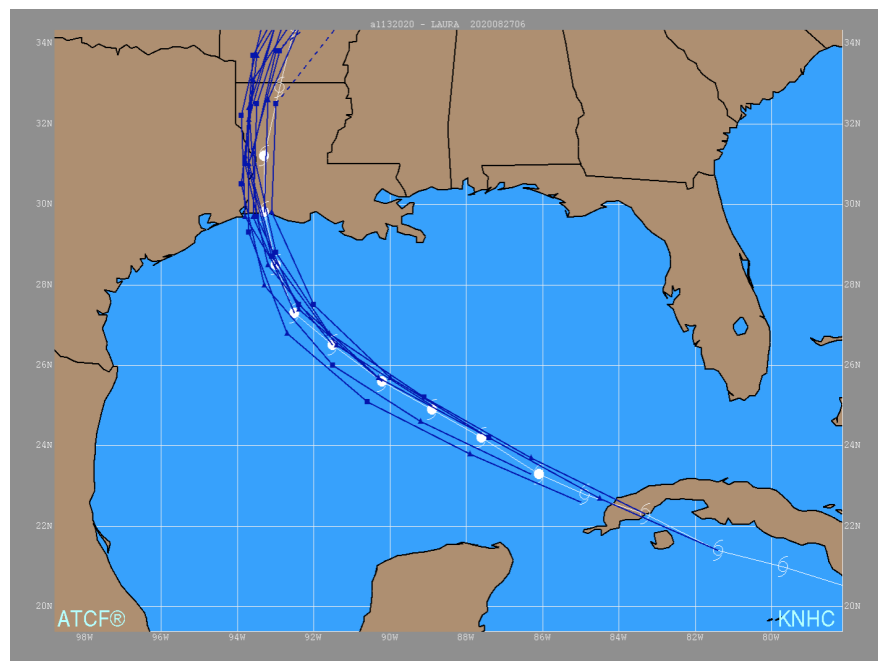
Hurricane  
Laura - Many  
Tracks  
Guidance  
MEOW for  
Storm Surge



# 6. Deterministic Concerns



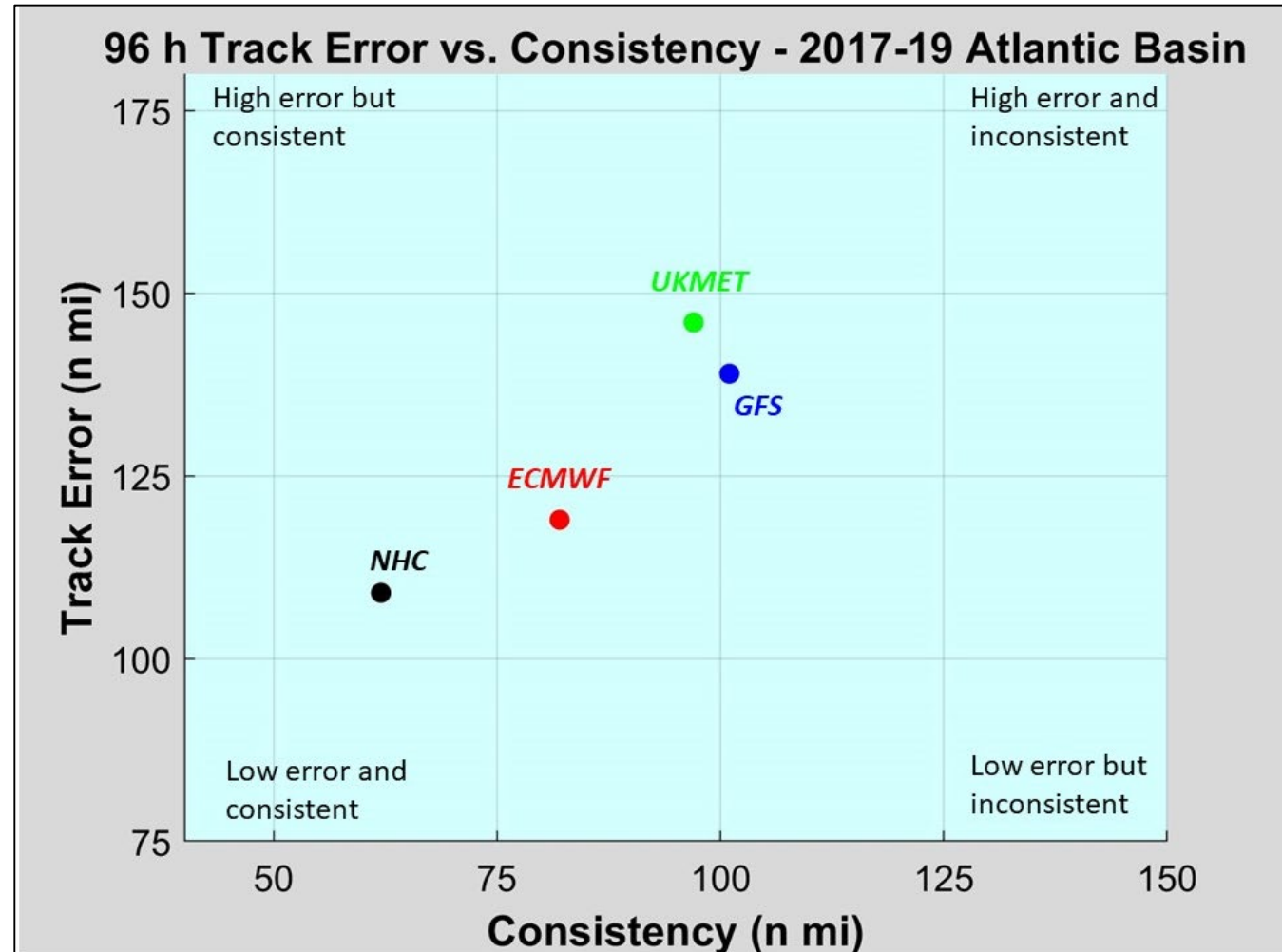
Every ECMWF ensemble member was too far west



Consistency of NHC track forecasts during Laura

## 6. Deterministic Concerns

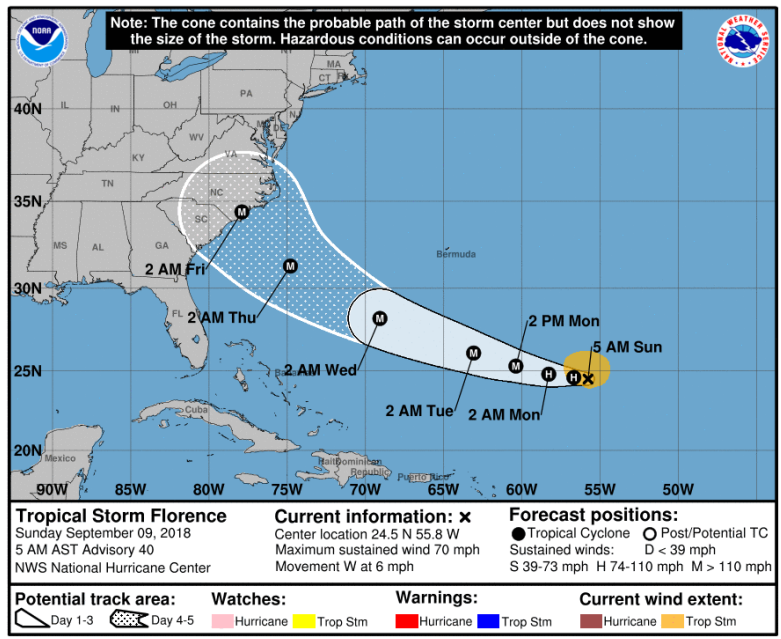
The forecast from NHC has a lower average track error and is more consistent than any individual model overall



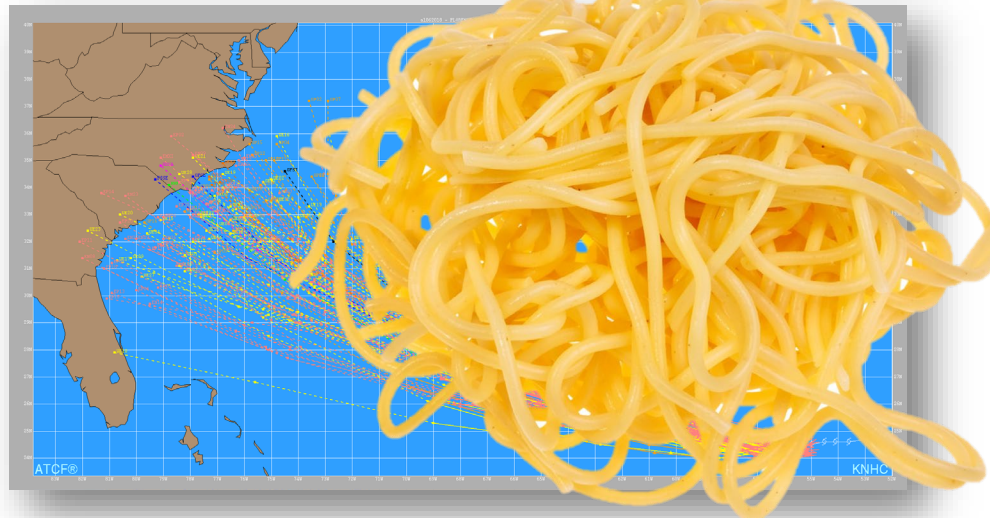


# Forecast Accuracy

## Forecast Models

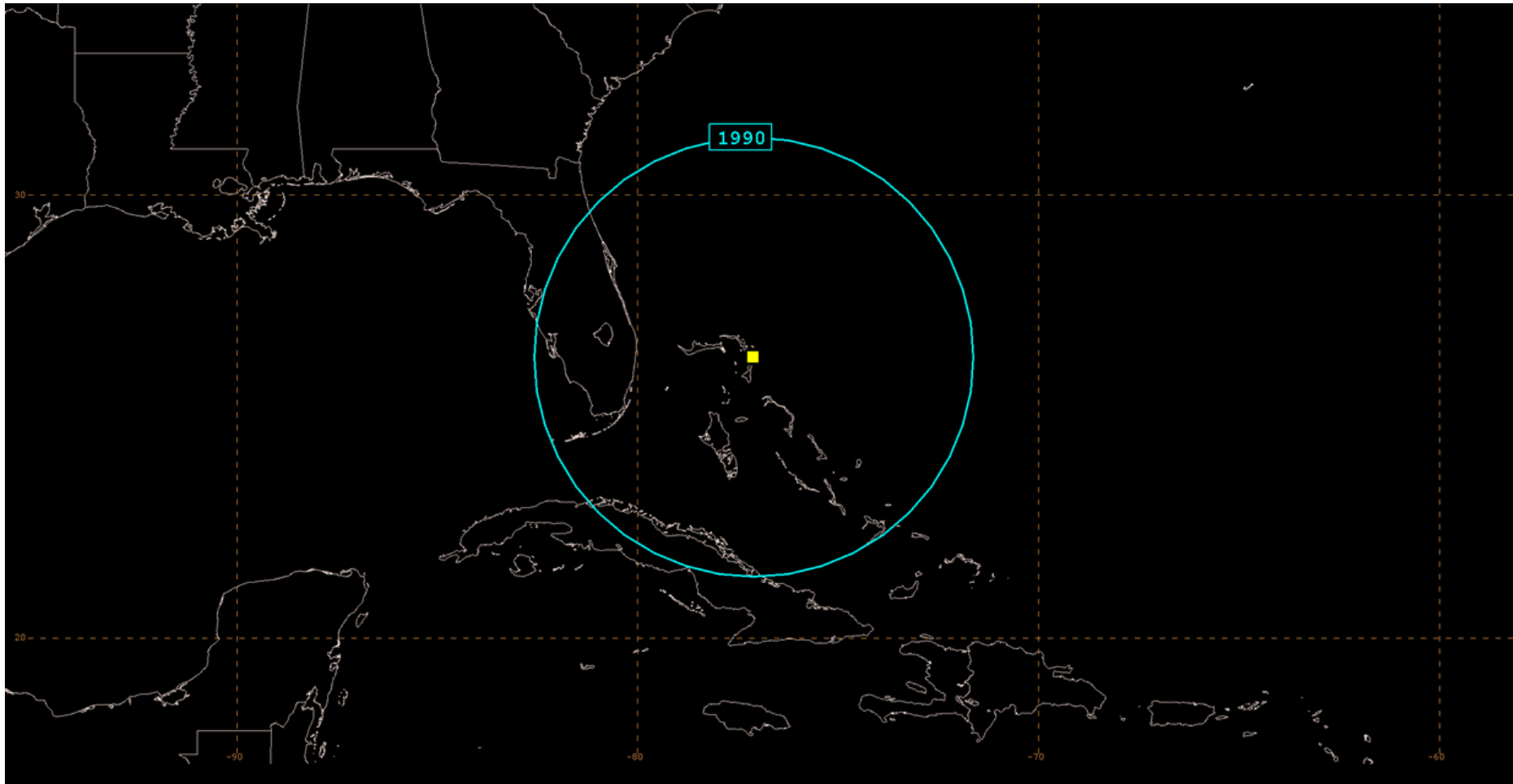


*Be careful looking at one run of one model. We are looking at more than 50!*



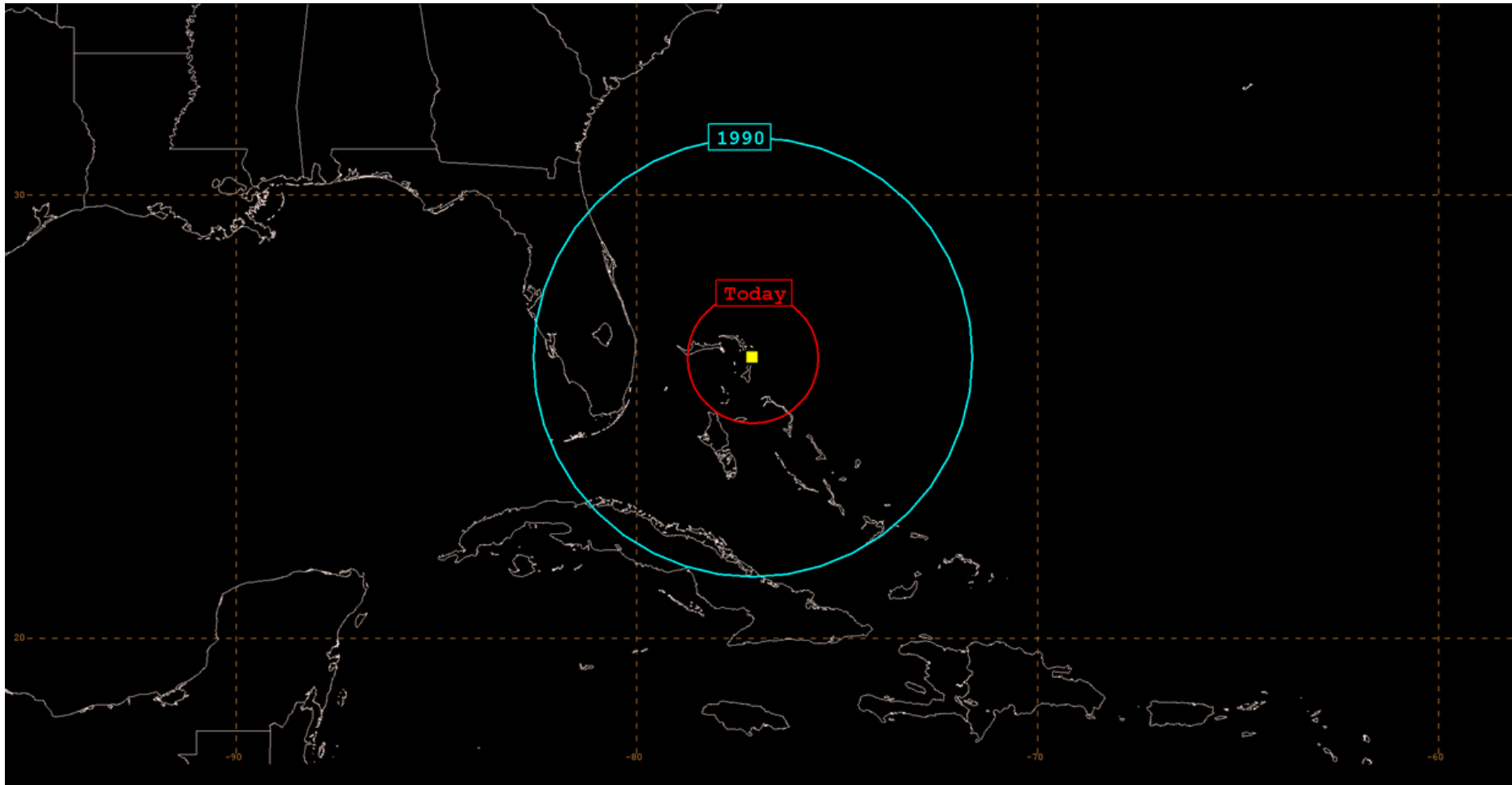


# Uncertainty





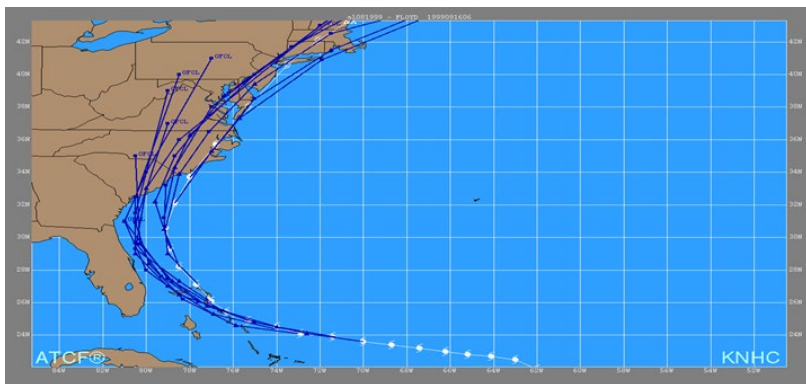
# Uncertainty





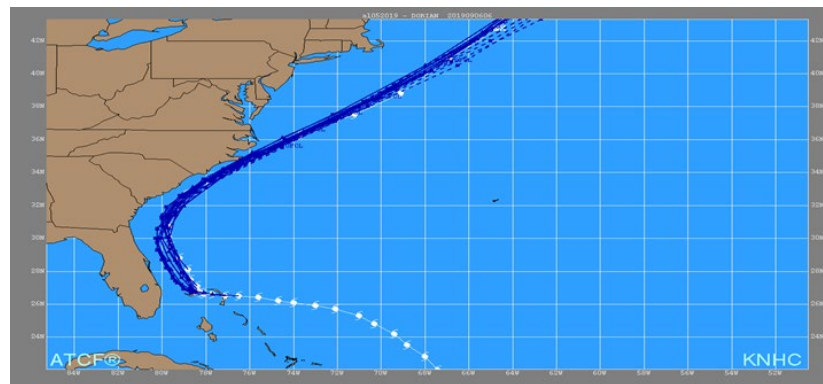
# Forecast Accuracy

## Why does this matter?



**NHC Track Forecasts for Floyd from  
06Z 13 Sep - 06Z 16 Sep 1999**

**2.6 million people evacuated**



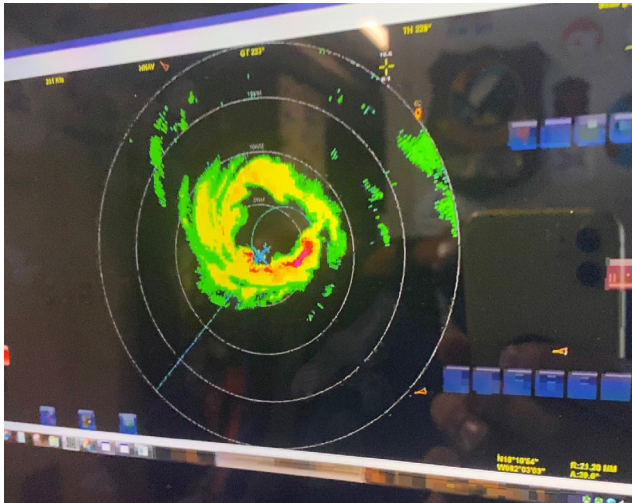
**NHC Track Forecasts for Dorian from  
06Z 1 Sep - 06Z 6 Sep 2019**

**As many as 3 million people NOT evacuated**



# Forecast Accuracy

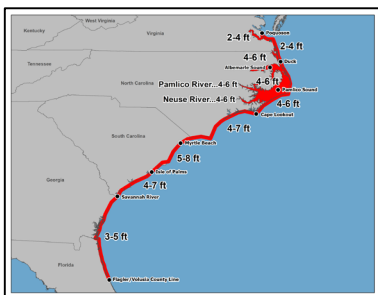
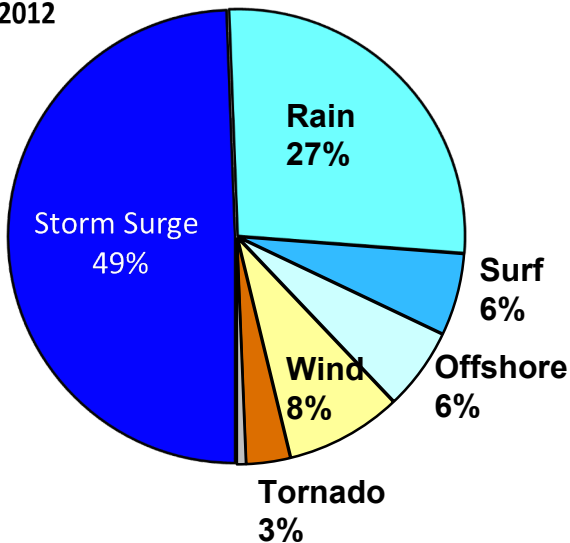
## Hurricane Hunters



NOAA OMAO Aircraft Operations Center (AOC) Hurricane Hunters fly the P3 and G-IV, with the US Air Force Reserve flying the WC-130J, all for hurricane surveillance and in-situ data reconnaissance

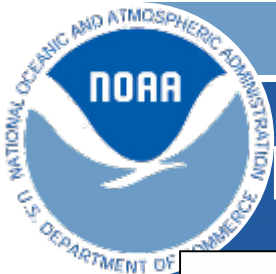
# What's New?

U.S. Tropical Cyclone Fatalities  
1963-2012

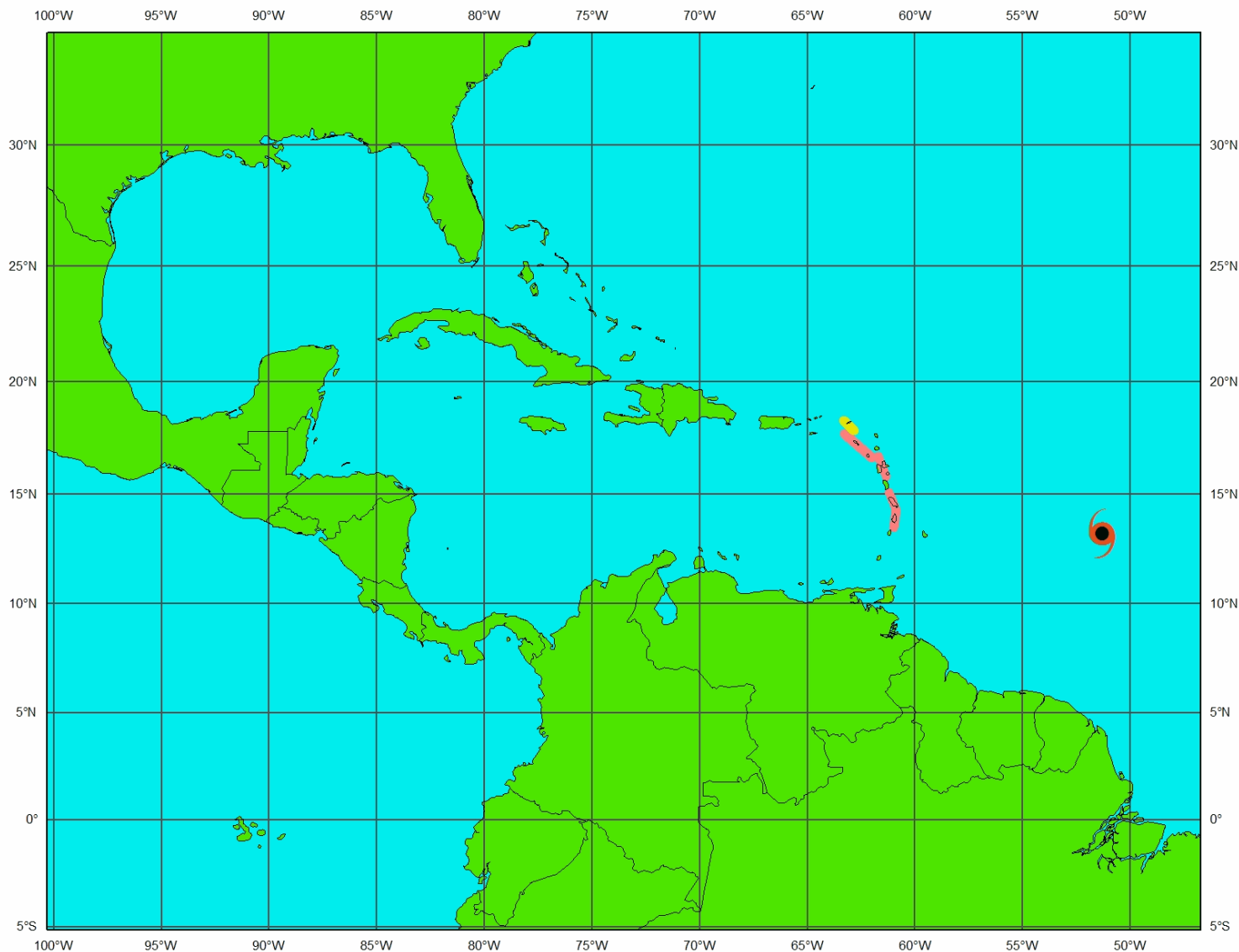


## Storm Surge Graphic





# Domestic and International Coordination





# What's New?

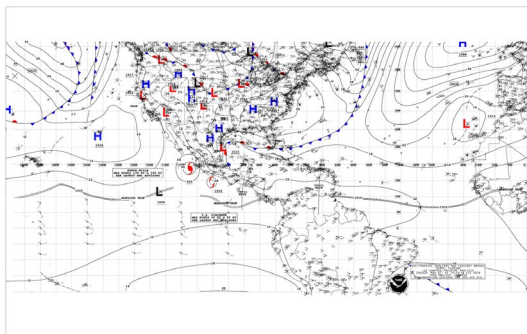
Michael Brennan - NOAA Federal is presenting

Meeting details

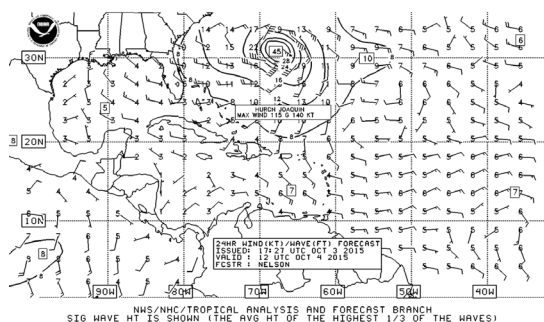
- Aaron Mayhew - NOAA Federal
- Andrew Kennedy - NOAA Federal
- Andrew Orrison - NOAA Federal
- Andrew Philpott - NOAA Federal
- Armani Cassel - NOAA Federal
- Ashley Sears - NOAA Federal
- Bryan Mroczka - NOAA Federal
- Bryce Tyner - NOAA Federal
- Cassandra Leahy - NOAA Federal
- Chris McKinney - NOAA Federal
- Chris Rothwell - NOAA Federal
- Christopher Bannan - NOAA Federal
- Christopher Landsea - NOAA Federal
- Daniel Martin - NOAA Federal
- Darone Jones - NOAA Federal

## Domestic and International Collaborative Tools

# What's New?



Oceanic Surface Analysis



Marine Charts

**SPOT FORECAST** FOR USCG SAR RC...USCG  
NWS NATIONAL HURRICANE CENTER MIAMI FL  
1118 PM EST Wed Dec 26 2018

**Forecast** is based on **forecast** start time of 2300 UTC on December 26.  
If conditions become unrepresentative...contact the NWS  
National Hurricane Center/Tropical Analysis and **Forecast**  
Branch at (305)229-4425.

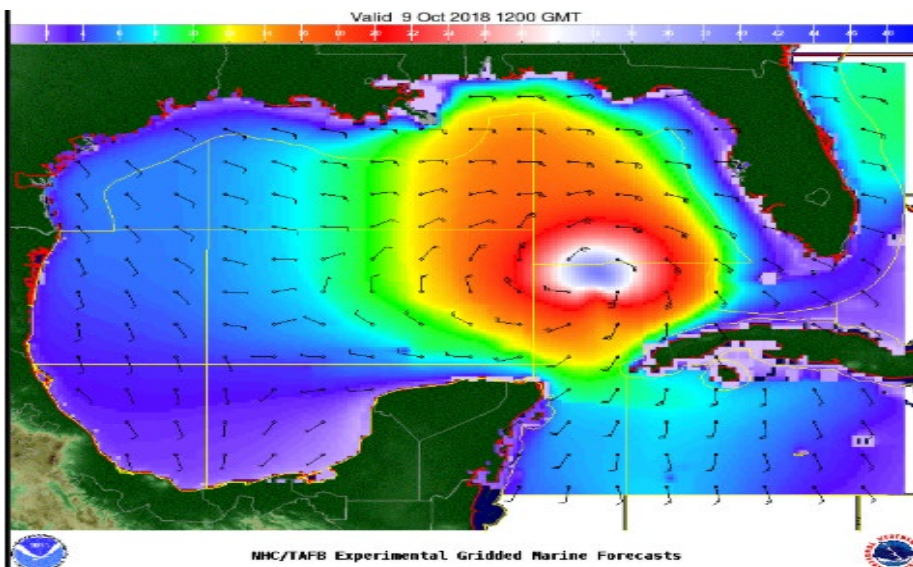
## .DISCUSSION...

For the SAR area...Fresh trade winds will increase to fresh to strong Thu and Thu night as strong high pres builds down from the N. Significant wave heights will build from 6 feet to 12 feet by early Fri. Isolated showers and thunderstorms will be possible the next few days.

## .REST OF TONIGHT...

Sky/weather.....Clear (0-5 percent).  
Min temperature.....Around 72.  
Max humidity.....93 percent.  
Dewpoint.....71 overnight.  
Surface winds (mph).East winds around 18 knots with gusts to around 26 knots.  
Swell height.....East swell 1 feet.  
Wave height.....6 feet.  
Wave period.....7 SECONDS.  
Wave period.....7 SECONDS.  
Wind wave.....6 feet overnight.  
Sea surface temp....81.2 F.

TIME (UTC)	4 UTC	7 UTC	10 UTC
Sky (%).....	0	0	0
Weather cov....			
Weather type...NONE	NONE	NONE	NONE
Tstm cov.....			
Temp.....73	73	73	
Dewpoint.....71	71	71	



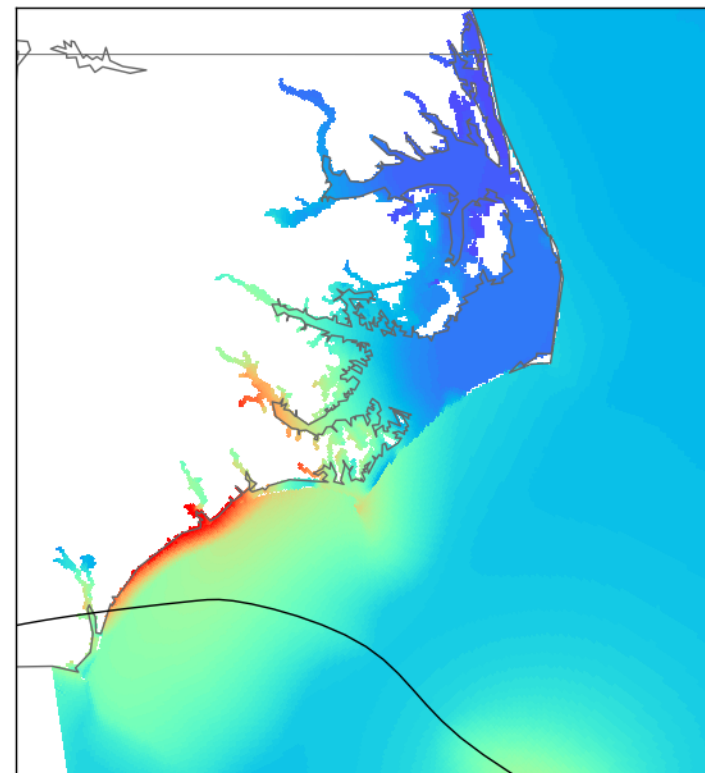
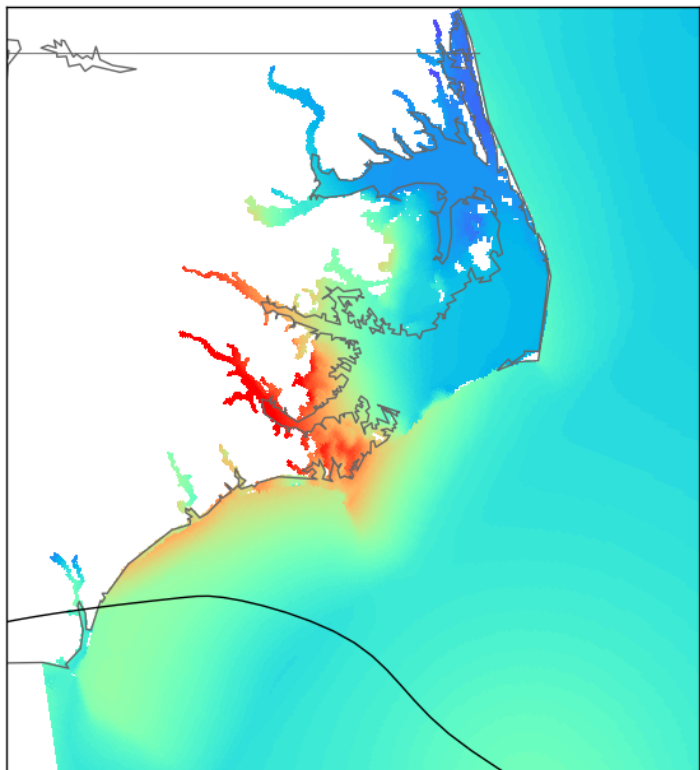
Digital Marine Forecasts

Marine Lat/Lon Emergency Spot Forecast



# What's New?

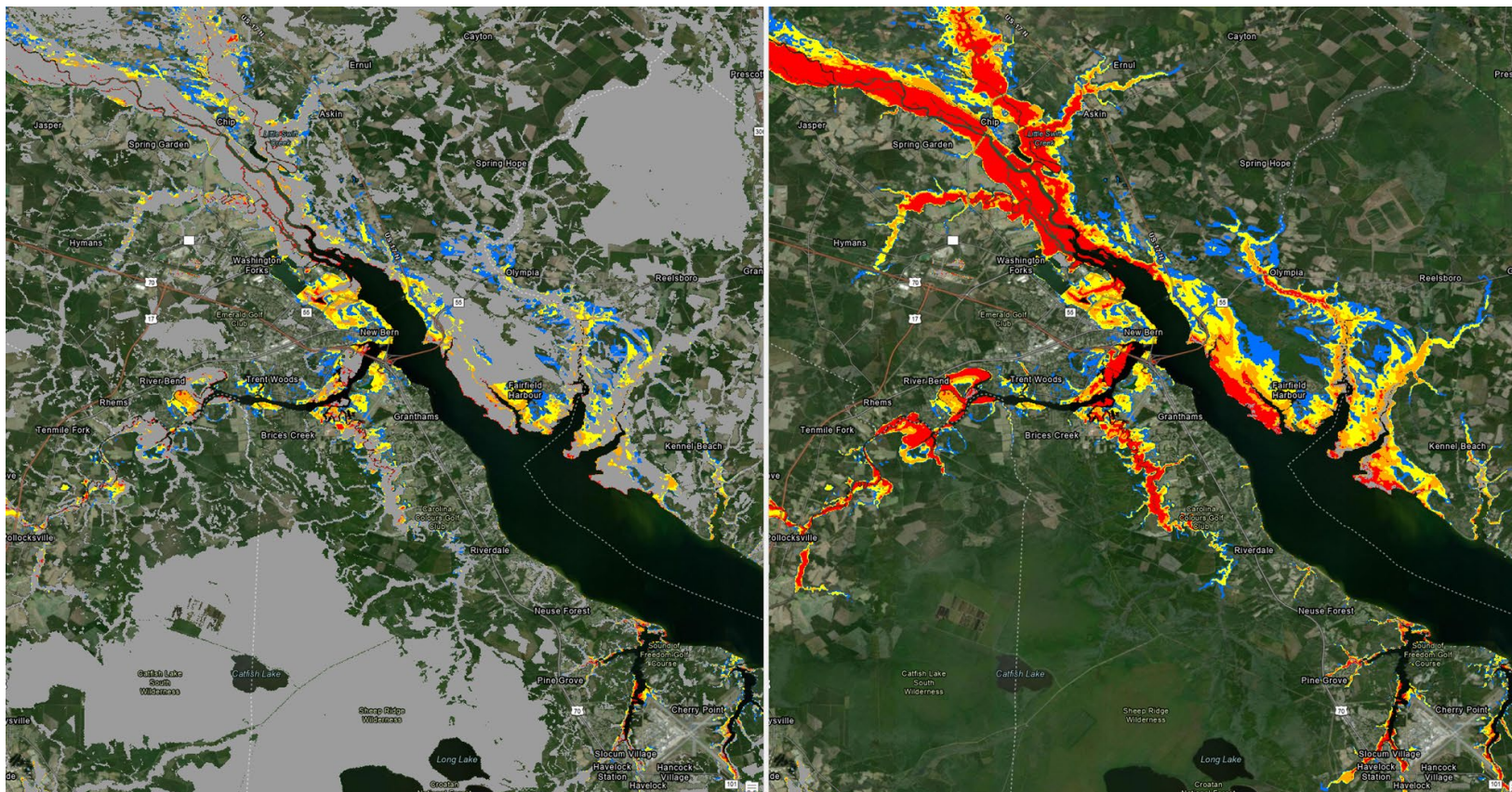
## Structure Matters!



Stronger, Smaller Storm

## Big Upgrade to Storm Surge Model

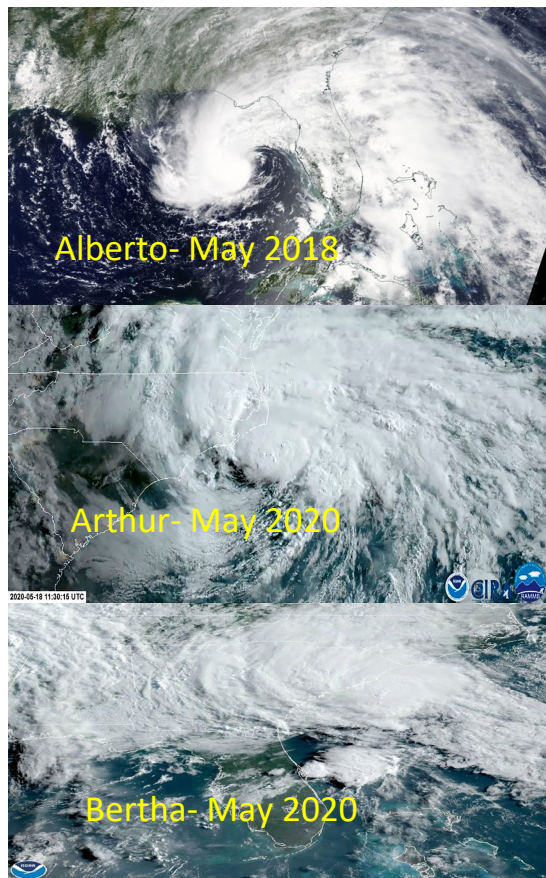
# What's New?



## Better Storm Surge Model Estuary Masking

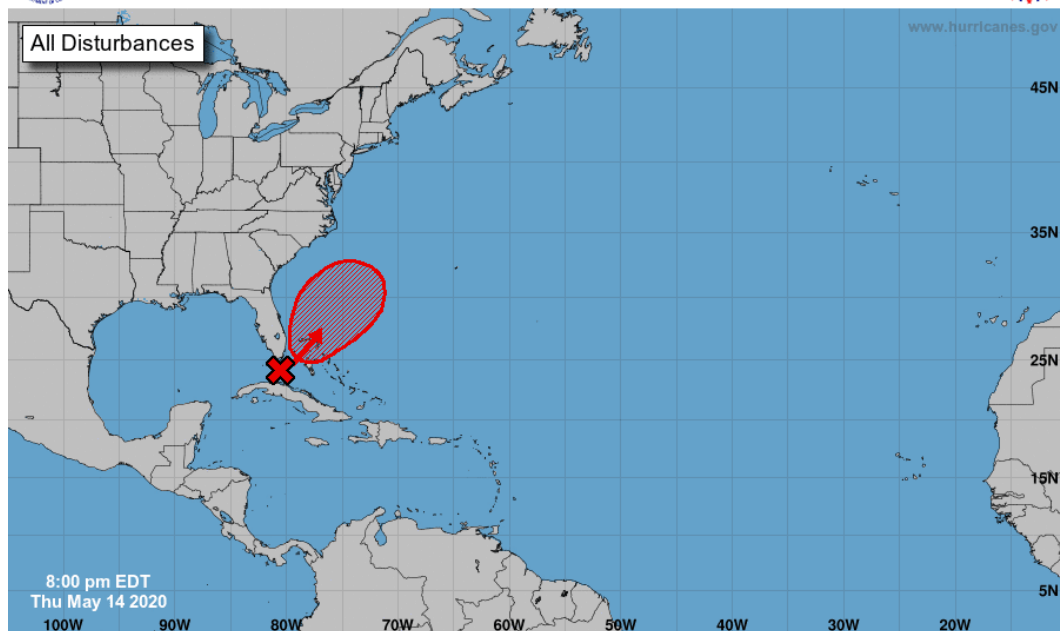


# What's New?



## Five-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida



Current Disturbances and Five-Day Cyclone Formation Chance:   
 Tropical or Sub-Tropical Cyclone:   
 X < 40% X 40-60% X > 60%   
 ○ Depression ● Storm ● Hurricane   
 ○ Post-Tropical Cyclone or Remnants

## Atlantic Tropical Weather Outlook Now Begins May 15



# What's New?

- World Meteorological Organization Region IV Hurricane Committee is responsible for names

A horizontal bar composed of four colored segments: blue, orange, green, and cyan.

## Retired Tropical Cyclone Names

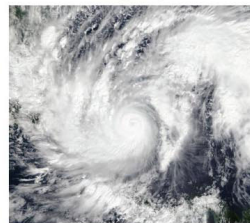
**Dorian**  
2019



**Laura**  
2020



**Eta**  
2020



**Iota**  
2020



## Overflow Name List Does Not Include Greek Alphabet

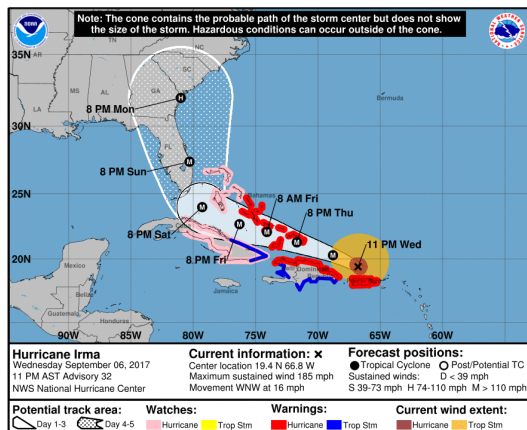


# What's New?

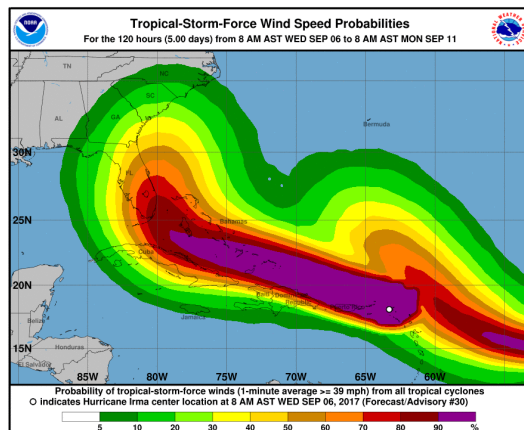
- **World Meteorological Organization Region IV Hurricane Committee is responsible for names**
- **Translation challenges into Spanish, French, and Portuguese**
- **Pronunciation of letters in succession (Zeta, Eta, Theta)**
- **Zeta perceived as the last letter**
- **Focus on the letters took away from critical impact messaging**
- **Rotating name list for 6 years continues**
- **An overflow name list created which remains the same each year**

## **Overflow Name List Does Not Include Greek Alphabet**

# Communicating the Danger



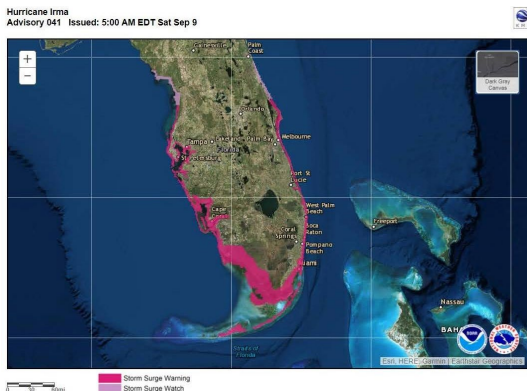
Forecast Cone/Wind Warnings/Size



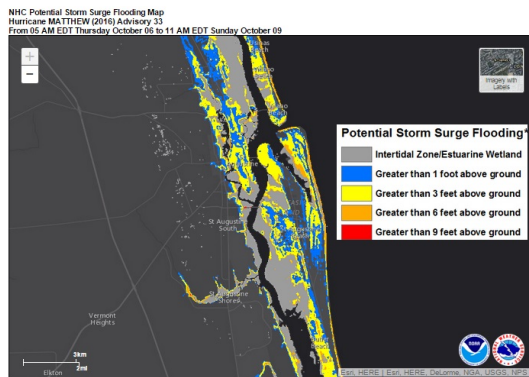
Wind Speed Probabilities



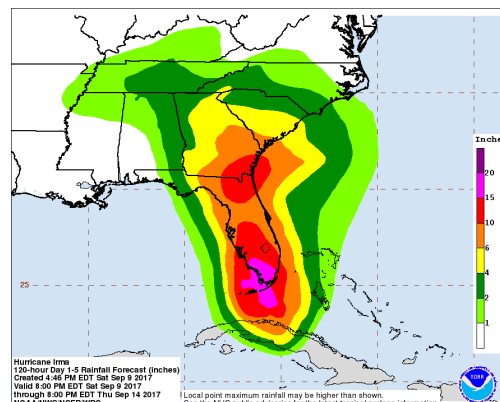
Time of Arrival of Winds



Storm Surge Warnings



Storm Surge Potential Inundation




Weather Prediction Center Rainfall




# Communicating the Danger

It's All About the Impacts



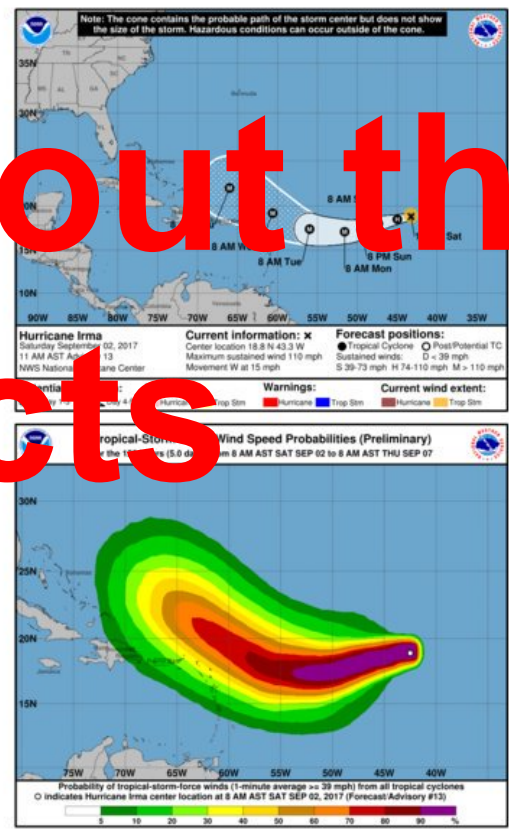
## Key Messages for Hurricane Irma

### Advisory 13: 11:00 AM AST Sat Sep 02, 2017



1. Irma is expected to be a major hurricane when it moves closer to the Lesser Antilles early next week, producing rough surf and rip currents. Irma could also cause dangerous wind storm surge, and rainfall impacts on some islands, although it is too soon to specify where and when those hazards could occur. Residents in the Lesser Antilles should monitor the progress of Irma through the weekend and listen to any advice given by local officials.

2. It is much too early to determine what direct impacts Irma will have on the Bahamas and the continental United States. Regardless, everyone in hurricane-prone areas should ensure that they have their hurricane plan in place, as we are now near the peak of the season.



**Note:** The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.

**Hurricane Irma**  
Saturday September 02, 2017  
11 AM AST Sep 02  
NWS National Hurricane Center

**Current information:**  
Center location 18.8 N 43.3 W  
Maximum sustained wind 110 mph  
Movement W at 15 mph

**Forecast positions:**  
● Tropical Cyclone ○ Possible Tropical Cyclone  
S 39 mph H 74-110 mph M > 110 mph

**Warnings:**  
Tropical Storm Hurricane Tropical Storm Hurricane

**Current wind extent:**  
Tropical Storm Hurricane Tropical Storm Hurricane

**Tropical-Storm-Force Wind Speed Probabilities (Preliminary)**  
of the 1-minute (5.0 m) average from 8 AM AST SEP 02 to 8 AM AST THU SEP 07

Probability of tropical-storm-force winds (1-minute average >= 39 mph) from all tropical cyclones  
○ Indicates Hurricane Irma center location at 8 AM AST SAT SEP 02, 2017 (Forecast Advisory #13)

0 10 20 30 40 50 60 70 80 90 %

For more information go to [hurricanes.gov](http://hurricanes.gov)



Thank you from the National Hurricane Center!

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[hurricanes.gov](http://hurricanes.gov)

