Rainfall Expertise: The Weather Prediction Center's Connection to NHC and the Tropical Program

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SECART Hurricane Awareness Webinar

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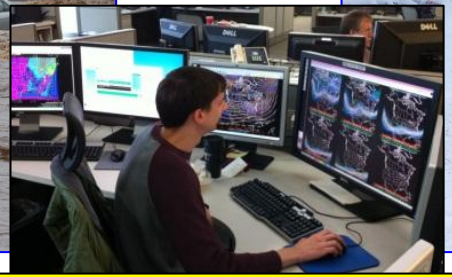
Rain falling; Wikimedia Commons, user W.carter

Major Focus: Extreme Precipitation

We do a lot of different types of weather forecasting over a very large area, but one common thread...

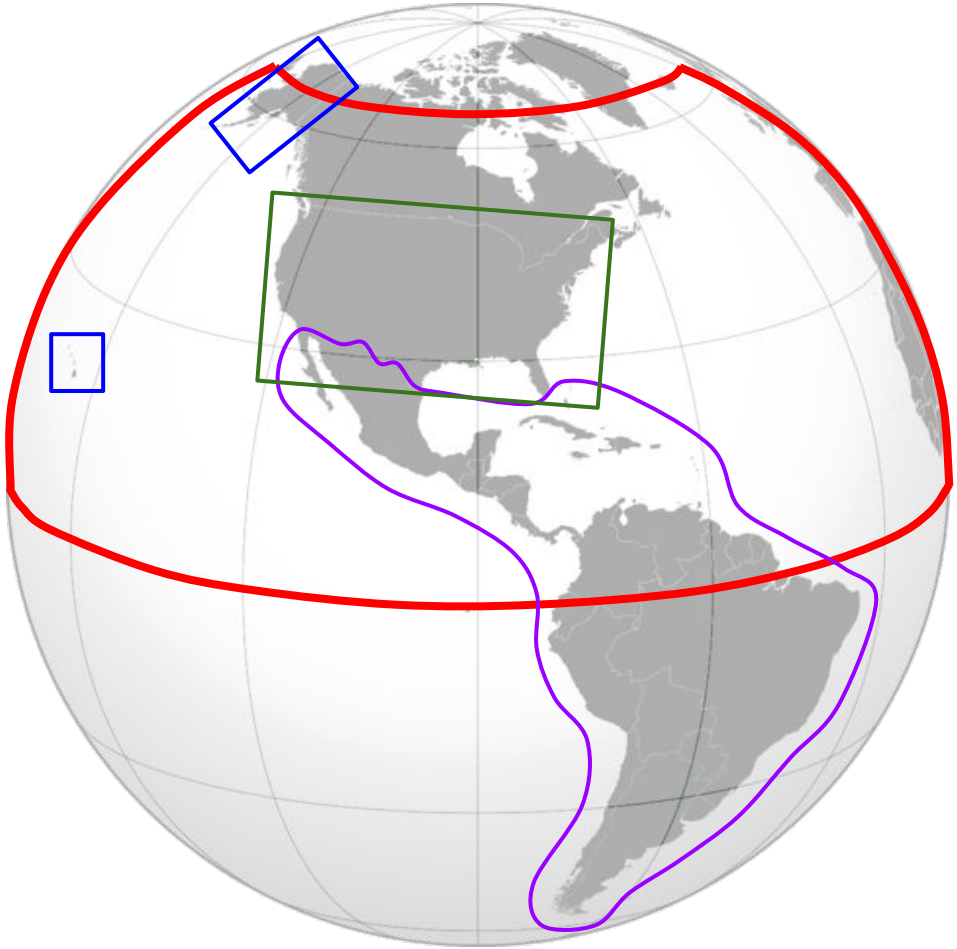
WPC is the national center of expertise in NOAA/NWS for extreme precipitation

Rain



Snow and Ice

A core focus for WPC forecasters is when and where extreme precipitation can be expected in the next seven days



WPC Forecast Domain

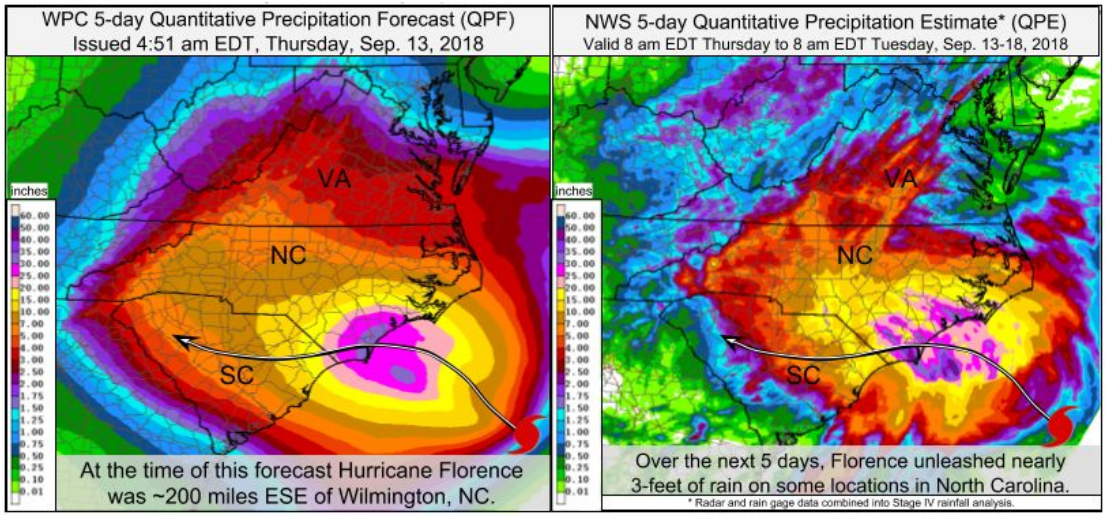
- CONUS: multitude of forecasts
- OCONUS: Alaska medium range and Hawaii forecast discussion
- **Tropical cyclone rainfall statements with NHC and CPHC**
- International Desk trains forecasters from Central and South America and the Caribbean

Partnership with NHC has Deep Roots

- **1960**: First Quantitative Precipitation Forecasts
- **1974**: Began issuing Storm Summaries for inland tropical depressions
- **1989**: Designated as backup office for National Hurricane Center
- **2002**: Inland Tropical Cyclone Advisories began to be issued once storms had weakened to tropical depression status; tropical cyclone rainfall project begins
- **2017**: First time NHC continuity of operations was invoked; real-time advisories issued for Jose and Katia while Irma threatened Miami

Two Key Tropical Roles

Rainfall and Flash Flood Forecasting

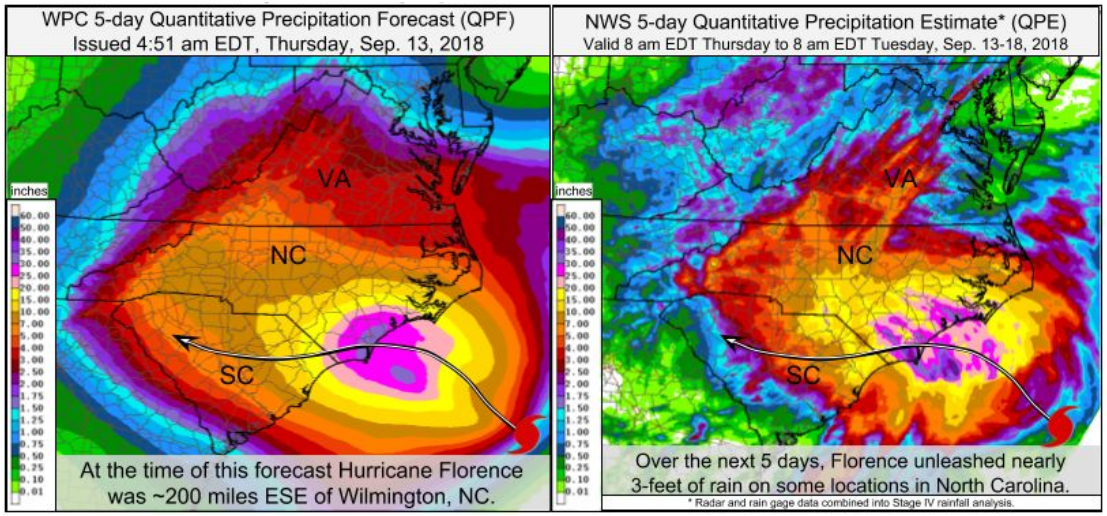


Inland Advisories and NHC Backup

Two Key Tropical Roles

Let's start by focusing on this...

Rainfall and Flash Flood Forecasting



Inland Advisories and NHC Backup

“An almost absurdly simple concept”

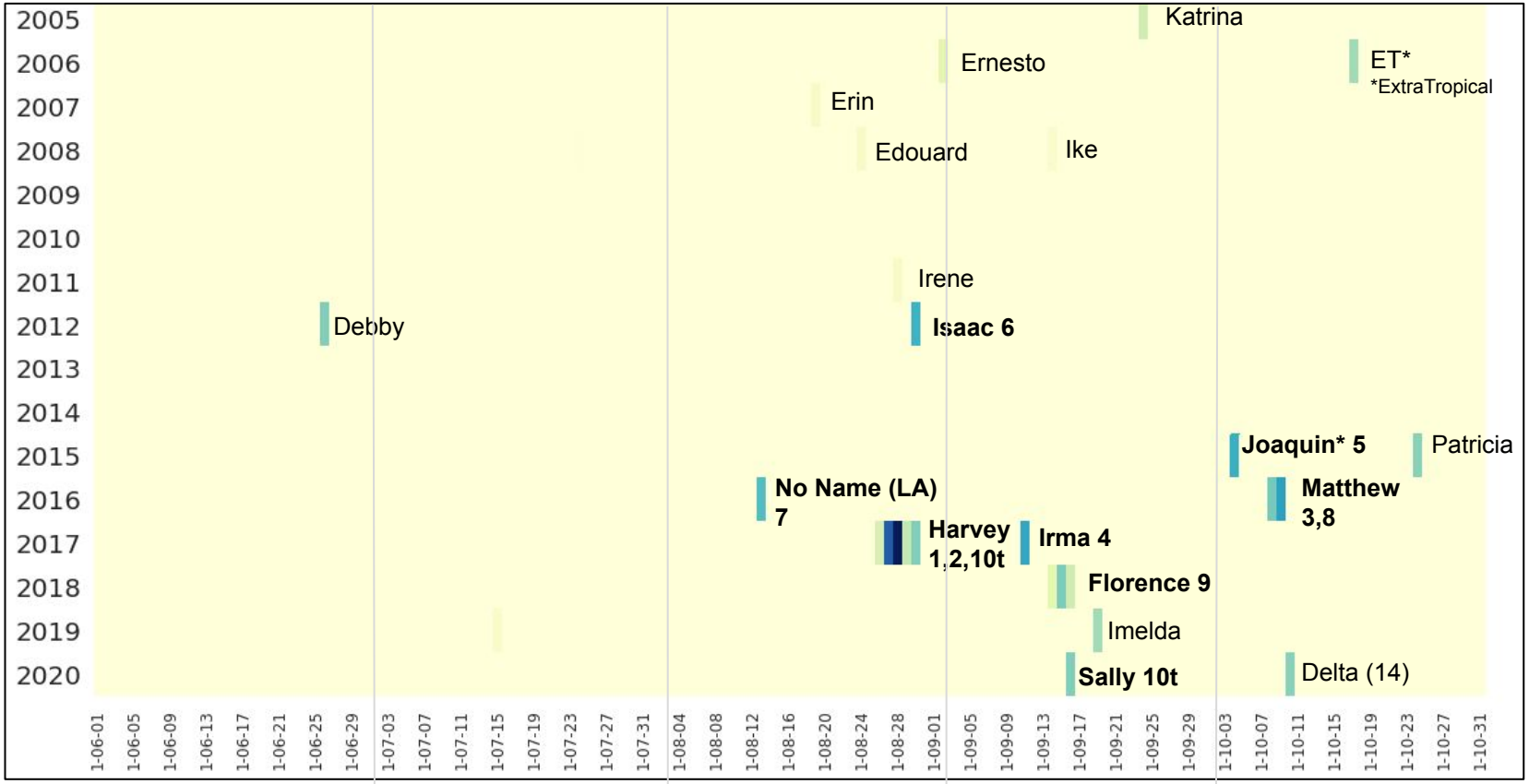
The heaviest rain falls where it rains hardest for the longest time.

(Paraphrase of Doswell, 1996)

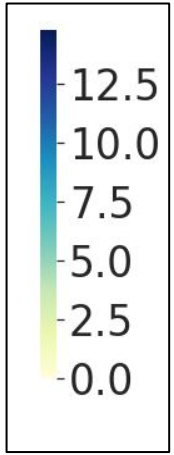
Tropical cyclones maximize both! Intensity and duration.

Tropical Cyclones: Prolific Rainfall Machines

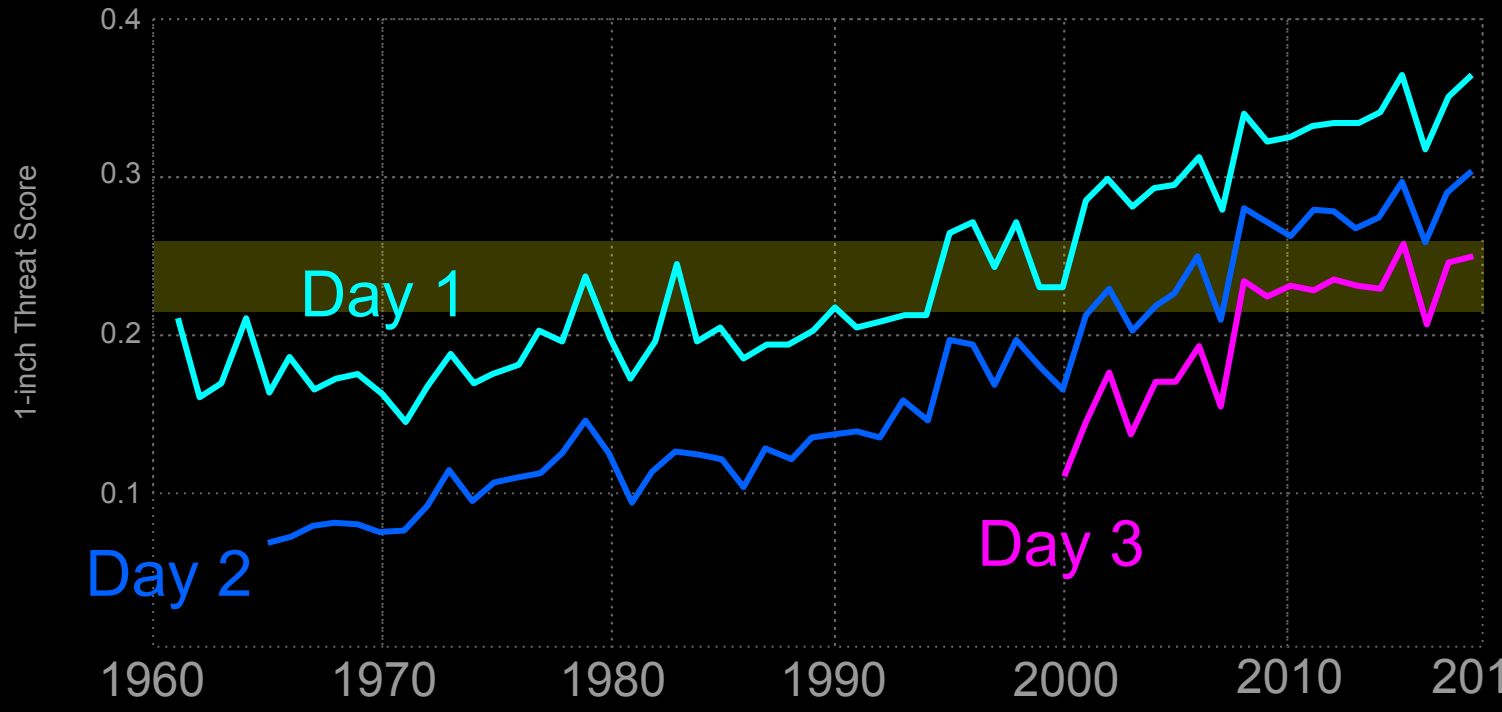
Top 10 days bolded with ranking indicated. 2,464 Jun-Oct days in this graphic; these cases are >99th percentile



Coverage of the daily 10" rainfall area (units 1000km^2)



Rainfall Forecasts Continue to Improve



Day 3 skill is roughly equal to Day 1 skill in the late 1990s. Improving about a day per decade.

But Rain Forecast Doesn't Convey Impacts

If an inch of rain is forecast, will it…?

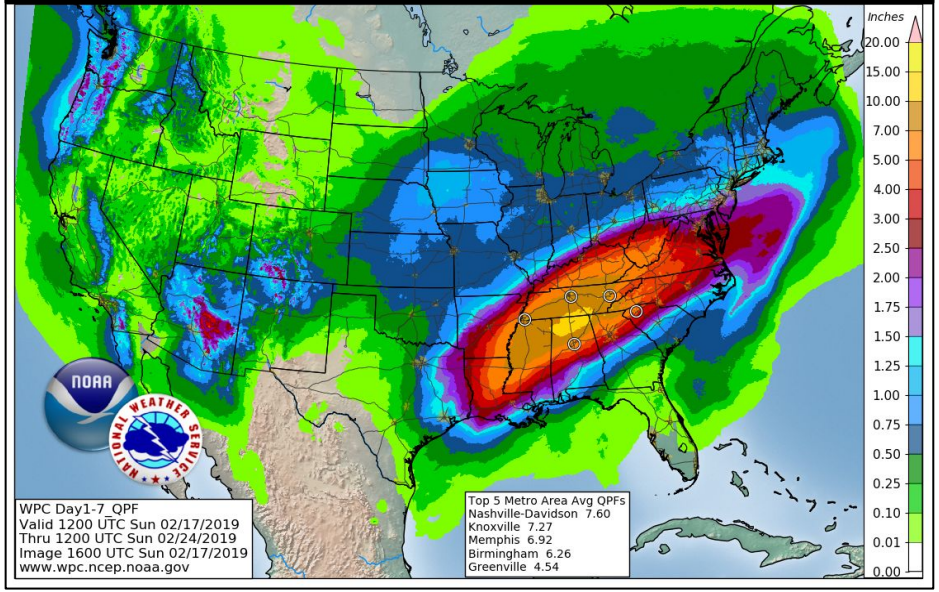
...fall gently over a whole day...

...or fall in 10 minutes

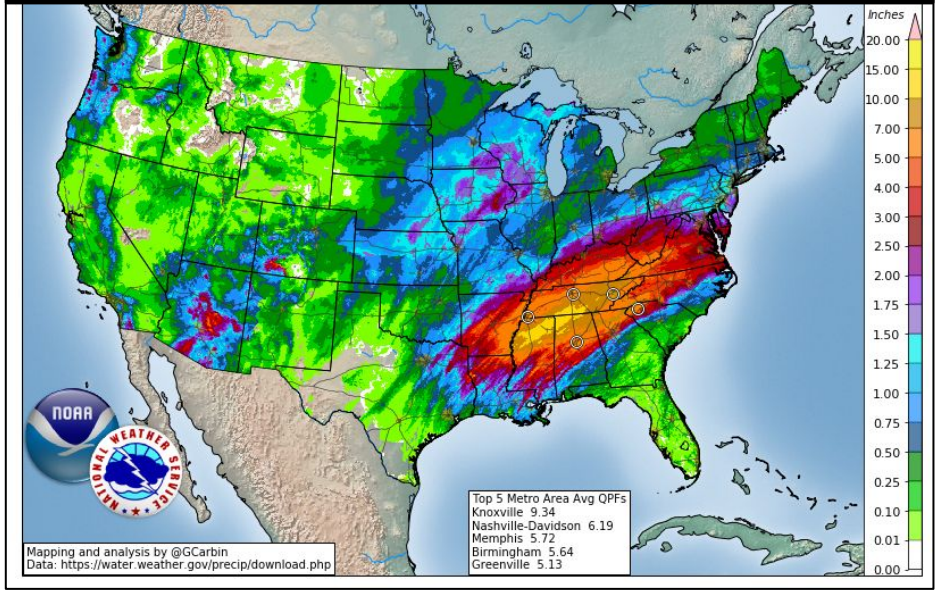
Context matters!

As Rainfall Forecasts Improve...

WPC 7-DAY FORECAST RAINFALL

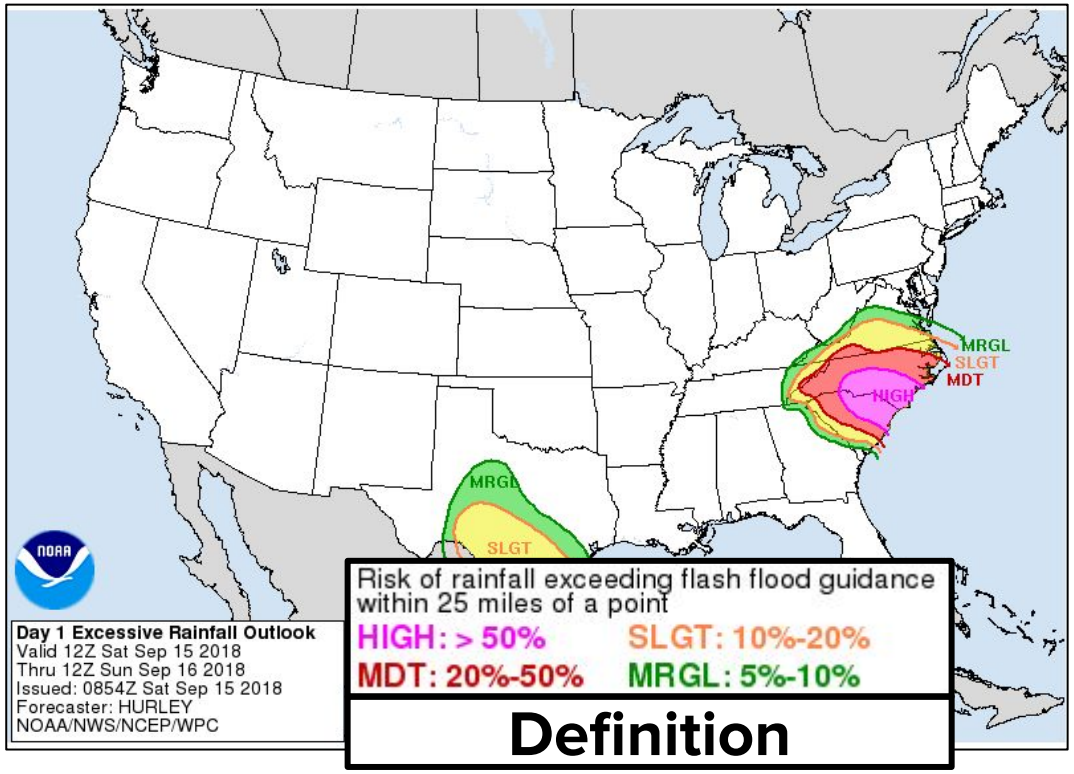


OBSERVED 7-DAY RAINFALL



...Risk Messaging Needs To Follow!

We Try To Differentiate With The ERO



Generally answers the question:

Where is the greatest risk of rainfall-induced flash flooding?

The ERO is:

A situational awareness and planning tool

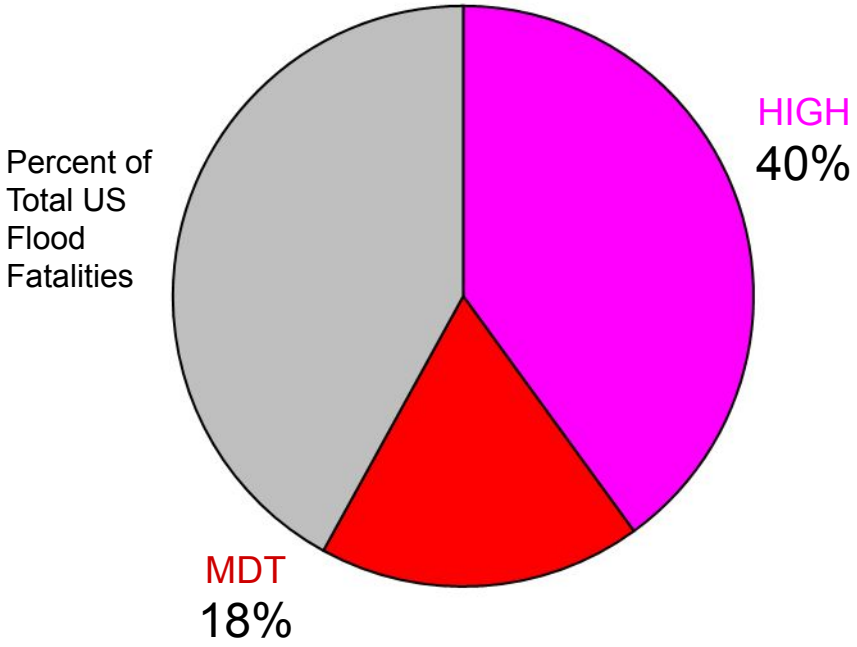
The ERO is *NOT*:

~~A forecast of flash flooding at a specific location~~

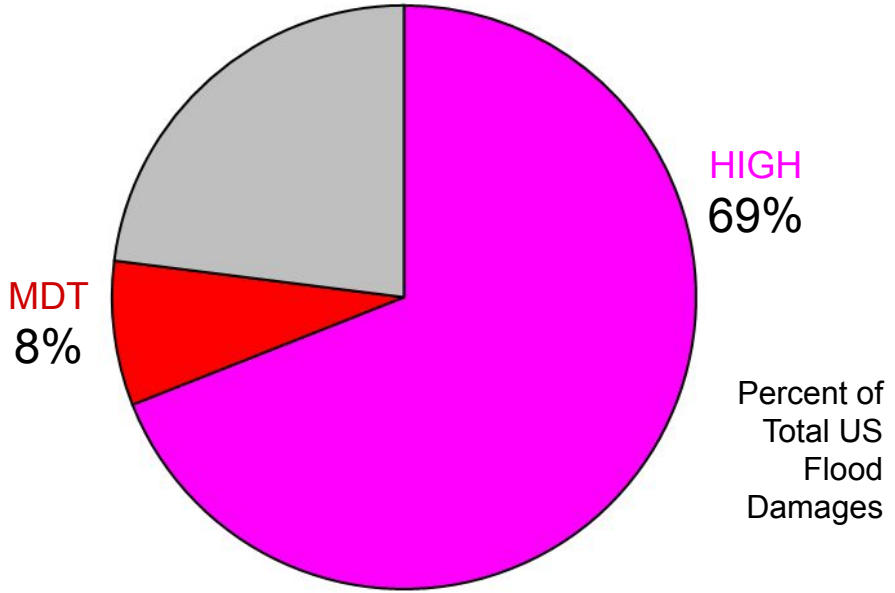
High Risks: Deadly and Damaging Day

"High Risk Days" have accounted [1] for the following. Excludes Harvey, which inflates damage figures.

2/5 of ALL Flood-related **Fatalities**



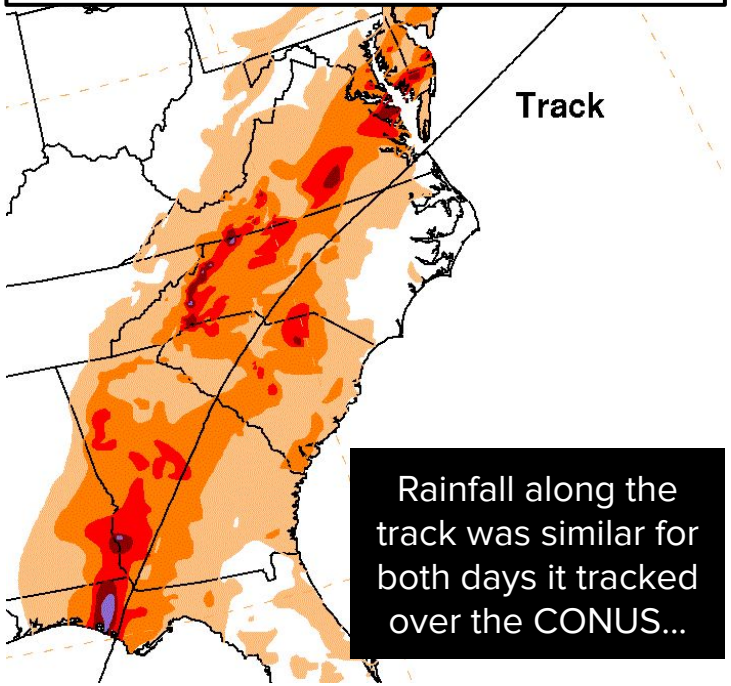
2/3 of ALL Flood-related **Damages**



[1] *From 2010 to 2018. Includes flood, flash flood, heavy rain, and debris flow Storm Data. Excludes Oso, WA landslide which occurred well after rainfall and on a sunny day.*

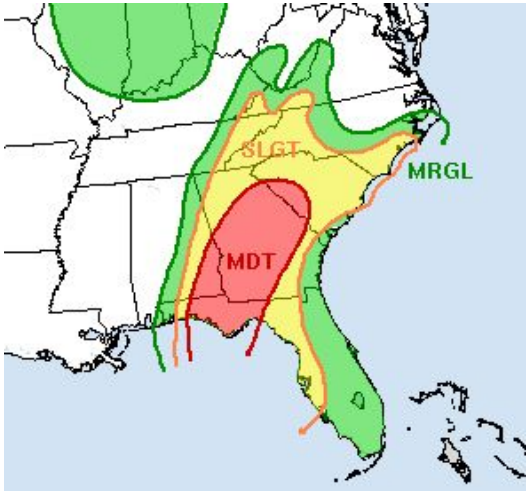
Not All Tropical Days Created Equal

Hurricane Michael (2018)

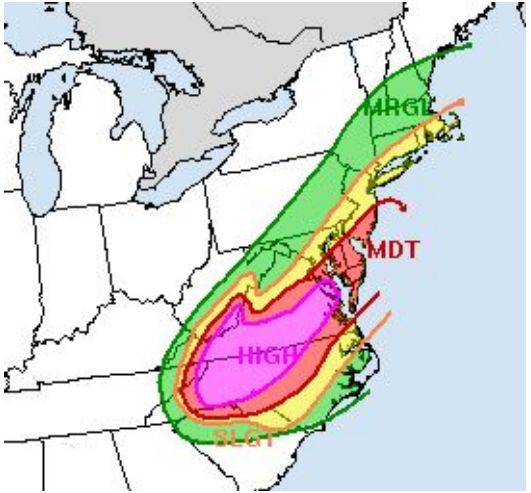


Rainfall along the track was similar for both days it tracked over the CONUS…

…however, WPC EROs account for difference in ***impacts***

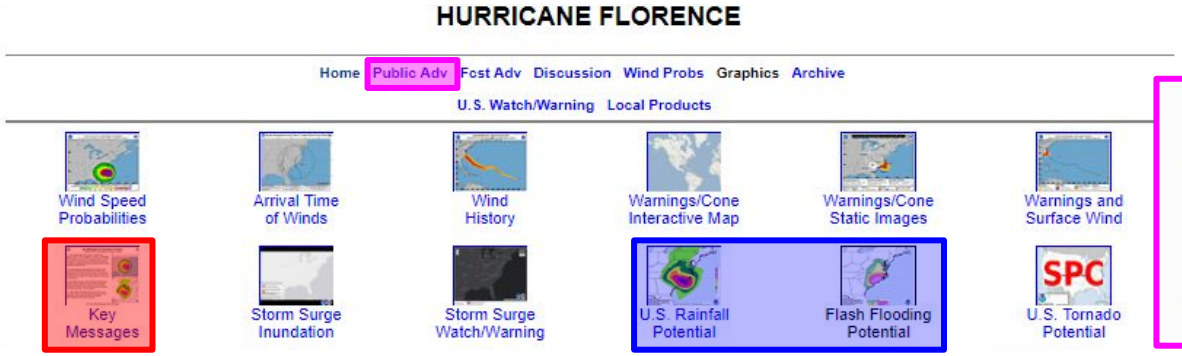


12Z October 10 to
12Z October 11, 2018
No fatalities, $8K damages



12Z October 11 to
12Z October 12, 2018
5 fatalities, $23M damages

Where WPC Fits in Tropical Information

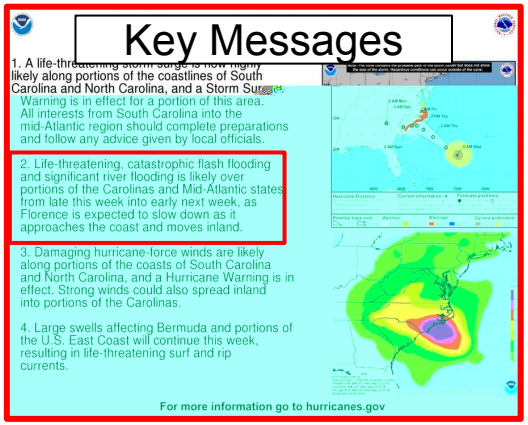


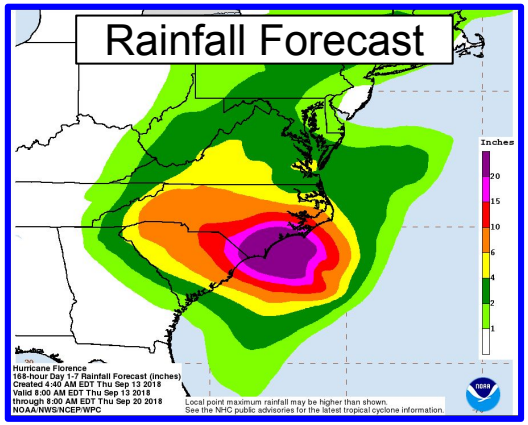
Public Advisory

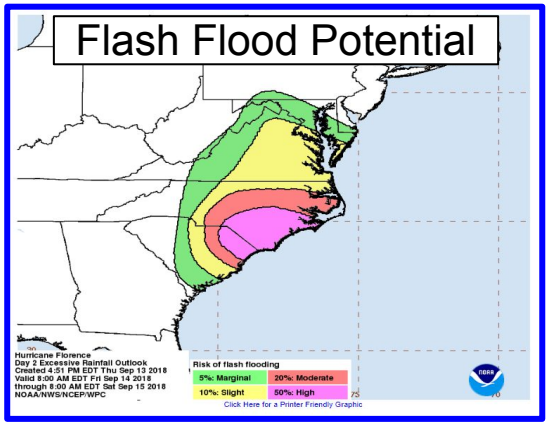
RAINFALL: Florence is expected to produce heavy and excessive rainfall in the following areas...

Coastal North Carolina...20 to 30 inches, isolated 40 inches
South Carolina, western and northern North Carolina...5 to 10 inches, isolated 20 inches
Elsewhere in the Appalachians and Mid-Atlantic states...3 to 6 inches, isolated 12 inches

This rainfall would produce catastrophic flash flooding and significant river flooding.

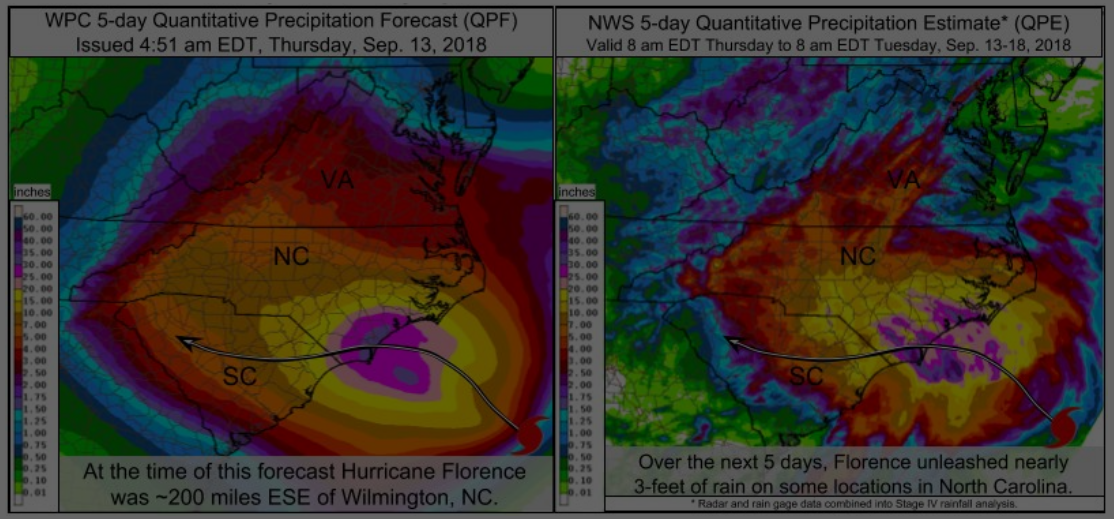






Two Key Tropical Roles

Rainfall and Flash Flood Forecasting



And now let's talk about...

Inland Advisories and NHC Backup

Inland Tropical Advisories Policy

WPC also issues Storm Summaries that highlight highest rainfall totals and peak winds.

NHC hands off responsibility to WPC for Tropical Advisories when…

✅ The storm has moved inland over the CONUS or Northern Mexico, and...

✅ Maximum sustained winds have decreased below tropical storm strength, and…

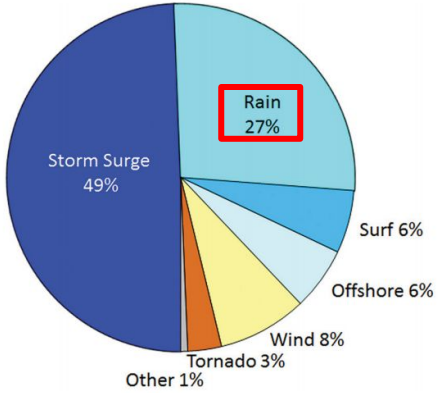
✅ Will affect the CONUS but is not forecast to re-emerge over water or regain tropical storm intensity.

WPC issues advisories as long as Flood Watches and/or Slight-or-higher ERO Risks are present, and there is a trackable low center.

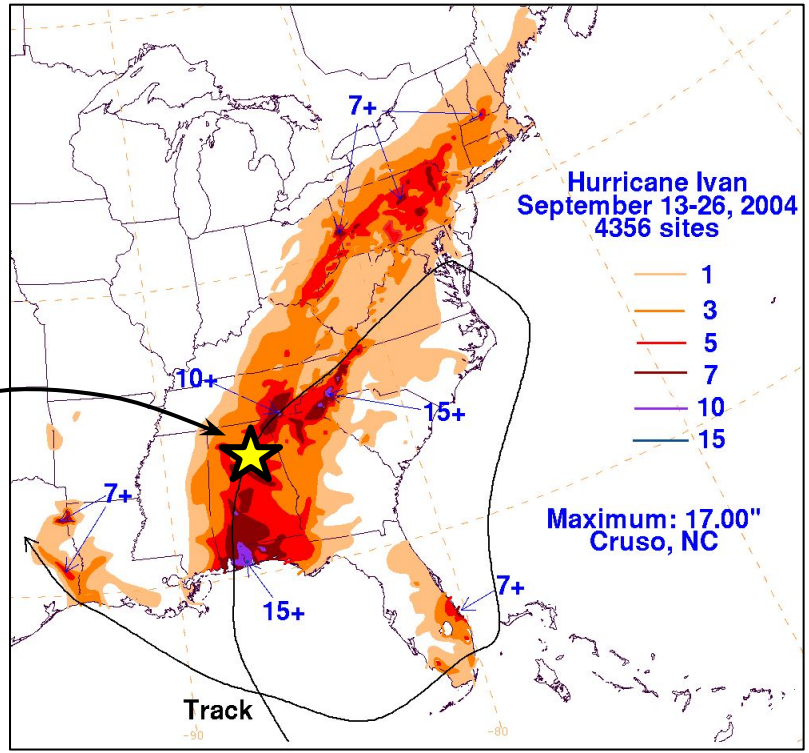
Inland Tropical Advisories Strategy

Tropical Advisories give extra visibility to weather hazards, and **the goal is to keep them going as long as there is a notable flash flood threat**.

Flooding from rainfall is the hazard type that is the most common killer in U.S. tropical cyclones



Example: Ivan becomes a tropical depression but continues to produce substantial rainfall much further inland over the next couple days.

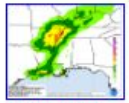


NHC Web Page After Handoff

Tropical Depression Barry Storm Archive

The NHC has issued its final advisory on this system. Public Advisories from the Weather Prediction Center will provide updates as long as the system remains a flood threat.

Public Advisory #19
1000 PM CDT

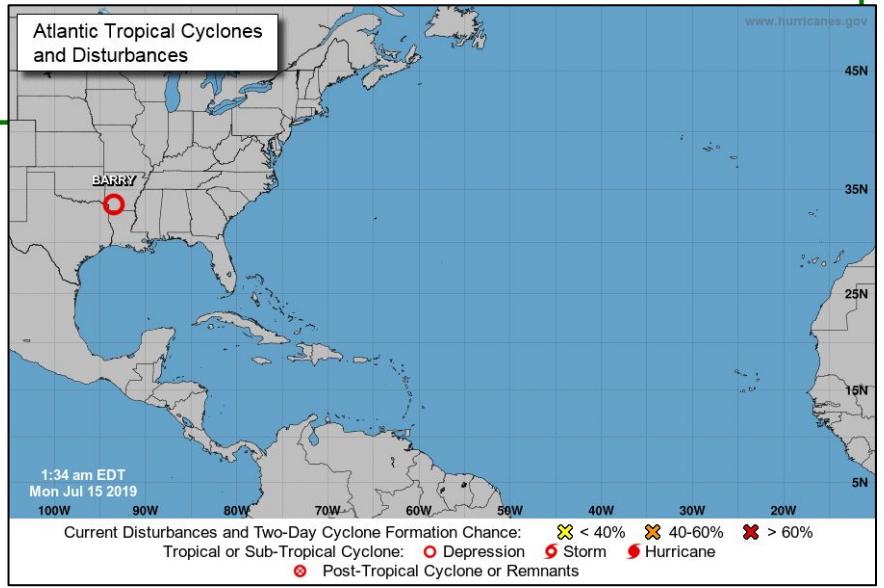


Rainfall Potential

Additional Information:
River & Flood Forecasts

Even when WPC takes over advisories, there is still a storm-specific box on the NHC website, and an icon still shows up on the map at the top of the page.

Links to WPC information and graphics, as well as a link to the NWS AHPS page.

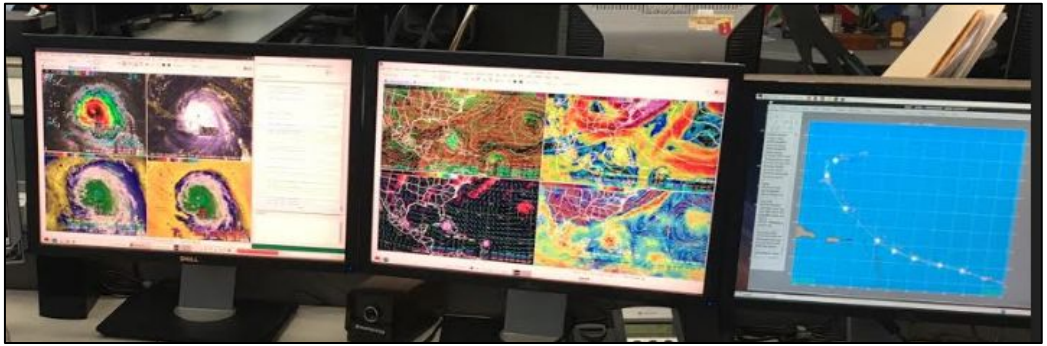


Approach to NHC Backup

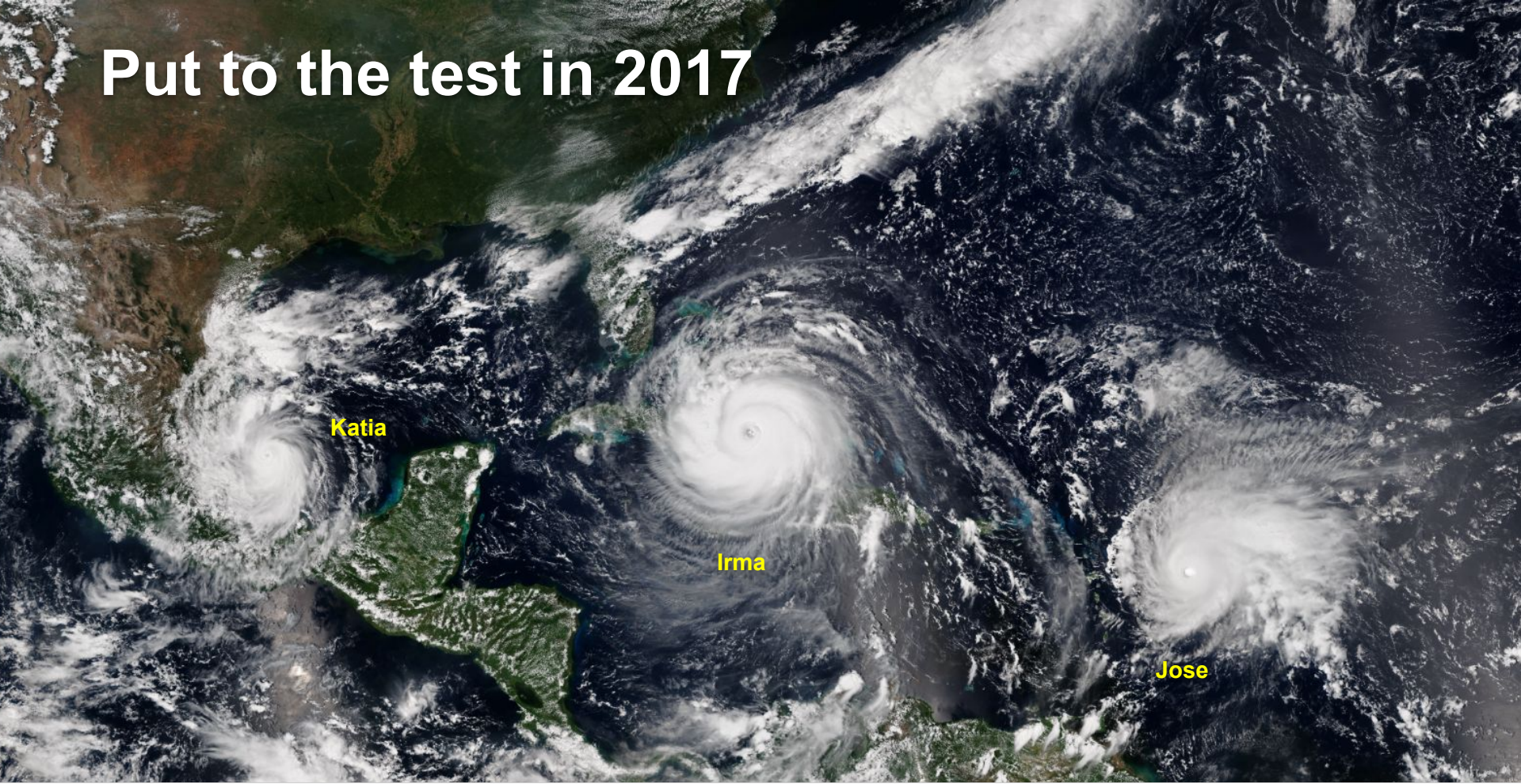
Some WPC forecasters receiving more tropical training, including participation in NHC-produced training courses (above).

Critical that this functionality be maintained in an emergency!

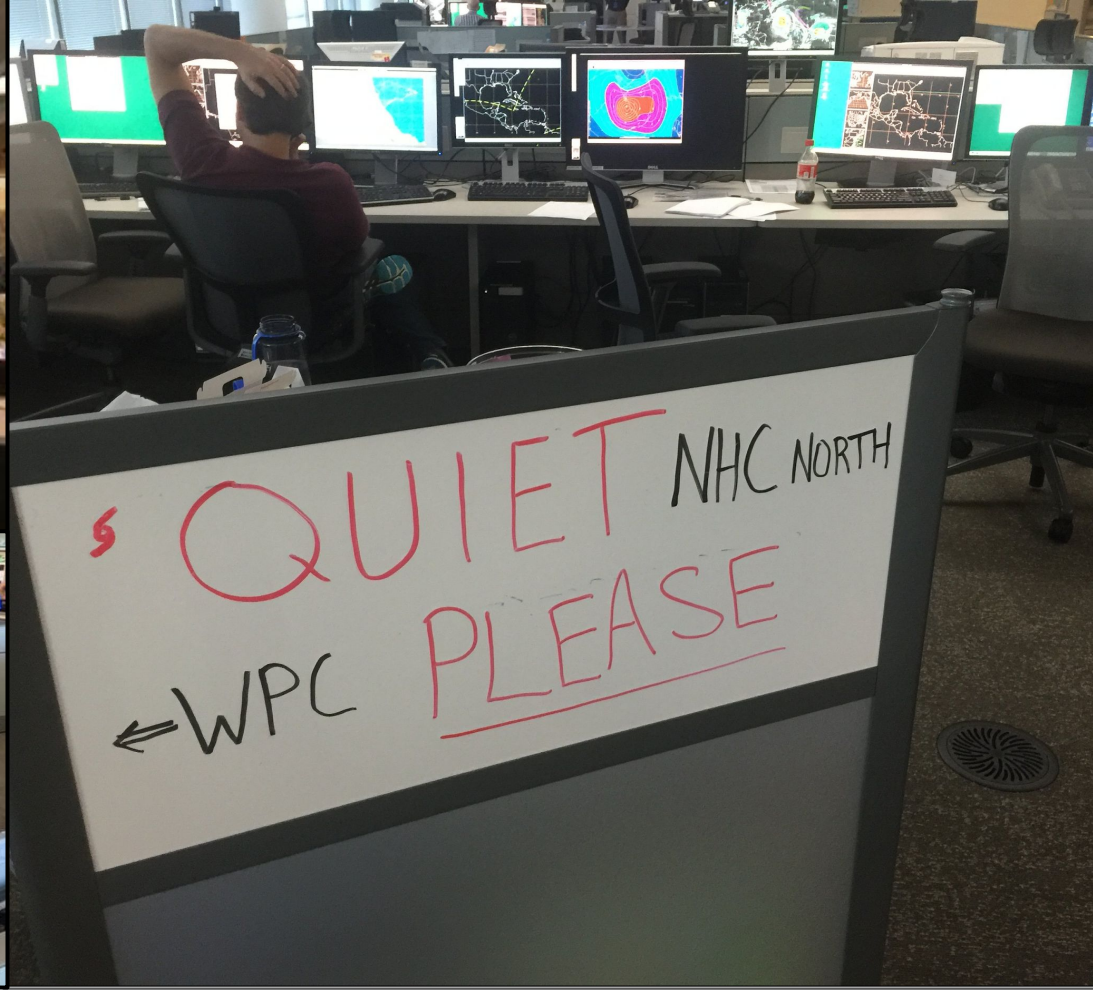
Regular annual testing of backup procedures and exercises that forecasters can practice the advisory process. Note: WPC backs up Hurricane Specialist Unit (HSU); OPC backs up Storm Surge Unit (SSU)



Put to the test in 2017




CPHC
EAST
WPC
NORTH
NHC
NORTH


QUIET
NHC NORTH
WPC
PLEASE

Closing Thoughts...

About 2 out of every 3 flood deaths are related to vehicles

Rainfall and flood forecasting, and getting the related message out, is a team effort. Vehicle safety needs to be at the forefront of those messages! You are all part of the team!

Car in flood waters in Oklahoma; FEMA Photo