



**Focus On The Impacts
Water Is What Kills
Don't Focus On JUST The Category!**

**Hurricane Preparedness
2022**

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, Wakefield 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

Coastal Flood Advisory
High Surf Advisory
Small Craft Advisory
Hazardous Weather Outlook

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

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



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
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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

Zoom Out
Zoom In

Radar
 Current Weather
 Rivers & Lakes
 Satellite
 Weather Info Display
 Forecast Maps
 Hour by Hour Forecast
 Winter Weather
 Map View
 Surf Forecast/Rip Currents
 Weather Hazard Briefing (when applicable)
 Local Self-Briefing Pages
 Forecaster Discussion
 Marine
 Text Products
 Tropical
 Skywarn
 Submit Storm Reports

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

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

Storm Location
 ○ < 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 %

All Times EDT

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.



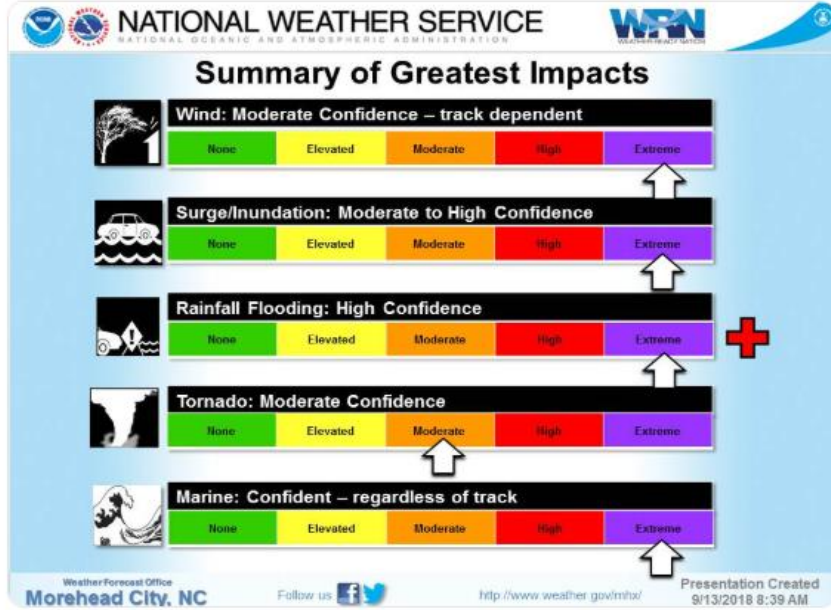
Social Media

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

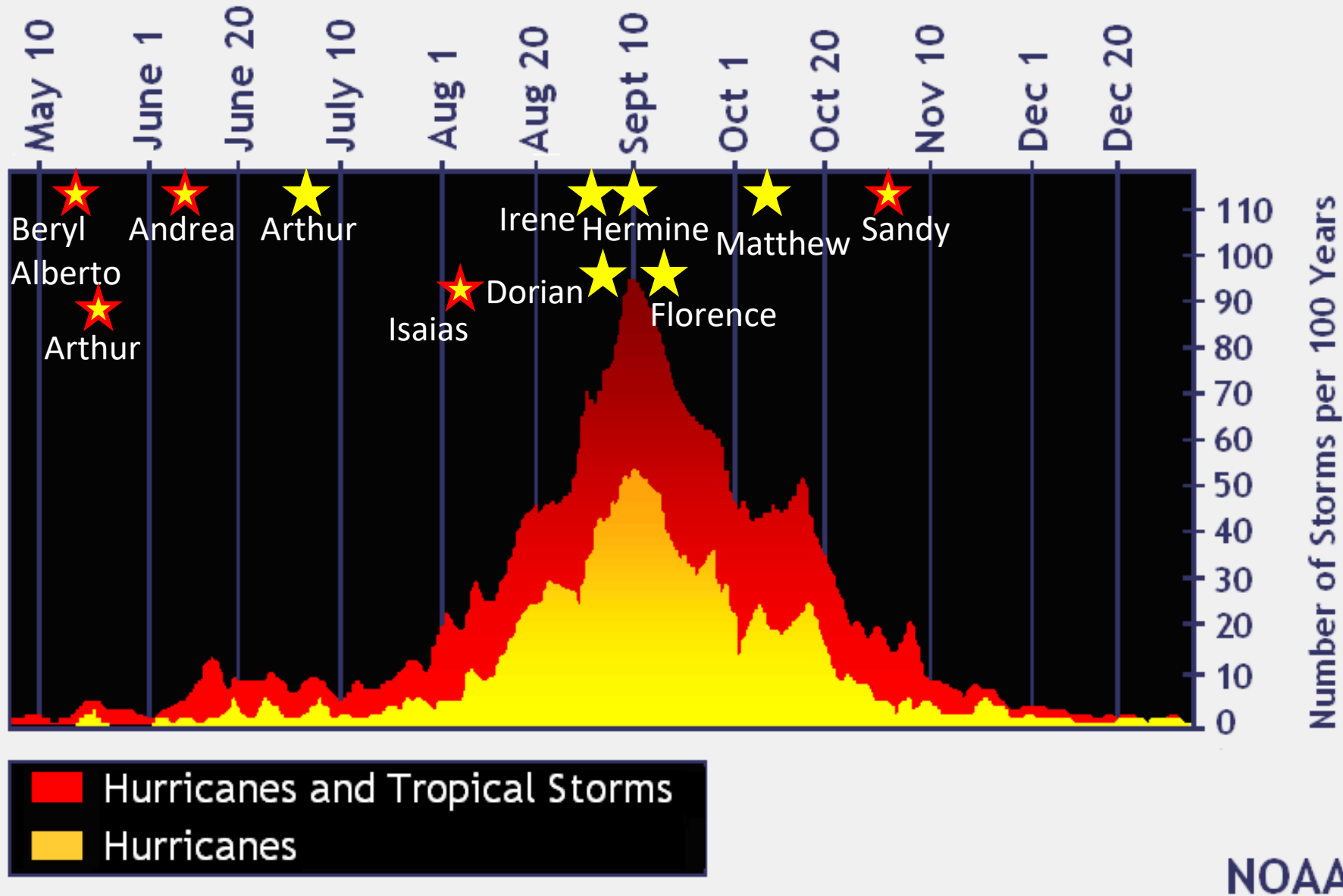


NWSMoreheadCity
Published on Sep 12, 2018

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

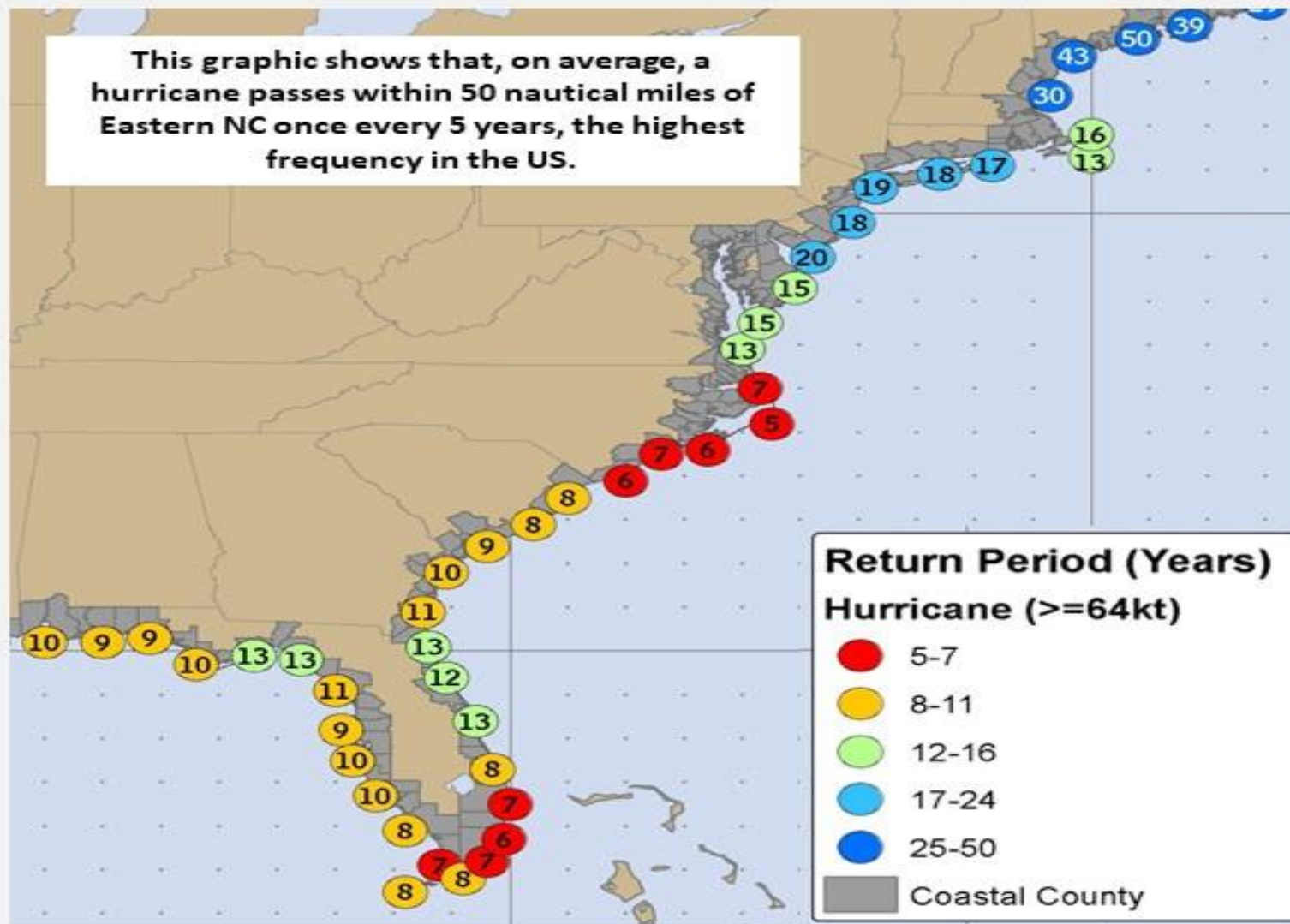
Tropical Cyclone Frequency

Eastern North Carolina is the most frequently impacted stretch of coastline by tropical systems in the US.

...

NOW is the time to prepare. Resources will be much more limited if you wait until a storm is approaching to prepare.

This graphic shows that, on average, a hurricane passes within 50 nautical miles of Eastern NC once every 5 years, the highest frequency in the US.



National Weather Service

National Oceanic and Atmospheric Administration



NWSMoreheadCity

Find more info at weather.gov/moreheadcity

Our Website

weather.gov/moreheadcity/hurricaneprep



Hurricane Preparedness

DETERMINE YOUR RISK



Hurricanes bring many hazards to U.S. coastlines and inland areas, including storm surge along the coast, inland flooding due to heavy rainfall, tornadoes, strong wind, rip currents and large waves.



Storm surge



Strong winds



Tornadoes



Inland flooding



Rip currents

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

NC Flood Maps

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



**At least a 3 day supply
(7 days would be best)**

**What would you need to
survive without
electricity?**

**Don't forget about pets
and medicine**

Our Website

weather.gov/moreheadcity/hurricaneprep



Hurricane Preparedness

DEVELOP AN EVACUATION PLAN



Find out today if you live in a hurricane evacuation zone and identify trusted sources for receiving evacuation orders. Plan for multiple options on where to go and how to get there. Have a go bag for supplies and a plan for your pets. Be prepared to leave immediately if ordered to evacuate.



Find out if you live in an evacuation zone



Plan several routes



Have a go bag for supplies



Plan for your pets



Follow evacuation orders if given

weather.gov/hurricane

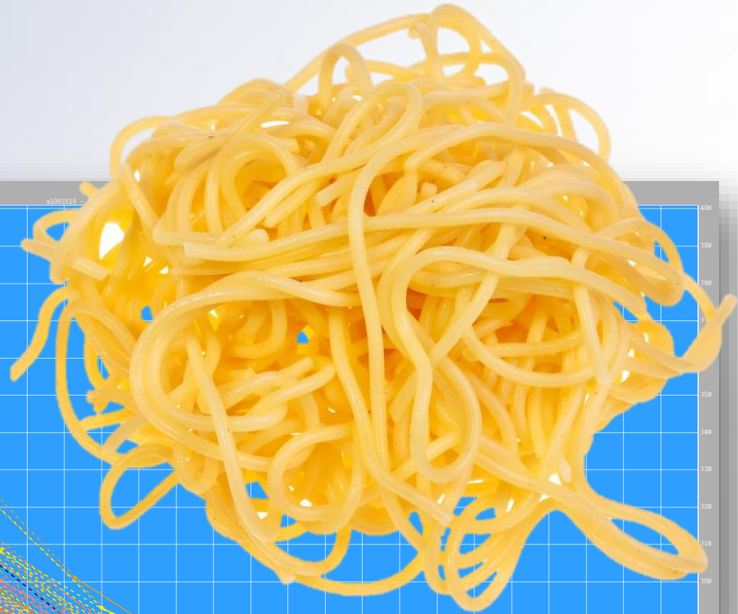


Where would you go?

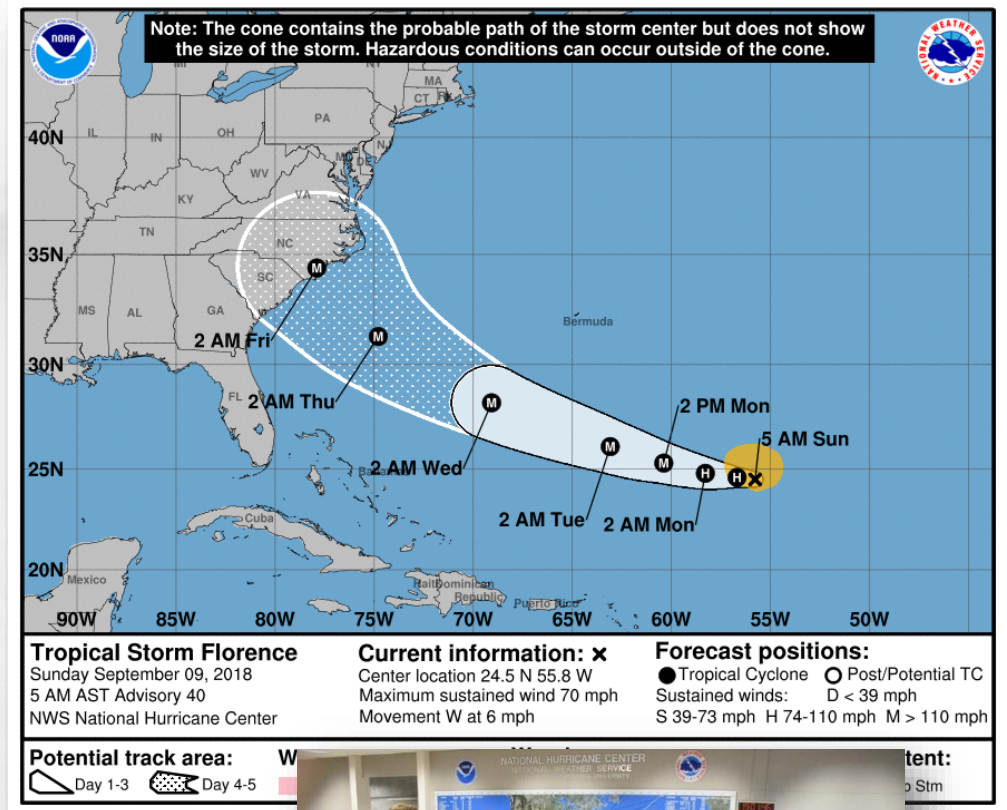
Have multiple options

Don't forget the pets

Spaghetti Models vs. NHC Forecasts



VS.

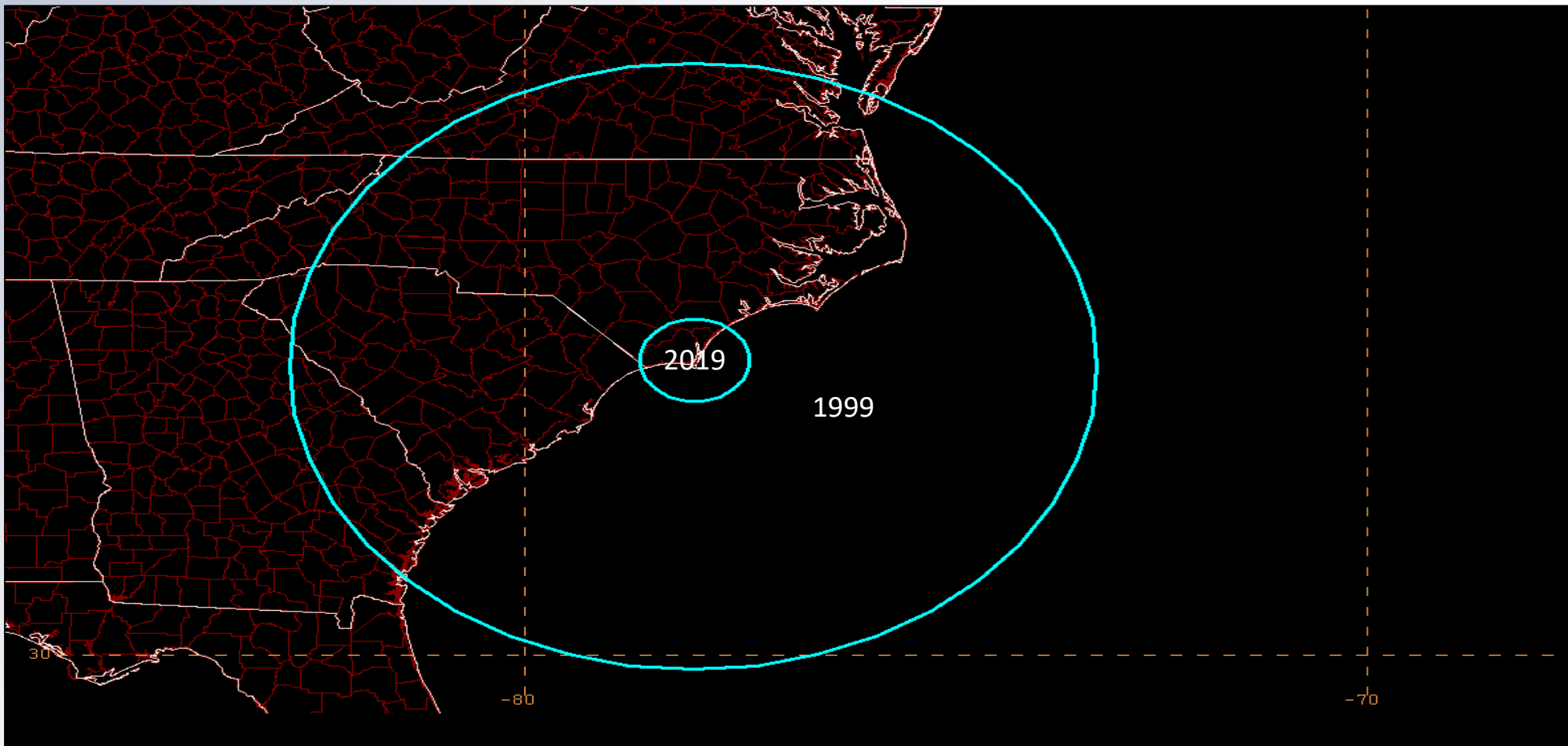


About 175 years of experience combined!



How Far Have We Come?

1999 (Floyd) Vs 2019 (Dorian)



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

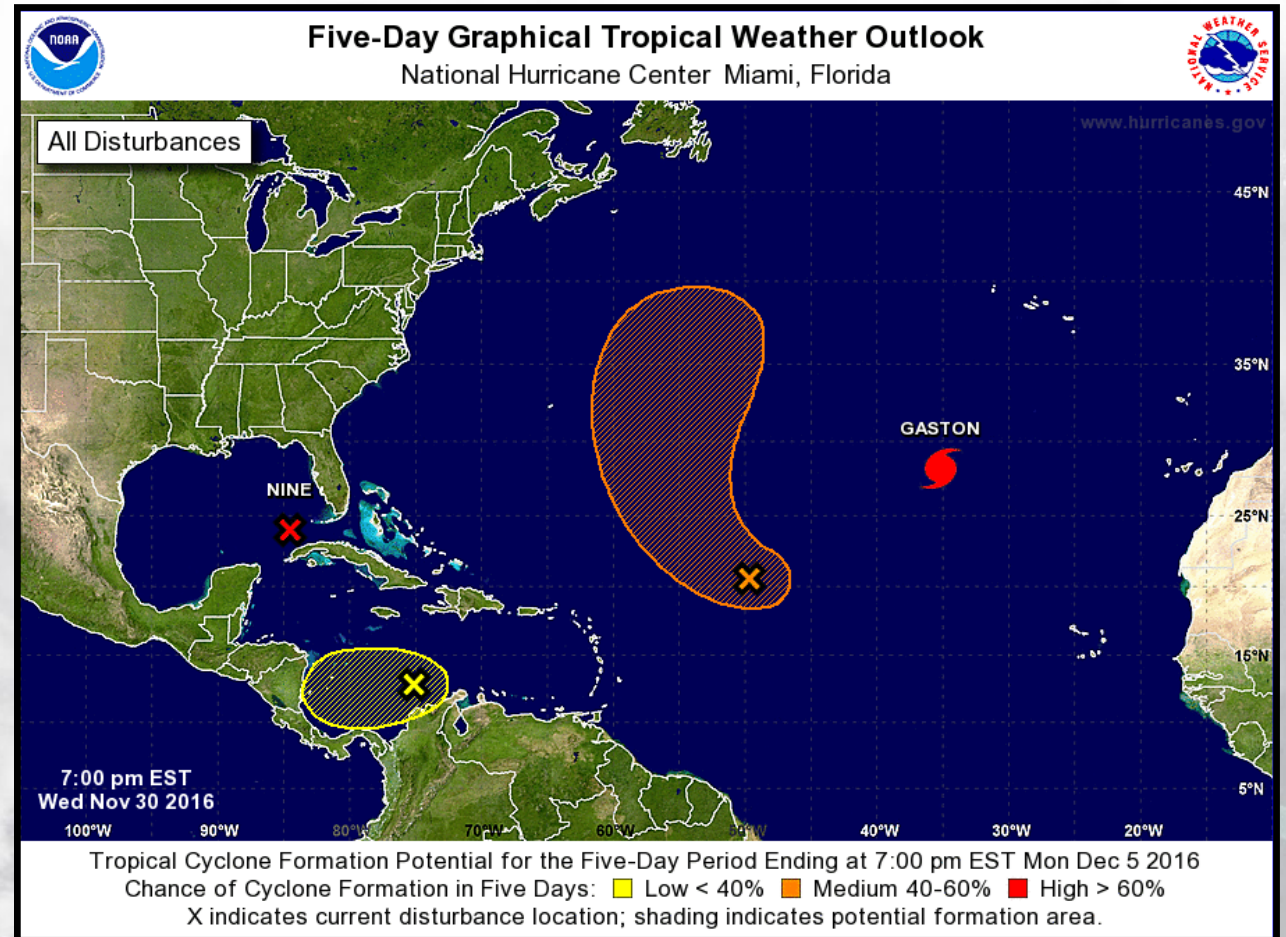
National Hurricane Center

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

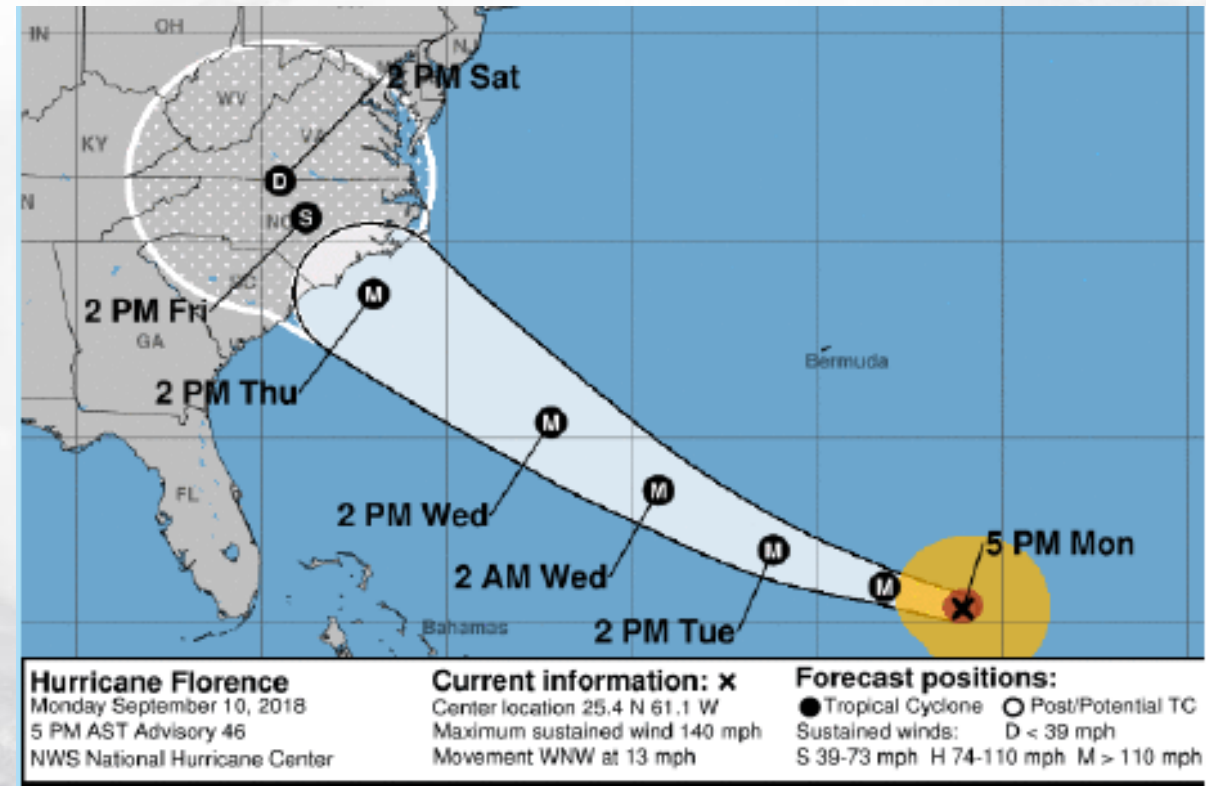


National Hurricane Center



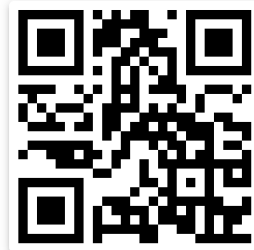
Tropical Cyclone Track Forecast Cone Watches/Warnings Initial Wind Field

- 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



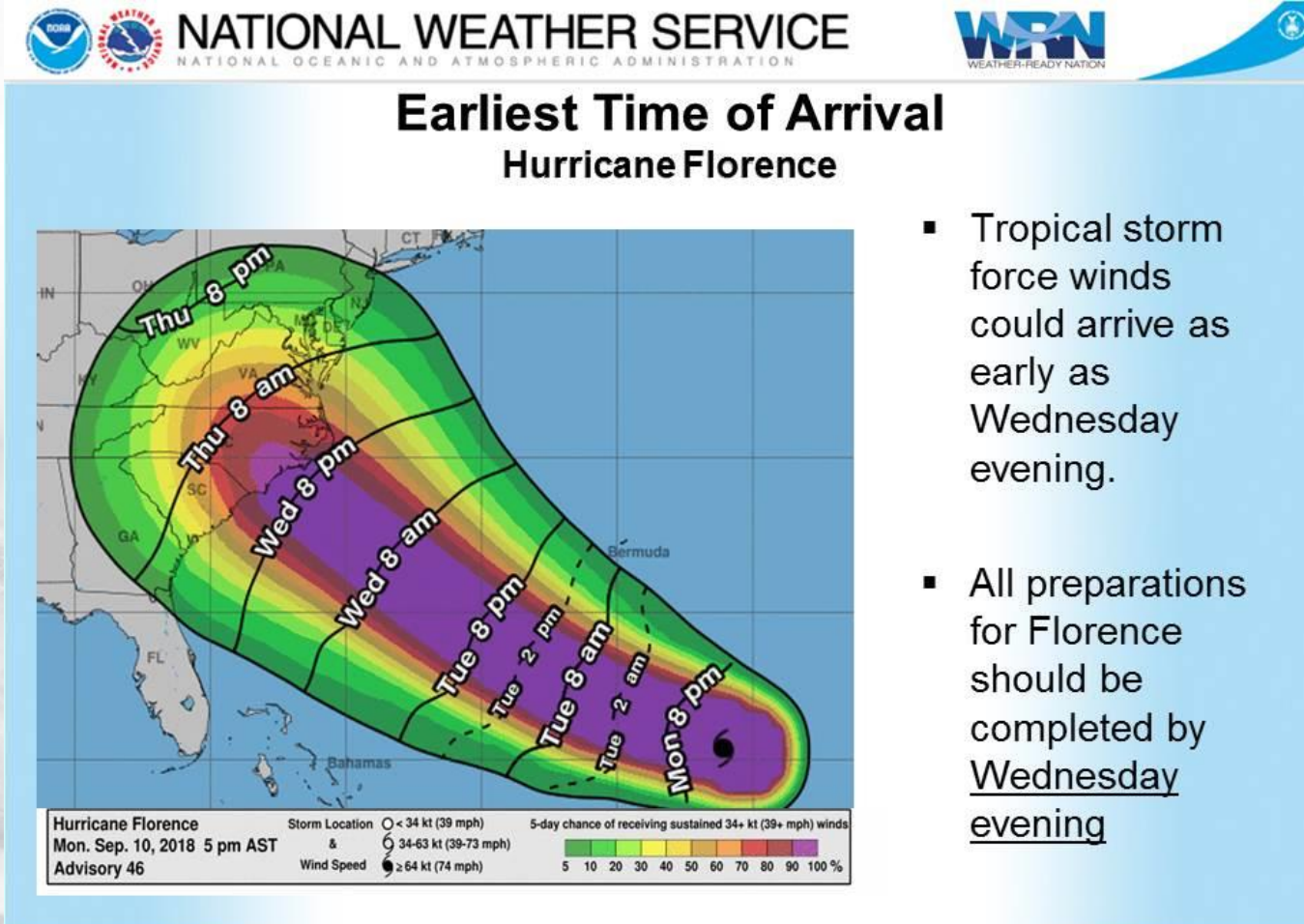
National Hurricane Center

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



- Tropical storm force winds could arrive as early as Wednesday evening.
- All preparations for Florence should be completed by Wednesday evening

Sometime late Wednesday or early Thursday

National Hurricane Center

Hurricanes.gov or weather.gov/moreheadcity/tropical



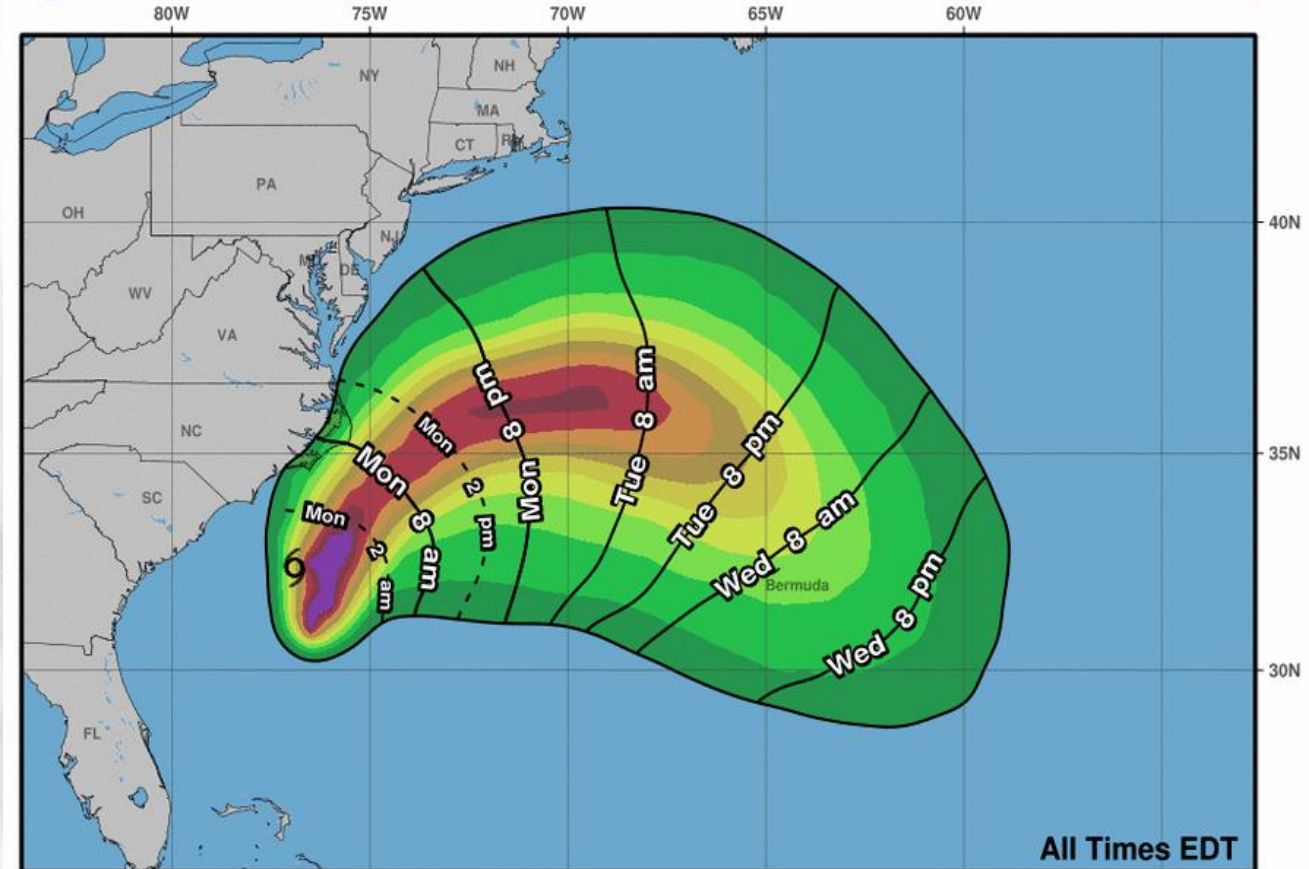
Most Likely Arrival Time Tropical Storm Force Winds

- 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



Tropical Storm Arthur
Sun. May. 17, 2020 11 pm EDT
Advisory 6

Storm Location & Wind Speed

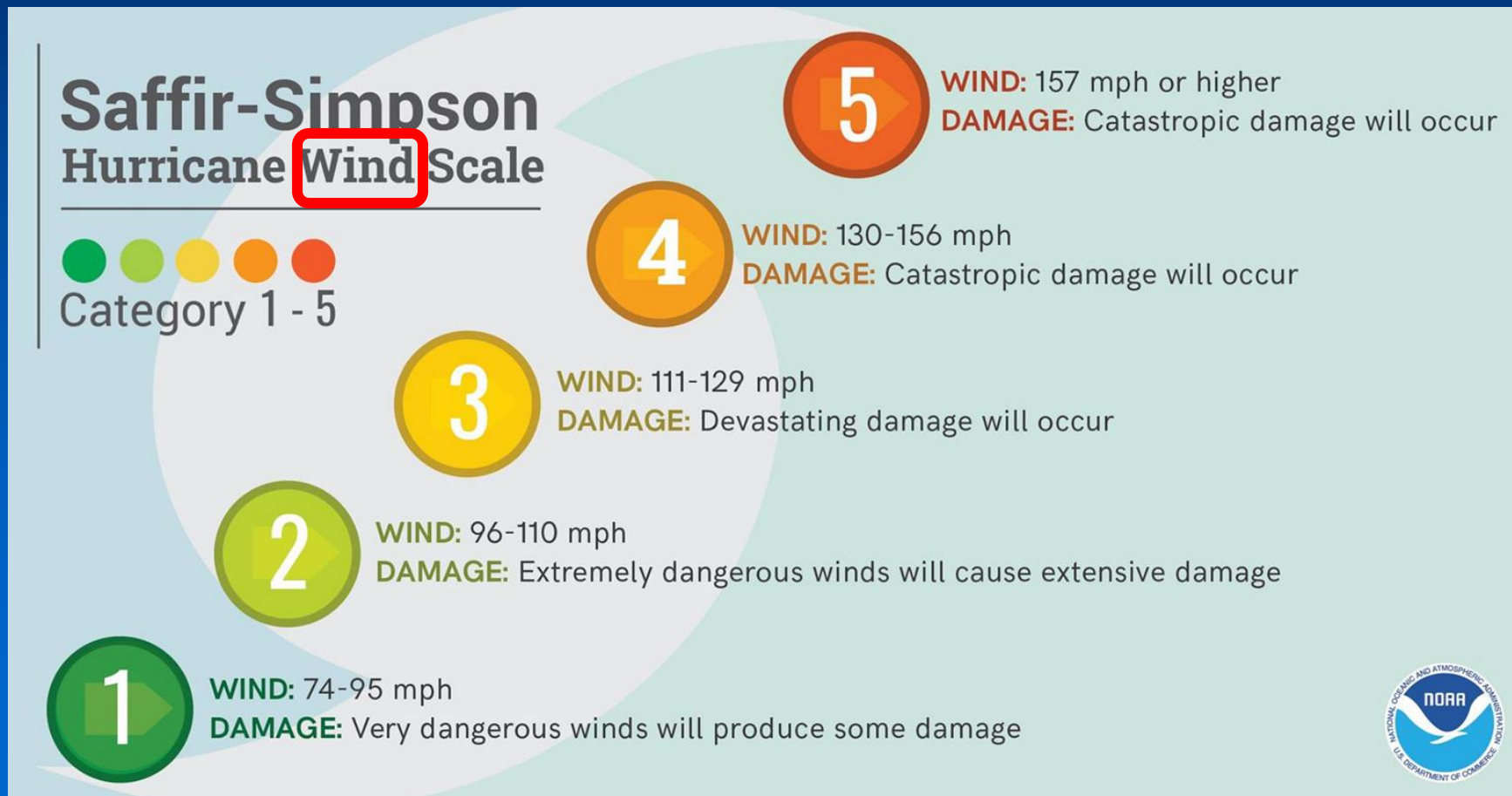
- < 34 kt (39 mph)
- 34-63 kt (39-73 mph)
- ≥ 64 kt (74 mph)

5-day chance of receiving sustained 34+ kt (39+ mph) winds

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

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***

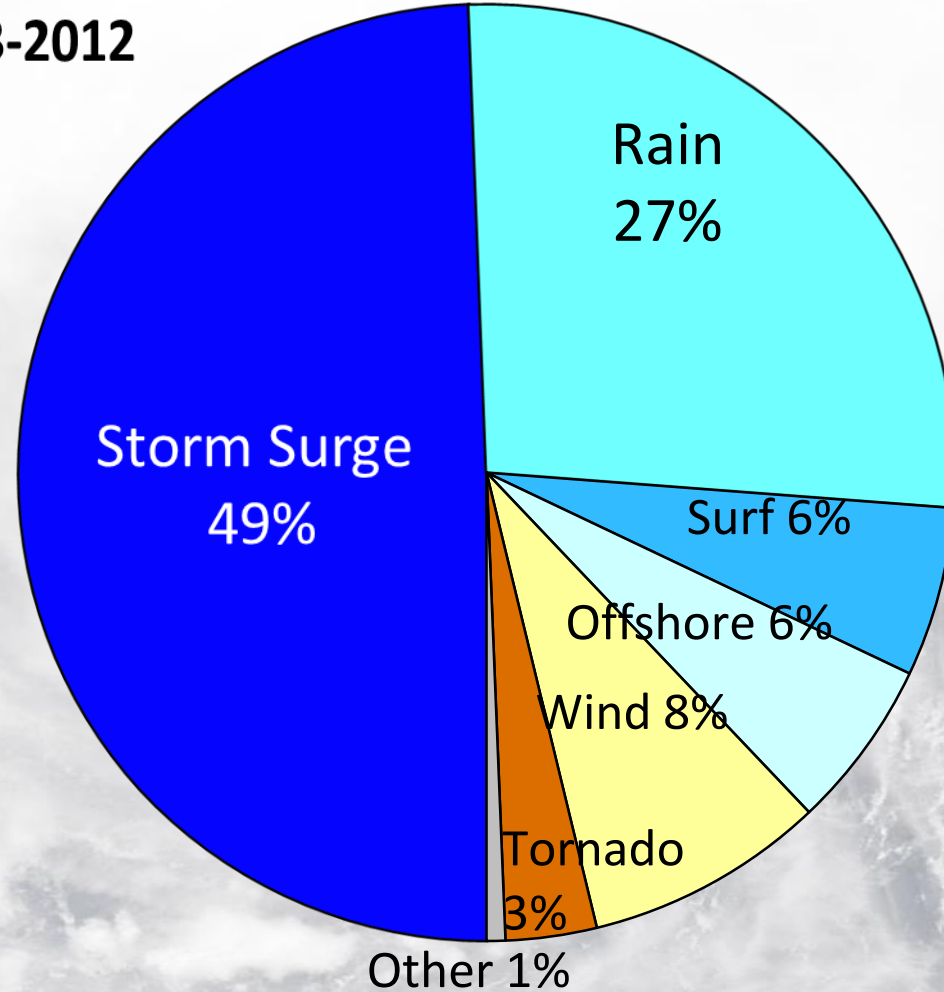
**175 direct deaths
\$105 billion**

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

Water is What KILLS!!!

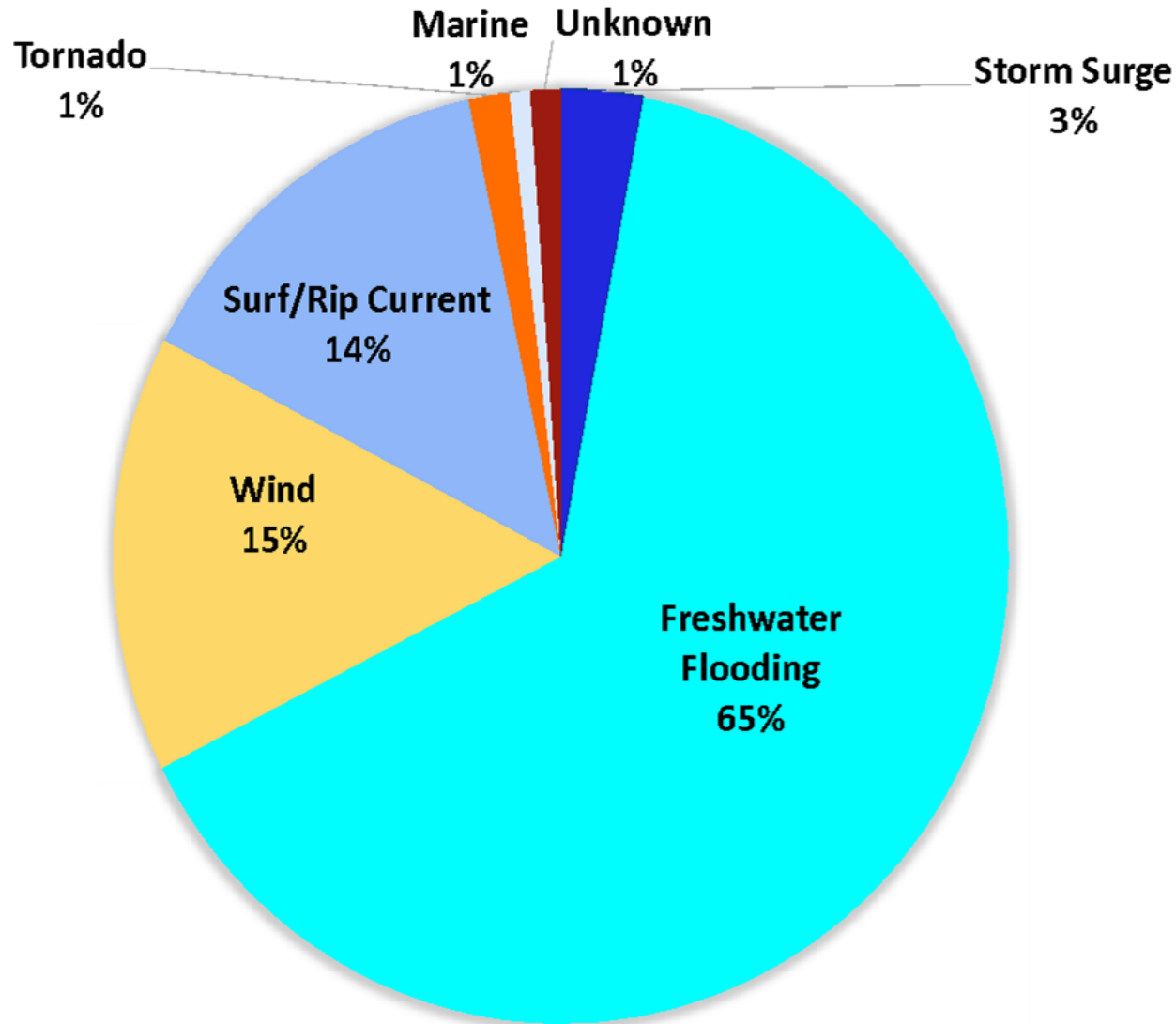


U.S. Tropical Cyclone Fatalities
1963-2012

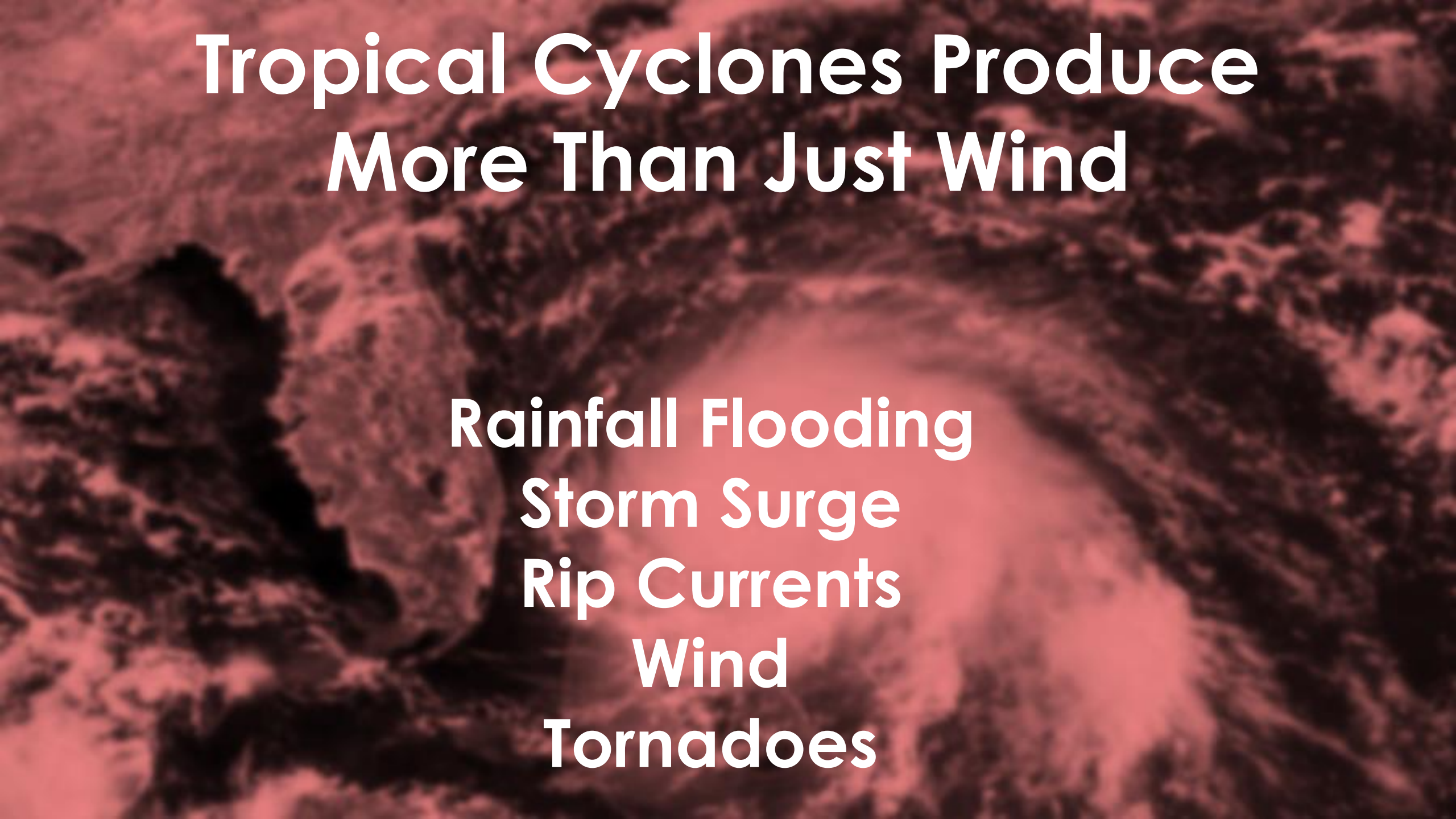


**Water
accounts
for about
90% of
the direct
deaths**

CONUS Atlantic Direct Tropical Cyclone Fatalities – 2017-2021



- Freshwater flooding responsible for 65% of the direct deaths
- 14% due to surf/rip currents, many from storms well away from the U.S.
- 15% due to wind – many tree related scattered across multiple storms
- Small contribution from storm surge – only 8 fatalities (5 in Michael) despite 7 major hurricane landfalls during this period

An aerial photograph of a tropical cyclone, showing a distinct eye and spiral cloud bands. The image is overlaid with a semi-transparent red filter. The text is centered over the image.

Tropical Cyclones Produce More Than Just Wind

Rainfall Flooding

Storm Surge

Rip Currents

Wind

Tornadoes

Flash Flooding

Heavy rainfall is common in tropical cyclones.

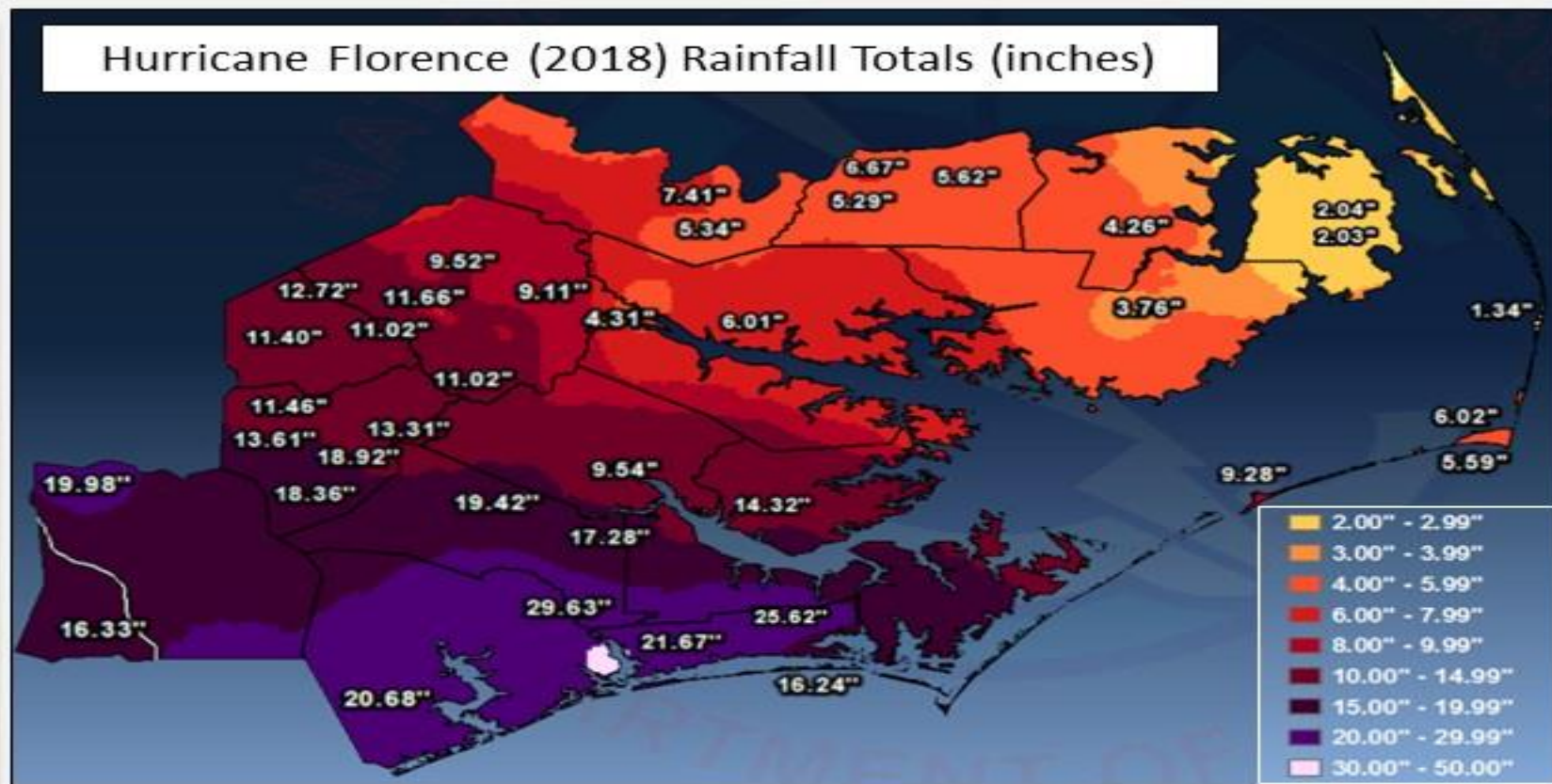
...

NWS Morehead City will issue Flash Flood Warnings as needed during a hurricane, so make sure you have a way to receive warnings, such as a NOAA Weather Radio.

...

A hurricane's category is **not** an indication of the amount of rainfall it will bring. More important is the movement and size of the storm.

Hurricane Florence (2018) Rainfall Totals (inches)



Very slow-moving Hurricane Florence (2018) brought nearly 3 ft of rainfall to portions of eastern NC, resulting in catastrophic flash flooding that destroyed infrastructure and made travel impossible.



National Weather Service

National Oceanic and Atmospheric Administration



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Find more info at weather.gov/moreheadcity

River Flooding

River flooding can last for weeks to months after a hurricane, impacting travel and inundating communities.

...

Inland areas not vulnerable to storm surge could still be vulnerable to river flooding.

...

River flooding in our area is partially dependent on local rainfall, but more so on rainfall further inland.



Hurricane Matthew Flooding: Tar River near Grimesland



Hurricane Matthew Flooding: Trent River in Jones County

Hurricane Matthew (2016) brought devastating flooding to much of eastern NC despite the highest rainfall totals falling inland of our area. River levels peaked almost a week after the storm, with many major roadways closed and business and residences inundated.



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National Oceanic and Atmospheric Administration



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Near Hookerton (Matthew)



Storm Surge

Much of eastern North Carolina is vulnerable to Storm Surge.

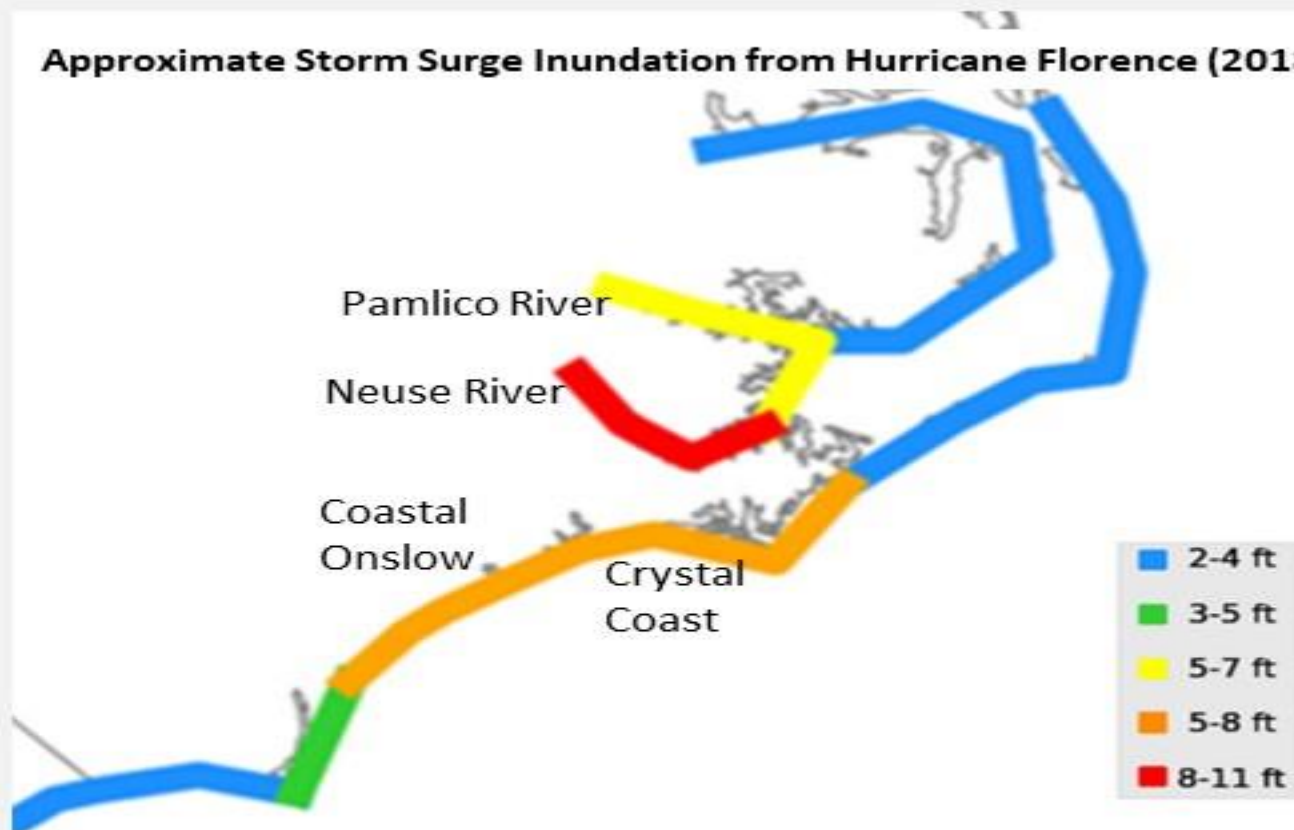
...

Do not assess your storm surge vulnerability based on previous storms. Know your elevation and monitor the forecast when a storm approaches.

...

Wave action can add to the damage done by storm surge.

Approximate Storm Surge Inundation from Hurricane Florence (2018)



Hurricane Florence produced the highest storm surge on record in some locations. Some people in locations like New Bern were skeptical of forecasts because they had never witnessed that level of storm surge before.



National Weather Service

National Oceanic and Atmospheric Administration



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Find more info at weather.gov/moreheadcity

Storm Surge Florence/Dorian



New Bern

8 to 11 feet storm surge inundation in New Bern

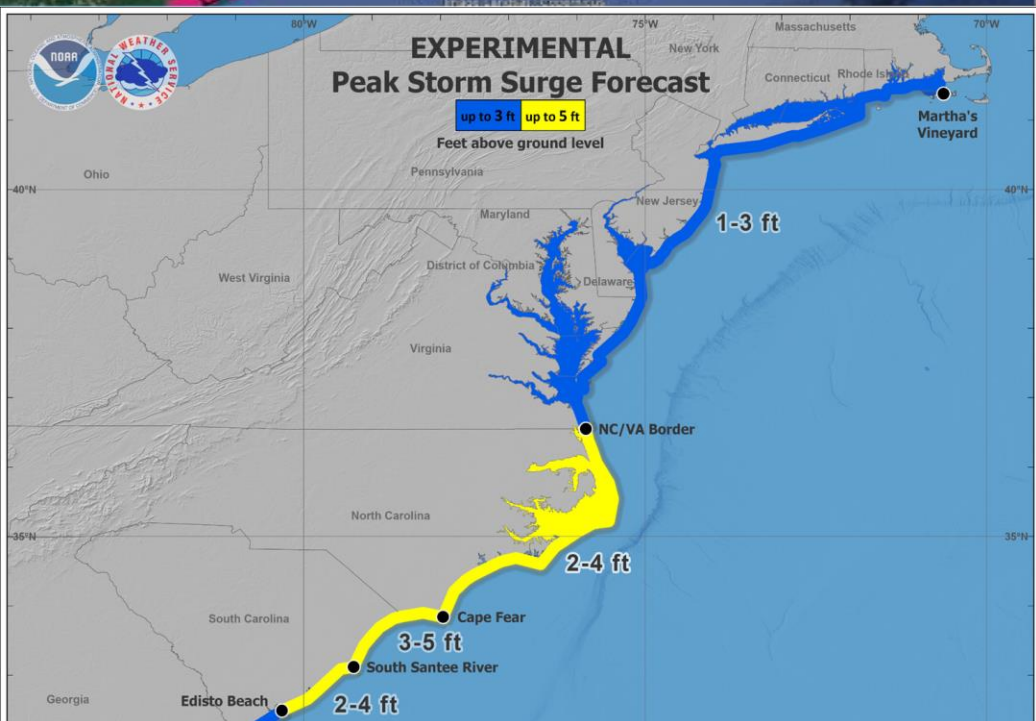
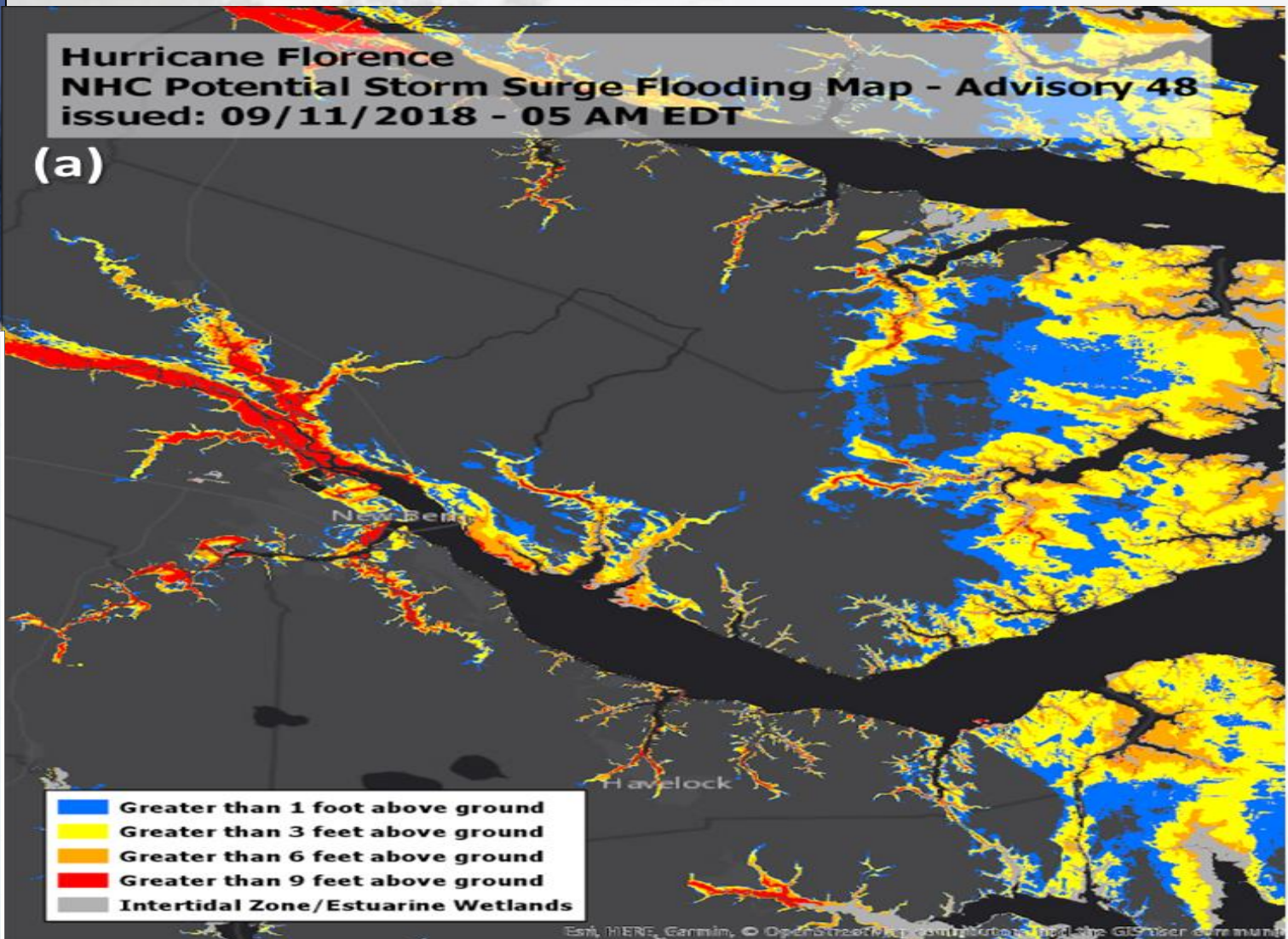
Over 1,800 water rescues in New Bern alone



Ocracoke

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

Storm Surge Forecasting



Rip Currents and Dangerous Surf

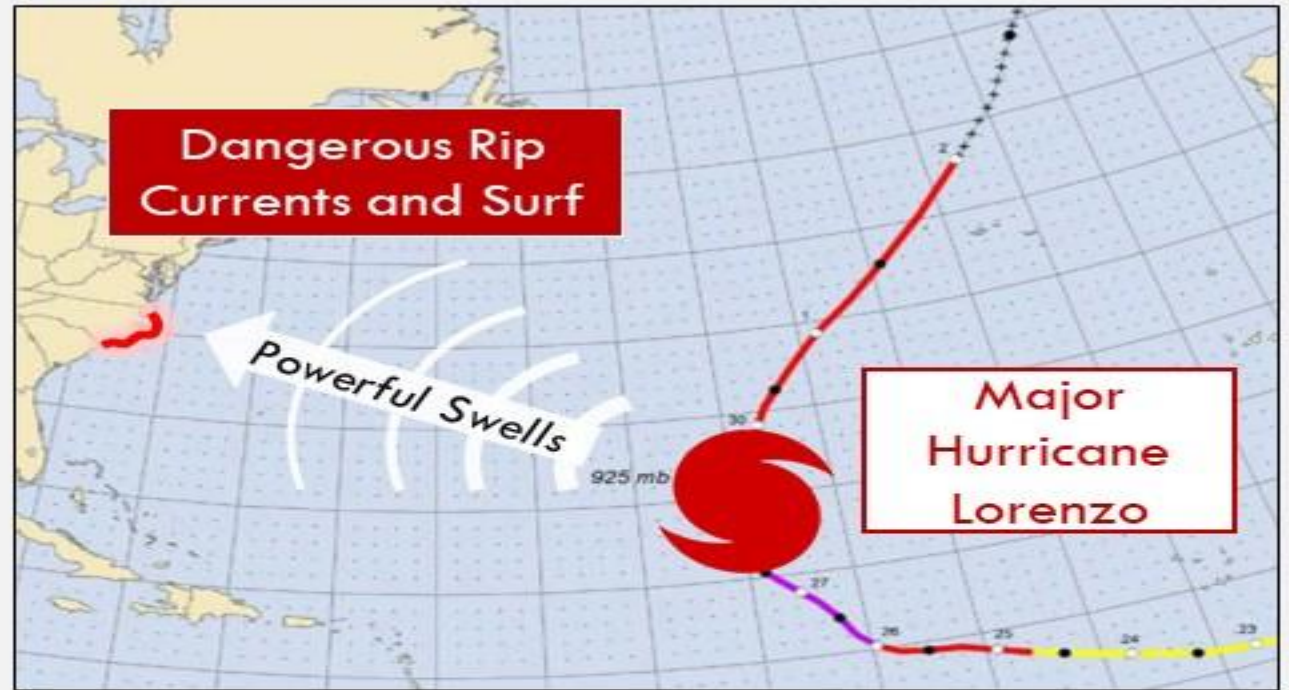
Distant hurricanes product strong swells, bringing dangerous rip currents to local beaches on otherwise nice weather days.

...

Always check the forecast before you head to the beach, obey beach flags, and swim near a lifeguard.

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.



Major Hurricane Lorenzo (2019) passed well out to sea, but sent powerful swell to the Carolinas creating strong rip currents and dangerous surf conditions along our beaches. There were 8 total Lorenzo-related surf deaths on the east coast, including 4 in the Carolinas.



National Weather Service

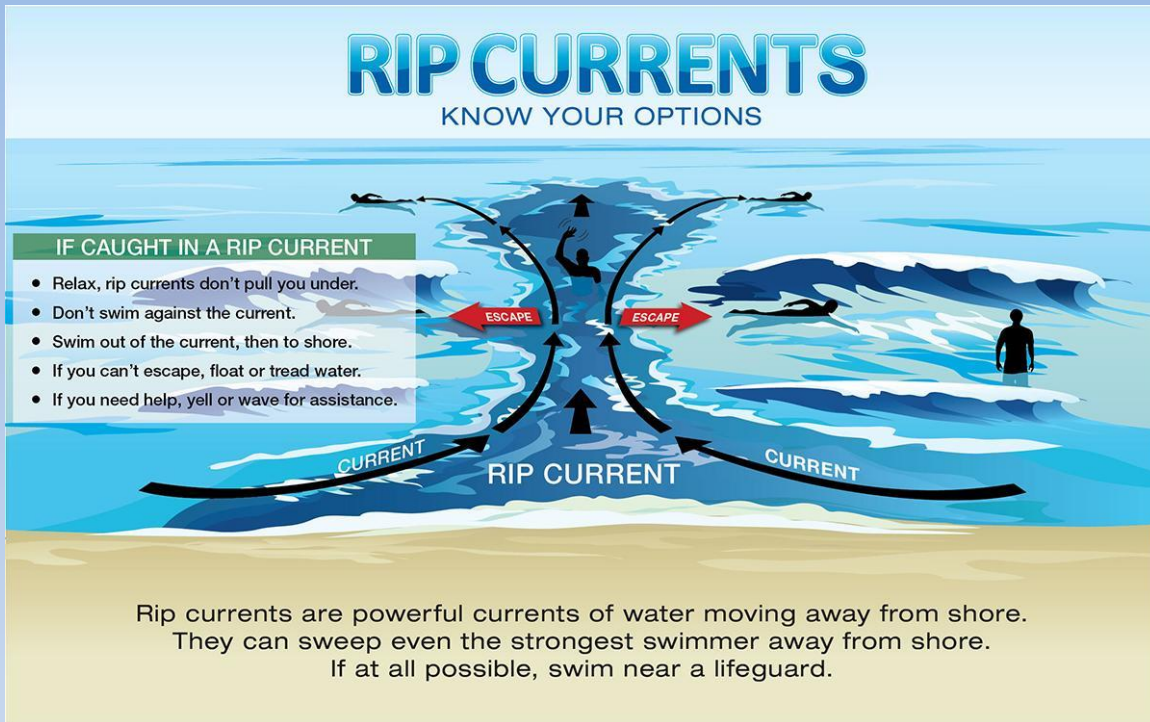
National Oceanic and Atmospheric Administration



NWSMoreheadCity

Find more info at [weather.gov/moreheadcity](https://www.weather.gov/moreheadcity)

General Beach Safety



If you're caught in a rip current...
Float, Wave, and Yell
OR
Swim Parallel

- Choose a beach with a lifeguard on duty, and talk with them before swimming.
- Pay attention to signs and flags to let you know where there might be danger.
- Make sure everyone, especially children, has adult supervision at all times when in the water, even if they know how to swim.
- Don't become a victim while trying to help someone else!
- Get help from a lifeguard. If a lifeguard is not present, call 9-1-1, then try to direct the victim to swim following the shoreline to escape. If possible, throw something that floats toward the swimmer. Never enter the water without a flotation device.

Tornadoes

Can Occur Well BEFORE A Storm Arrives (First Rain Bands)

Tornadoes can bring localized areas of much more extensive damage during (and ahead of) hurricanes.

...

NWS Morehead City will issue Tornado Warnings as needed during a hurricane, so make sure you have a way to receive warnings, such as a NOAA Weather Radio.



A tornado (seen coming onshore as a waterspout via Surfline Camera, top) caused extensive damage on Emerald Isle ahead of the main core of Hurricane Dorian (2019). A Tornado Warning was issued and no injuries were reported.



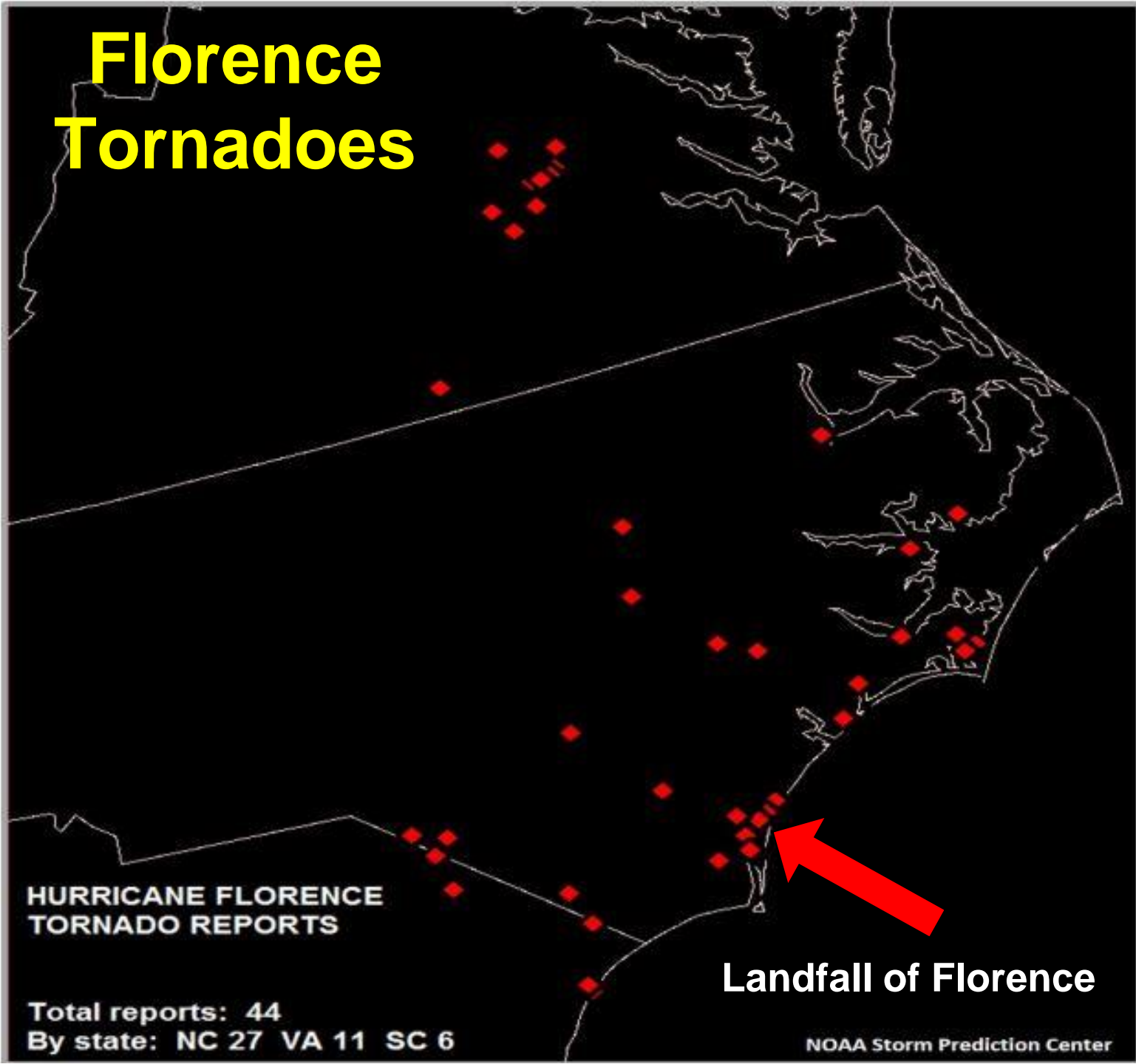
National Weather Service
National Oceanic and Atmospheric Administration



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Florence Tornadoes

**Can Occur Well
AWAY from actual
landfall**



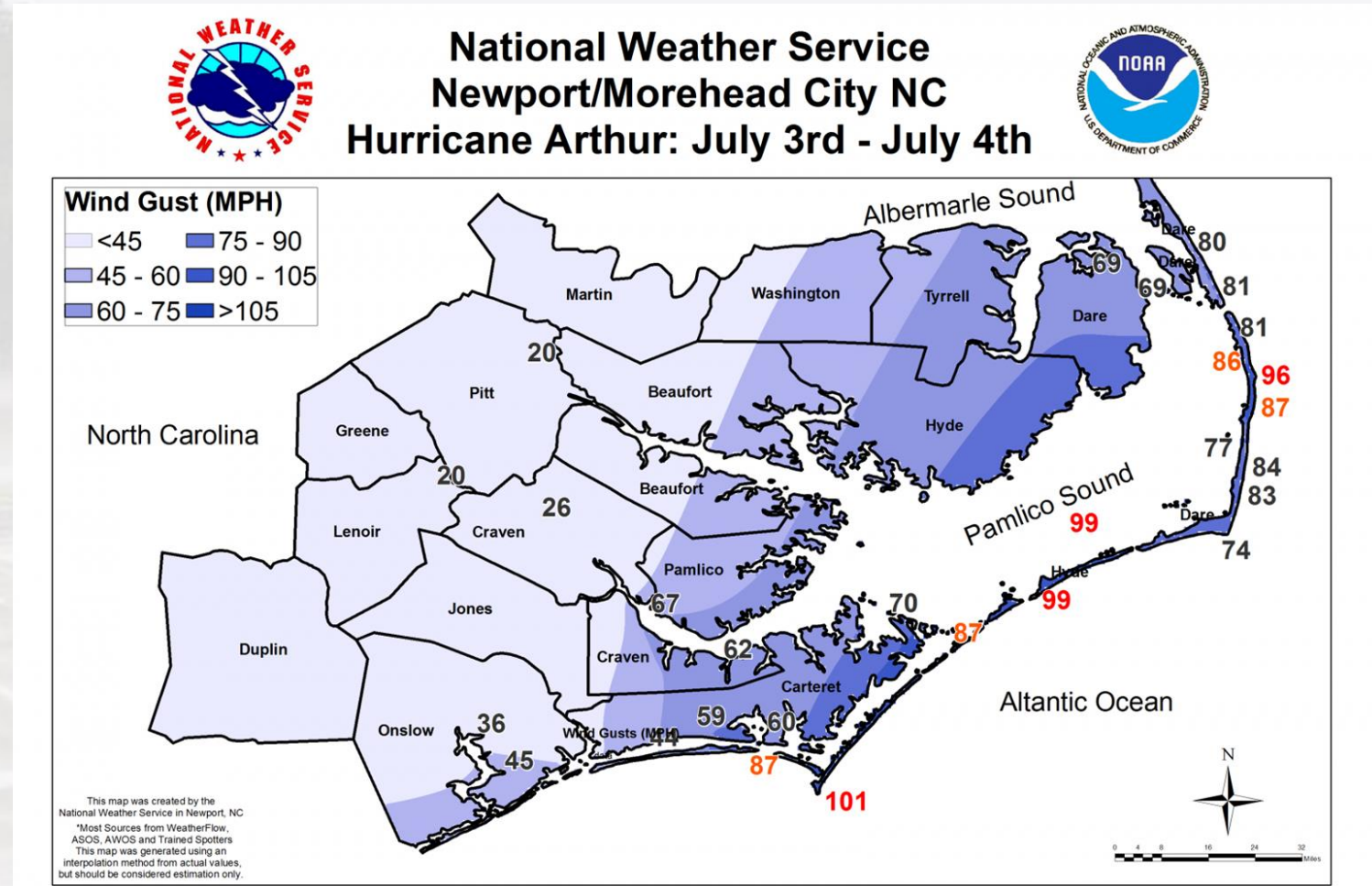
Arthur 2014

CAT 2

Similar Landfall

Faster Moving

Smaller Storm



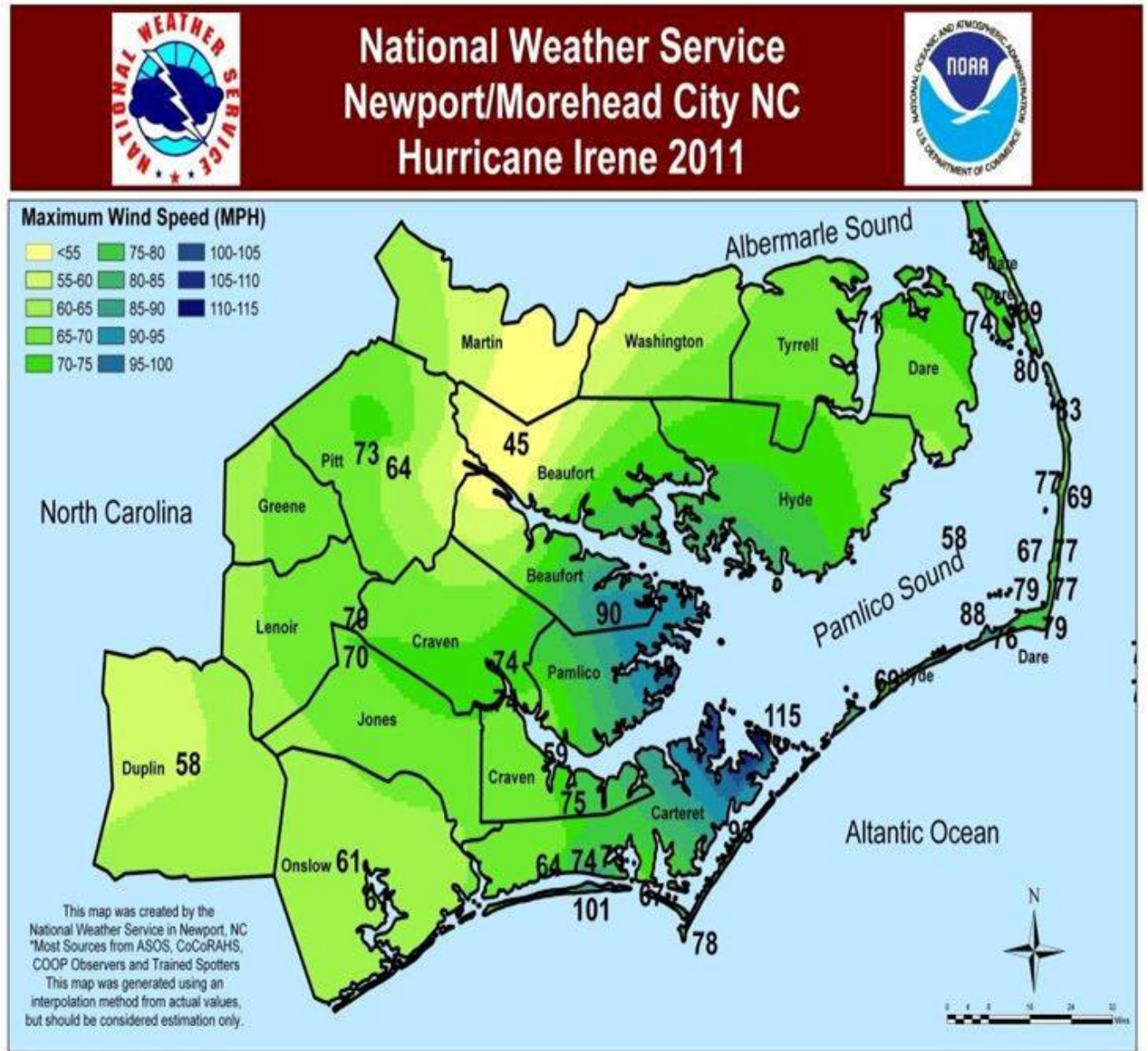
Irene 2011

CAT 1

Similar Landfall

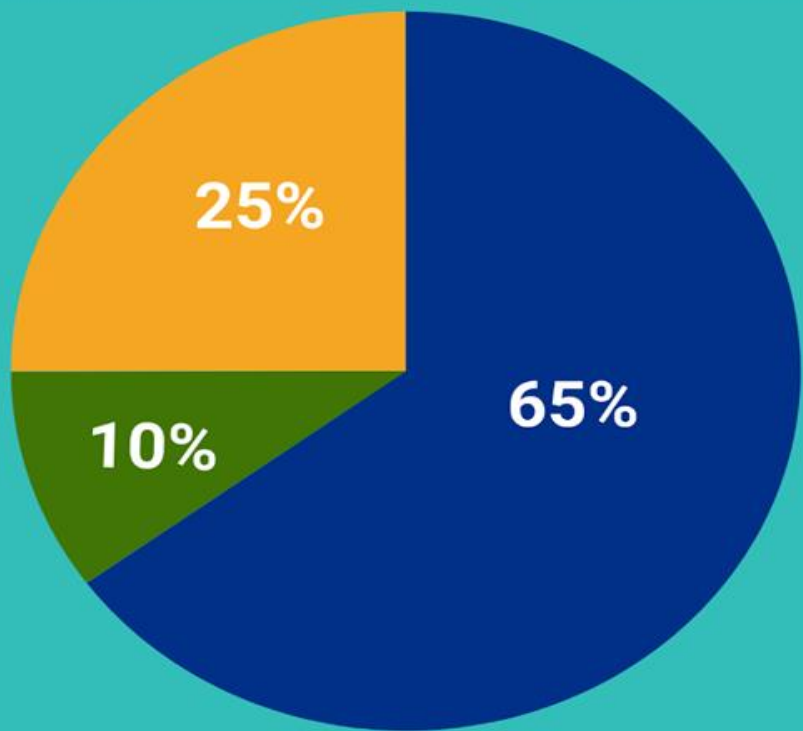
Slower Moving

Large Storm





2022 Atlantic Hurricane Season Outlook



■ Above-normal ■ Near-normal ■ Below-normal season

Season probability

Named storms

14-21

Hurricanes

6-10

Major hurricanes

3-6

What Can You Do Now?



SHARE This Information!

Start working on your hurricane kit

Assess your risk

Remember to focus on all of the impacts

Don't make your plan decisions just on Category!

Don't forget about after the storm

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



Hurricane Preparedness

DETERMINE YOUR RISK



Hurricanes bring many hazards to U.S. coastlines and inland areas, including storm surge along the coast, inland flooding due to heavy rainfall, tornadoes, strong wind, rip currents and large waves.



Storm surge



Strong winds



Tornadoes



Inland flooding



Rip currents

weather.gov/hurricane



Questions/Comments



erik.heden@noaa.gov