

# Hurricane Community Forum



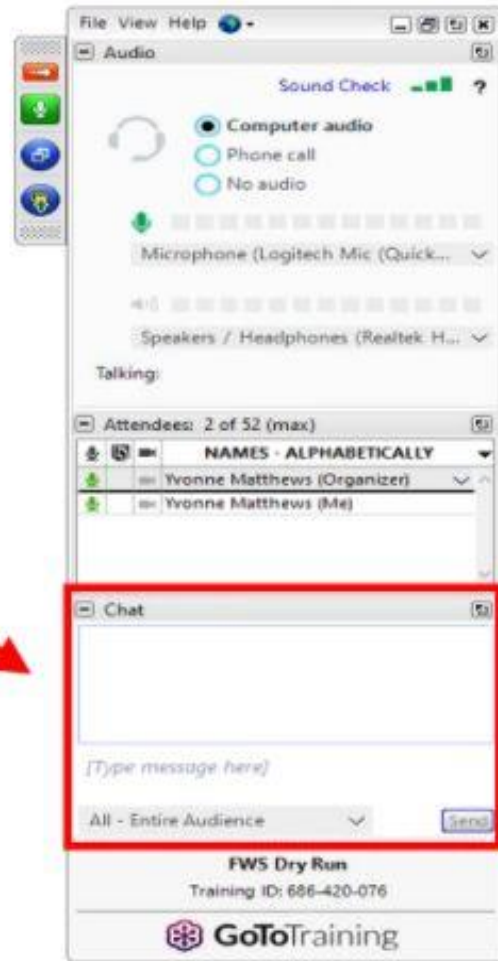
**Jason Baker**  
**Pine Knoll Shores**  
**Fire Chief**



**Erik Heden**  
**Warning Coordination Meteorologist**  
**NWS Morehead City**

# COMMUNICATING With the Presenters

1



Type your Question or Comment in the Chat box. Select who you would like to send it to, i.e., All-Entire Audience or a specific attendee. Click the **Send** Button

2



Don't see the question box?

3



Use the *Raise your Hand* button to respond to the presenter(s) when they ask for a show of hands.

# Technical

**Your mics have been muted.**

**At the end we will take questions. Feel free to type in your question at anytime using the webinar feature.**

**If you raise your hand, we can call on you, unmute your mic, and take a question verbally.**



The screenshot displays the GoToWebinar interface. At the top, there is a menu bar with 'File', 'View', and 'Help'. Below this is a 'Audio' section with a 'Sound Check' indicator. The audio settings are set to 'Computer audio' and 'Phone call'. A microphone icon is shown with a red 'MUTED' label. The selected microphone is 'Microphone (HD Webcam C510)'. Below the microphone settings is a volume slider and a speaker icon. The selected speakers are 'Speakers (High Definition Aud...'. Below the audio settings is a 'Questions' section with a text input field containing '[Enter a question for staff]' and a 'Send' button. At the bottom, there is a footer with the text 'Multi sessions different registrants', 'Webinar ID: 980-960-603', and the GoToWebinar logo.



**Focus On The Impacts  
Water Is What Kills**

**Hurricane Preparedness  
2021**

**Erik Heden**

**National Weather Service Morehead City, NC**





# Our Local Office



Eastern part of North Carolina

Includes: Land areas, inland rivers, sounds, and adjacent ocean

Other parts of the state covered by other local offices (Raleigh, Wilmington, etc)





# Work Hours



24 hours a day, 7 days a week, plus any overtime for severe weather...we never close!

Two to three forecasters per shift.

Shifts per day: midnight, day and evening.

Management team: 8 am to 5 pm Mon.-Fri. (they work shifts sometimes too!)

In total 22 to 25 people



# Our Website

weather.gov/moreheadcity



Weather information from past events, current weather, and forecast

Explore the website and bookmark or save what you like

Go in depth as much as you need

The screenshot displays the National Weather Service website for Morehead City, NC. At the top, there is a navigation menu with links for HOME, FORECAST, PAST WEATHER, SAFETY, INFORMATION, EDUCATION, NEWS, SEARCH, and ABOUT. Below the menu, there is a local forecast section showing "Overcast" conditions with a temperature of 49°F (9°C). A "Today" section shows "Partly Sunny" with a high of 55°F, and a "Tonight" section shows "Mostly Cloudy" with a low of 43°F. The main content area features a "NWS Forecast Office Newport/Morehead City, Newport/Morehead City, NC" header and a map of the region. The map includes a legend for "Watches, Warnings & Advisories" with categories like Coastal Flood Advisory, High Surf Advisory, Small Craft Advisory, and Hazardous Weather Outlook. Below the map are three panels: "Tropical" (showing a cyclone icon), "Local Radar" (showing a radar map of the area), and "Satellite" (showing a satellite image of the region).



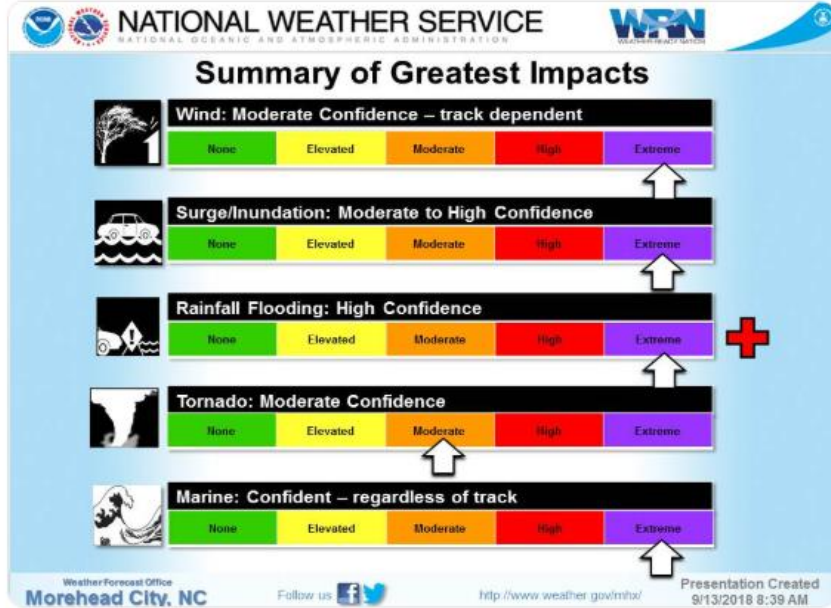
# Social Media

Search NWS Morehead City



**NWS Newport/Morehead** @NWSMoreheadCity

Category of the storm is only related to wind, it does not tell you about all of the impacts with a #hurricane like #florence. Our impacts have not changed with storm surge and catastrophic flooding. Do not let your guard down. [weather.gov/media/mhx/Late...](http://weather.gov/media/mhx/Late...)



8:44 AM - 13 Sep 2018

765 Retweets 1,078 Likes

40 765 1.1K

YouTube

Search

**NATIONAL WEATHER SERVICE**  
Hurricane Florence Briefing #15  
As of: 630 AM  
Wednesday, September 12th 2018

**What has Changed?**

- Track has shifted a bit further south and west, and has slowed significantly near the coast
- Extreme rainfall amounts now are expected across southern coastal counties
- Major River Flooding Likely

Disclaimer: Do not use after 5 PM Wednesday 9/12/18  
Next Briefing: By 600 PM Wednesday (9/12/18)

Hurricane Florence NWS Morehead City Wednesday 900 AM Briefing

2,895 views

13 0 SHARE SAVE



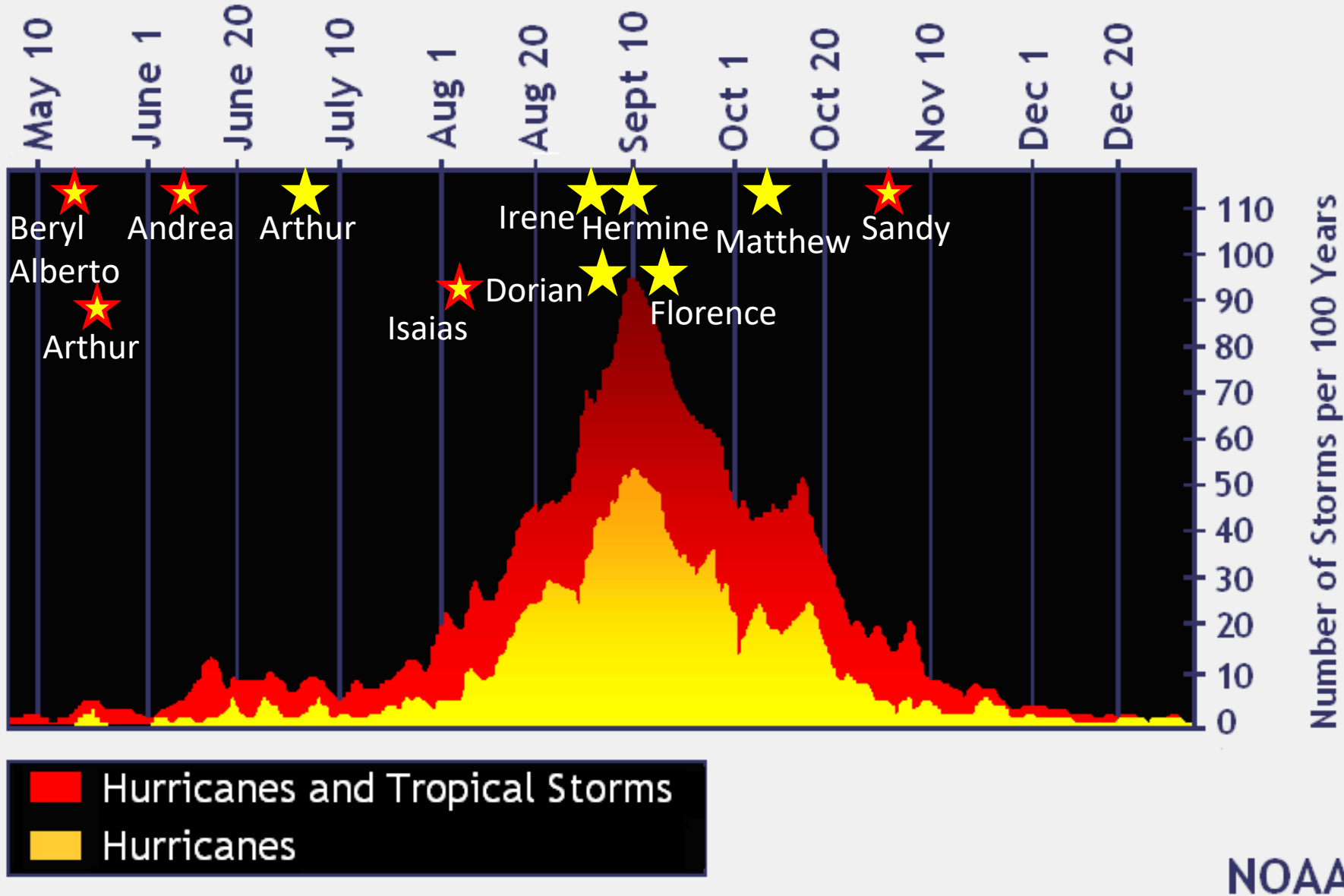
NWSMoreheadCity  
Published on Sep 12, 2018

SUBSCRIBE 199

# Hurricane Florence Lead Up



# The Time To Prepare Is NOW



Peak of the season is around September 10<sup>th</sup>

Tropical systems can occur from May through November

# Our Website

[weather.gov/moreheadcity/hurricaneprep](http://weather.gov/moreheadcity/hurricaneprep)

Hurricane Preparedness

## ASSEMBLE DISASTER SUPPLIES



Make a list of supplies and assemble them before hurricane season begins. Have enough food and water for each person for at least three days. Fill your prescriptions and have medicine on hand. Radios, batteries and phone chargers are also must-haves. Gas up your vehicle and have cash on hand.



Food & water



Medicine & prescriptions



Keep gas tank full



Radio, batteries, phone chargers



Cash on hand

[weather.gov/hurricane](http://weather.gov/hurricane)



**Modeled after hurricane awareness week**

**Graphics and information on how to prepare**

**Graphics and information on ALL impacts from a tropical cyclone**

# Weather Briefings

weather.gov/moreheadcity

**NATIONAL WEATHER SERVICE**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HOME FORECAST PAST WEATHER SAFETY INFORMATION EDUCATION NEWS SEARCH ABOUT

Local forecast by "City, ST" or ZIP code  
Enter location ... Go  
Location Help

**News Headlines**

- Here's the Updated Skywarn Training Schedule!
- Here's a Summary on the March 2-5, 2018 Wind/Coastal Flood/Low Water Event.
- Summary on the Minor Winter Weather Event, March 12-13, 2018

**NWS Forecast Office Newport/Morehead City, Newport/Morehead City, NC**  
Weather Forecast Office  
Weather.gov > Newport/Morehead City, NC

Current Hazards Current Conditions Radar Forecasts Rivers and Lakes Climate and Past Weather Local Programs

Click a location below for detailed forecast.

Watches Warnings & Advisories

- Small Craft Advisory
- Freeze Watch
- Hazardous Weather Outlook

Forecast Maps

Weather Hazard Briefing (when applicable)

Local Self-Briefing Pages

Submit Storm Reports

Forecasters Discussion

Marine

Text Products

Tropical

Skywarn

Follow us on Twitter Follow us on Facebook MHX RSS Feed

## Earliest Reasonable Time of Arrival

Tropical Storm Arthur

Morehead City, NC  
WEATHER FORECAST OFFICE

**0-3 Day Earliest Reasonable Arrival Time of Tropical-Storm-Force Winds**

All Times EDT

Tropical Storm Arthur  
Sun. May. 17, 2020 5 am EDT  
Advisory 3

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

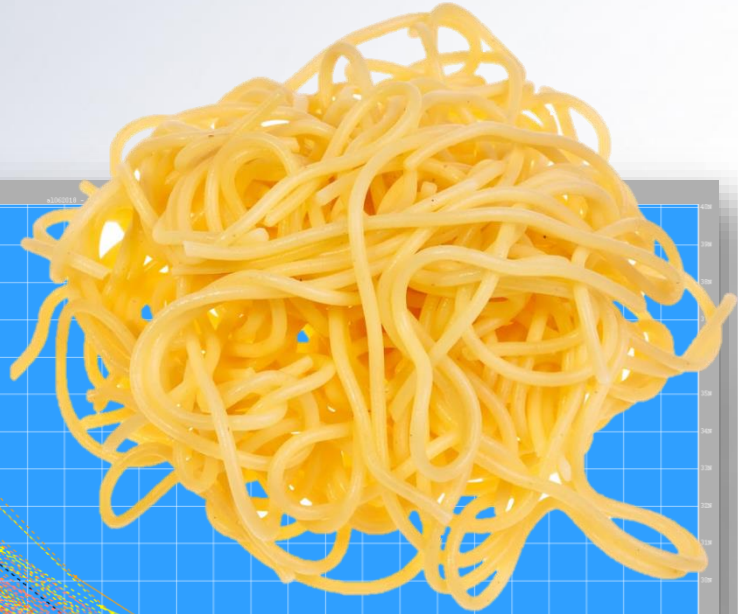
5 10 20 30 40 50 60 70 80 90 100 %

5/17/2020 6:24 AM

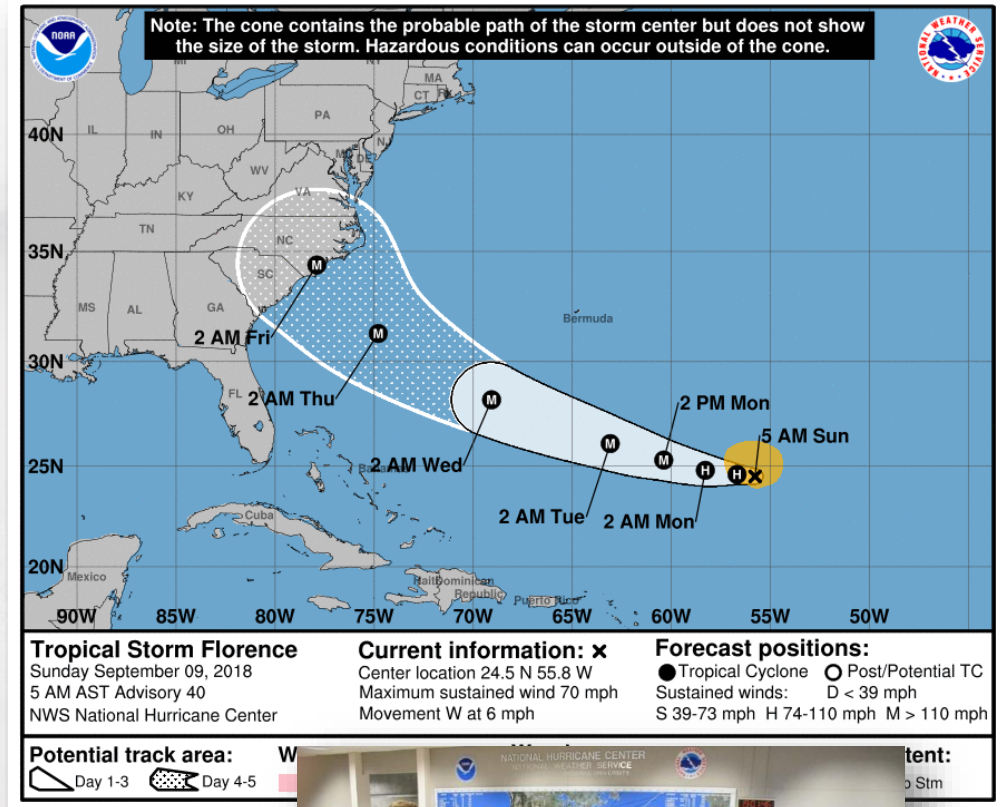
www.weather.gov/MoreheadCity

- The earliest reasonable time of arrival of Tropical Storm Force Winds for Eastern North Carolina would be sometime tonight.
- However, the most likely time this area could see Tropical Storm Force Winds will be during the day on Monday.

# Spaghetti Models vs. NHC Forecasts



VS.

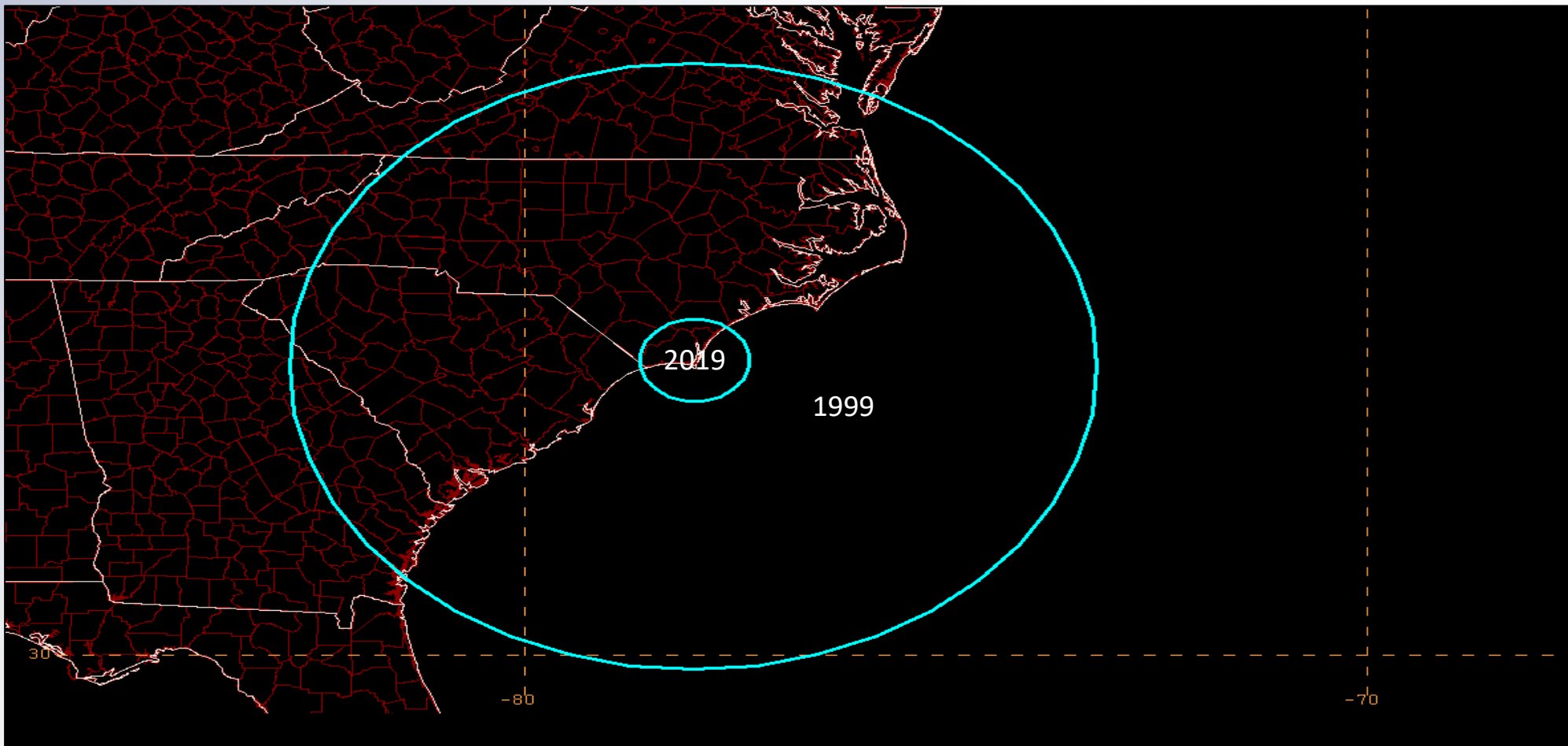


About 175 years of experience combined!



# How Far Have We Come?

1999 (Floyd) Vs 2019 (Dorian)

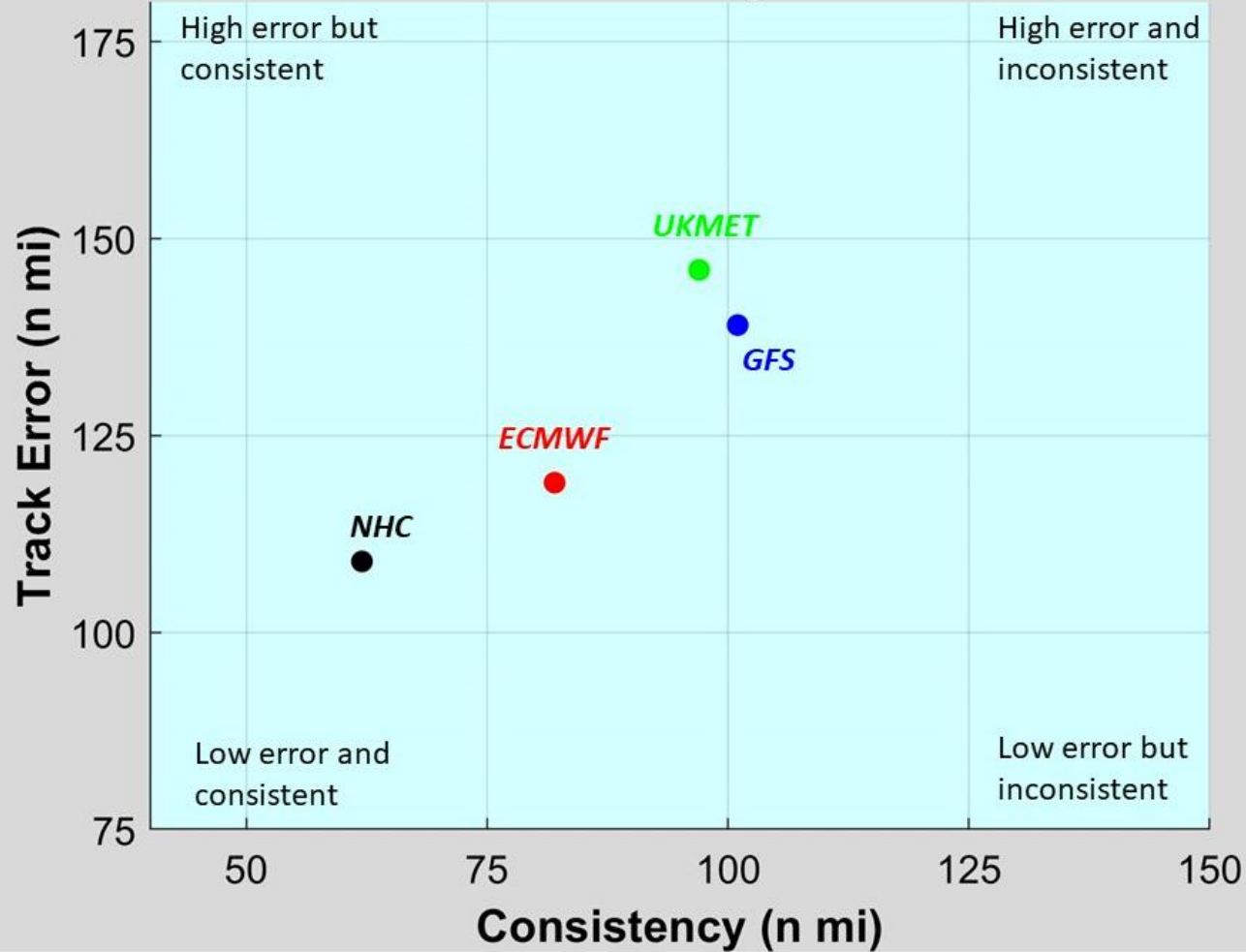


**Difference in  
average 3-  
day track  
forecasts for  
Floyd (1999)  
and Dorian  
(2019)**

# NHC Track Forecasts

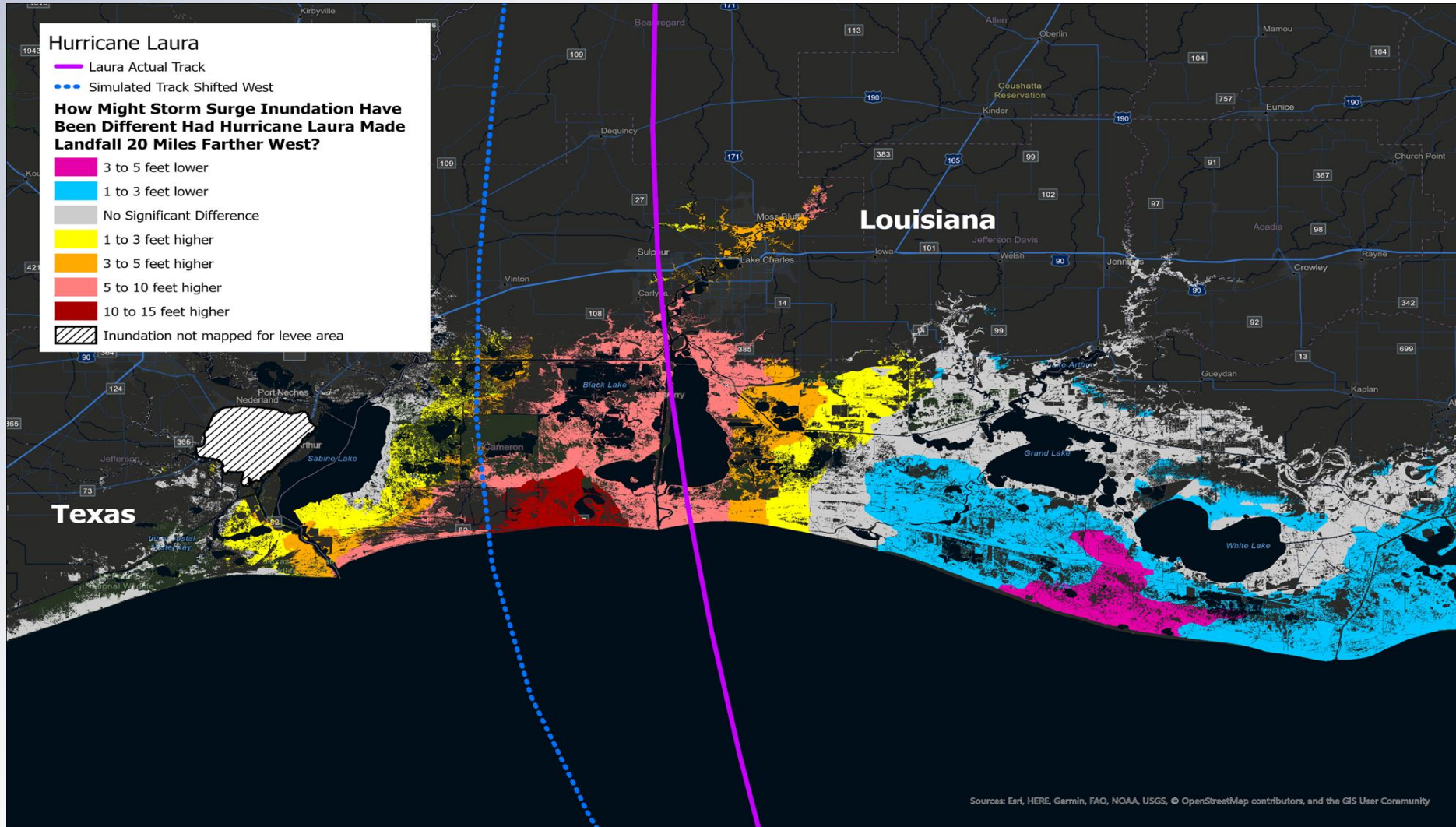
## More Accurate and More Consistent

96 h Track Error vs. Consistency - 2017-19 Atlantic Basin



NHC's track forecasts not only have smaller average error than the individual models, but they are also more consistent from cycle to cycle

# Little Wiggles Matter – Laura Storm Surge

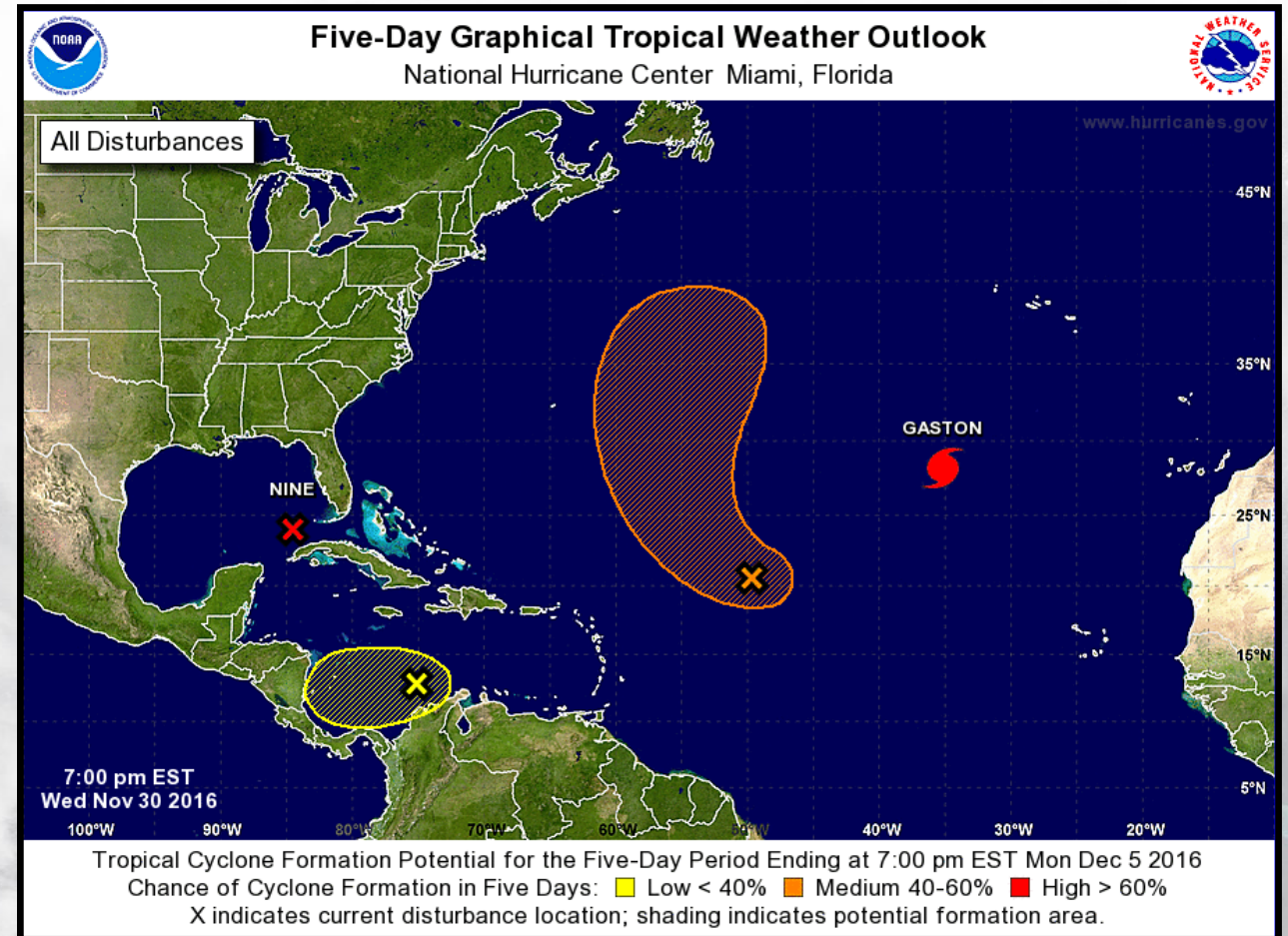


# National Hurricane Center

Hurricanes.gov or weather.gov/moreheadcity/tropical

## Tropical Weather Outlook

- Issued 4 times a day
- 8 and 2 AM/PM EDT
- Tropical cyclone formation potential for next 5 days

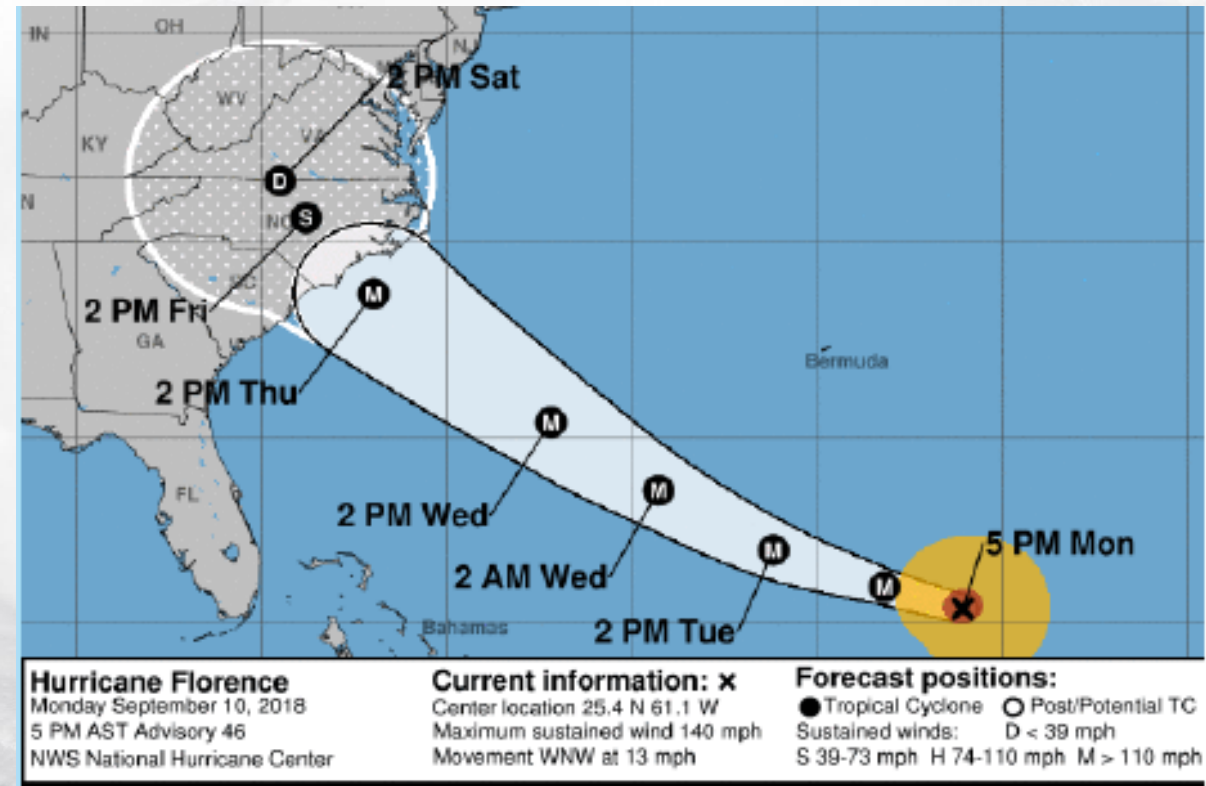




# National Hurricane Center

## Tropical Cyclone Track Forecast Cone Watches/Warnings Initial Wind Field

- Cone represents probable path of the CENTER of the storm
- The cone does NOT show impacts
- Impacts can occur HUNDREDS of miles from the center of the storm
- The center of the storm passes within the cone roughly of the time



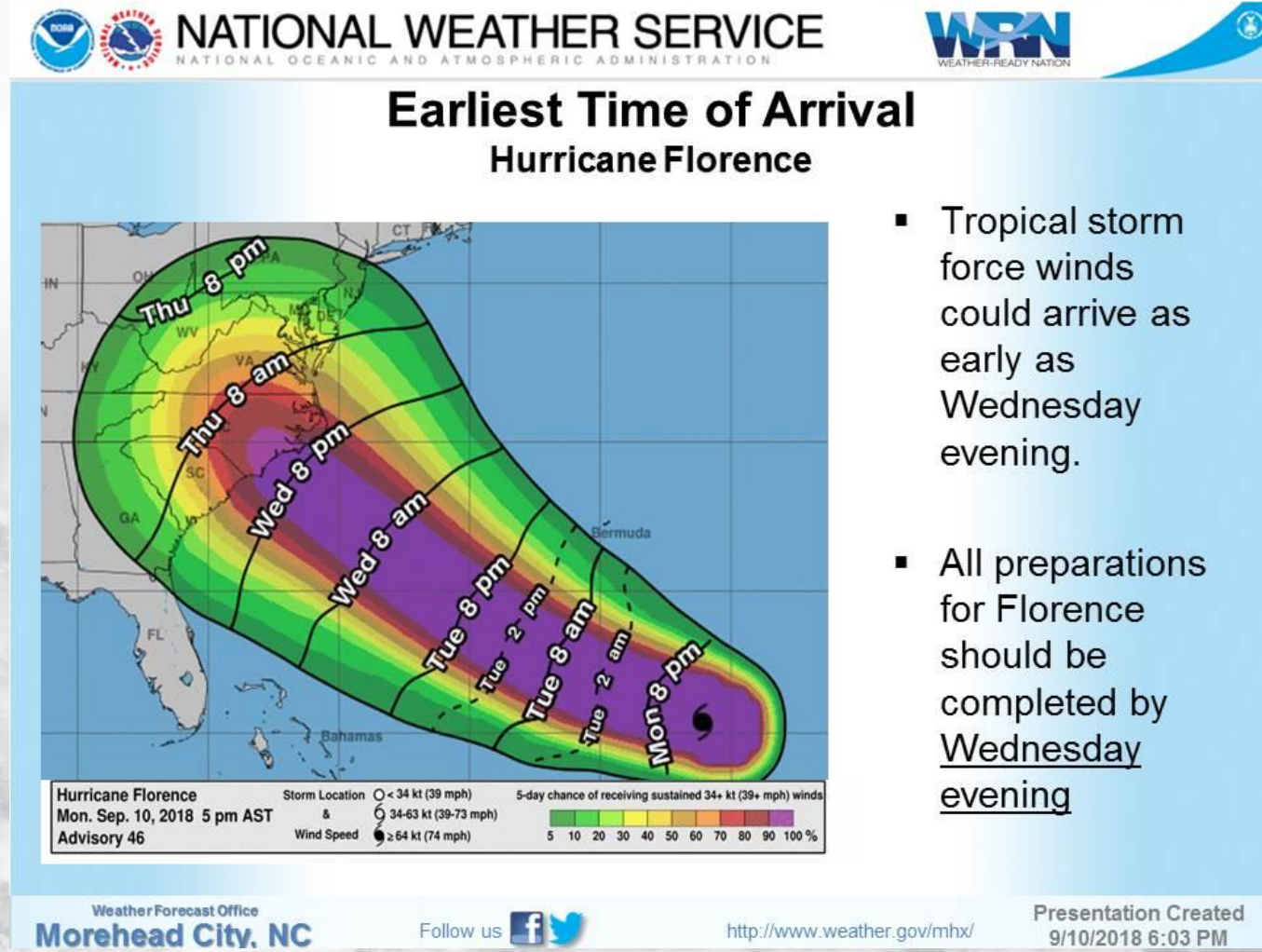
# National Hurricane Center

Hurricanes.gov or weather.gov/moreheadcity/tropical

## Earliest Reasonable Arrival Time Tropical Storm Force Winds

- Reasonable worst case scenario
- Identifies a window when preparations should be made by
- While times are given, especially farther out, focus in more general terms
- For example instead of Wednesday 8 PM or Thursday 8 AM

Sometime late Wednesday or early Thursday



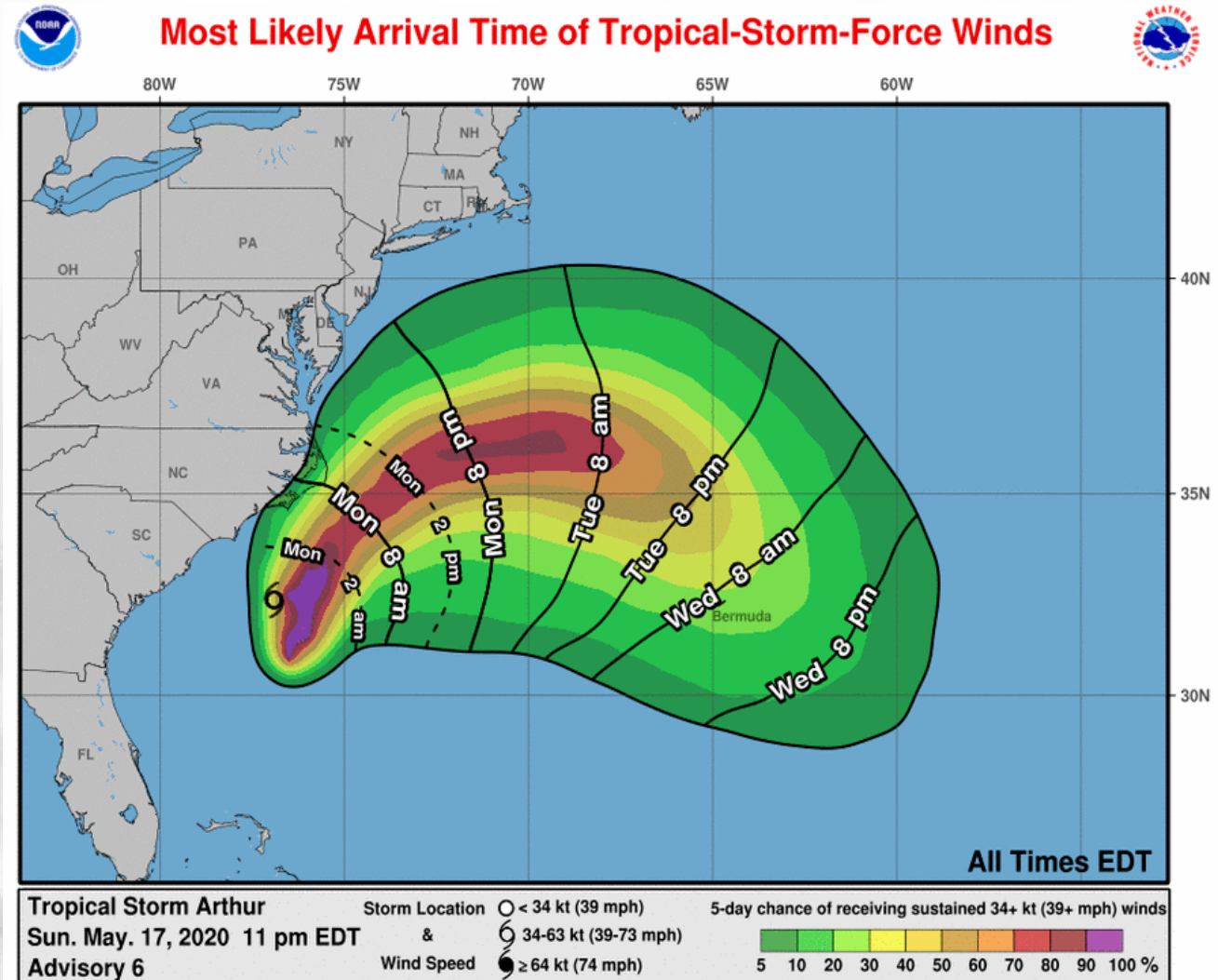
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## Most Likely Arrival Time Tropical Storm Force Winds

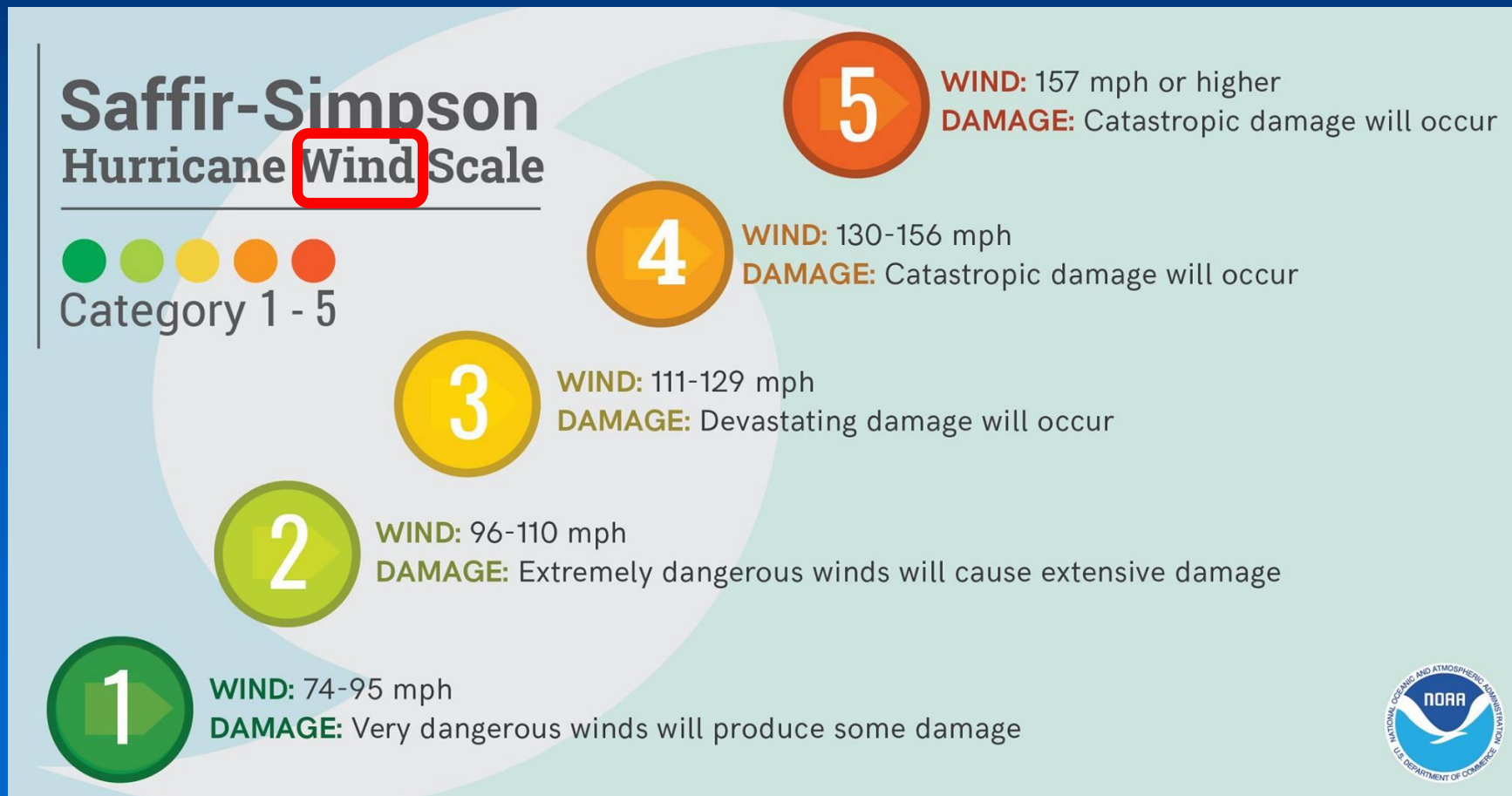
- Most likely scenario
- Identifies a window when we expect tropical storm force winds to arrive
- While times are given, especially farther out, focus in more general terms
- For example instead of Monday 8 AM

Sometime Monday Morning



# Saffir/Simpson Hurricane Scale

Used to categorize hurricane strength and to give an estimate of potential property damage



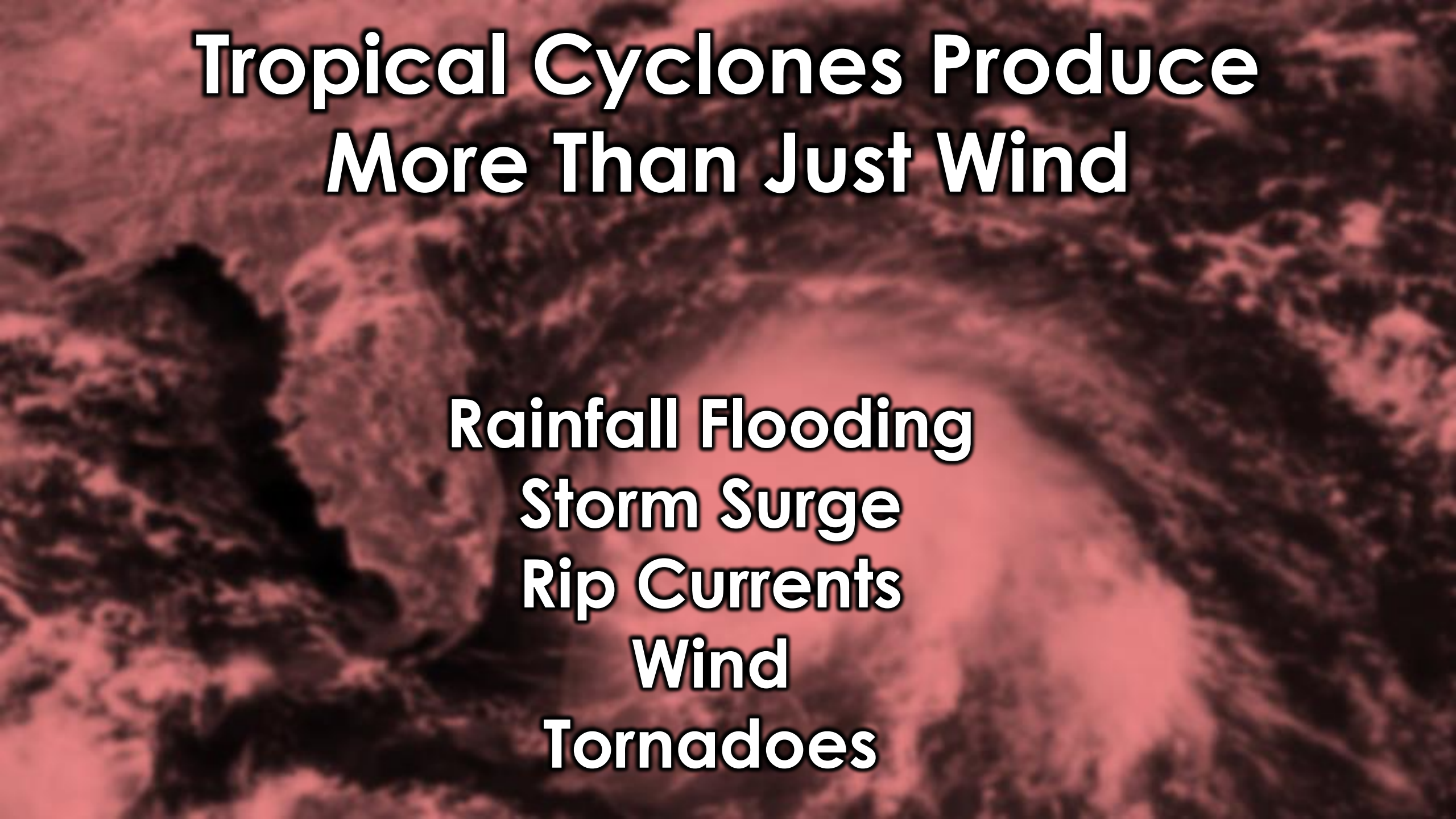
# It's About the Impacts



**2010 – 2019  
in the U.S., Category 1  
hurricanes\***

**175 direct deaths  
\$105 billion**

**\*Irene, Isaac, Sandy, Hermine, Matthew, Nate, Florence, Barry, Dorian**



# **Tropical Cyclones Produce More Than Just Wind**

**Rainfall Flooding**

**Storm Surge**

**Rip Currents**

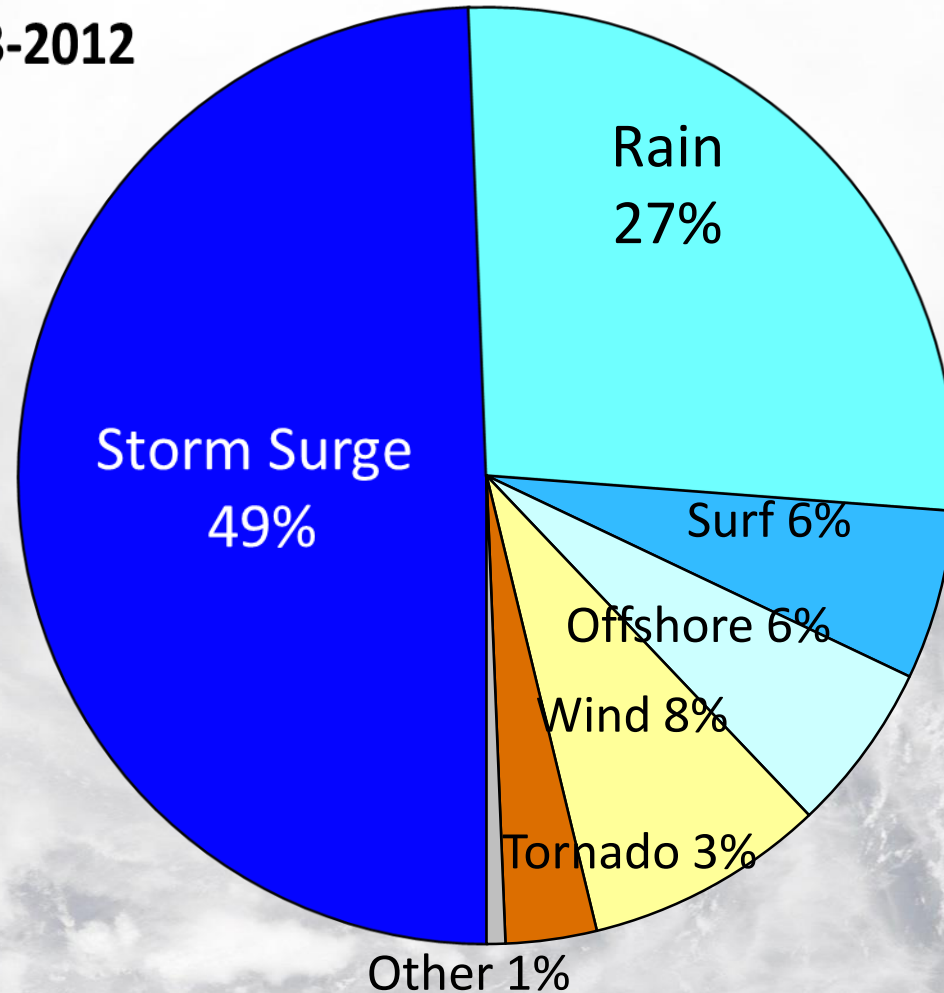
**Wind**

**Tornadoes**

# Water is What KILLS!!!

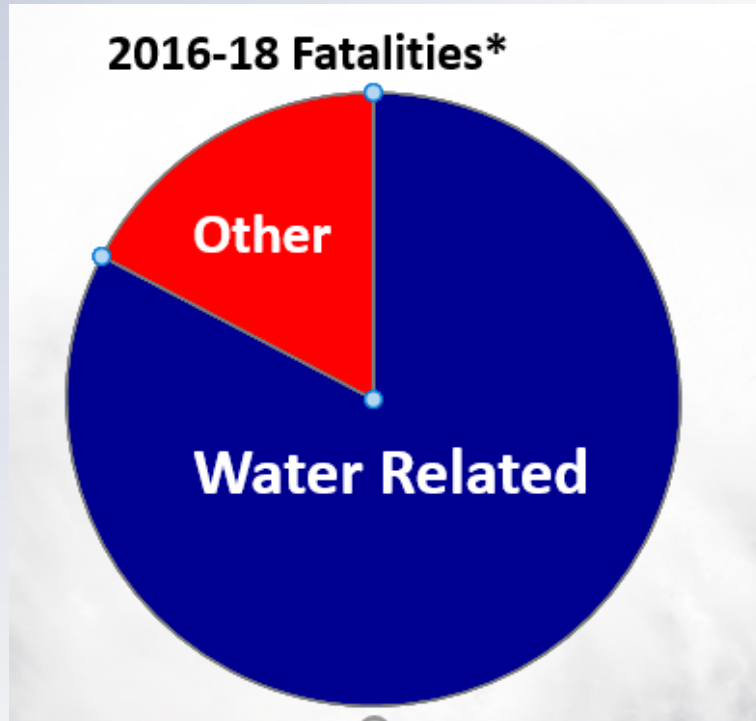


U.S. Tropical Cyclone Fatalities  
1963-2012



**Water  
accounts  
for about  
90% of  
the direct  
deaths**

# Water is What KILLS!!!

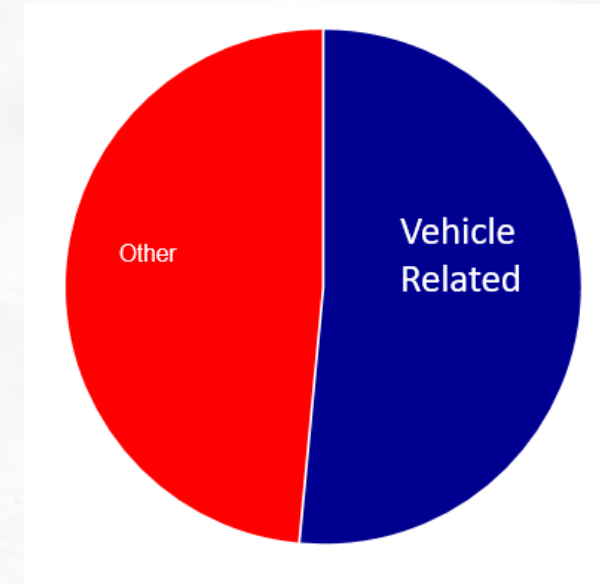


**83% Water Related**

Most Inland Flooding – Only 4%  
Storm Surge Related

\*excludes Maria due to uncertainty related to causes of direct deaths

## 2016-18 U.S. Tropical Cyclone Water Related Fatalities



More than half  
the U.S. tropical cyclone water-related fatalities were vehicle related!

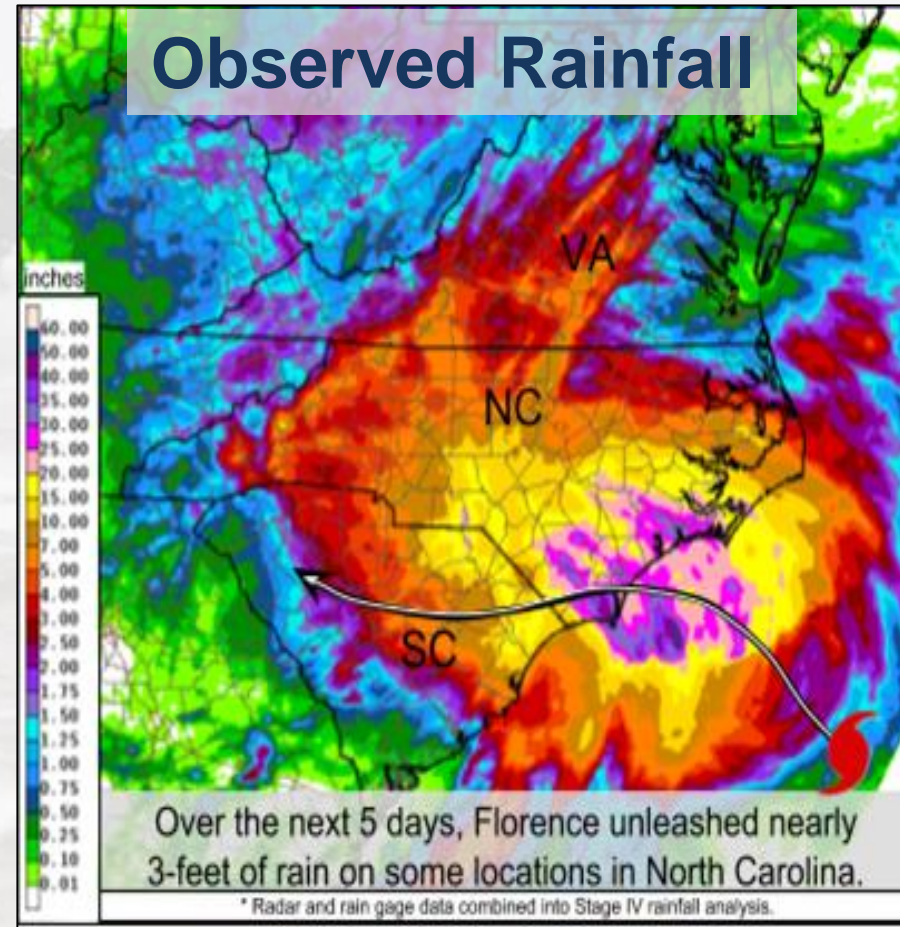
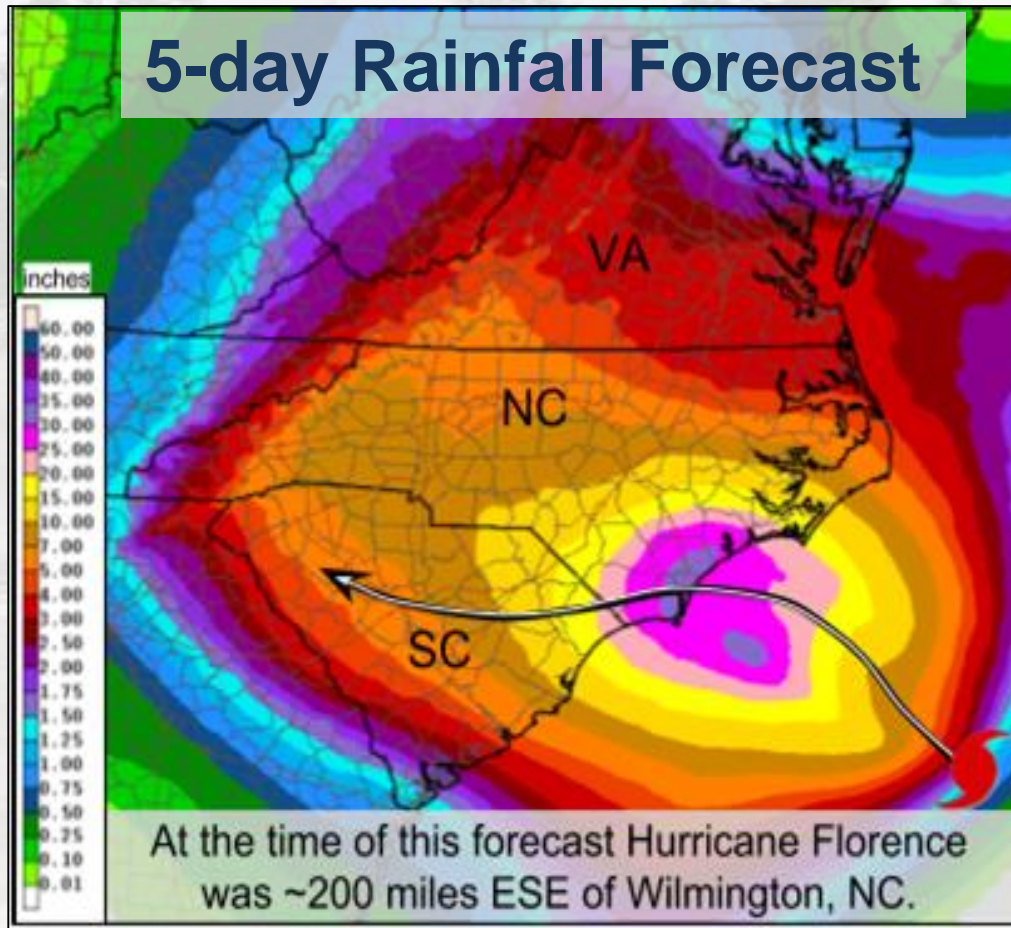


# 2020 U.S. TC Fatalities

- 47 direct fatalities
  - 16 surf/rip current
  - 14 wind
  - 10 freshwater flooding (NC-7 from Eta)
  - 3 marine
  - 2 storm surge
  - 2 tornado (NC-Isaias)

**\*\*\*31 Deaths Water Related\*\*\***

# Hurricane Florence



**Excellent Forecasts – Yet 16 out of 17 flood related fatalities were in vehicles!**

# Storm Surge Florence/Dorian



New Bern

**8 to 11 feet storm surge inundation in New Bern**

**Over 1,800 water rescues in New Bern alone**



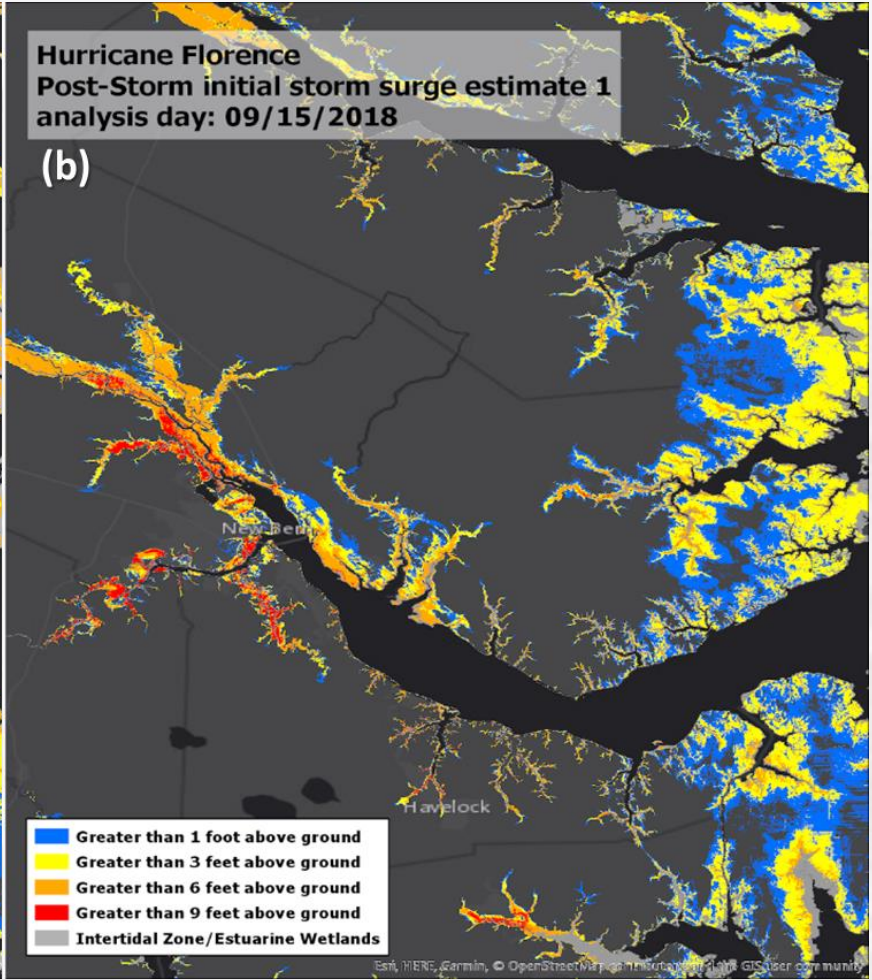
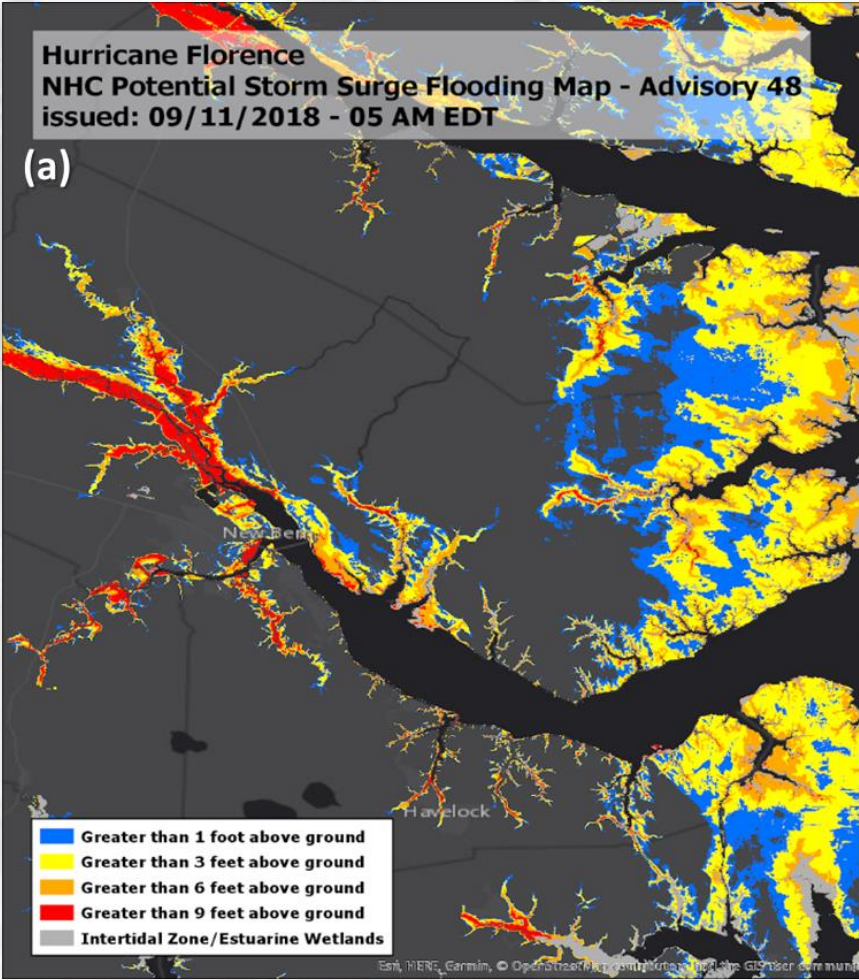
Ocracoke

**4 to 7 feet of surge from Dorian on Ocracoke and Hatteras Island**

# Storm Surge Forecasting

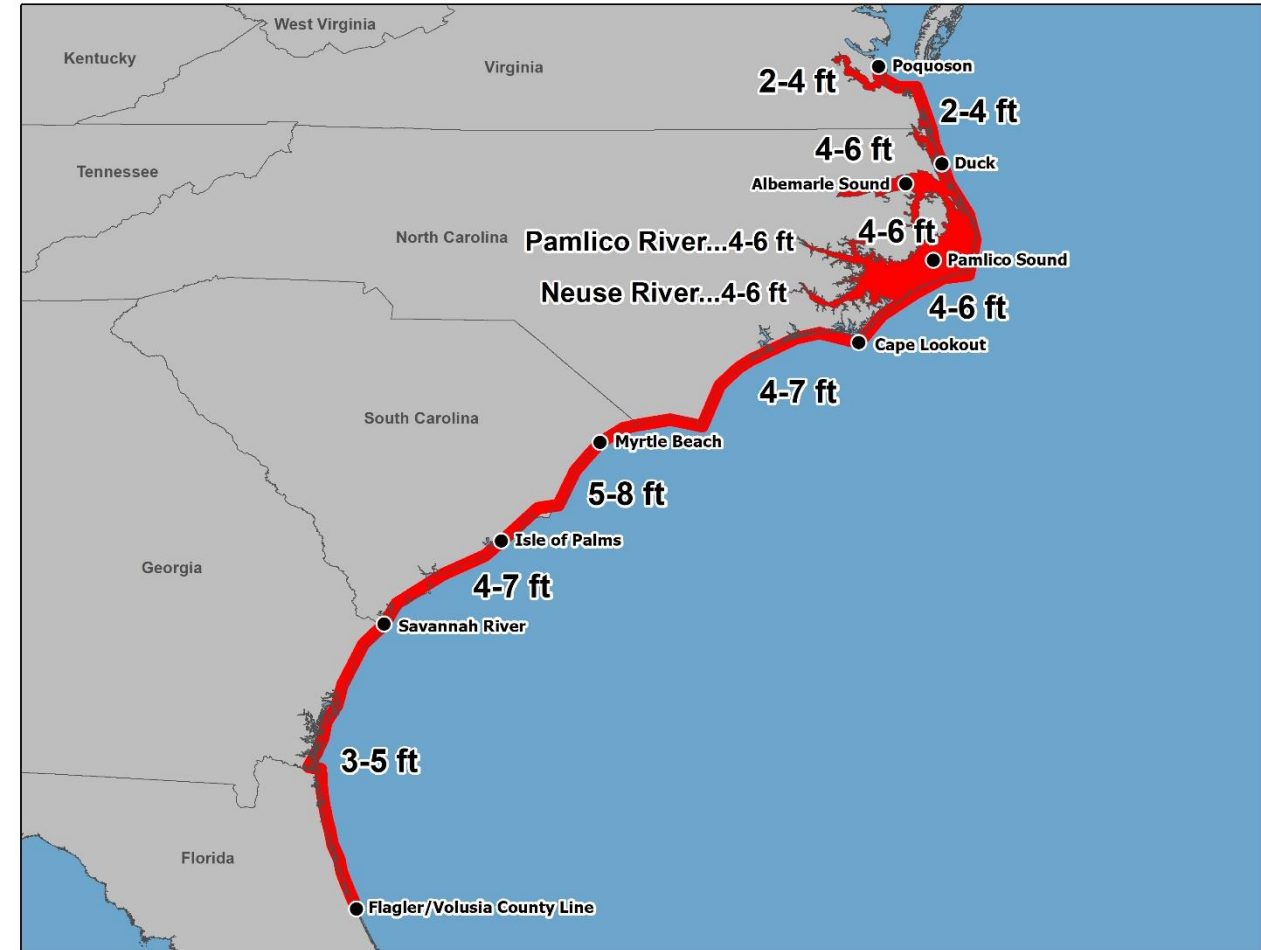


# Storm Surge Forecasting

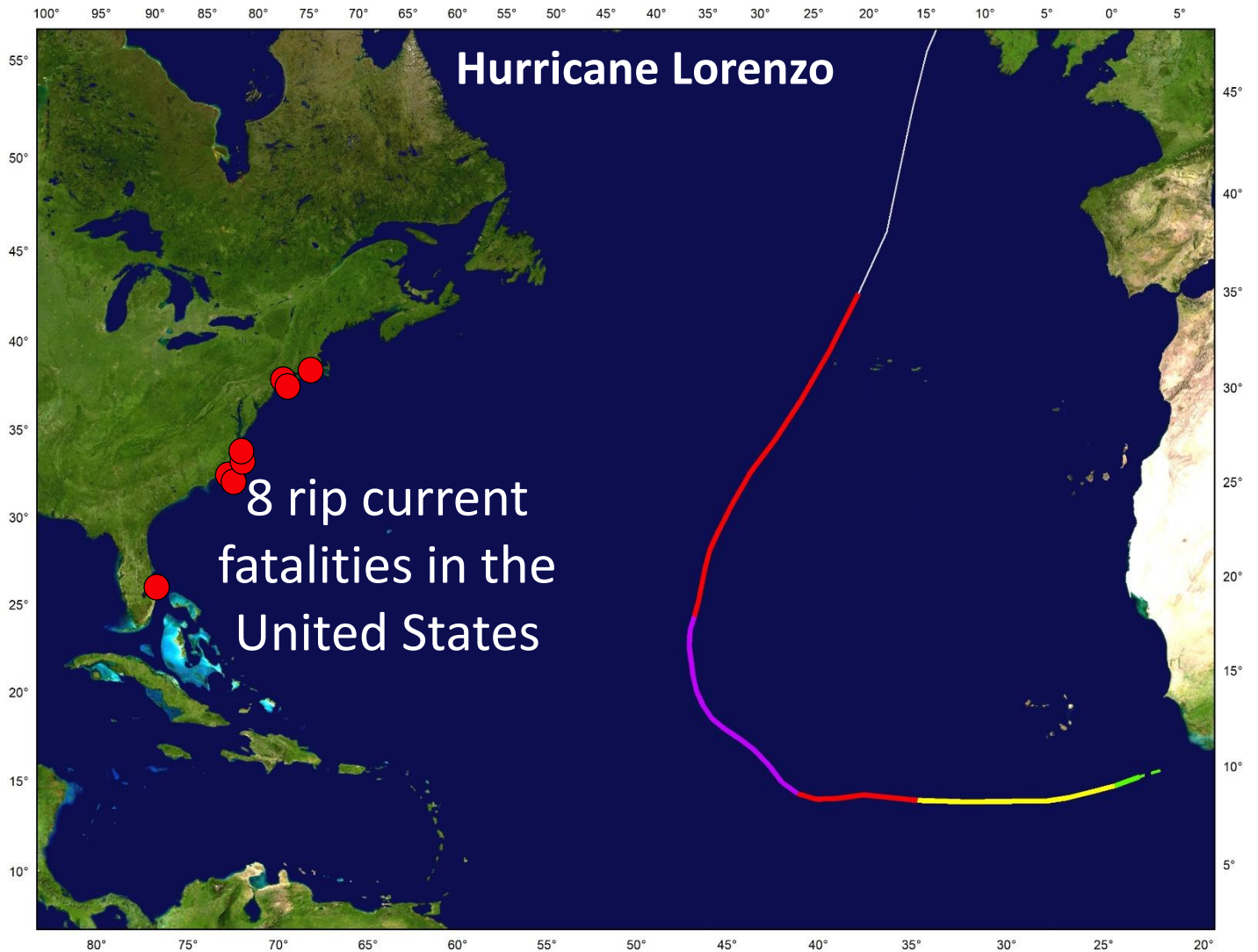


# Experimental Peak Storm Surge Forecasting Graphic

- Visual representation of peak storm surge forecast values  
Public Advisory
- Primarily for media and social media applications where point probabilities and/or high-resolution inundation mapping not easily displayed
- Experimental for 2021 – NHC interested in comments and feedback



# Second Deadliest 2019 Atlantic Basin Storm Lorenzo – 19 Direct Fatalities – All Water Related



- **Powerful Major Hurricane for several days.**
- **North most CAT 5 on record in Atlantic.**
- **8 rip current deaths in the United States from Florida to Rhode Island**
- **4 in North Carolina alone**
- **Dangerous rip currents can occur well ahead of approaching storms**

# Rip Current Messaging

## High Risk For Rip Currents

Tropical Storm Arthur



Morehead City, NC  
WEATHER FORECAST OFFICE

**RIP CURRENTS**  
KNOW YOUR OPTIONS

**IF CAUGHT IN A RIP CURRENT**

- Relax, rip currents don't pull you under.
- Don't swim against the current.
- Swim out of the current, then to shore.
- If you can't escape, float or tread water.
- If you need help, yell or wave for assistance.

The infographic shows a diagram of a rip current flowing away from the shore. Swimmers are depicted being pulled into the current. Red arrows labeled "ESCAPE" point outwards from the current, indicating the correct direction to swim. Labels "CURRENT" and "RIP CURRENT" are placed on the respective flow lines.

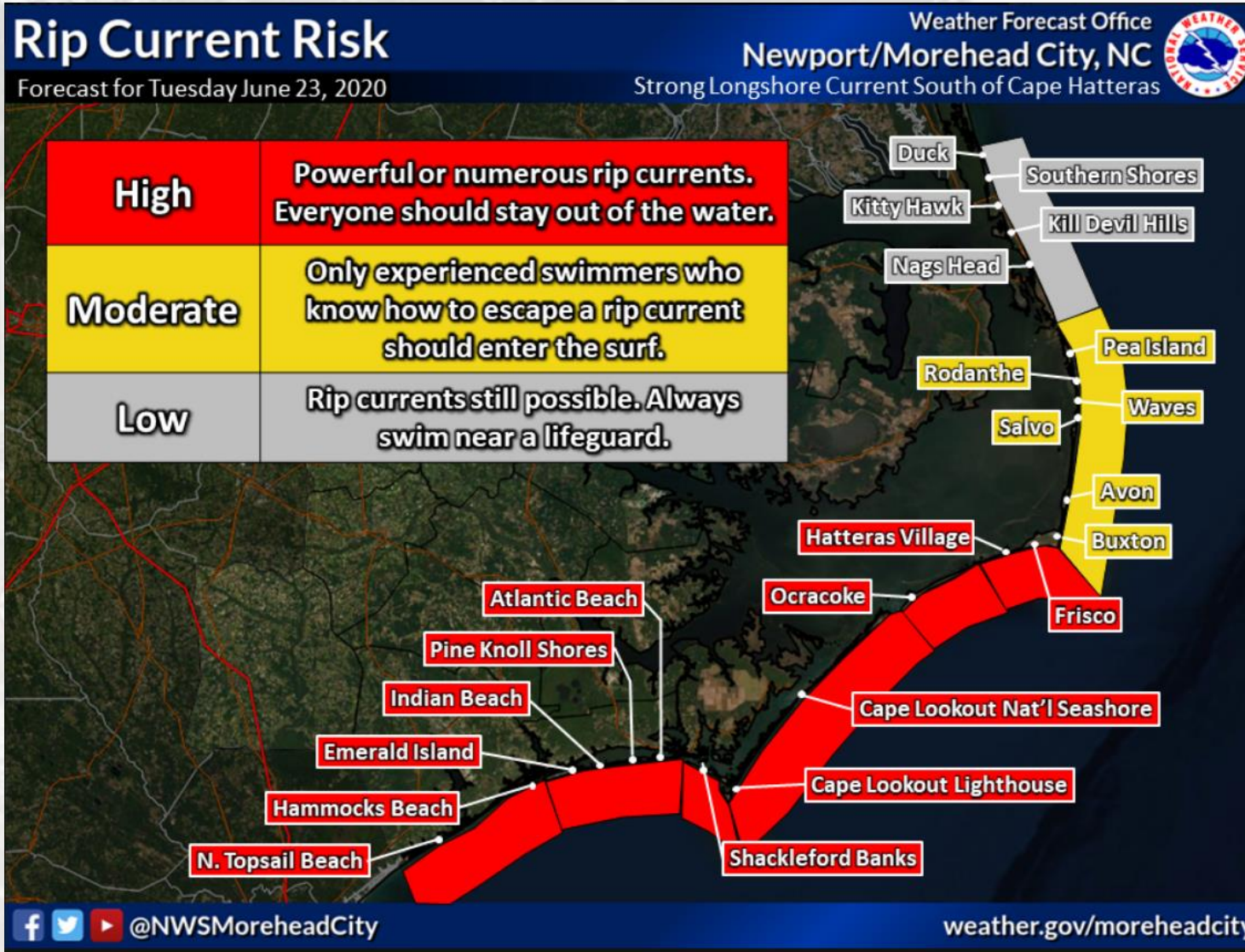
Rip currents are powerful currents of water moving away from shore. They can sweep even the strongest swimmer away from shore. If at all possible, swim near a lifeguard.

## Impacts

- Increased swell will produce very dangerous swimming conditions through early week.
- Visit [Beach Forecast Page](#) (experimental) for the latest beach conditions forecast.



# Rip Current Messaging



**US National Weather Service**  
Newport/Morehead City NC  
Published by Sean Bandy [?]  
· June 23 ·

Tuesday 6/23 @ 6:30 AM:  
\*\*\*ATTENTION BEACHGOERS\*\*\*

There is a HIGH RISK for rip currents and a strong longshore current is expected today south of Cape Hatteras, including the southern OBX and Crystal Coast. Swimming could be dangerous even for strong swimmers.

If in doubt, don't go out!

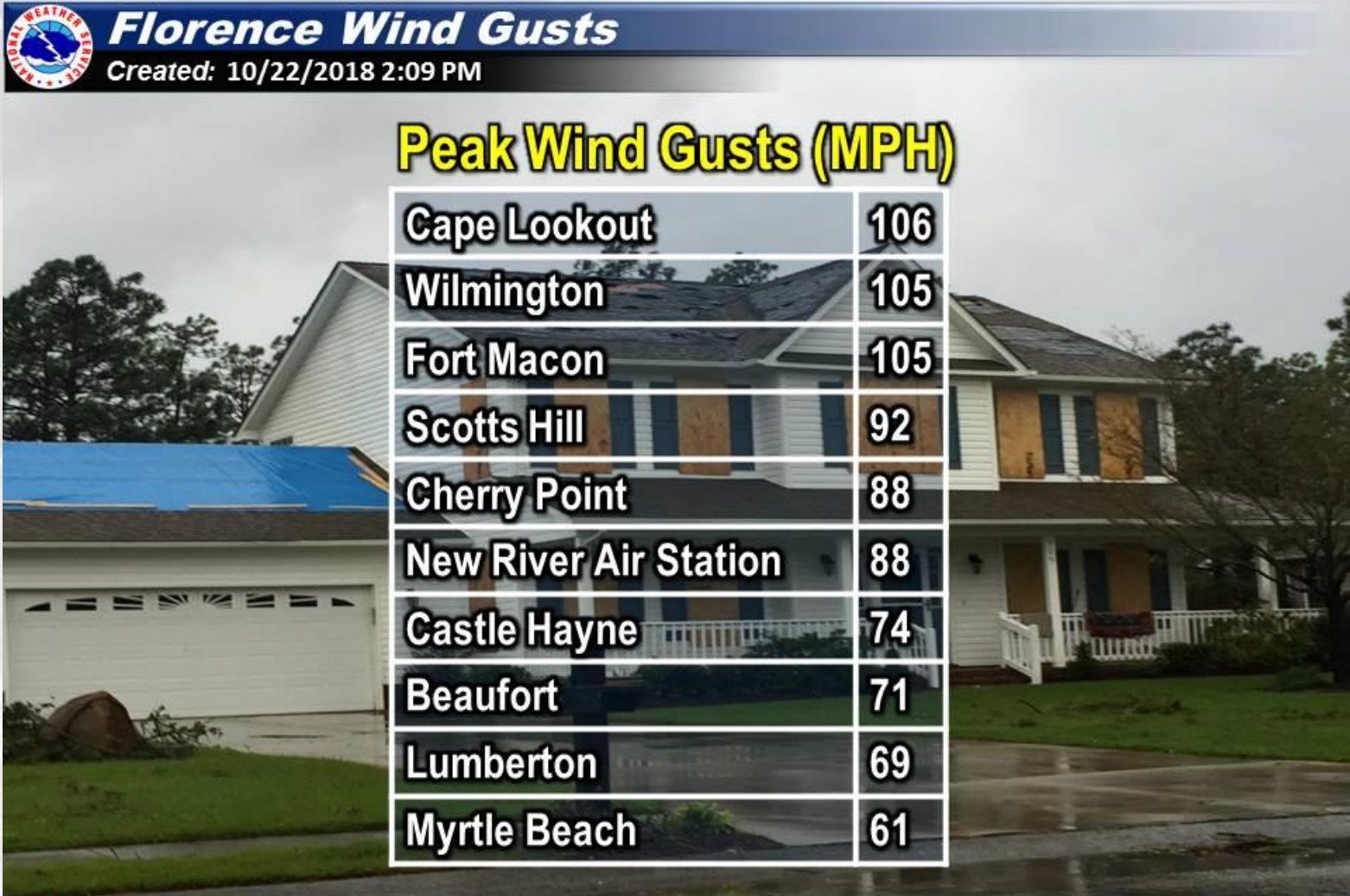
45,254 People Reached 2,039 Engagements [Boost Post](#)

45 1 Comment 229 Shares

Like Comment Share

Comment as US National ...

# Wind Threat



- Disruption to power and communication network
- Blocked evacuation or return routes due to fallen trees, power lines
- Fallen tree danger

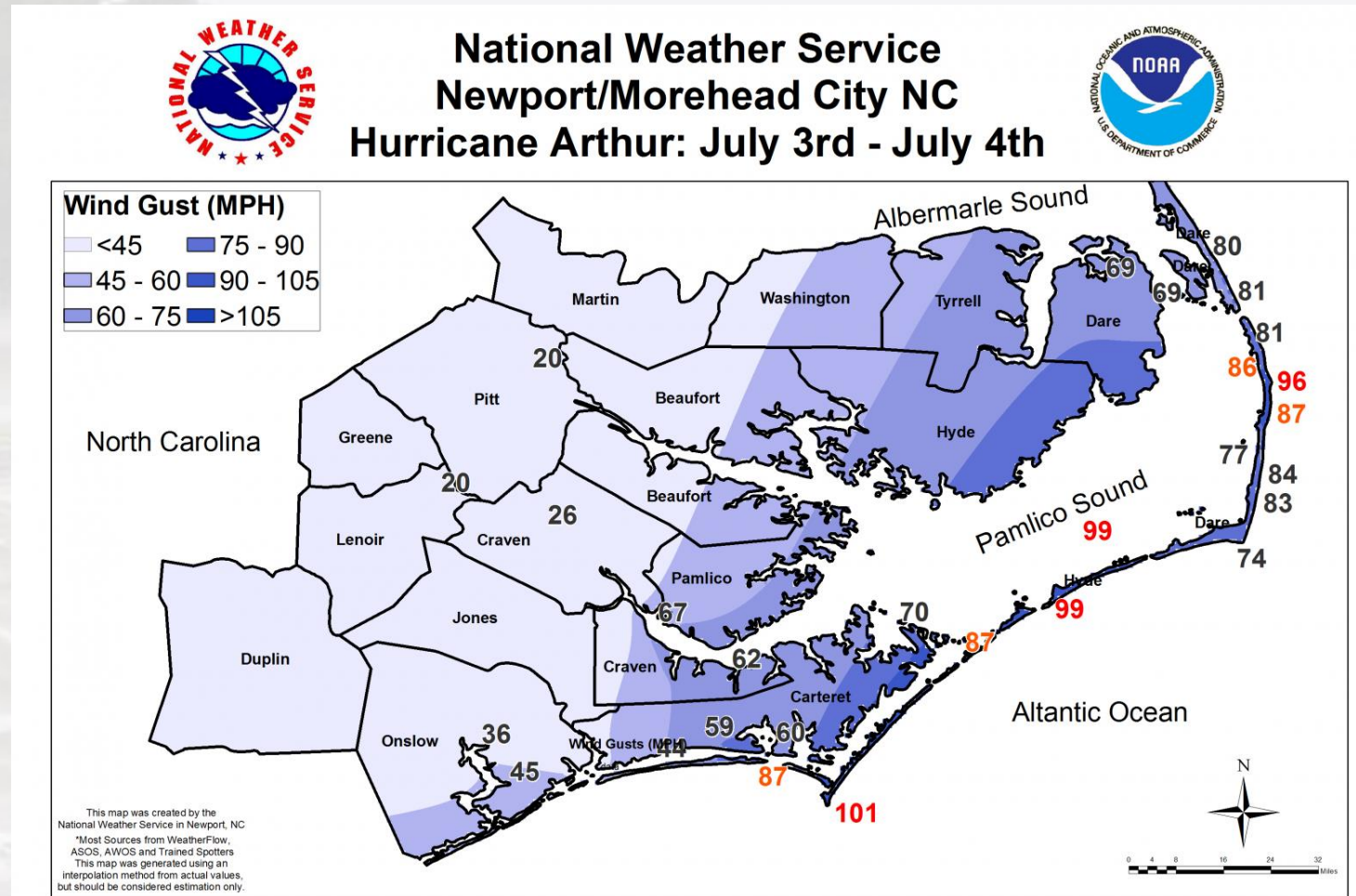
# Arthur 2014

## CAT 2

### Similar Landfall

### Faster Moving

### Smaller Storm



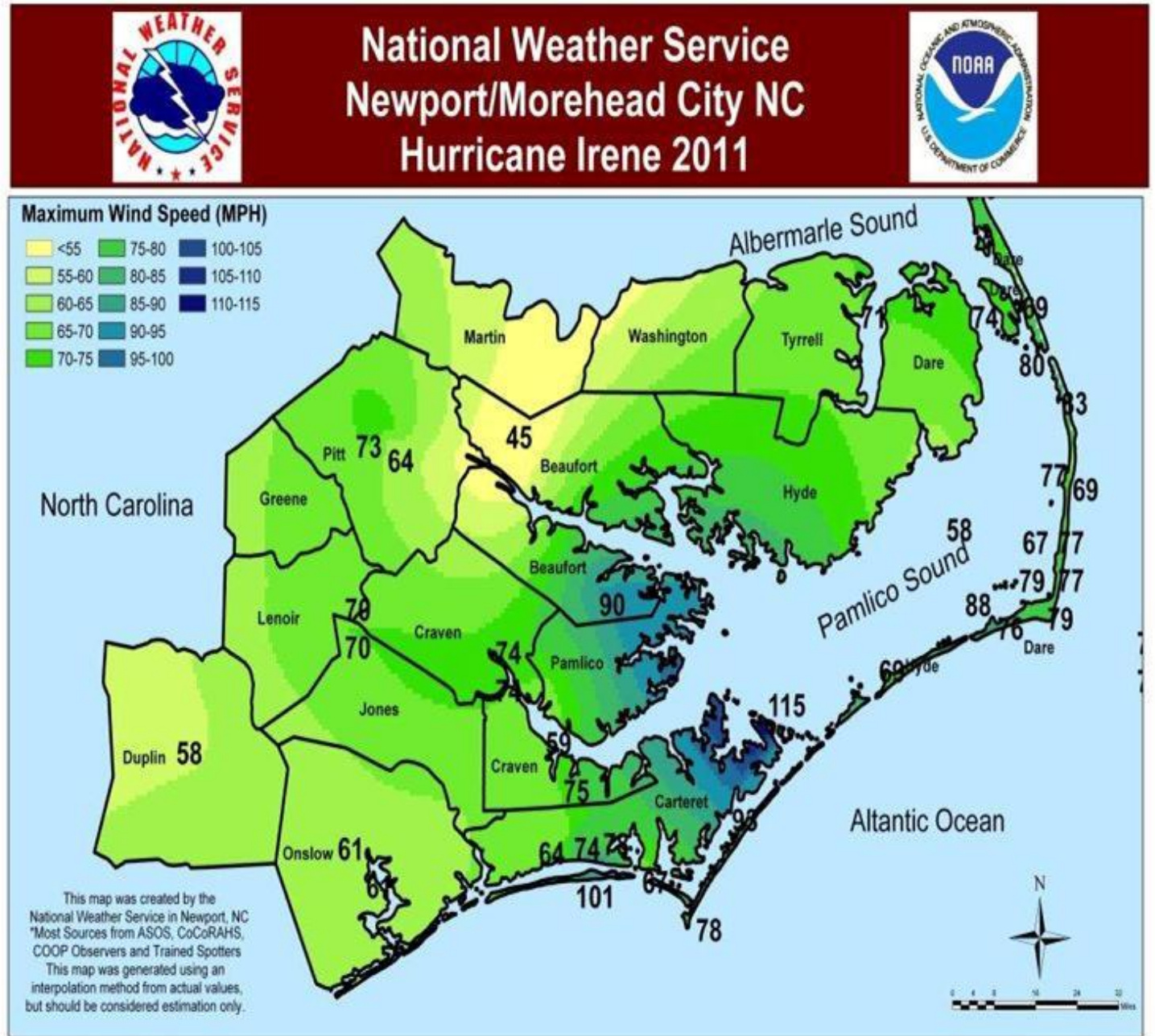
# Irene 2011

## CAT 1

### Similar Landfall

### Slower Moving

### Large Storm



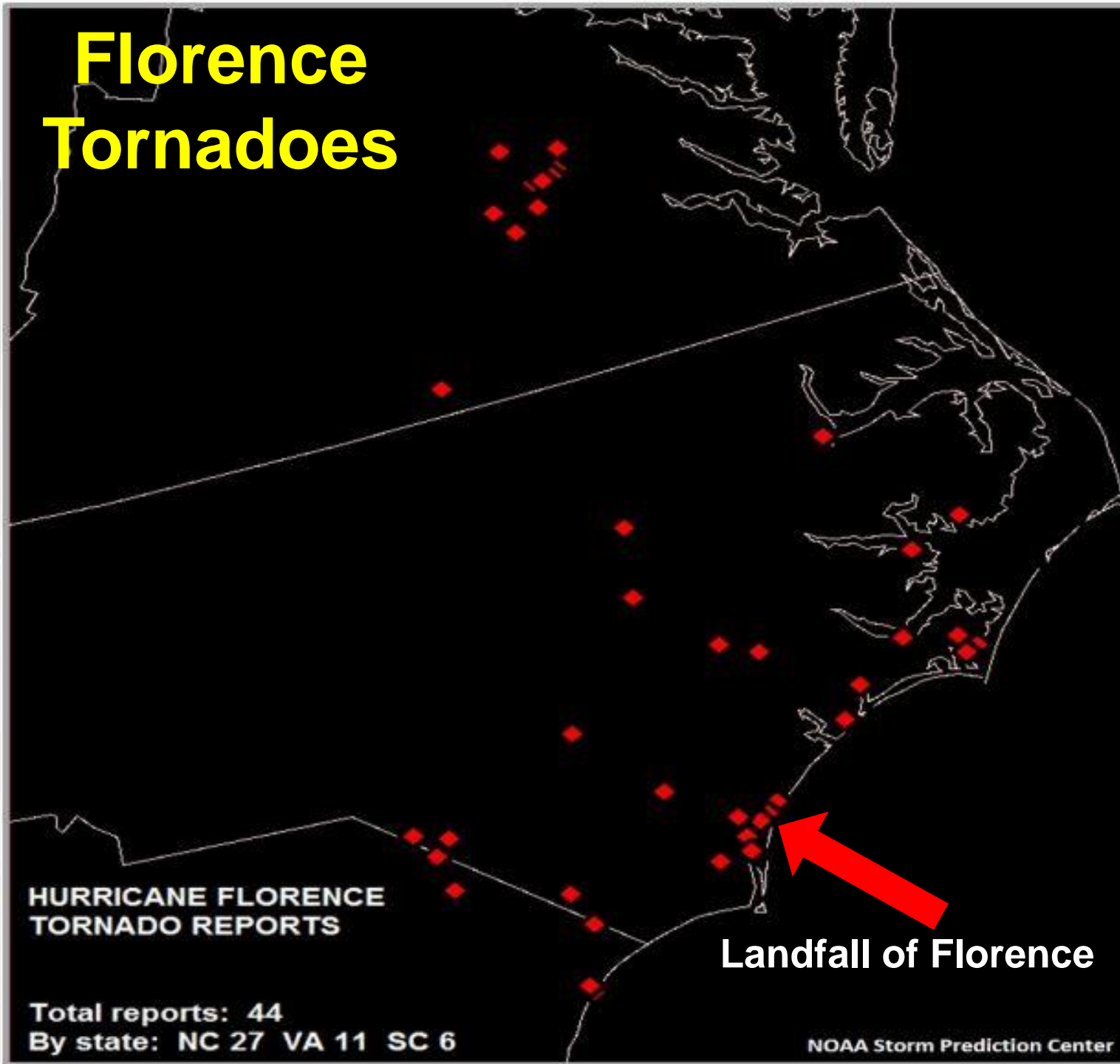
# Tornado Threat



Hurricane Dorian  
EF2 Tornado Estimated  
Winds 115 MPH  
Emerald Isle, NC

- Isolated areas of enhanced damage
- Often occur with smaller windows to react to warnings
- Can occur well ahead of the actual landfall, or well away from the center (first outer bands)

# Florence Tornadoes



# Indirect Fatalities

Hurricane Laura: 7 Direct U.S. Fatalities

34 Indirect U.S. Fatalities (16 from carbon monoxide)

Since 2017: 14 U.S. Hurricane Landfalls, 7 Major Hurricanes

7 Storm Surge Fatalities

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

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

2020 U.S. indirect fatalities: 51

19 carbon monoxide, 9 heat related, 10 accidents





# Questions/Comments



[erik.heden@noaa.gov](mailto:erik.heden@noaa.gov)