# THE HAZARDS OF HURRICANES



# ATLANTIC TROPICAL SEASON





# NC'S TROPICAL THREAT

Ready Control CAROLINA

- NC is impacted by a tropical storm/hurricane about twice/year
- ✤ Major hurricanes (Category 3+) threated NC once every 15 years
- The last major hurricane to impact NC was Hurricane Fran ('96)





## **PRIMARY TROPICAL HAZARDS**





**Strong Winds** 



**Storm Surge** 



#### **Coastal Impacts**



**Heavy Rainfall** 



#### Tornadoes

#### **TROPICAL CYCLONE FATALITIES** [DIRECT DEATHS] UNITED STATES: 1963 – 2012





- Almost 50% the deaths are due to storm surge
- Over 80% of deaths are due to water
- Wind causes less than 10% of deaths
- 84% think they need to evacuate based on the strength/wind speed

Edward N. Rappaport, 2014: Fatalities in the United States from Atlantic Tropical Cyclones: New Data and Interpretation. Bull. Amer. Meteor. Soc., 95, 341–346.

#### **TROPICAL CYCLONE FATALITIES** [INDIRECT DEATHS] UNITED STATES: 1963 – 2012





#### Most Frequent Factors:

Loss of electricity

Cardiovascular Failure

Vehicle Accident

Evacuation





#### Avoid the "it's just a..." mindset!





Landfall: Shackleford Banks Intensity: Category 2





Landfall: Cape Lookout Intensity: Category 1





Not only a coastal hazard!

- Speed of forward motion is critical in determining the inland extent of strong winds
- Gusts over land can easily be one SS scale category higher than sustained winds
- Strong winds tend to occur in stronger thunderstorm activity within the circulation

# THE DANGER OF HEAVY RAIN

#### What factors govern how much rain falls?

- The size of the storm (bigger = typically more rain)
- The forward motion (slower = typically more rain)
- Stability of the atmosphere (greater instability = more rain)
- Vertical wind shear, topography, frontal boundaries







Read

About <sup>1</sup>/<sub>4</sub> of deaths occur to people who drowned in, or attempted to abandon, their vehicles.

## THE DANGER OF TORNADOES



- Nearly half of all storms produce at least 3 tornadoes
- Tropical cyclones tend to produce more tornadoes in the daytime
- The majority of tornadoes occur in the right-front quadrant and are weak & short-lived



## THE DANGER OF COASTAL IMPACTS



- Rough surf and dangerous rip currents can be deadly – even in fair conditions!
- Remember: You can't outswim the current, but you can swim OUT of the current. Follow the direction of the shore.



Swells with a hurricane well offshore!







 Storm surge = the abnormal rise of water above normal tide levels, caused primarily by strong winds

 Occurs where the strongest winds are blowing onshore

 Main threat to life and property!





Hurricane Katrina Before & After

Storm surge inundation can be devastating!



Storm surge and large waves from tropical cyclones pose the greatest threat to life and property along the coast. Storm surge DOES NOT factor into hurricane categories.

<u>Storm Surge</u> = Water pushed towards the shore by wind swirling around the storm. <u>Storm Tide</u> = The water level rise due to storm surge + astronomical tide.





- Even a Category 1 hurricane can bring storm surge to a wide area!
- 22 NC counties are susceptible to significant storm surge flooding



Cape Hatteras 2016







 Storm surge is not just a threat along the immediate coast

 Surge is possible farther inland along NC's rivers

 Downtown New Bern could see up to 6-9' of surge from a Cat 2 and 10-24' from a Cat 5

## **ARE YOU WEATHER AWARE?**

Tropical activity peaks in September/October? True/False
The last major hurricane to impact NC was Matthew? True/False
Storm surge is the greatest threat to life and property? True/False
The Saffir-Simpson Scale only considers wind? True/False
It's safe to surf days ahead of an approaching storm? True/False
Tornadoes only occur in the right-front quadrant? True/False
Storm surge is only a threat to the immediate coast? True/False

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# HURRICANE HAZARD PRODUCTS





# Hurricane Watch

Hurricane conditions (sustained winds of 74 mph or higher) are **possible** within the **next 48 hours** 

## Hurricane Warning

Hurricane conditions (sustained winds of 74 mph or higher) are expected within the next 36 hours



## TROPICAL WEATHER OUTLOOK



#### Provides categorical probability of formation during the 5-day forecast period

<u>Note</u>: Location of existing disturbance indicated by an 'X'. Users can mouse over disturbances for advisory information.

ropical Cyclone Formation Potential for the Five-Day Period Ending at 7:00 pm EST Mon Dec 5 201 Chance of Cyclone Formation in Five Days: □ Low < 40% ■ Medium 40-60% ■ High > 60% X indicates current disturbance location; shading indicates potential formation area.

> Atlantic Basin (June 1 – November 30)

Local Issuance Times (EDT)

2AM, 8AM, 2PM, 8PM



#### FORECAST CONE W/ WIND FIELD



Current Position Initial Wind Field NHC Forecast Track Coastal Watches/Warnings

<u>Note</u>: The letter inside the dot indicates the NHC's forecast intensity for that time.

**D:** Trop. Depression (<39mph) **S:** Trop. Storm (39 – 73 mph) **H:** Hurricane (74 – 110 mph) **M:** Major Hurr. (> 110 mph)

Atlantic Basin (June 1 – November 30) Local Issuance Times (EDT)

5AM, 11AM, 5PM, 11PM



FORECAST CONE W/ WIND FIELD

#### NOT an impact cone! Impacts can be felt far from the center.







## STORM SURGE WATCH/WARNING



Highlights areas that are most at risk for life-threatening storm surge

<u>Note</u>: When warning is issued, NWS will request activation of WEA. Based on update cycles, not all cell phone carriers will push this message this season.

Storm Surge WATCH: <u>Possibility</u> of life-threatening inundation within **48 hours** Storm Surge WATCH: <u>Danger</u> of life-threatening inundation within **36 hours** 



#### POTENTIAL TROPICAL CYCLONES

Advisories, watches and warnings for disturbances that pose a threat to land within 48 hours now available

Note: Potential tropical cyclones will follow the naming conventions currently in place

ZCZC MIATCPAT1 ALL TTAA00 KNHC DDHHMM

BULLETIN Potential Tropical Cyclone Two Advisory Number 1 NWS National Hurricane Center Miami FL AL022017 500 PM EDT Wed Jun 05 2017

... TROPICAL STORM WARNING ISSUED FOR PORTIONS OF THE WEST COAST OF FLORIDA... ... DISTURBANCE OVER THE EAST-CENTRAL GULF OF MEXICO EXPECTED TO BECOME A TROPICAL STORM TOMORROW...



### **ARRIVAL OF TS FORCE WINDS**

#### 1. "Most Likely" Arrival Time 2. "Earliest Reasonable" Arrival Time [low risk tolerance]





### **2018 ATLANTIC NAMES**

#### **Questions or concerns?** Katie Webster, NCEM Meteorologist

Alberto
Beryl
Chris
Debby
Ernesto
Florence
Gordon
Helene
Isaac
Joyce
Kirk

12. Leslie
13. Michael
14. Nadine
15. Oscar
16. Patty
17. Rafael
18. Sara
19. Tony
20. Valerie
21. William