

Hurricane Community Forum

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Emergency Management



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Meteorologist
NWS Morehead City



Talk Starts
at 700 PM

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.

We have provided this talk as a PDF in the handouts section.



The screenshot displays a software interface with a menu bar at the top containing 'File', 'View', 'Help', and a globe icon. Below the menu bar is a 'Sound Check' section with a green bar and a question mark. The 'Audio' section is expanded, showing 'Computer audio' selected with a radio button, and 'Phone call' unselected. A red microphone icon with the word 'MUTED' in orange is visible. Below this, a dropdown menu shows 'Microphone (HD Webcam C510)'. A volume slider is present, and another dropdown menu shows '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 area 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

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 ...
[Location Help](#)

News Headlines

- [The Fall 2019 Edition Of Our Newsletter, Carolina Skywatcher, Is Now Online!](#)

MY FORECAST
Morehead City NC

Overcast
49°F
9°C [Get Detailed info](#)

Today

Partly Sunny
High: 55°F

Tonight

Mostly Cloudy
Low: 43°F
[change location](#)

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](#)

[Zoom Out](#)

Last Map Update: Tue, Nov. 19, 2019 at 11:58:19 am EST

Tropical **Local Radar** **Satellite**

11/19/19 16:46Z GOES-East



Social Media

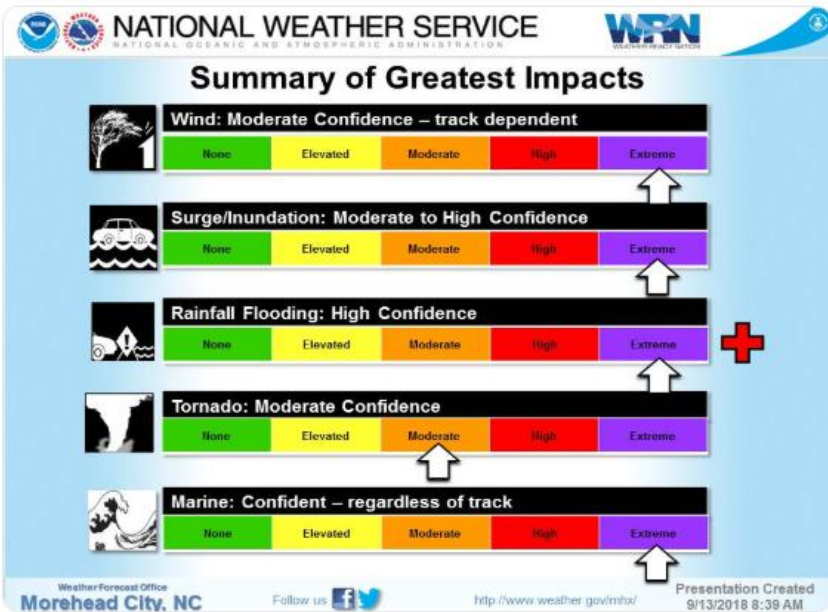
Search NWS Morehead City



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...



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



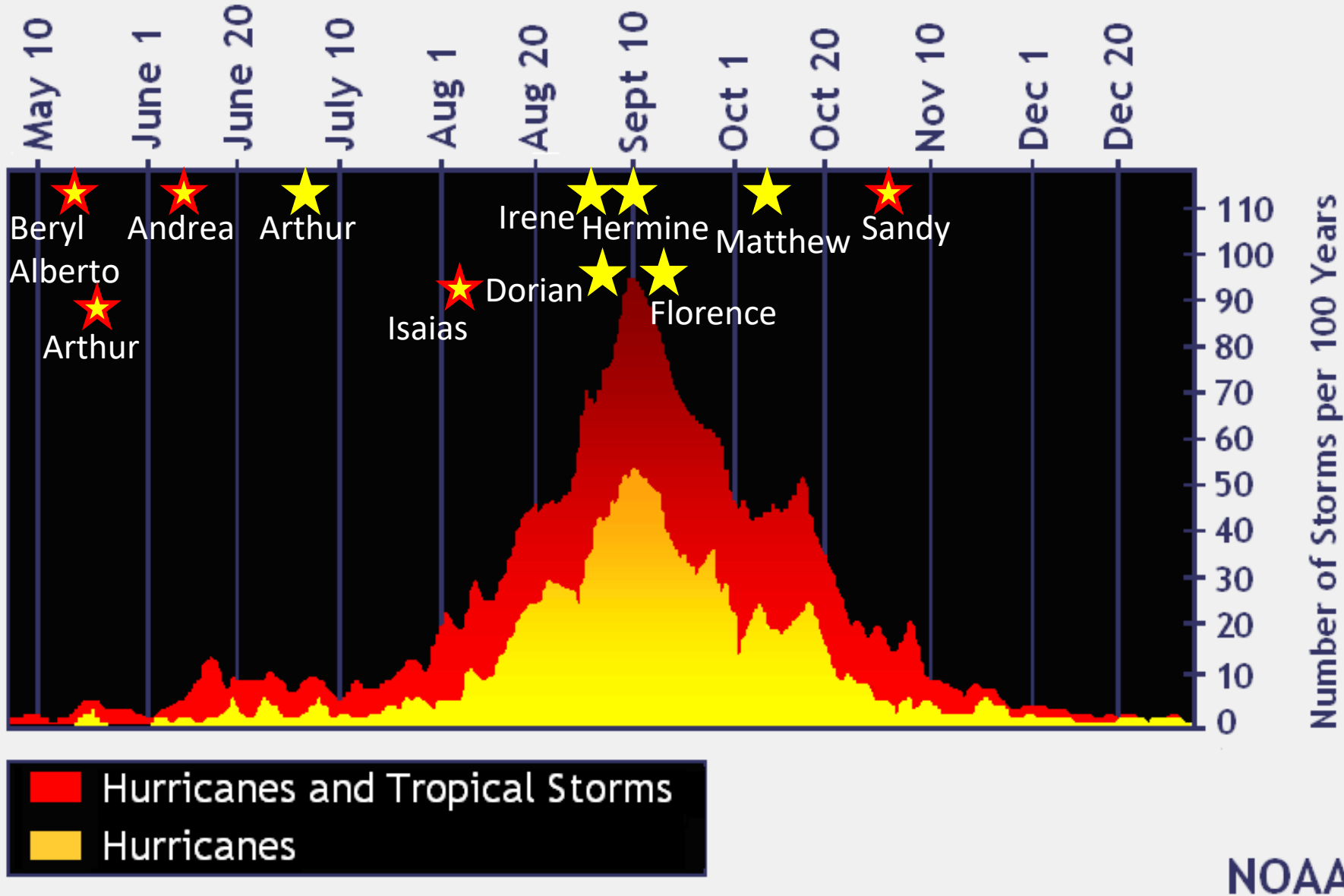
NWSMoreheadCity

Published on Sep 12, 2018

SUBSCRIBE 199

Hurricane Florence Lead Up

The Time To Prepare Is NOW



Peak of the season is around September 10th

Tropical systems can occur from May through November

Our Website

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



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

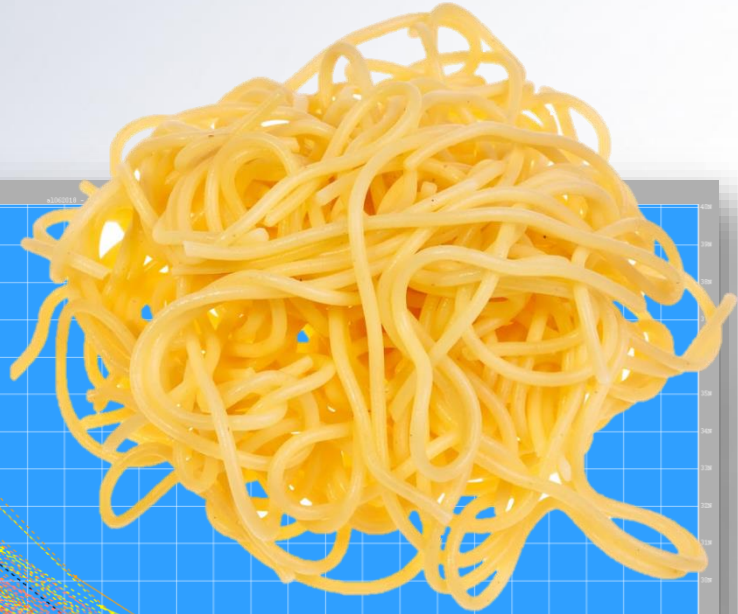
5 10 20 30 40 50 60 70 80 90 100 %

5/17/2020 6:24 AM

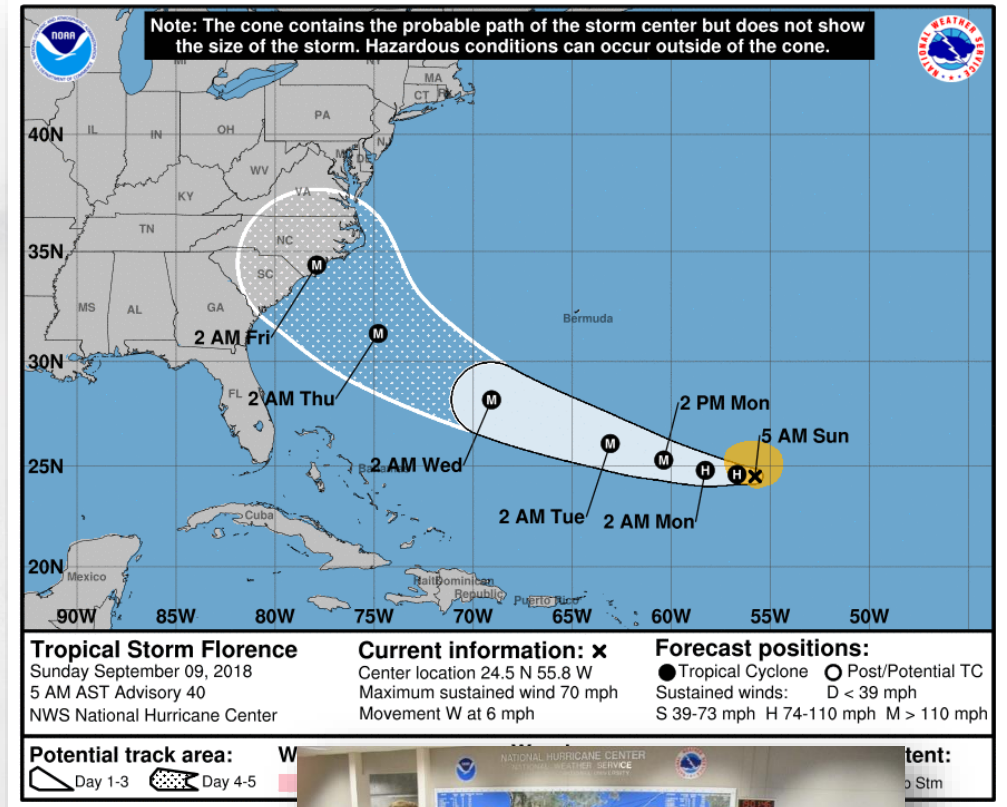
www.weather.gov/MoreheadCity

- 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.

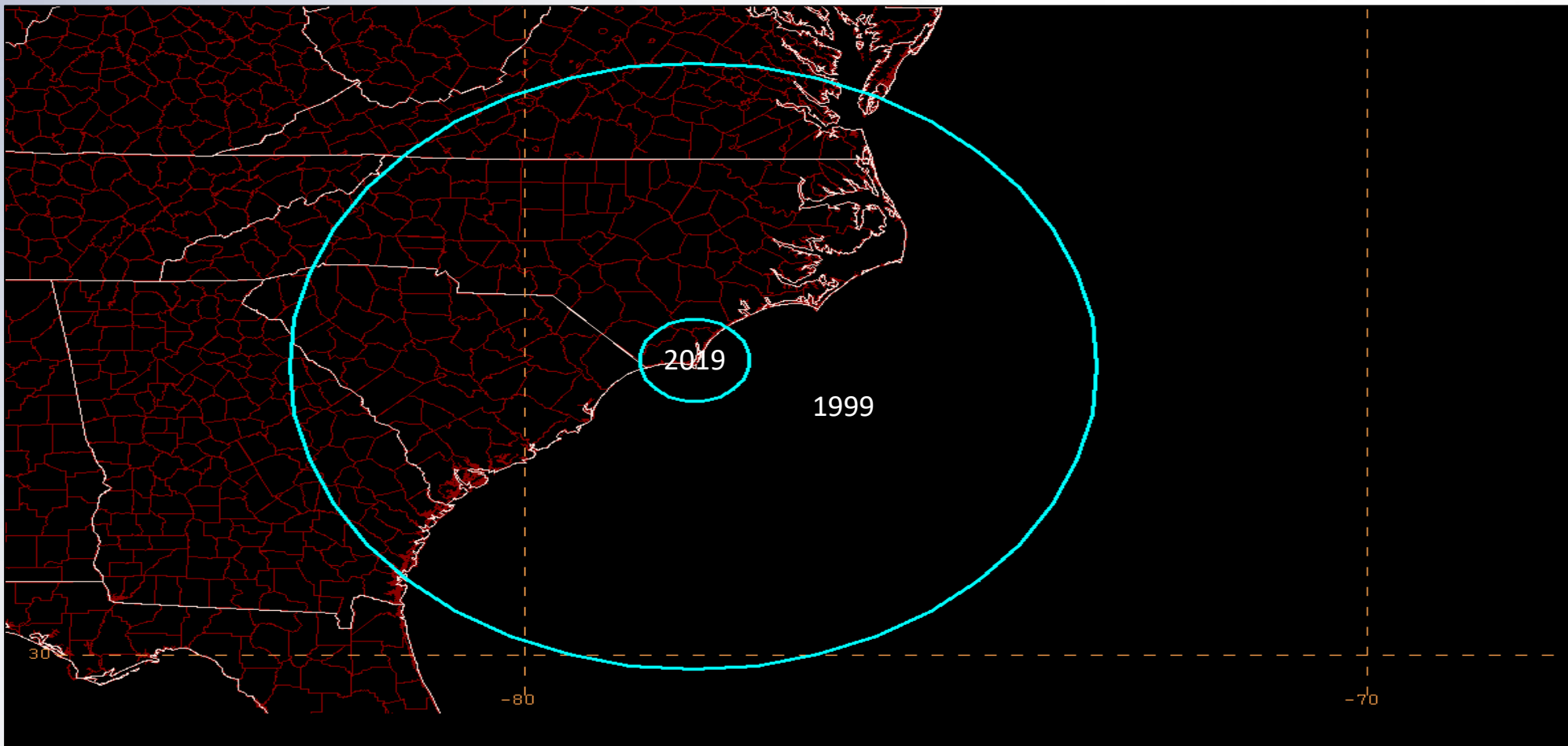


About 175 years of experience combined!



How Far Have We Come?

1999 (Floyd) Vs 2019 (Dorian)

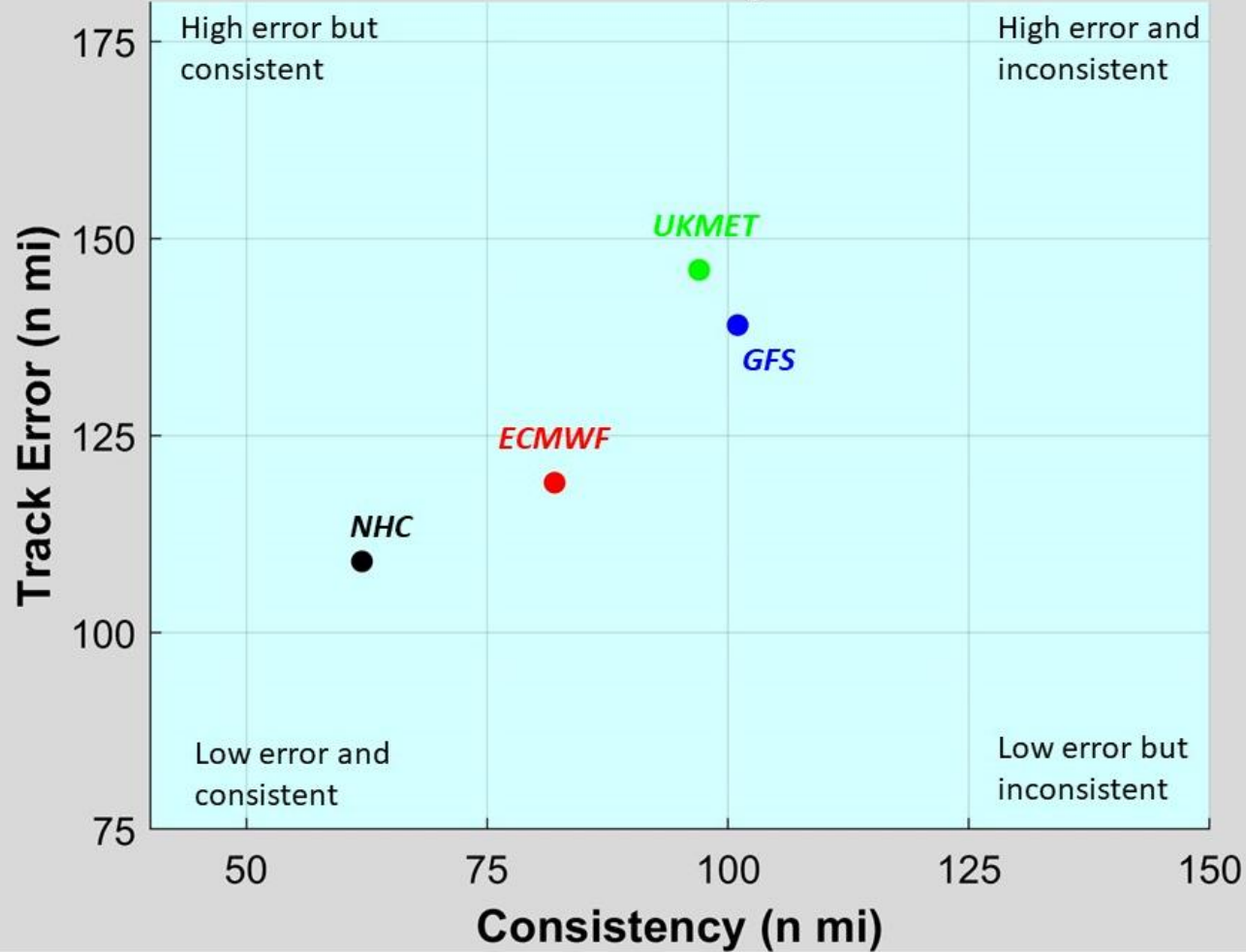


**Difference in
average 3-
day track
forecasts for
Floyd (1999)
and Dorian
(2019)**

NHC Track Forecasts

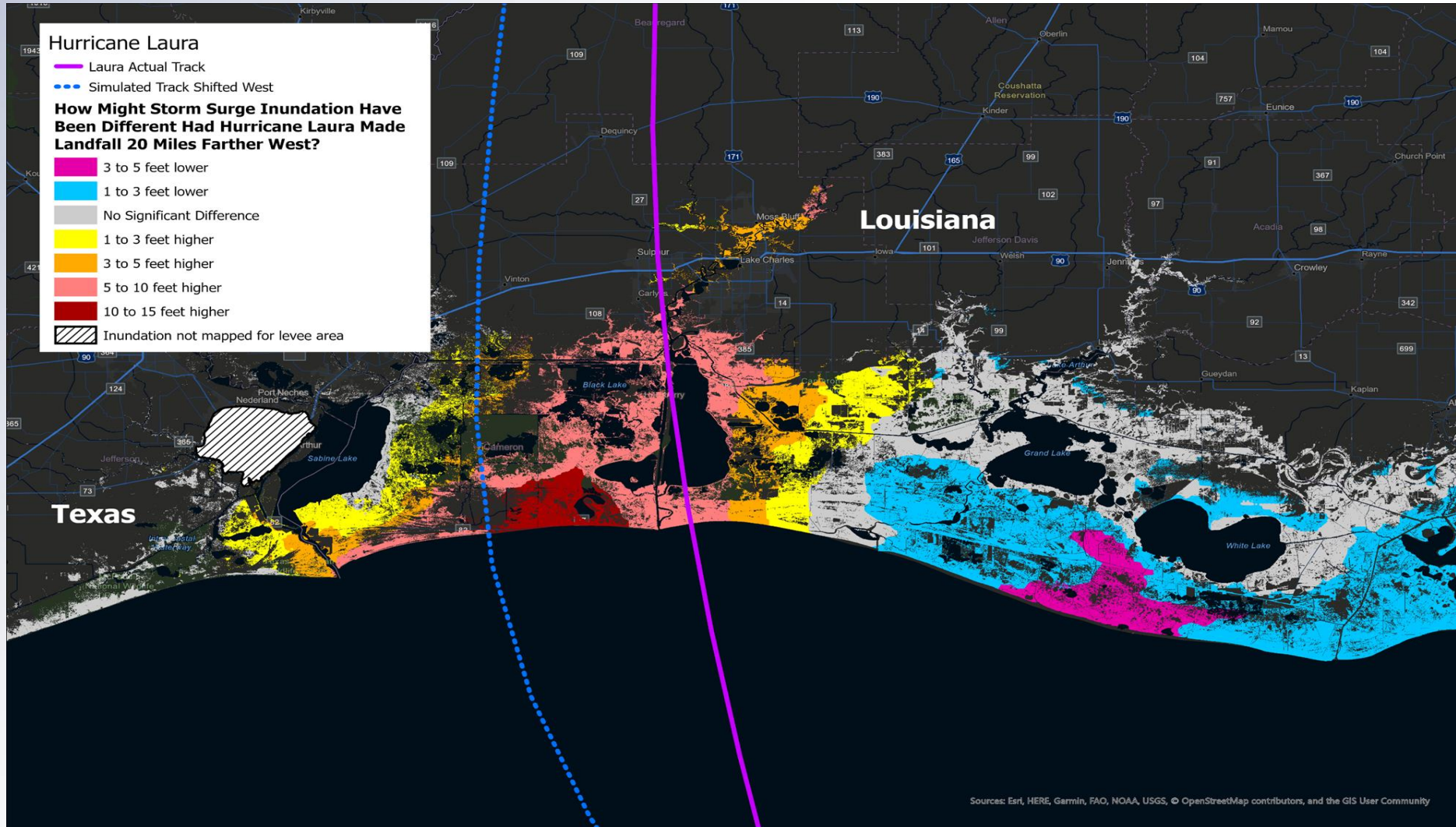
More Accurate and More Consistent

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

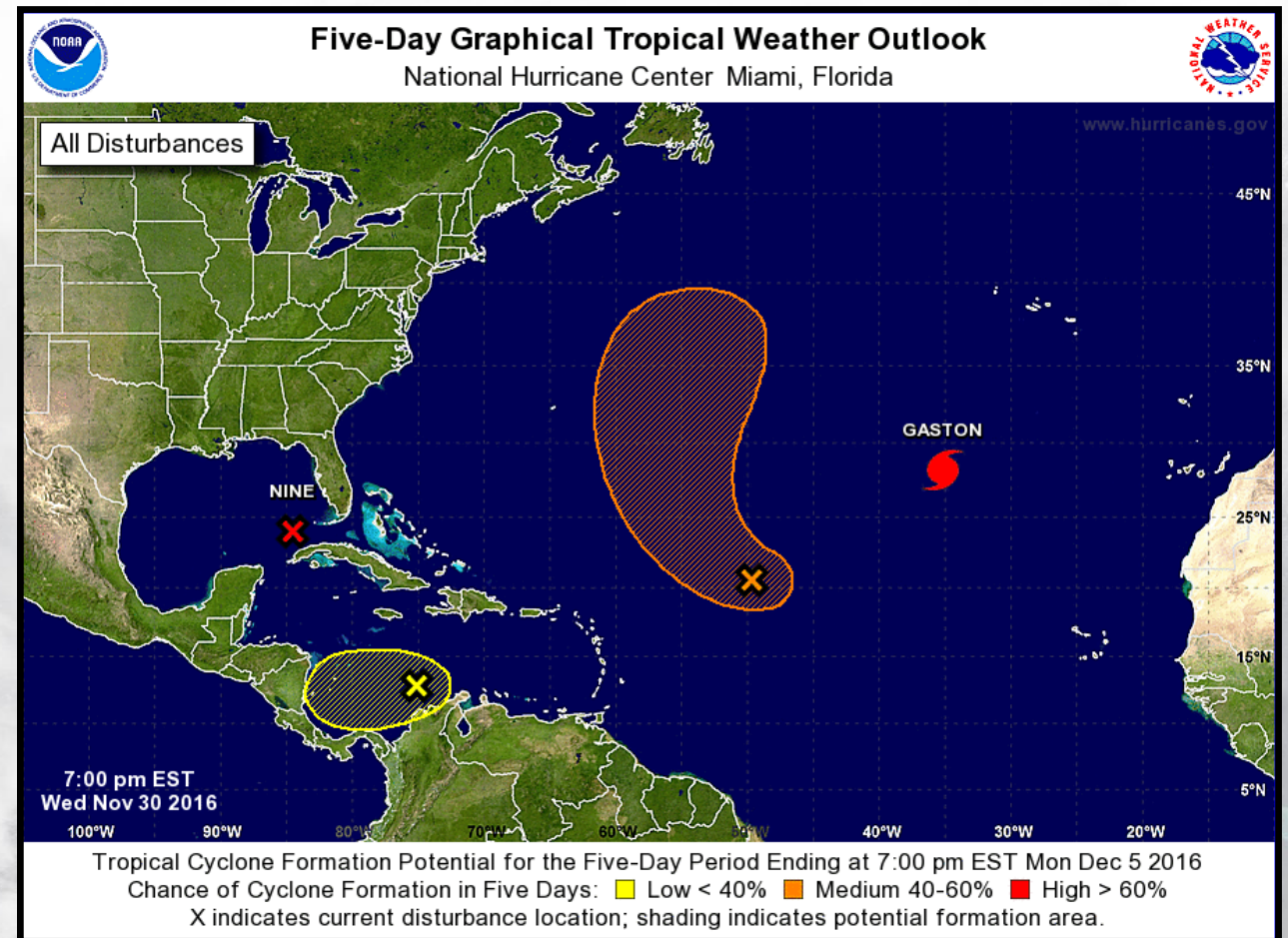


National Hurricane Center

Hurricanes.gov or weather.gov/moreheadcity/tropical

Tropical Weather Outlook

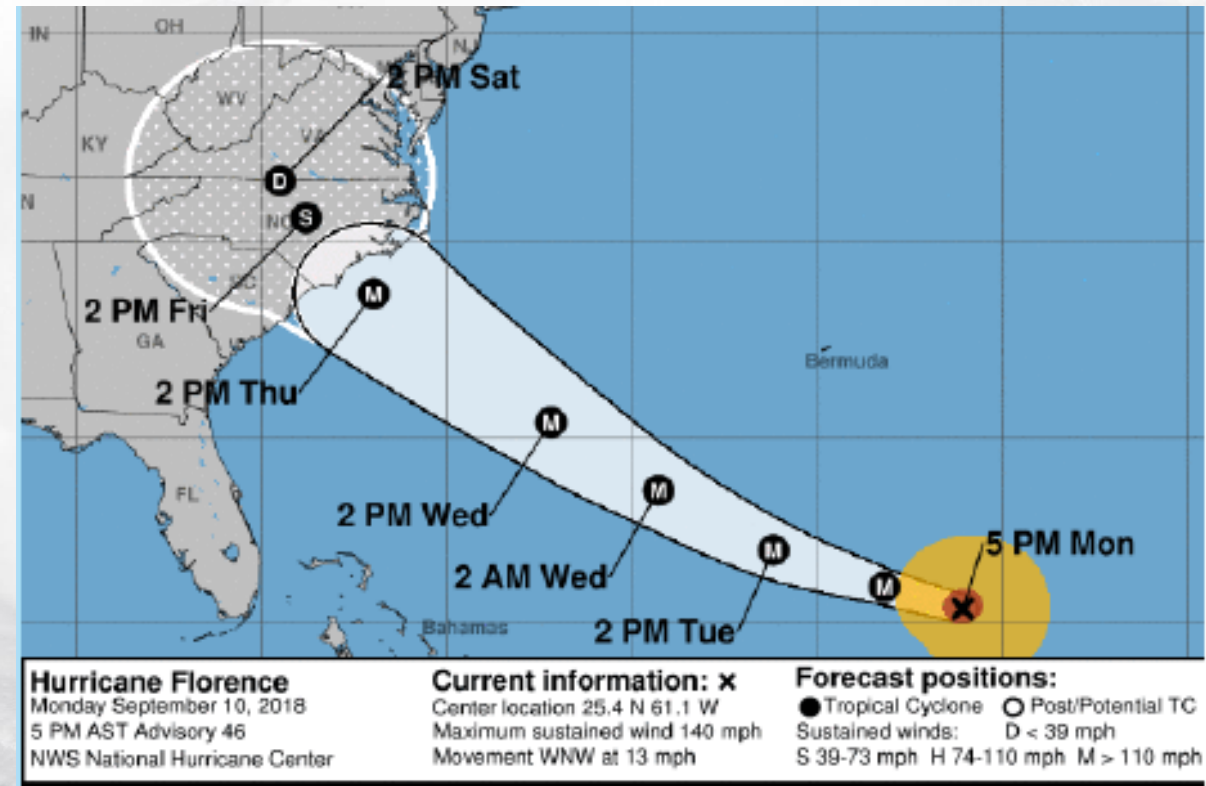
- Issued 4 times a day
- 8 and 2 AM/PM EDT
- Tropical cyclone formation potential for next 5 days



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



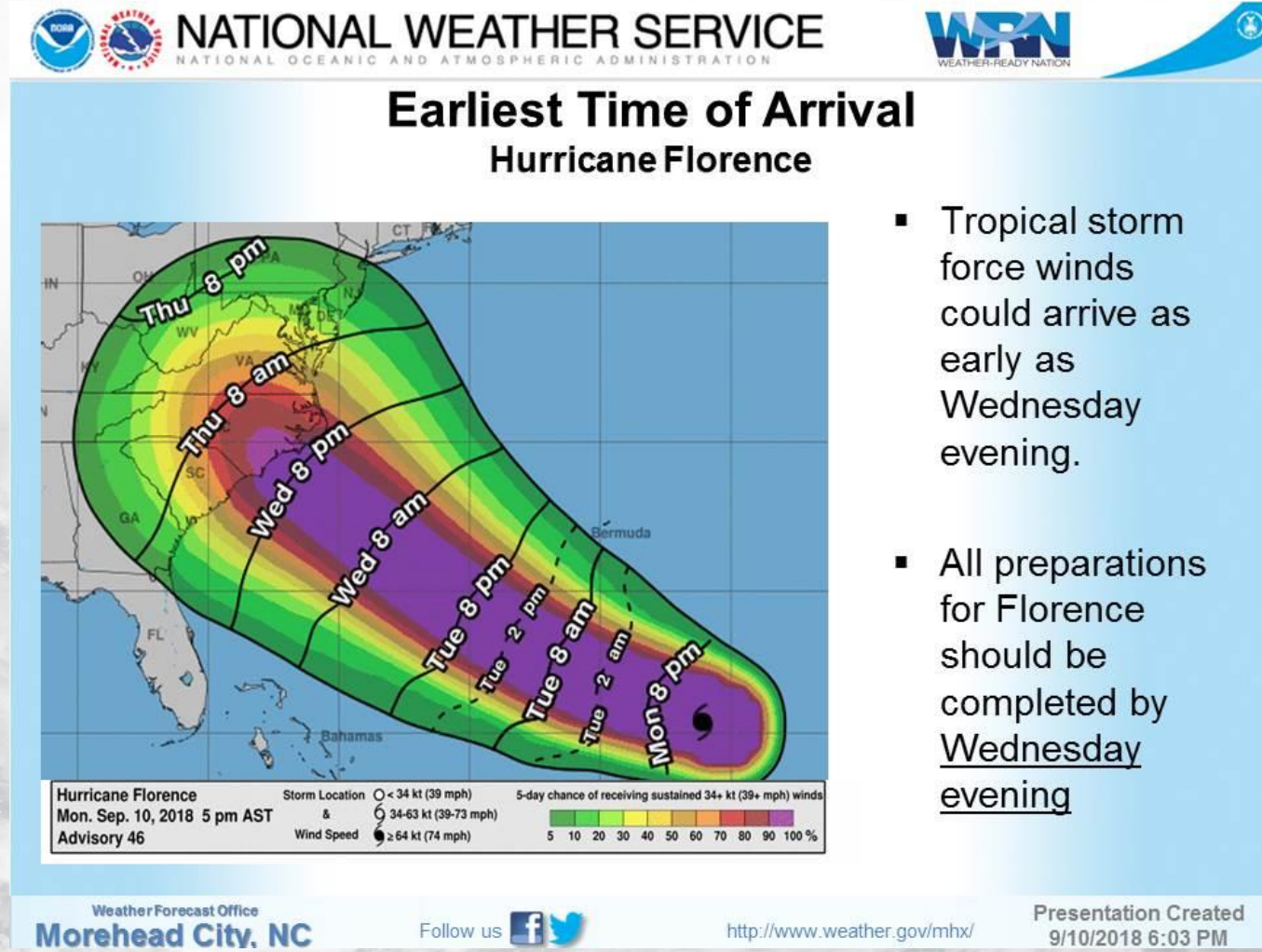
National Hurricane Center

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



National Hurricane Center

Hurricanes.gov or weather.gov/moreheadcity/tropical

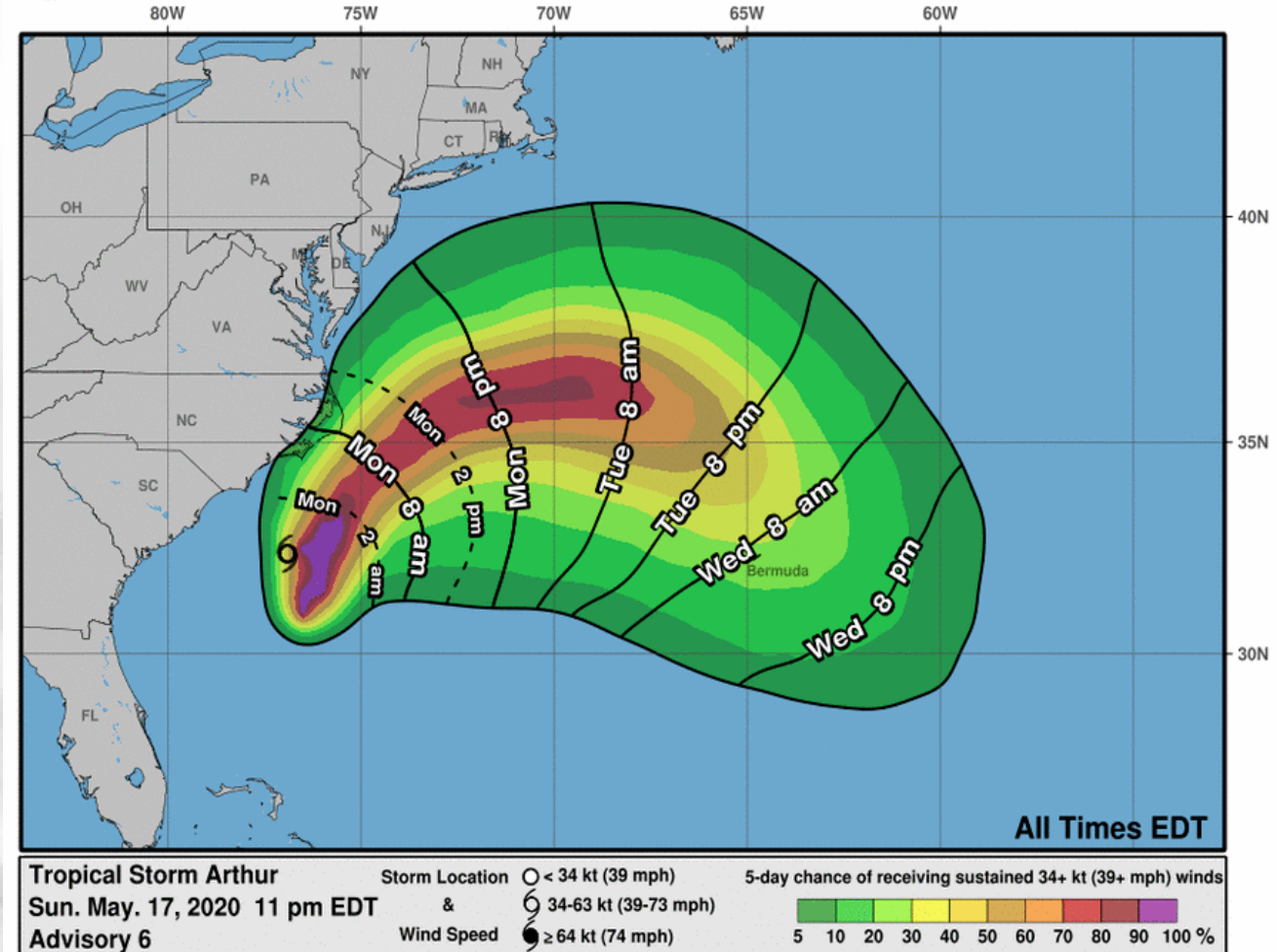
Most Likely Arrival Time Tropical Storm Force Winds

- 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

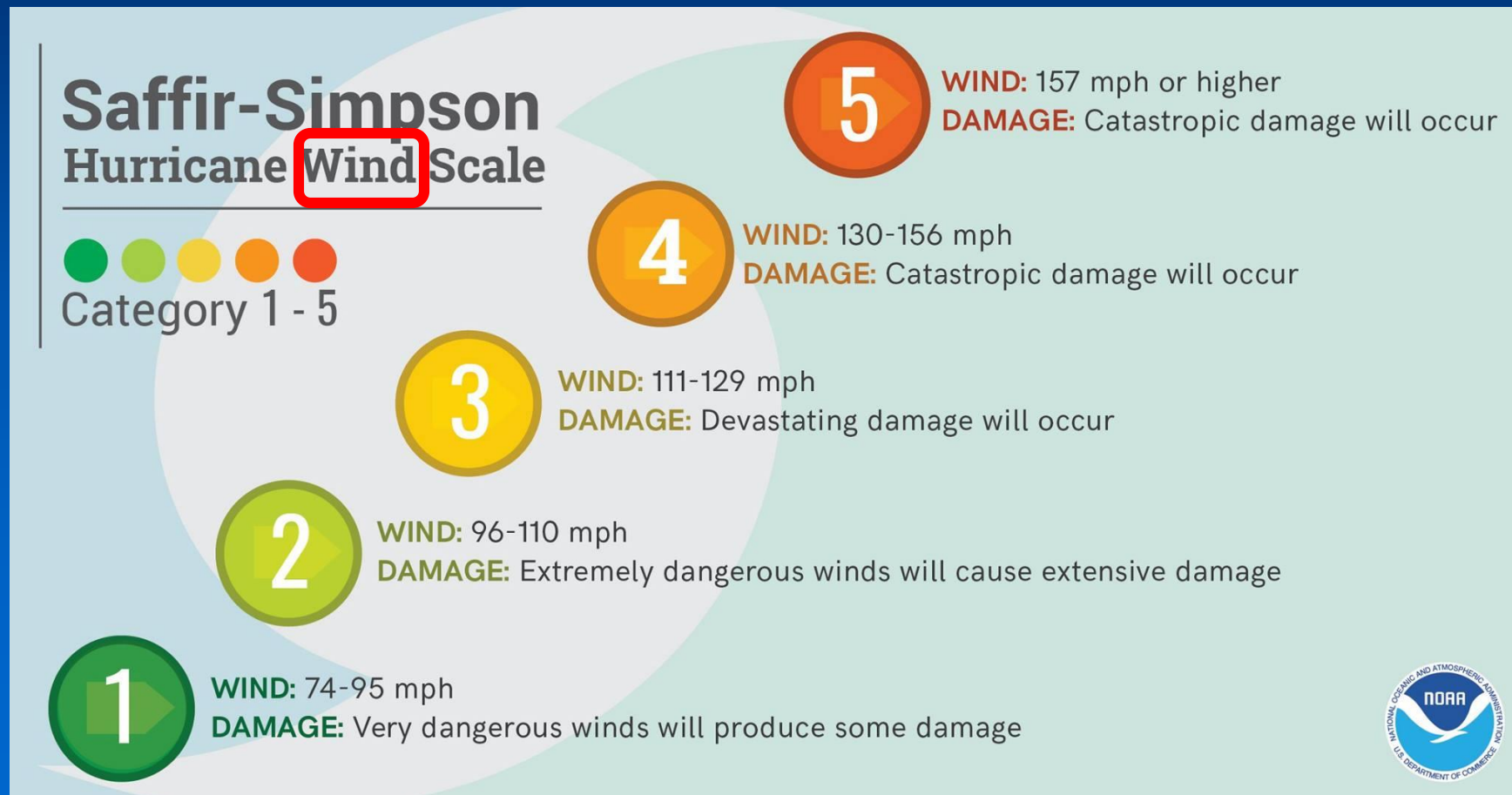


Most Likely Arrival Time of Tropical-Storm-Force Winds



Saffir/Simpson Hurricane Scale

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



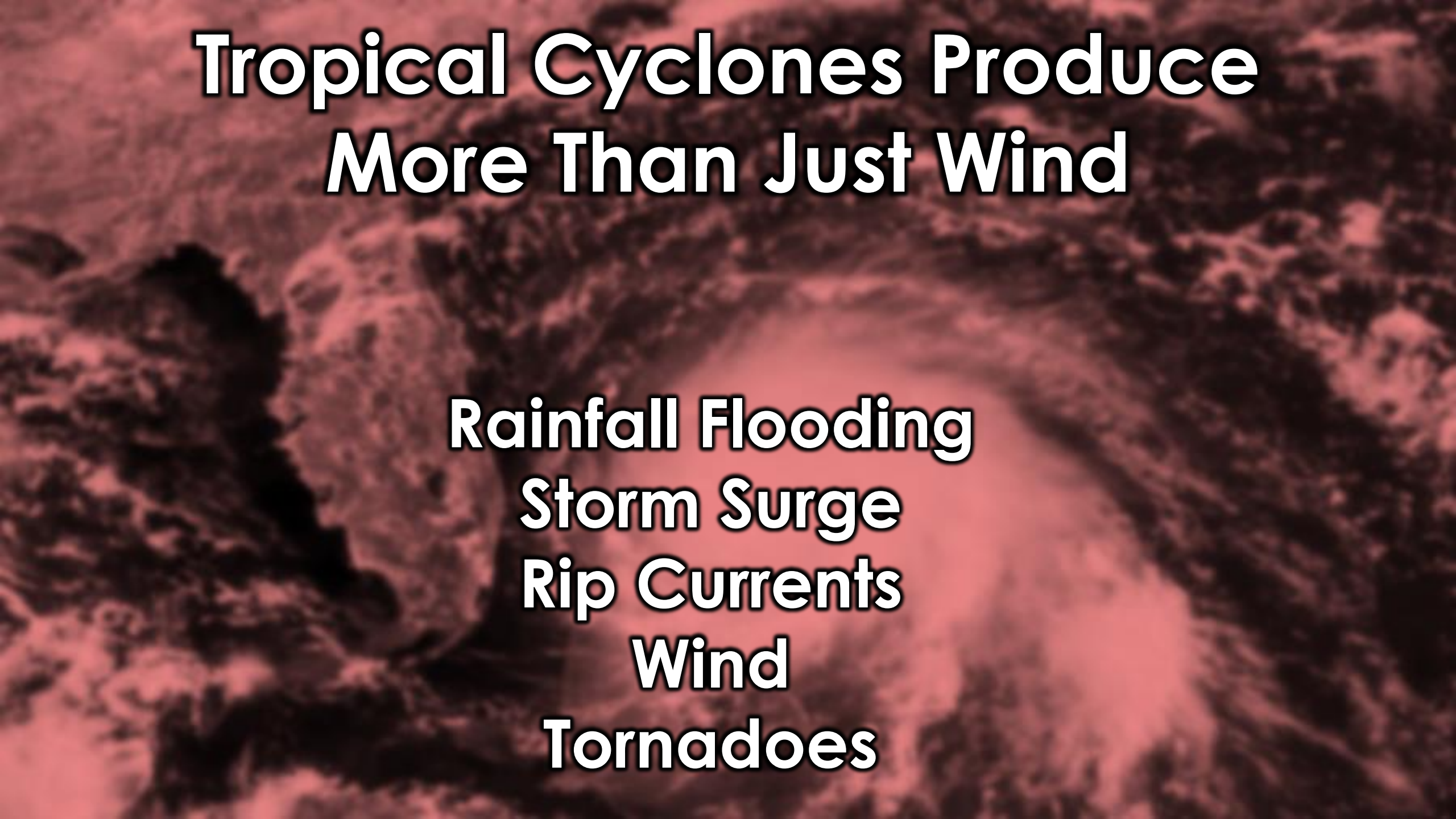
It's About the Impacts



**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

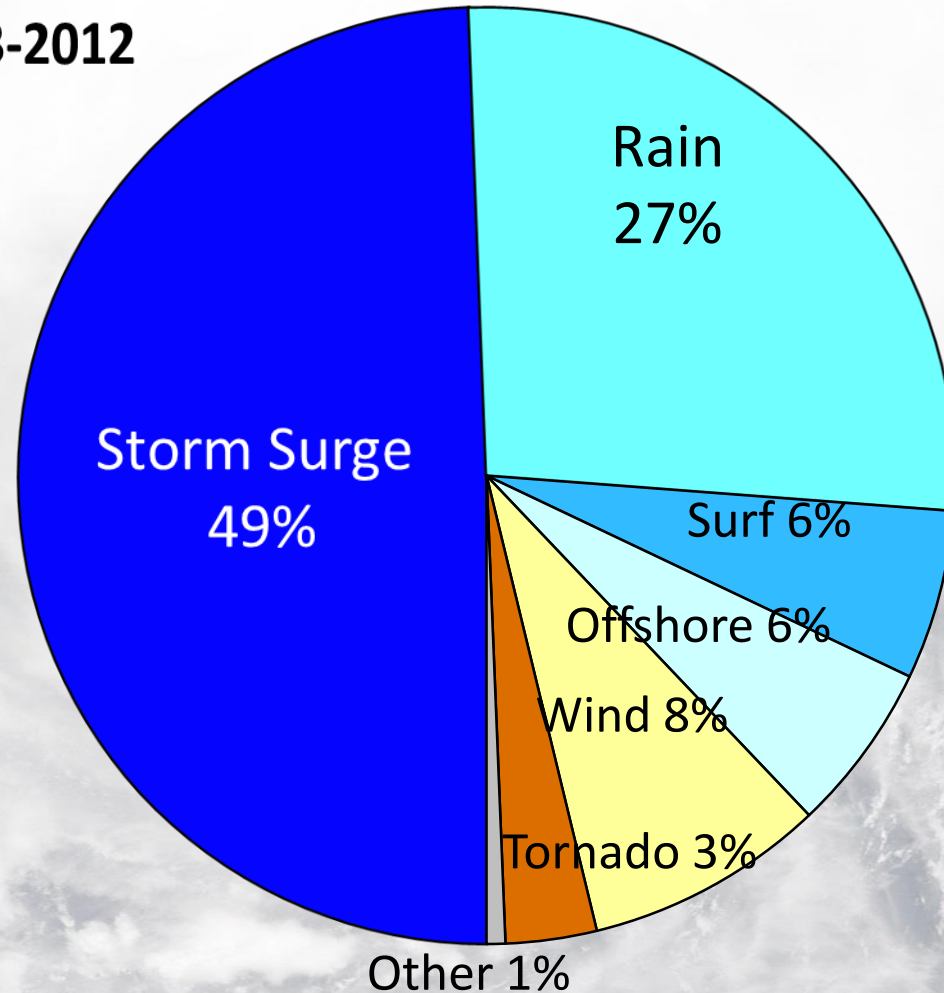
Wind

Tornadoes

Water is What KILLS!!!

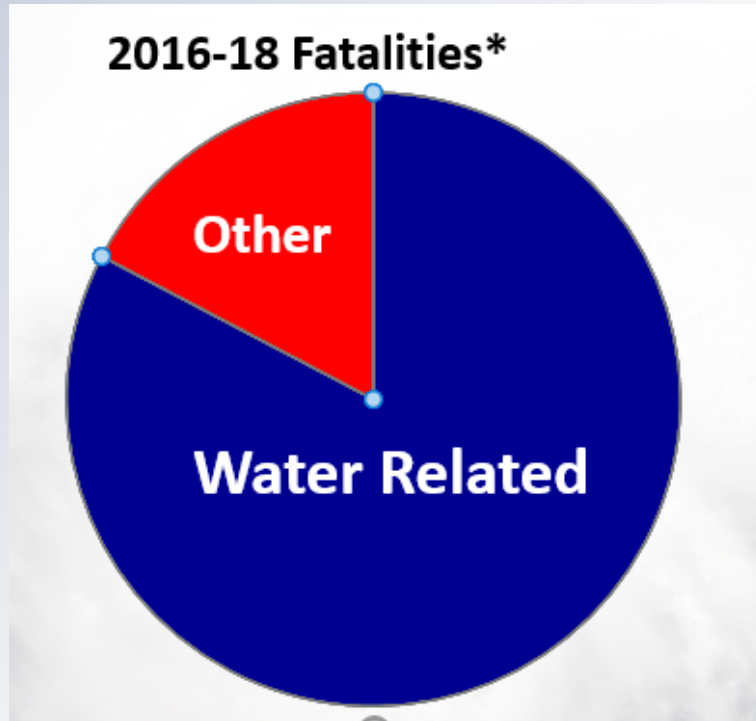


U.S. Tropical Cyclone Fatalities
1963-2012



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

Water is What KILLS!!!

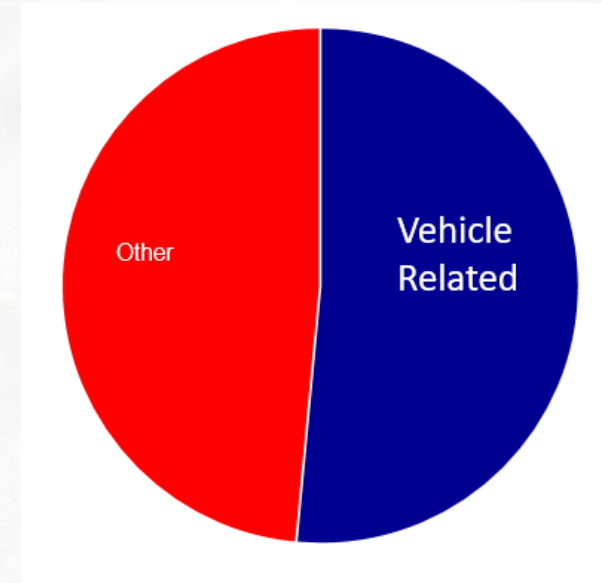


83% Water Related

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



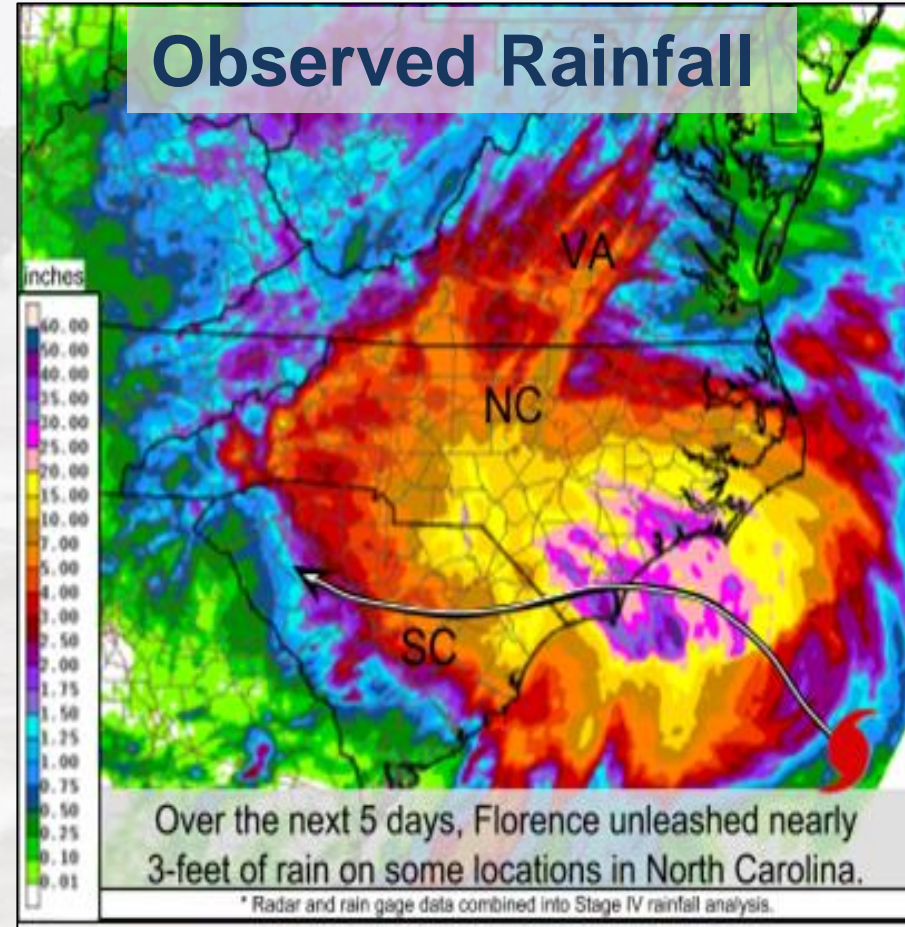
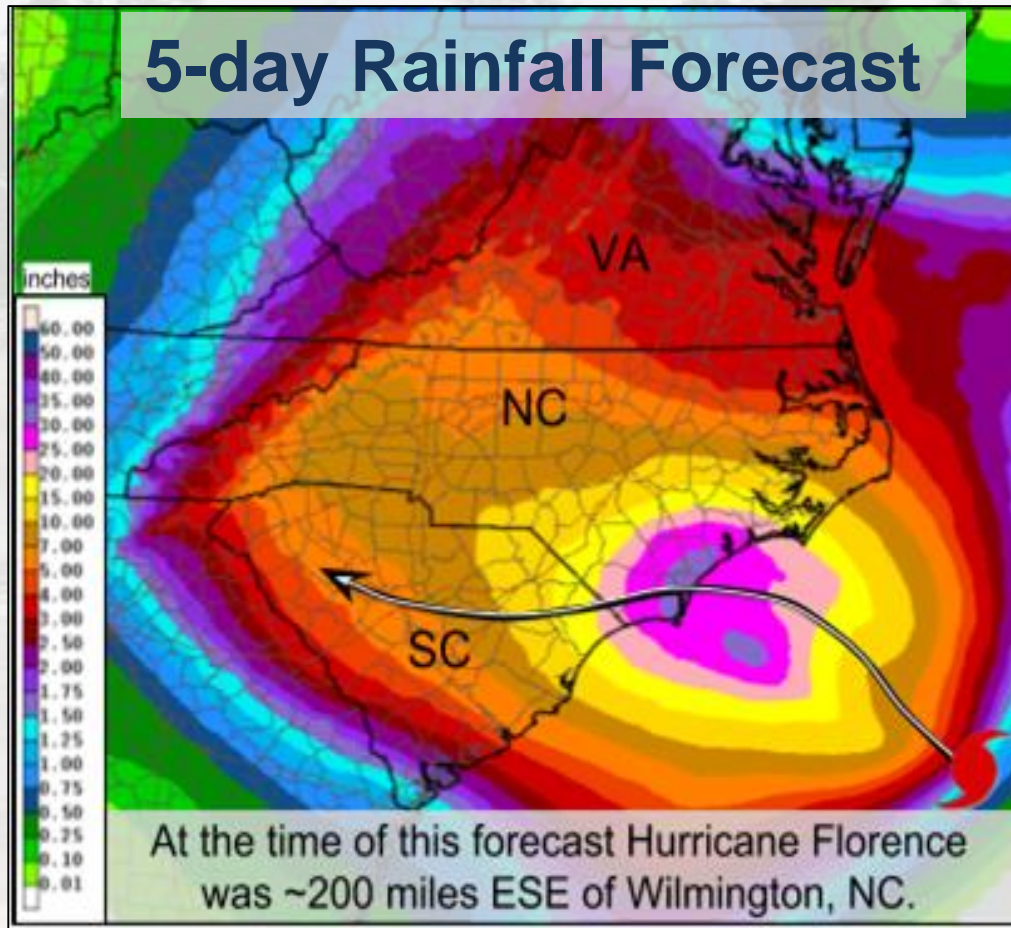
More than half
the U.S. tropical cyclone water-related fatalities were vehicle related!

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**

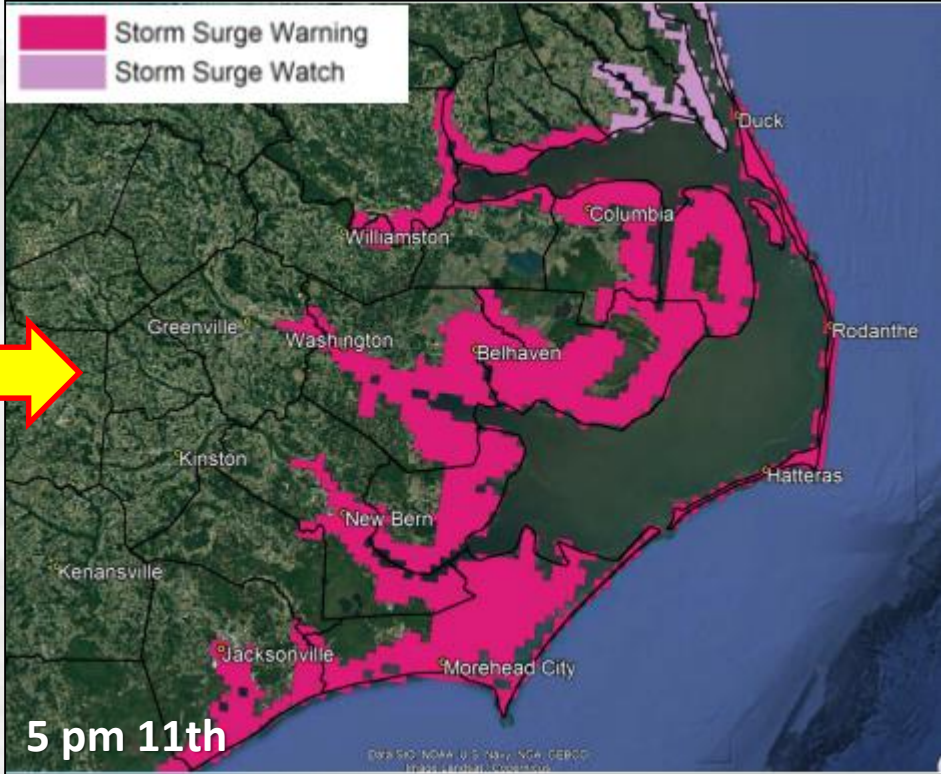
**Over 1,800 water rescues
in New Bern alone**



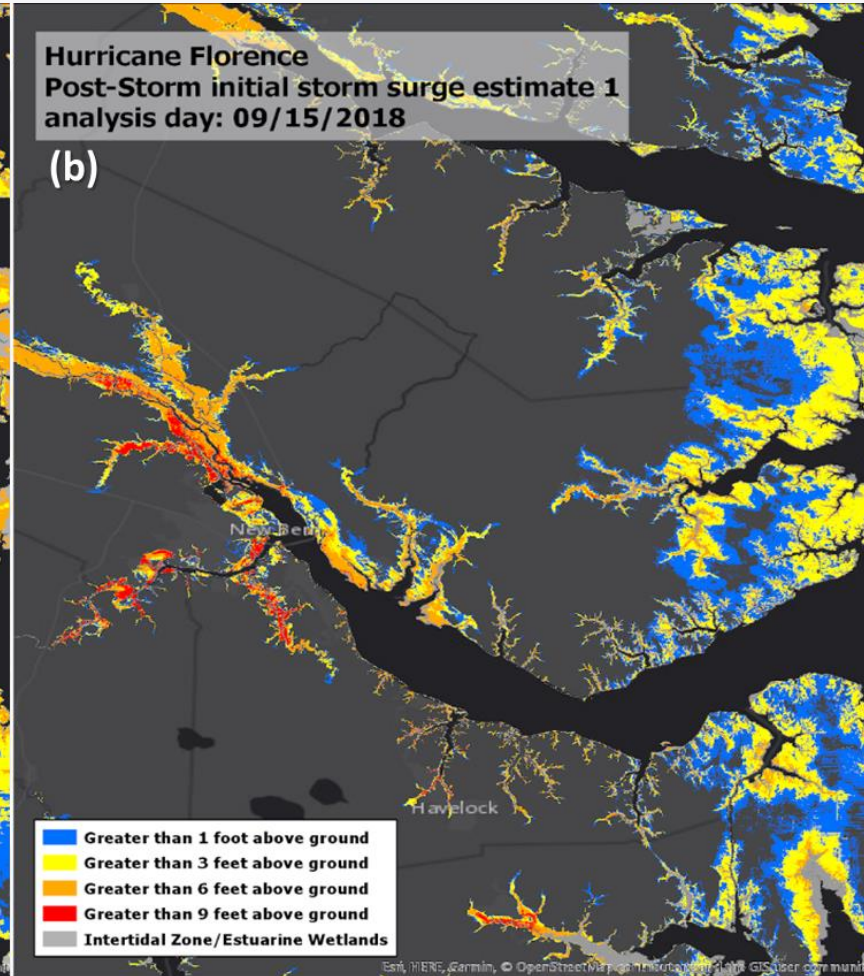
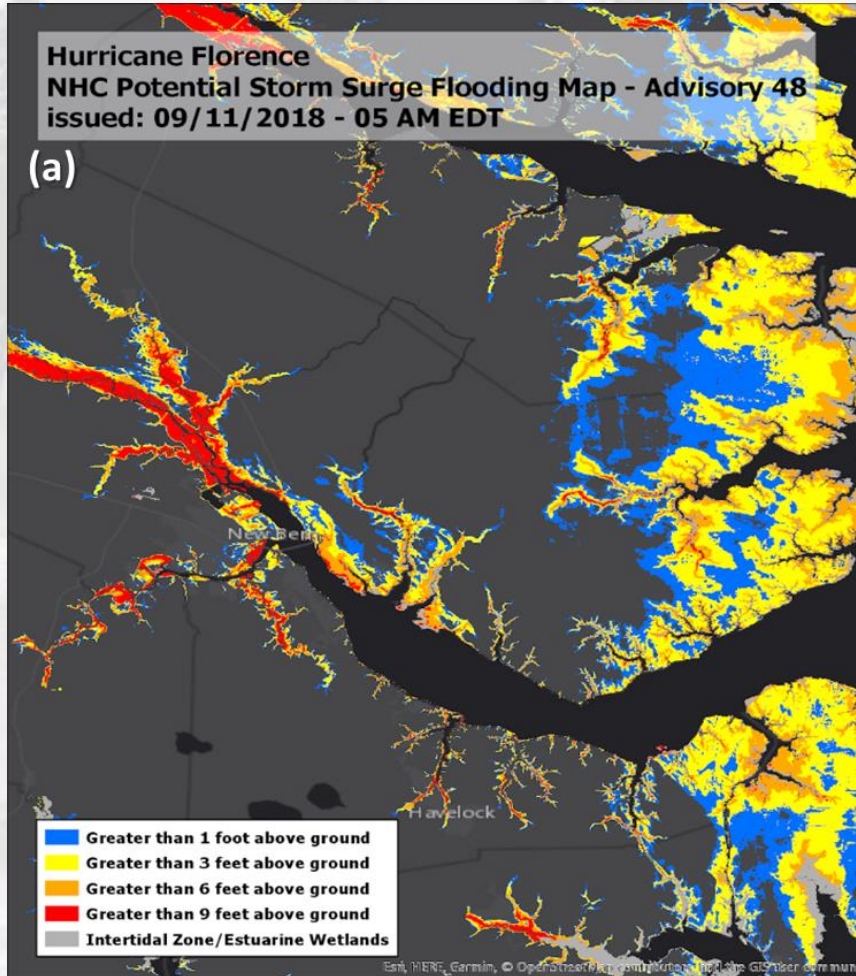
Ocracoke

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

Storm Surge Forecasting

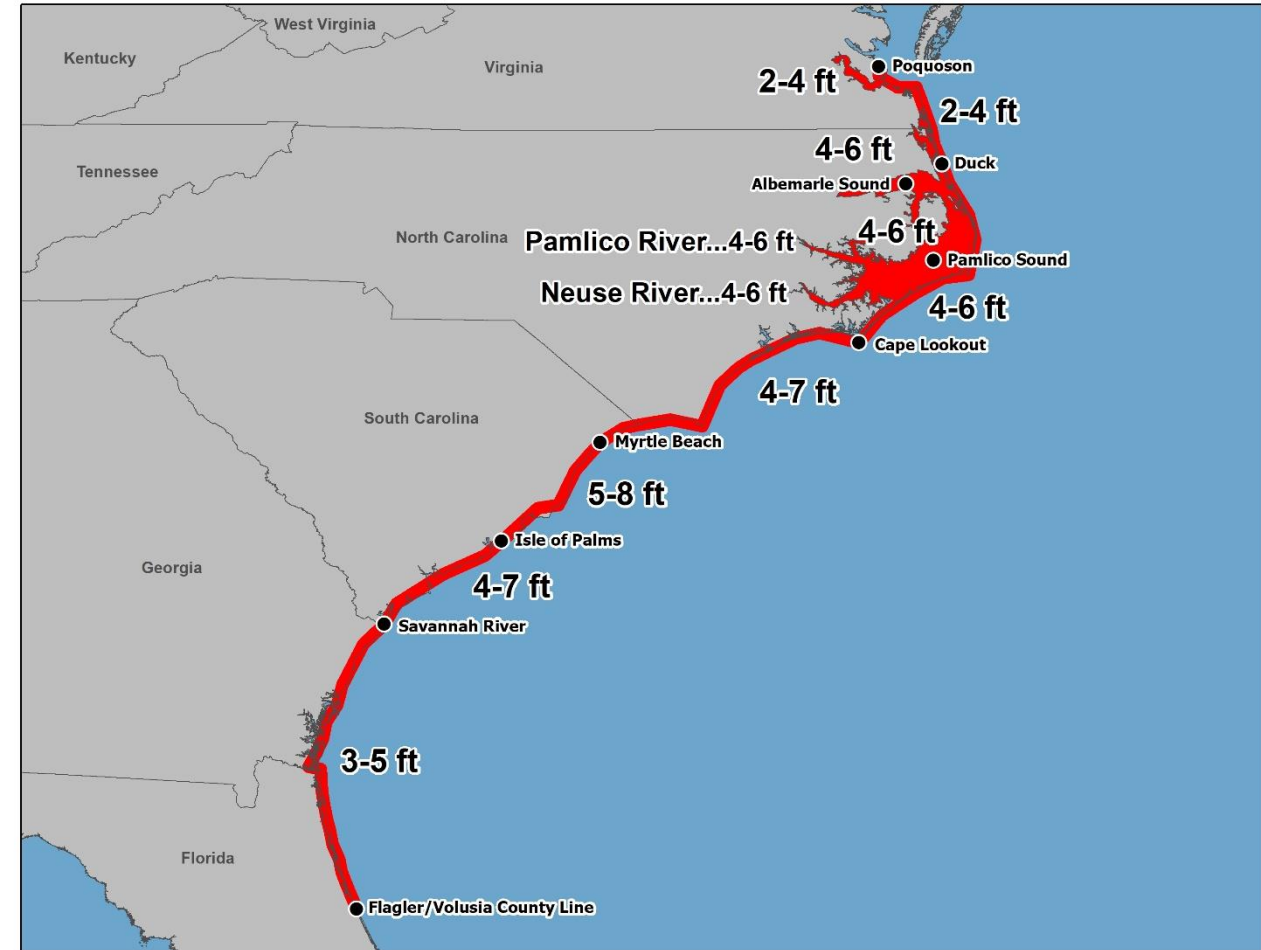


Storm Surge Forecasting

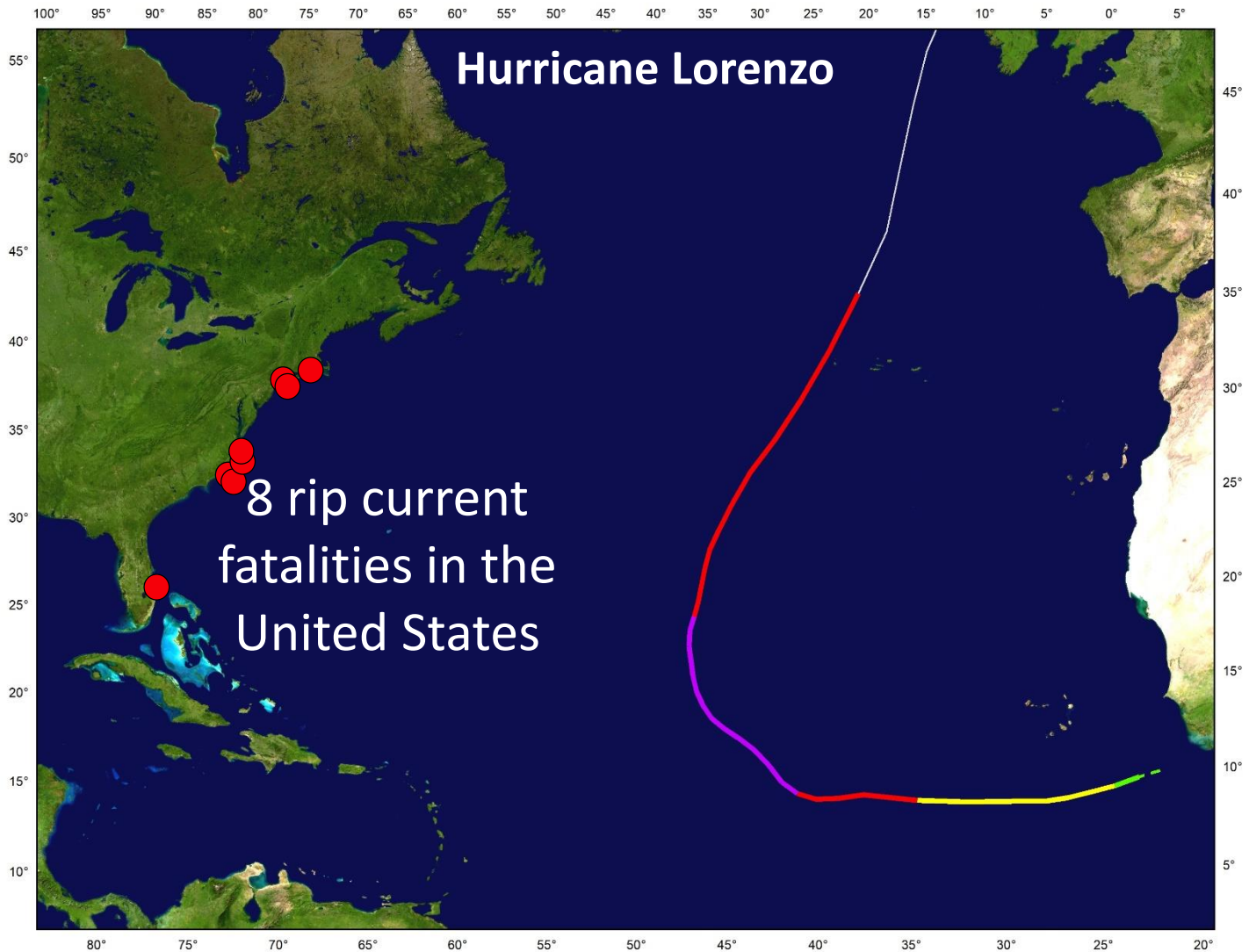


Experimental Peak Storm Surge Forecasting Graphic

- 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 towards the shore. 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

Rip Current Risk

Weather Forecast Office
Newport/Morehead City, NC
Strong Longshore Current South of Cape Hatteras

High	Powerful or numerous rip currents. Everyone should stay out of the water.
Moderate	Only experienced swimmers who know how to escape a rip current should enter the surf.
Low	Rip currents still possible. Always swim near a lifeguard.

Locations marked on the map: Duck, Kitty Hawk, Nags Head, Southern Shores, Kill Devil Hills, Rodanthe, Salvo, Pea Island, Waves, Avon, Buxton, Hatteras Village, Frisco, Ocracoke, Atlantic Beach, Pine Knoll Shores, Indian Beach, Emerald Island, Hammocks Beach, N. Topsail Beach, Cape Lookout Nat'l Seashore, Cape Lookout Lighthouse, Shackleford Banks.

social media icons | @NWSMoreheadCity | weather.gov/moreheadcity

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!

Tag Photo | Add Location | Edit

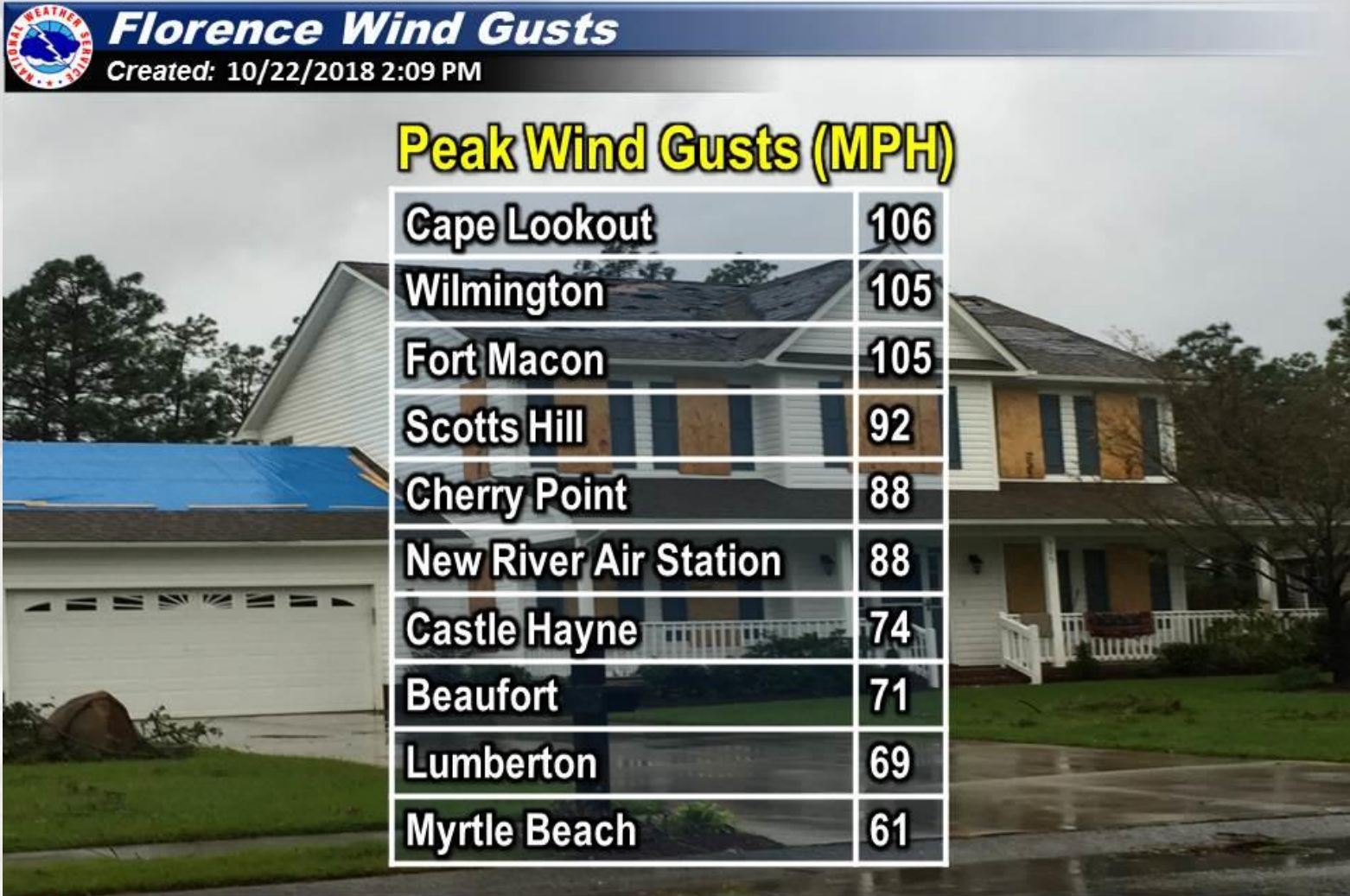
45,254 People Reached | 2,039 Engagements | [Boost Post](#)

45 Reactions | 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

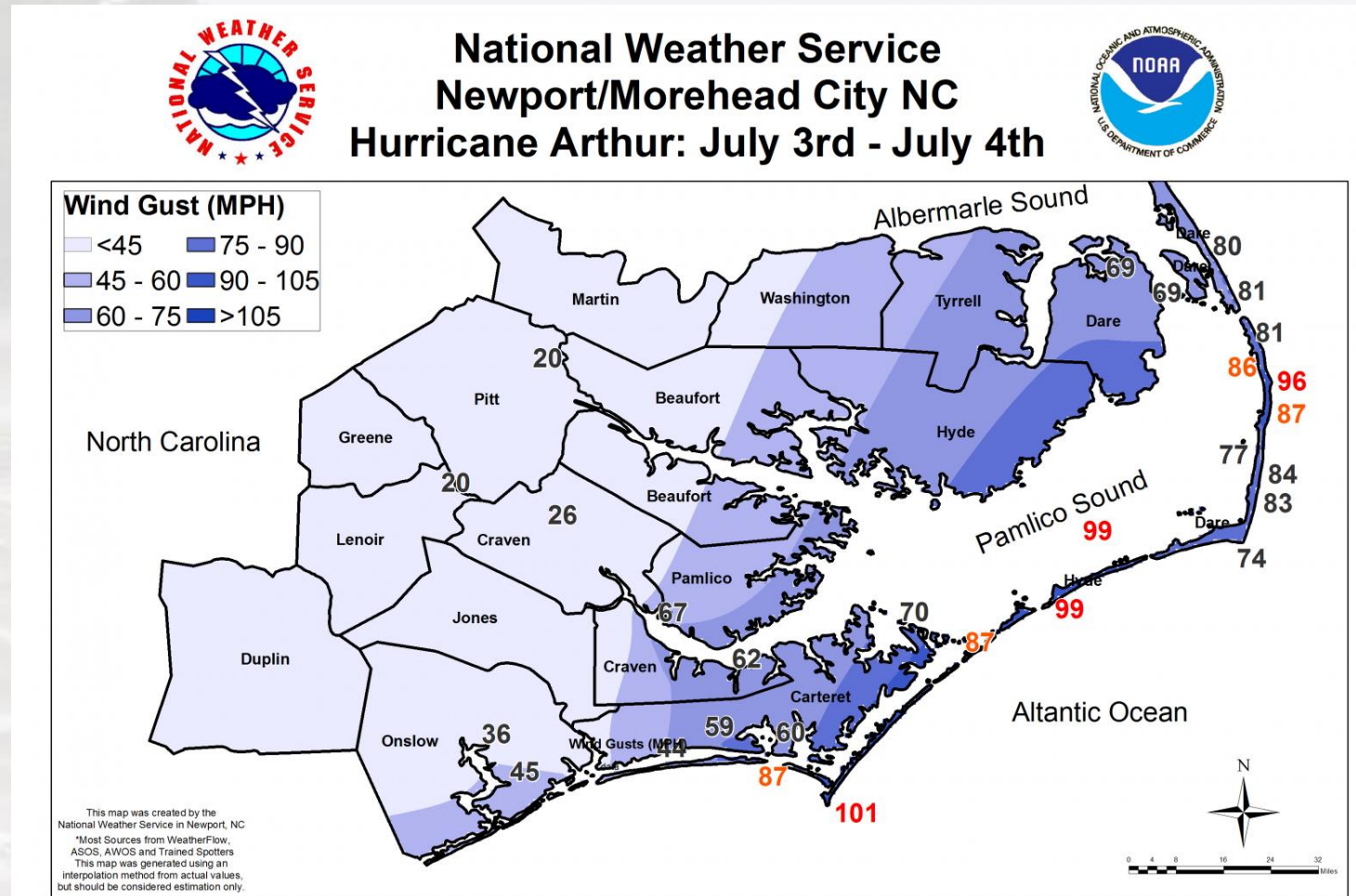
Arthur 2014

CAT 2

Similar Landfall

Faster Moving

Smaller Storm



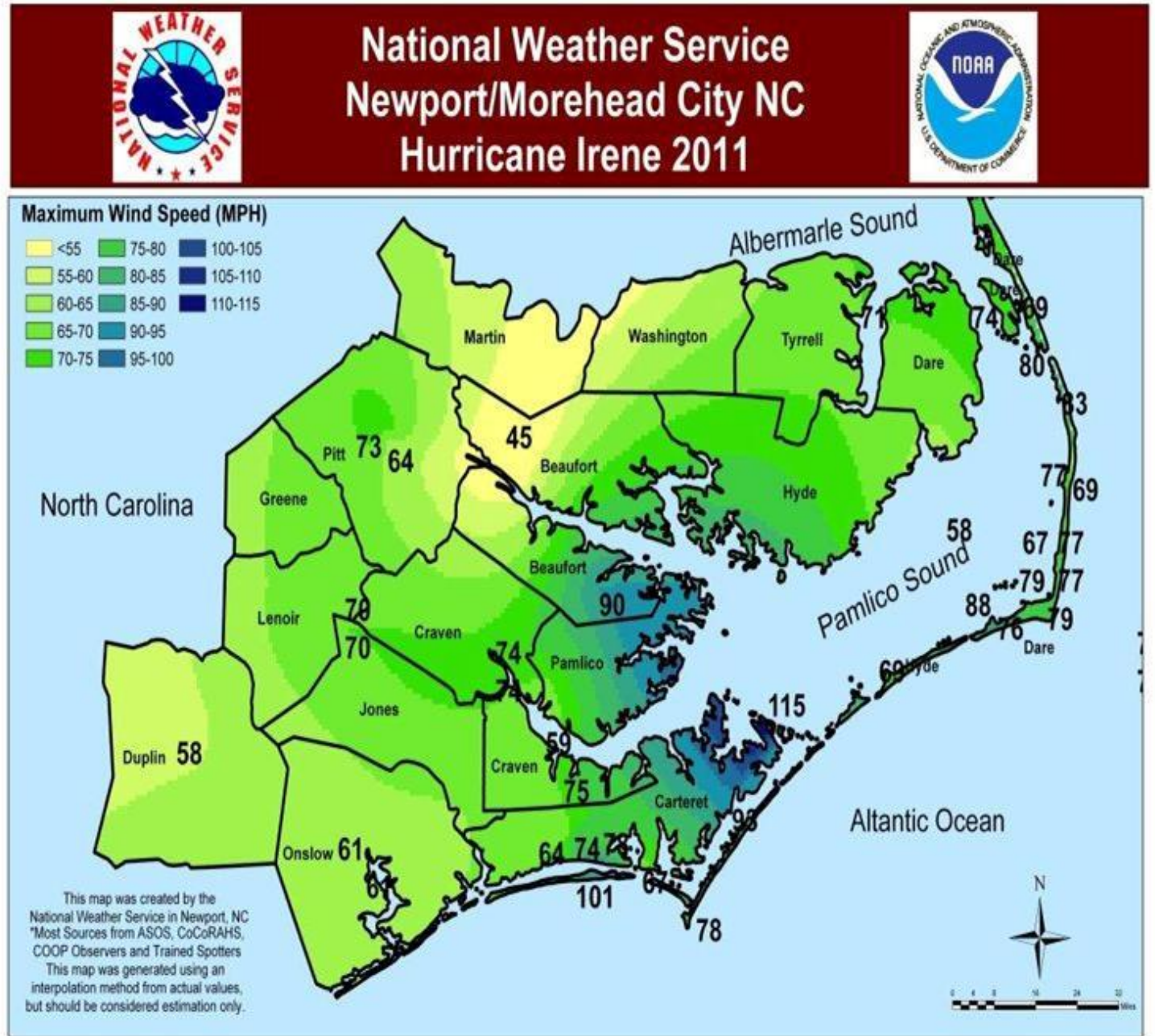
Irene 2011

CAT 1

Similar Landfall

Slower Moving

Large Storm



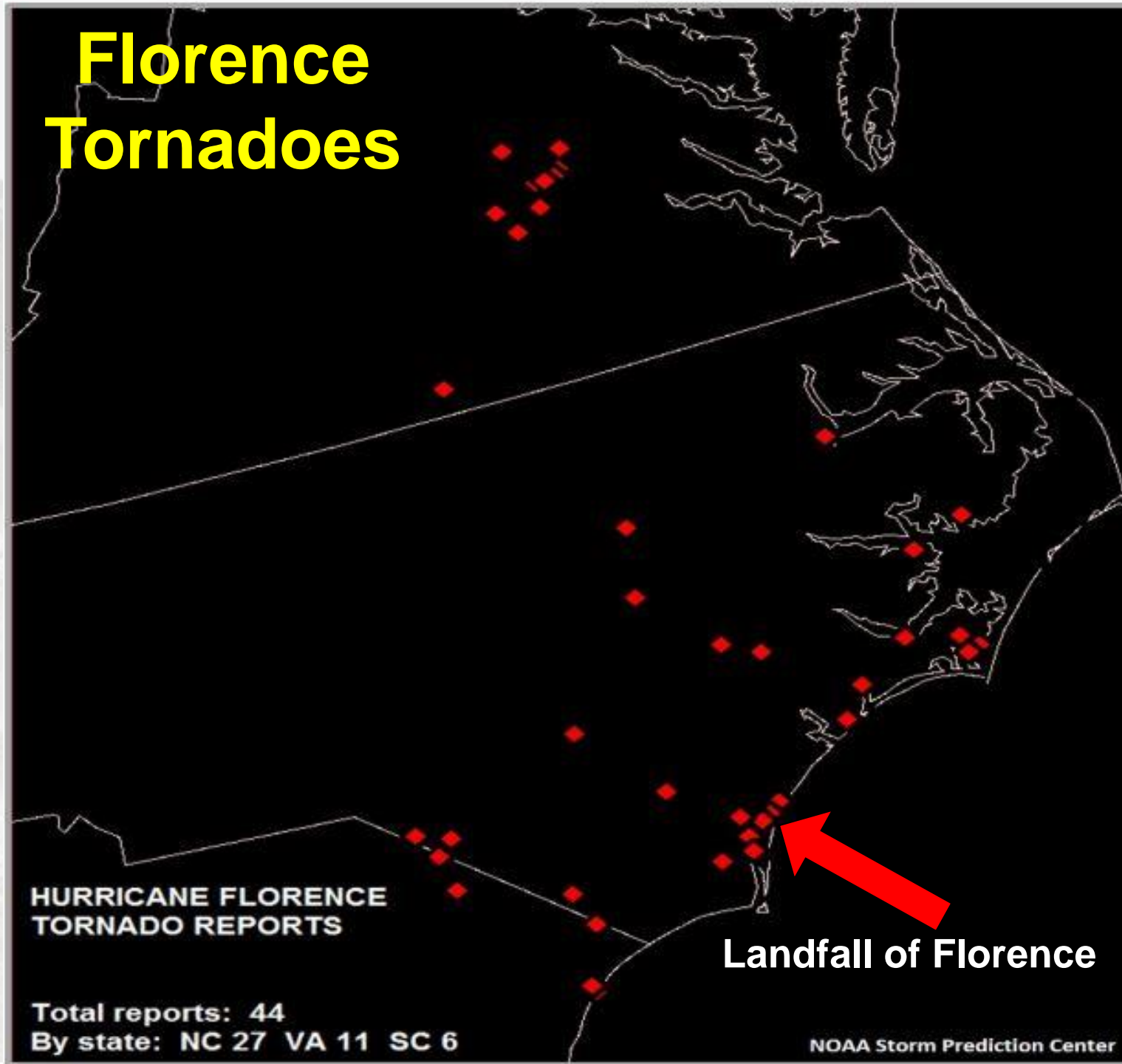
Tornado Threat



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

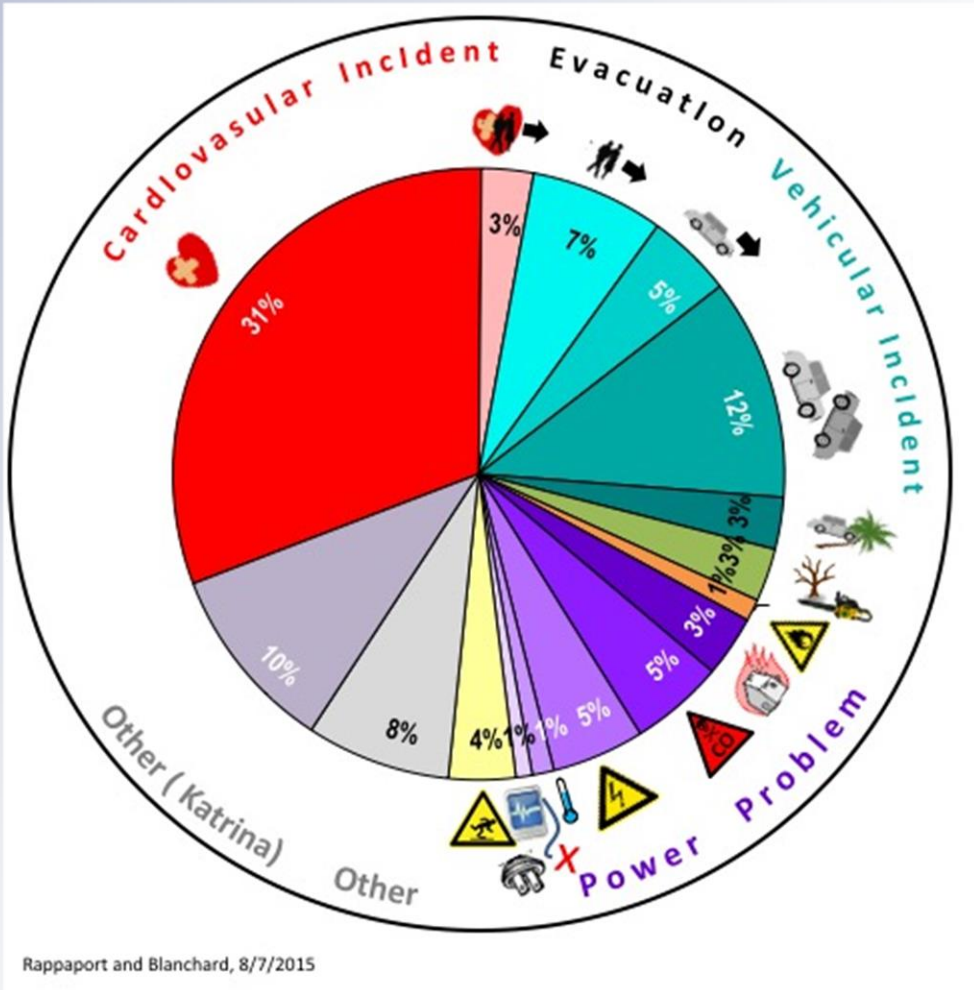
In the last 4 years, we've lost more people to carbon monoxide poisoning after a storm than we have lost from storm surge

2020 U.S. indirect fatalities: 51

19 carbon monoxide, 9 heat related, 10 accidents

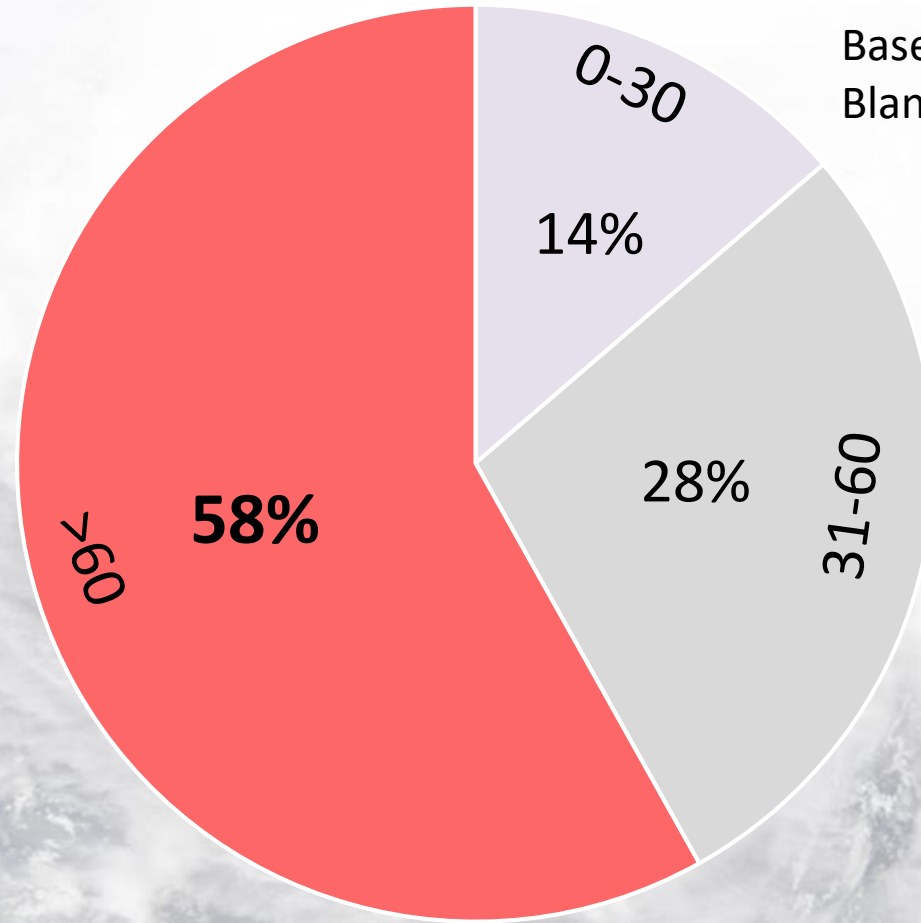
Indirect Fatalities

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



Rappaport and Blanchard, 8/7/2015

Based on Rappaport and Blanchard (2016)



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

Questions/Comments



erik.heden@noaa.gov