

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

Alex Lamers

Warning Coordination Meteorologist  
NOAA/NWS Weather Prediction Center

SECART Hurricane Awareness Webinar

June 3, 2021 | SECART Webinar Series



# 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**

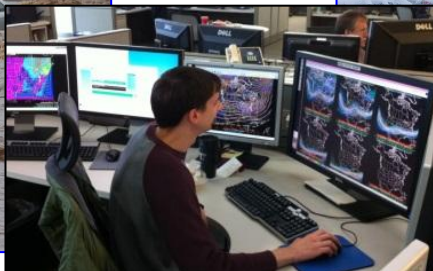


*Creative Commons*

**Snow and Ice**



*Creative Commons*



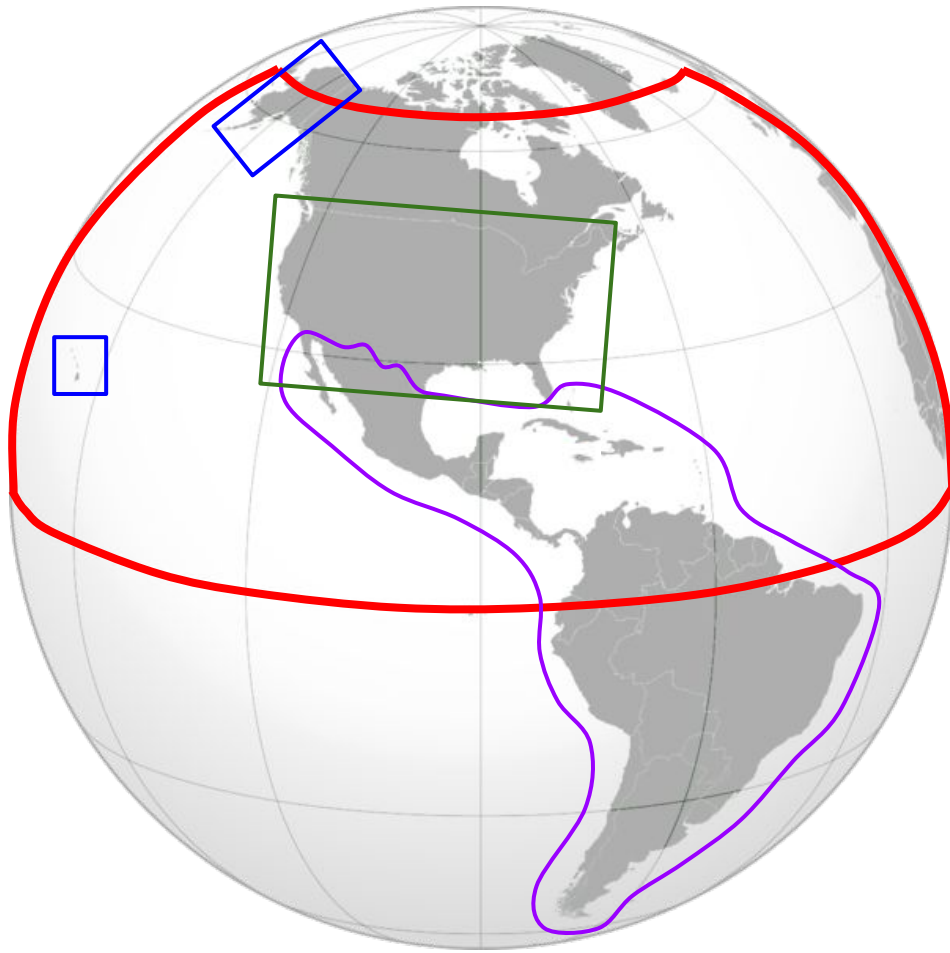
**A core focus for WPC forecasters is when and where extreme precipitation can be expected in the next seven days**



**WEATHER PREDICTION CENTER**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

*WPC's Connection to NHC and the Tropical Program  
June 3, 2021 | SECART Webinar Series*

# 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

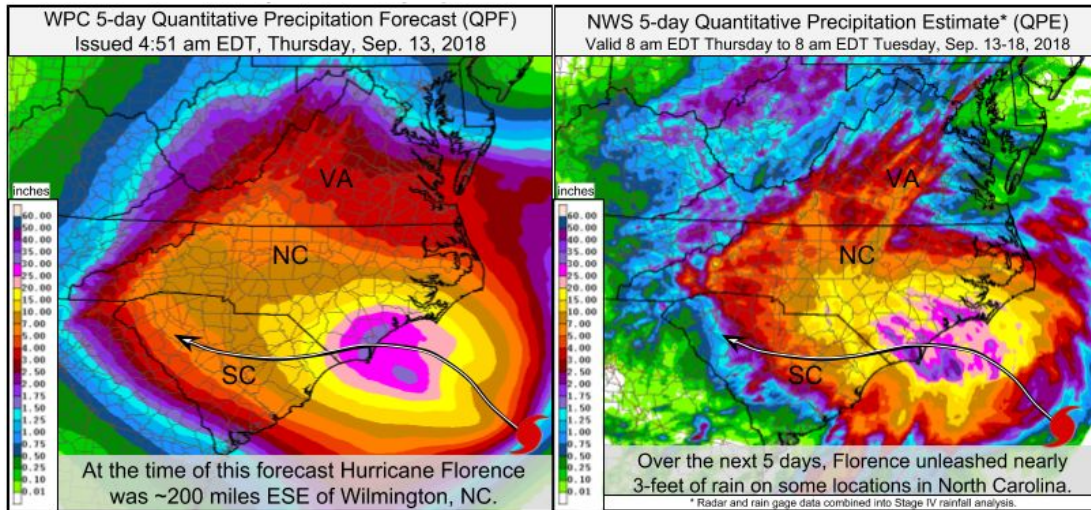
# Partnership with NHC has Deep Roots

- **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



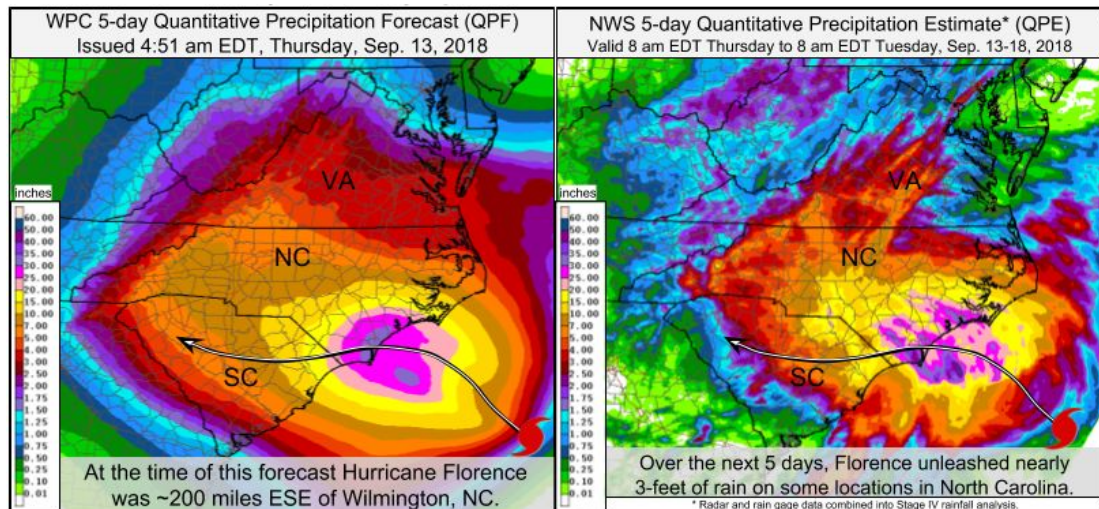
## Inland Advisories and NHC Backup



# 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**.

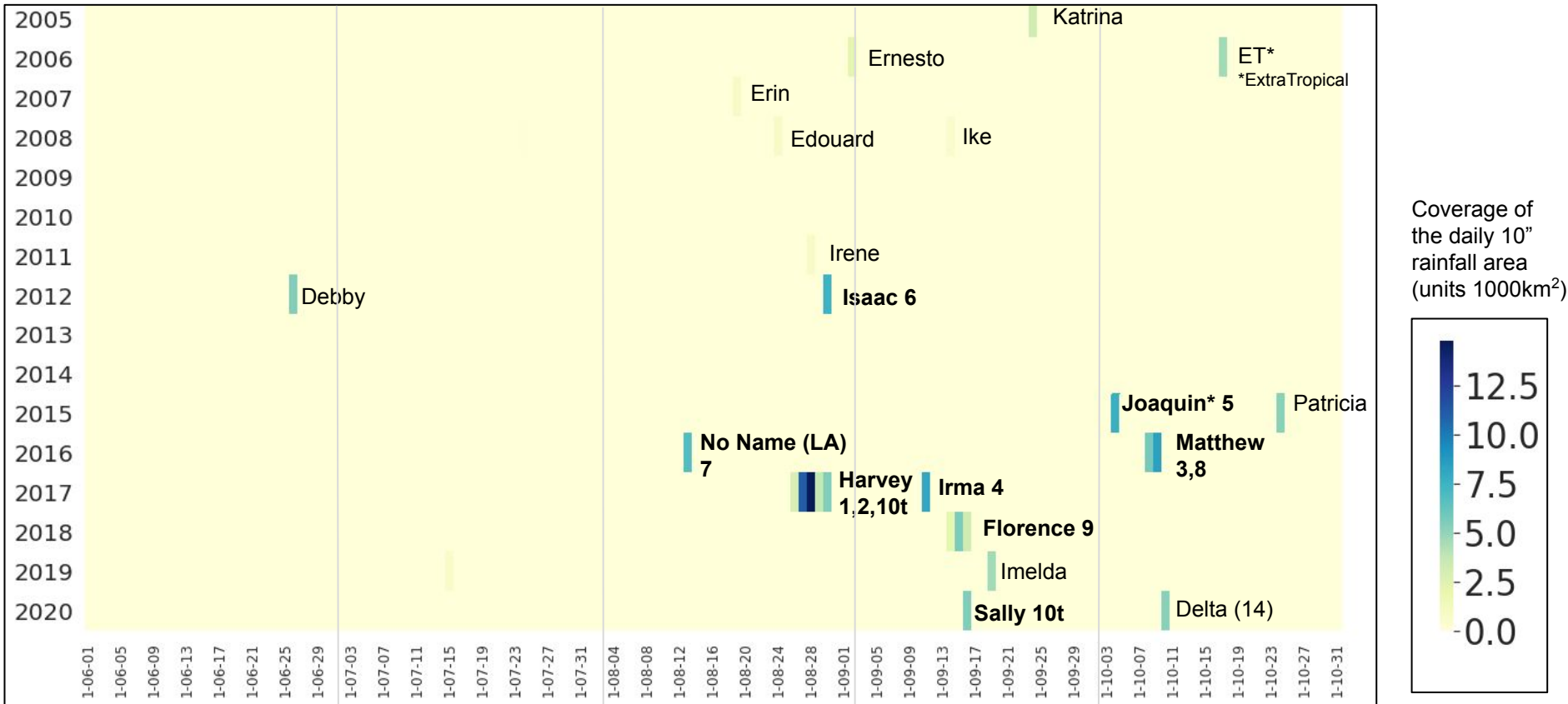
*(Paraphrase of Doswell, 1996)*

Tropical cyclones maximize both! **Intensity** and **duration**.



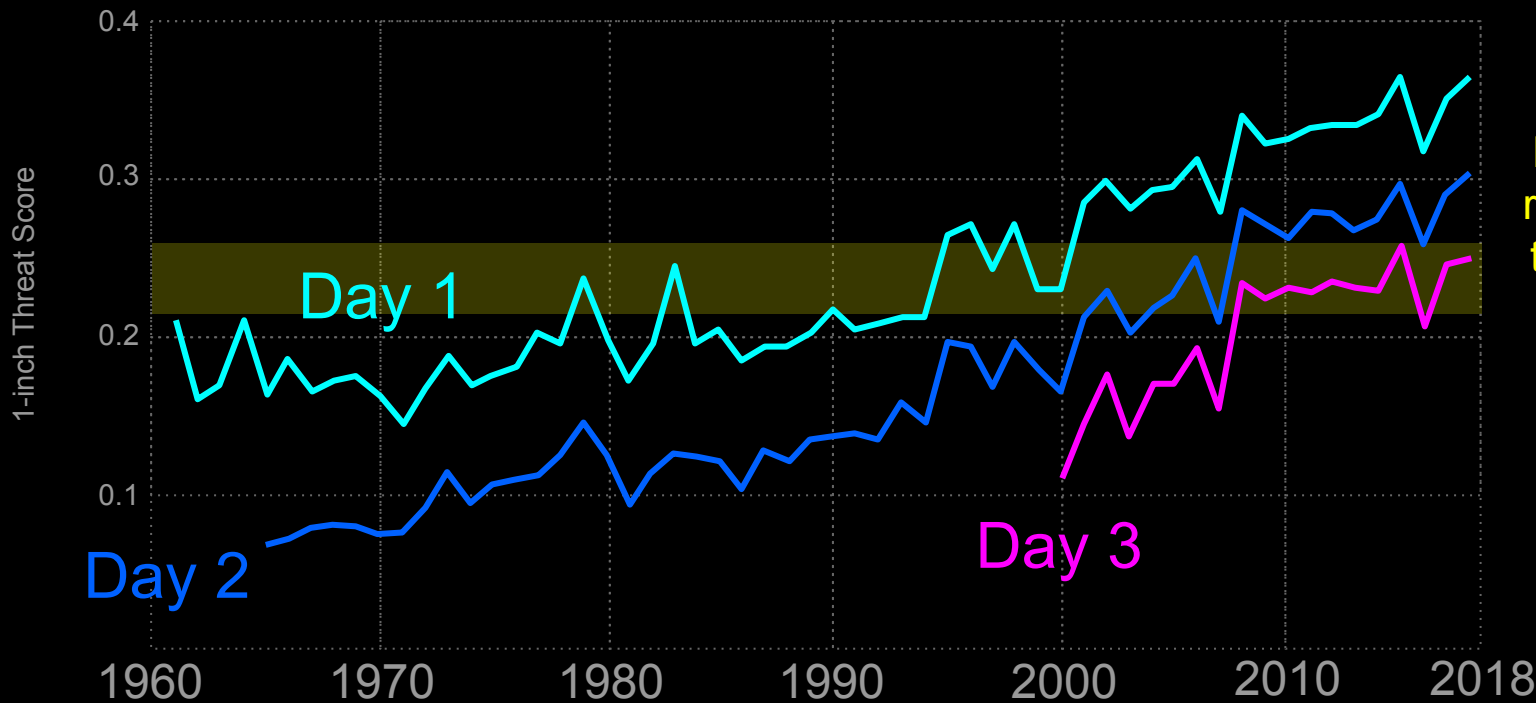
# Tropical Cyclones: Prolific Rainfall Machines

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





# 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



Pixabay



Wikimedia/Kingbob86

**Context matters!**

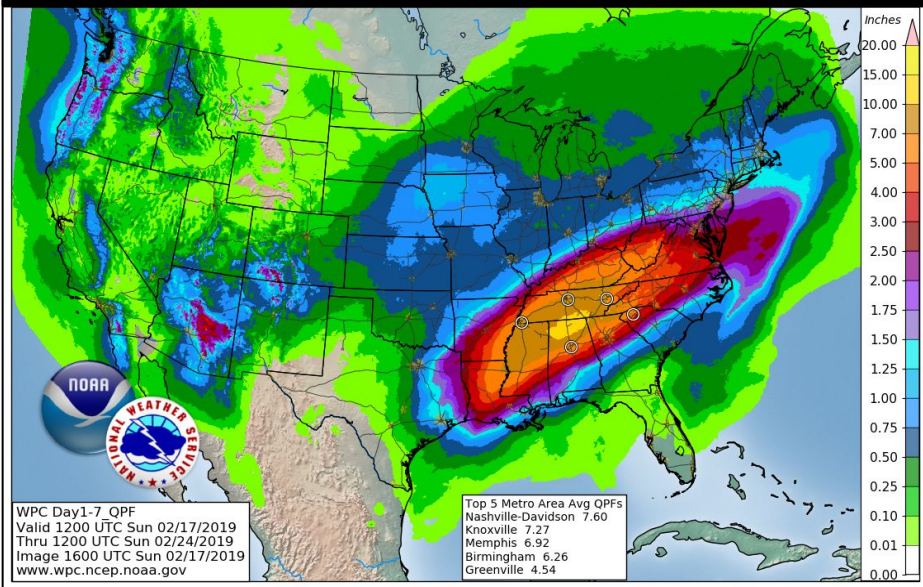


WEATHER PREDICTION CENTER  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

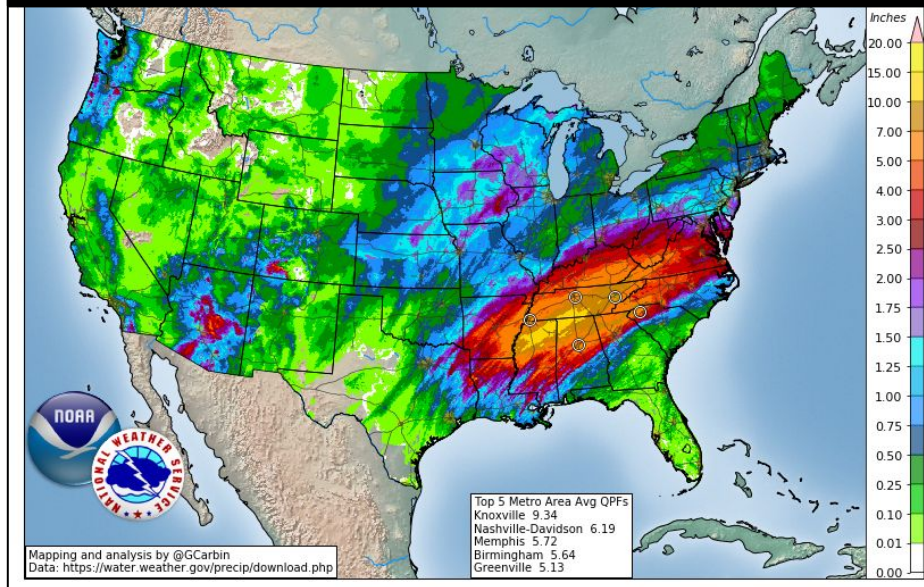
WPC's Connection to NHC and the Tropical Program  
June 3, 2021 | SECART Webinar Series

# As Rainfall Forecasts Improve...

## WPC 7-DAY FORECAST RAINFALL

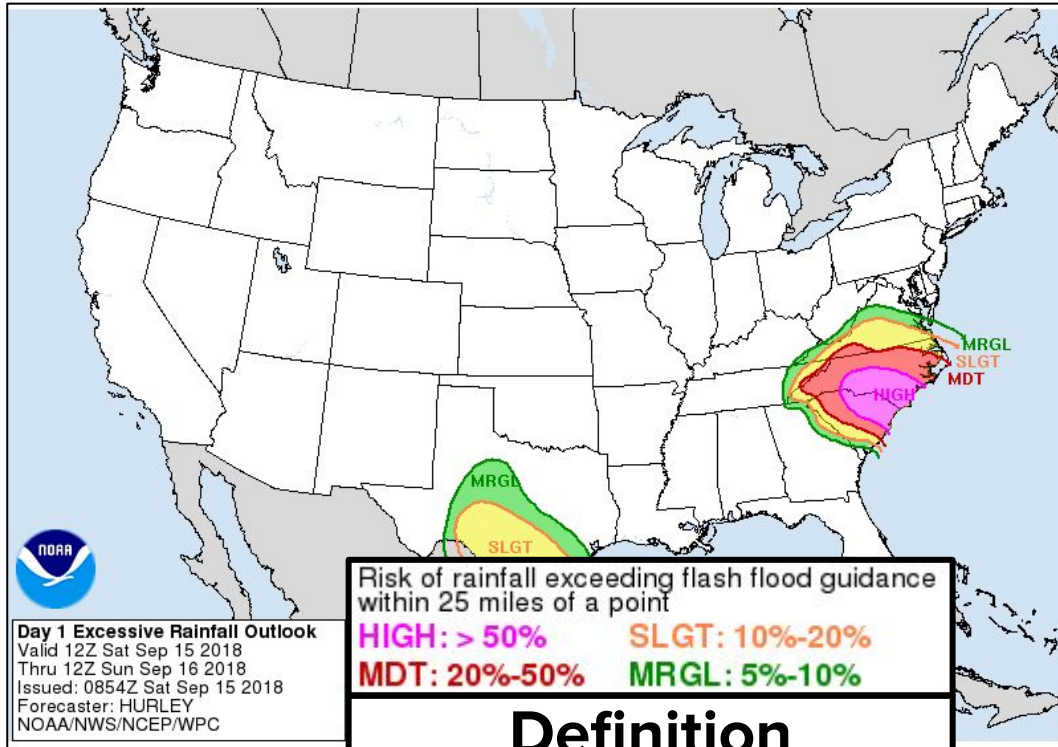


## OBSERVED 7-DAY RAINFALL



**...Risk Messaging Needs To Follow!**

# We Try To Differentiate With The ERO



**Definition**

Generally answers the question:

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

The ERO is:

A situational awareness and planning tool

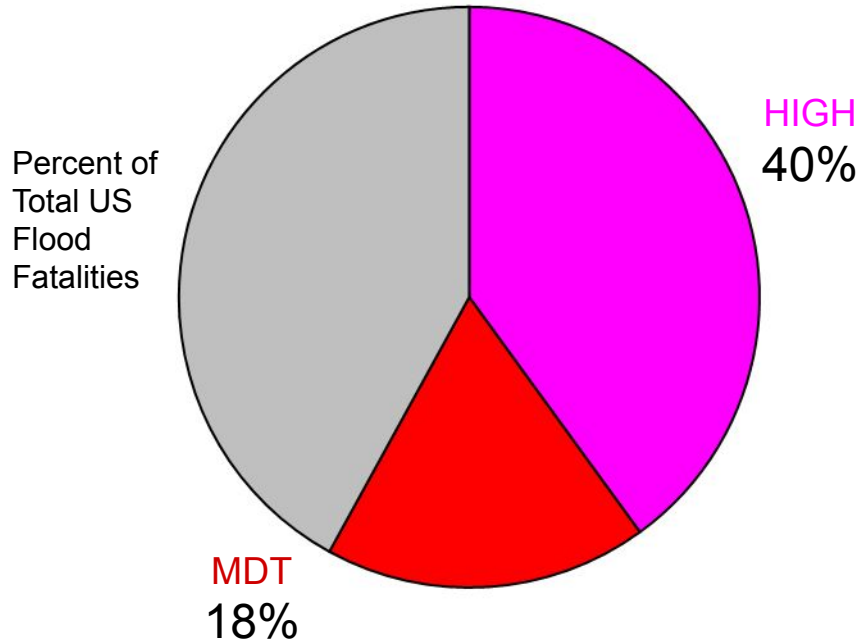
The ERO is **\*NOT\***:

A forecast of flash flooding at a specific location

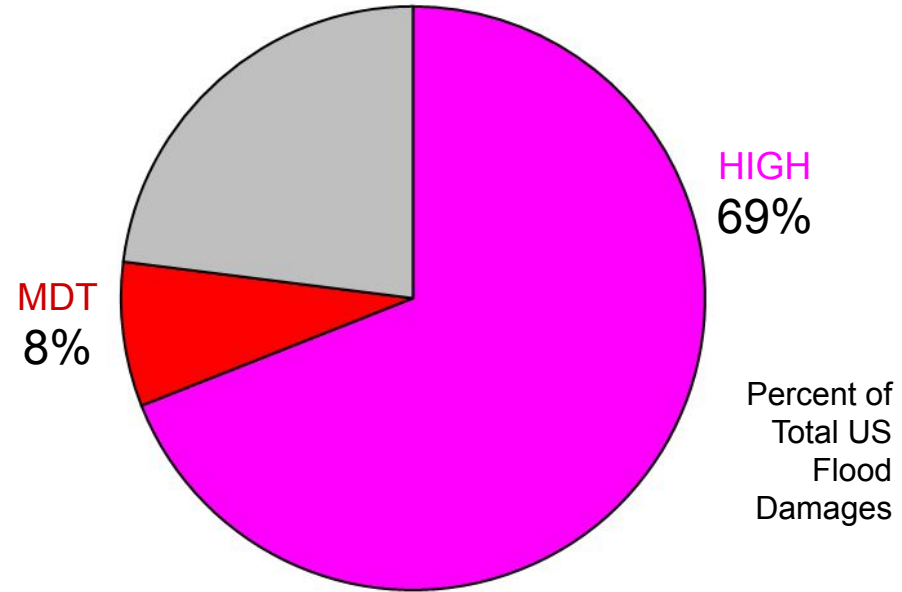
# High Risks: Deadly and Damaging Day

“High Risk Days” have accounted <sup>1</sup> for the following. Excludes Harvey, which inflates damage figures.

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



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

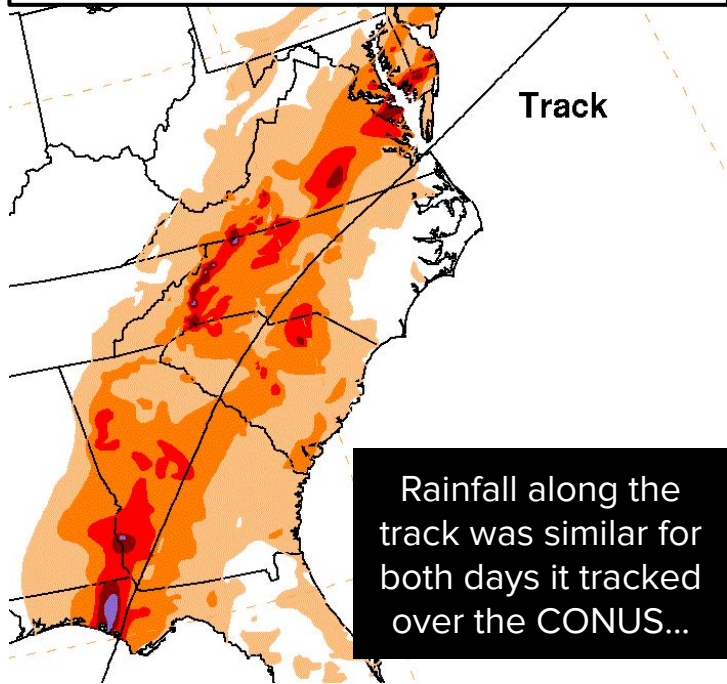


<sup>1</sup> From 2010 to 2018. Includes flood, flash flood, heavy rain, and debris flow Storm Data. Excludes Oso, WA landslide which occurred well after rainfall and on a sunny day.

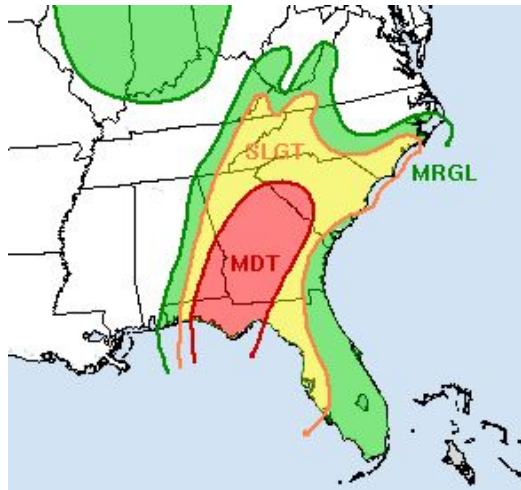


# Not All Tropical Days Created Equal

## Hurricane Michael (2018)



...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

## HURRICANE FLORENCE

Home **Public Adv** Post Adv Discussion Wind Probs Graphics Archive

U.S. Watch/Warning Local Products



Wind Speed Probabilities



Arrival Time of Winds



Wind History



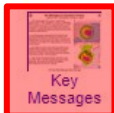
Warnings/Cone Interactive Map



Warnings/Cone Static Images



Warnings and Surface Wind



Key Messages



Storm Surge Inundation



Storm Surge Watch/Warning



U.S. Rainfall Potential



Flash Flooding Potential



U.S. Tornado Potential

## Public Advisory

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

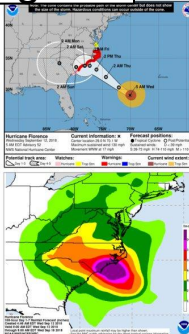
Coastal North Carolina...20 to 30 inches, isolated 40 inches  
 South Carolina, western and northern North Carolina...5 to 10 inches, isolated 20 inches  
 Elsewhere in the Appalachians and Mid-Atlantic states...3 to 6 inches, isolated 12 inches

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

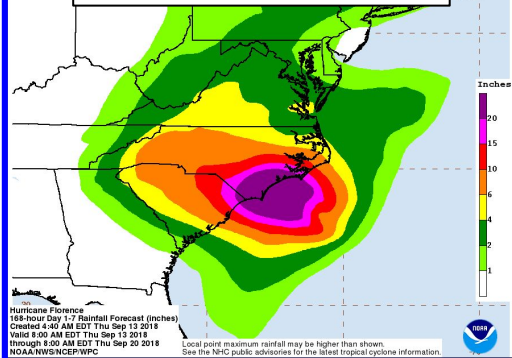
## Key Messages

1. A life-threatening storm surge is likely along portions of the coastlines of South Carolina and North Carolina, and a Storm Surge Warning is in effect for a portion of this area. All interests from South Carolina into the mid-Atlantic region should complete preparations and follow any advice given by local officials.
2. Life-threatening, catastrophic flash flooding and significant river flooding is likely over portions of the Carolinas and Mid-Atlantic states from late this week into early next week, as Florence is expected to slow down as it approaches the coast and moves inland.
3. Damaging hurricane-force winds are likely along portions of the coasts of South Carolina and North Carolina, and a Hurricane Warning is in effect. Strong winds could also spread inland into portions of the Carolinas.
4. Large swells affecting Bermuda and portions of the U.S. East Coast will continue this week, resulting in life-threatening surf and rip currents.

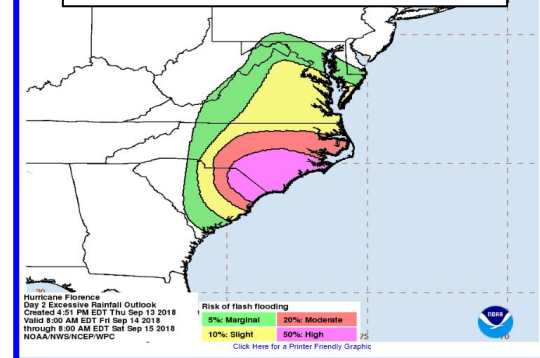
For more information go to [hurricanes.gov](https://hurricanes.gov)



## Rainfall Forecast



## Flash Flood Potential



WEATHER PREDICTION CENTER  
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

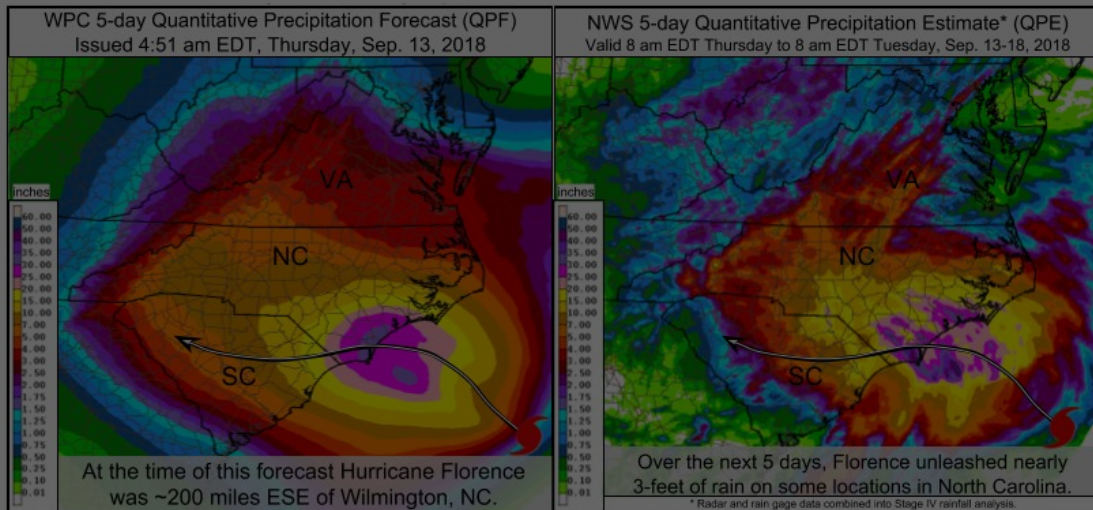
WPC's Connection to NHC and the Tropical Program  
 June 3, 2021 | SECART Webinar Series

# Two Key Tropical Roles

And now let's talk about...

## Inland Advisories and NHC Backup

### Rainfall and Flash Flood Forecasting





# 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.

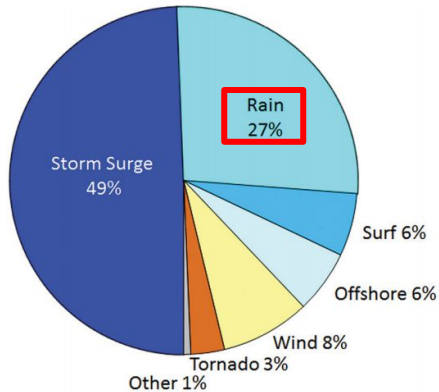
**WPC issues advisories as long as Flood Watches and/or Slight-or-higher ERO Risks are present, and there is a trackable low center.**



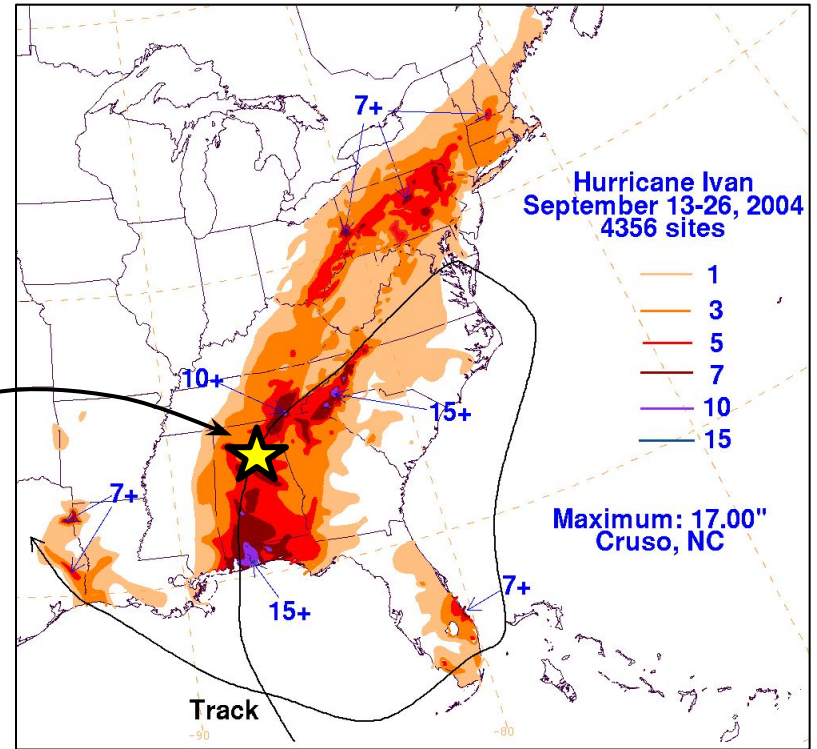
# Inland Tropical Advisories Strategy

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

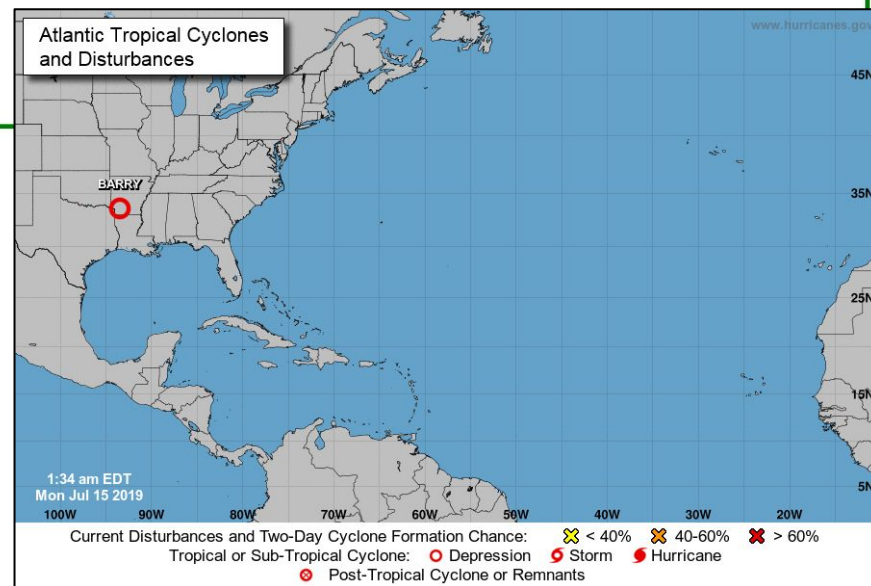


Rainfall  
Potential

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.



WEATHER PREDICTION CENTER  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

WPC's Connection to NHC and the Tropical Program  
June 3, 2021 | SECART Webinar Series

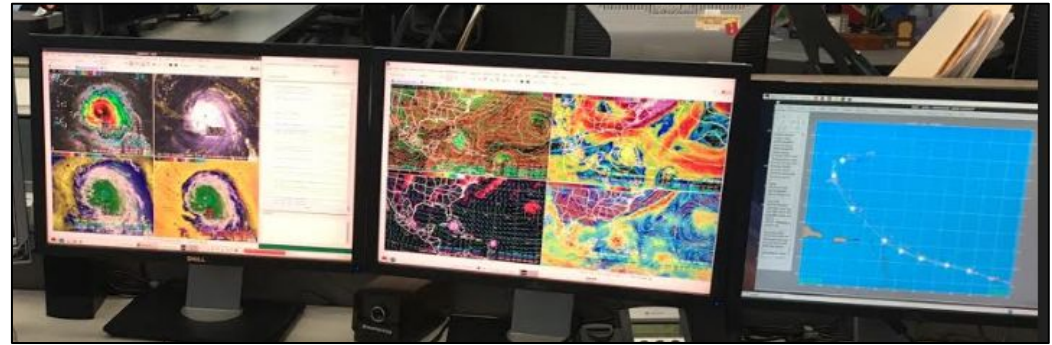
# Approach to NHC Backup



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

Katia

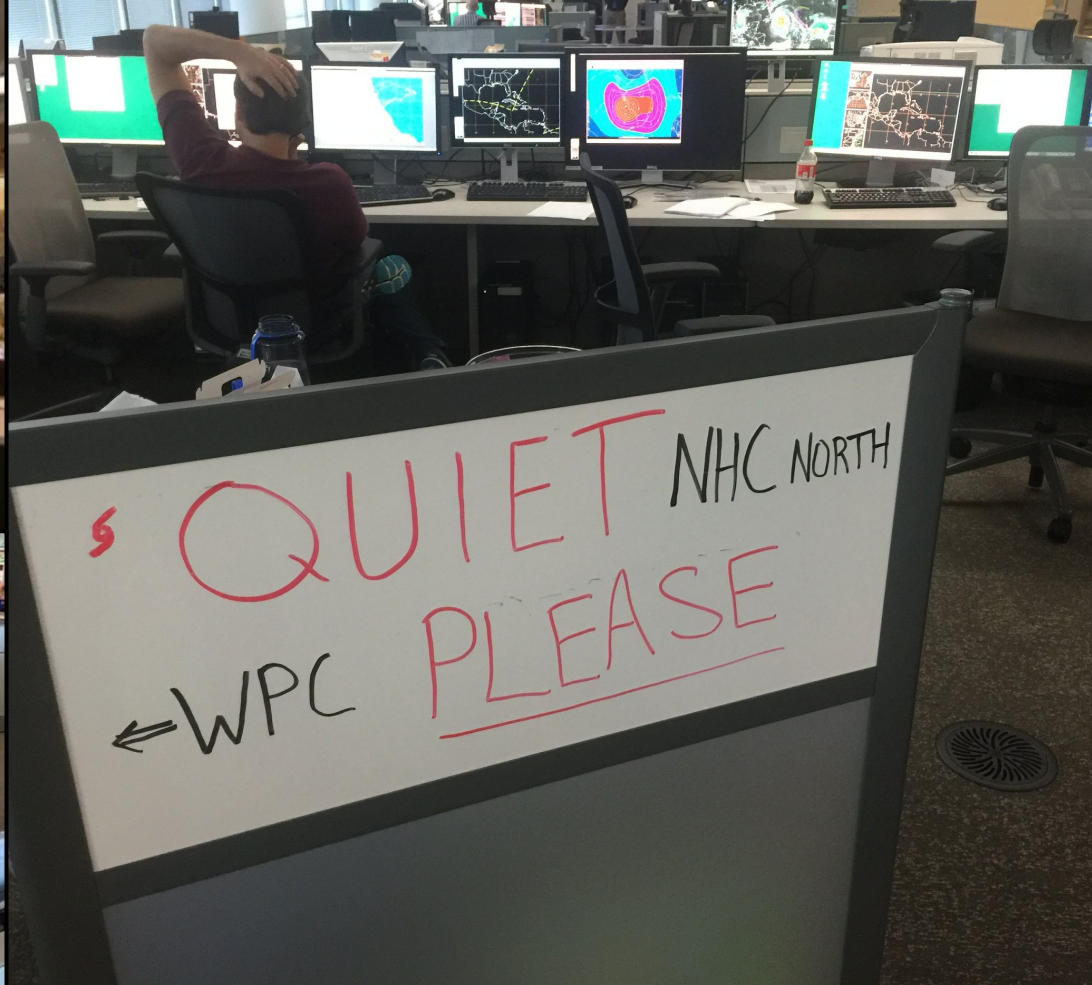
Irma

Jose



**WEATHER PREDICTION CENTER**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

*WPC's Connection to NHC and the Tropical Program  
June 3, 2021 | SECART Webinar Series*



# 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*



**WEATHER PREDICTION CENTER**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

*WPC's Connection to NHC and the Tropical Program  
June 3, 2021 | SECART Webinar Series*