



Unit 2: National Weather Service Products

Unit 2 Objectives



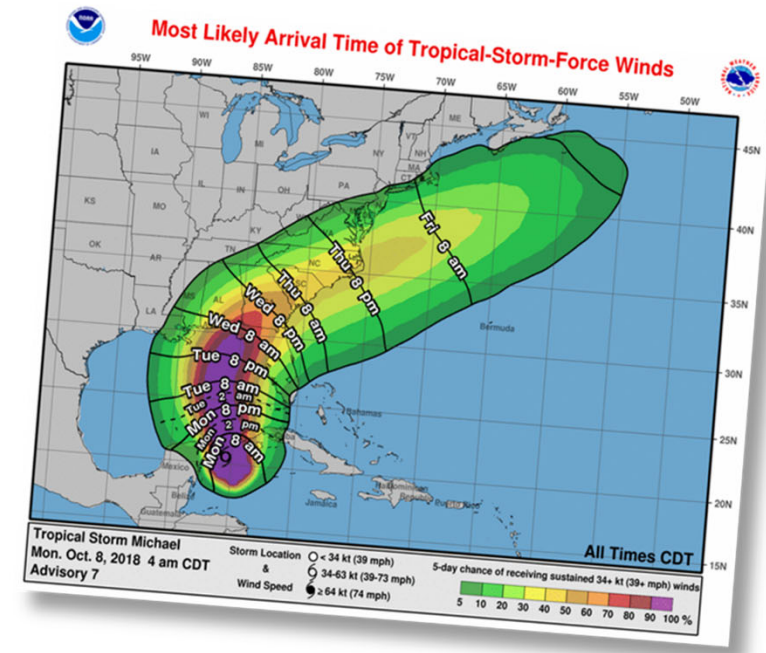
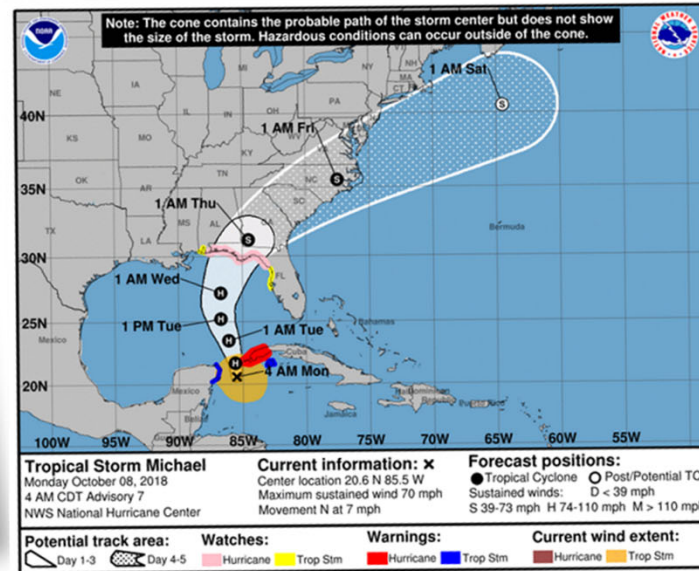
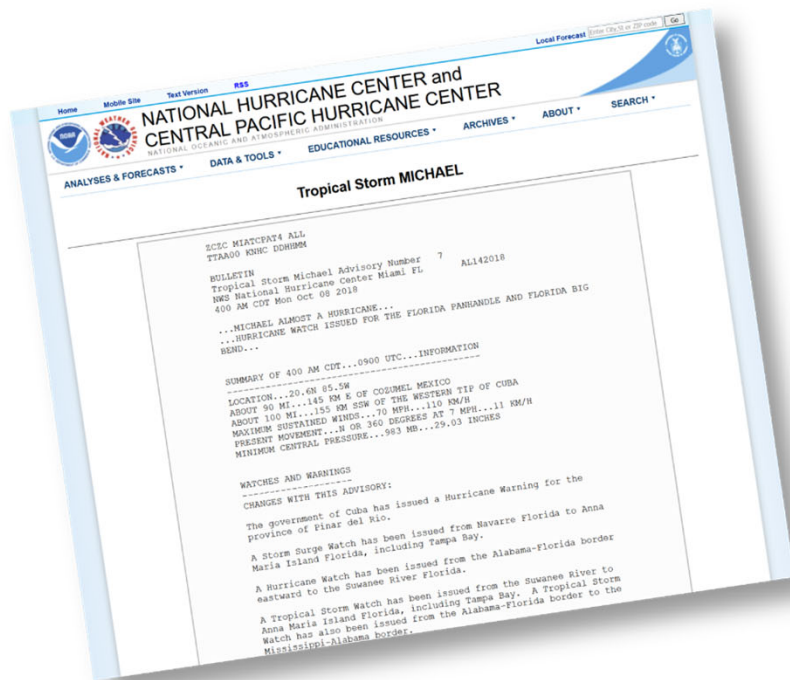
At the end of this unit, you should be able to:

1. Identify the National Weather Service (NWS) forecast products.
2. Explain when NWS products are available.
3. Describe NHC text and graphics products related to wind, such as the Public Advisory, Forecast Discussion, Wind Speed Probabilities, and Arrival Times.
4. Describe NWS text and graphics products related to rainfall and flooding, such as Quantitative Precipitation Forecast (QPF), Excessive Rainfall Outlook (ERO), and hydrographs.

Tropical Cyclone Products



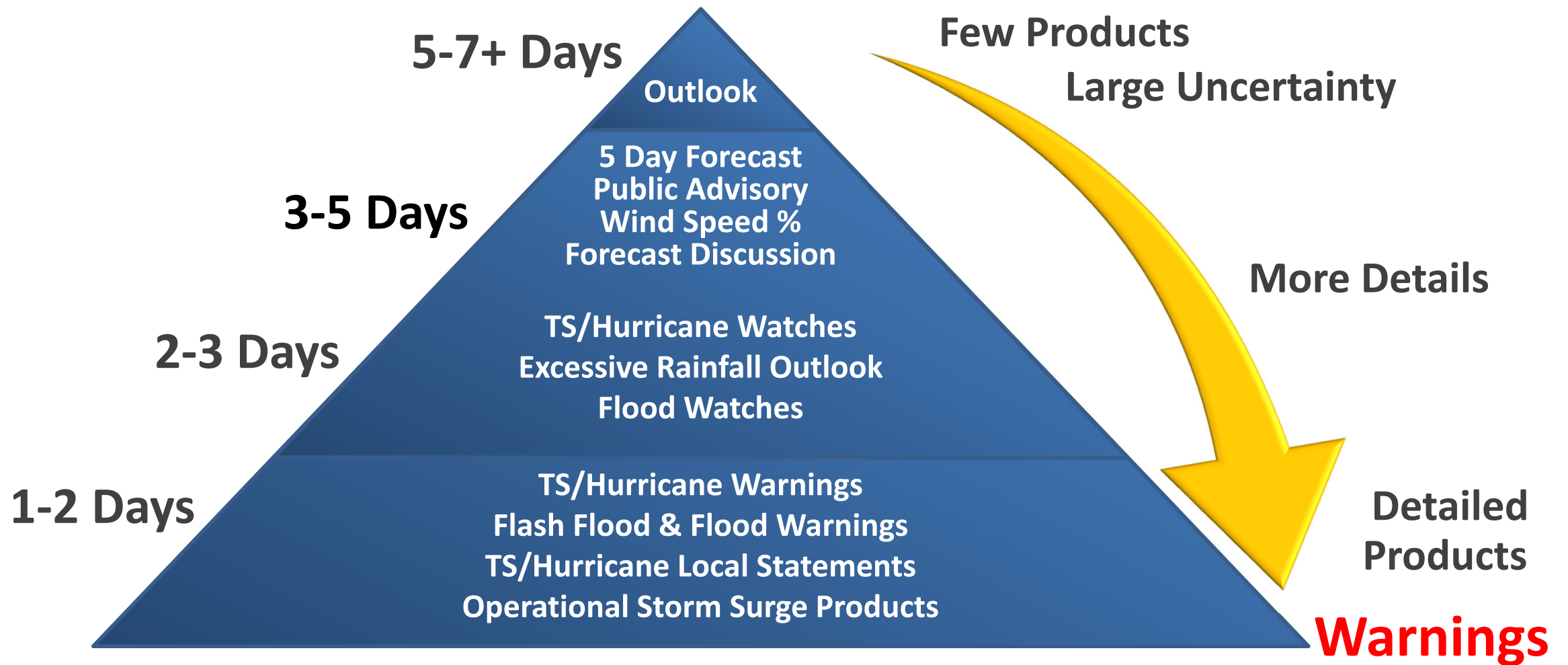
The NWS national centers (National Hurricane Center (NHC), Weather Prediction Center (WPC), National Water Center (NWC), etc.) provide the ‘big picture’ that complements and guides local NWS forecast office products.



Tropical Cyclone NWS Products Timeframe



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NWS TC Product Overview



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Wind-related Products

- Tropical Weather Outlook
 - Special Tropical Weather Outlook
- Advisories
 - Public Advisory
 - Intermediate Advisory
 - Tropical Cyclone Update
- Forecast Discussion
- Forecast Error Cone
- Wind Speed Probabilities
- Wind Speed Arrival Timing
- Wind-based Watches/Warnings

Water-related Products

- SLOSH MEOWs/MOMs
- Rainfall forecasts
 - QPF
 - ERO
- Hydrographs
- Flash Flood Warnings/Emergencies
- Flood Warnings (Mainstem)

Tropical Weather Outlook (TWO)

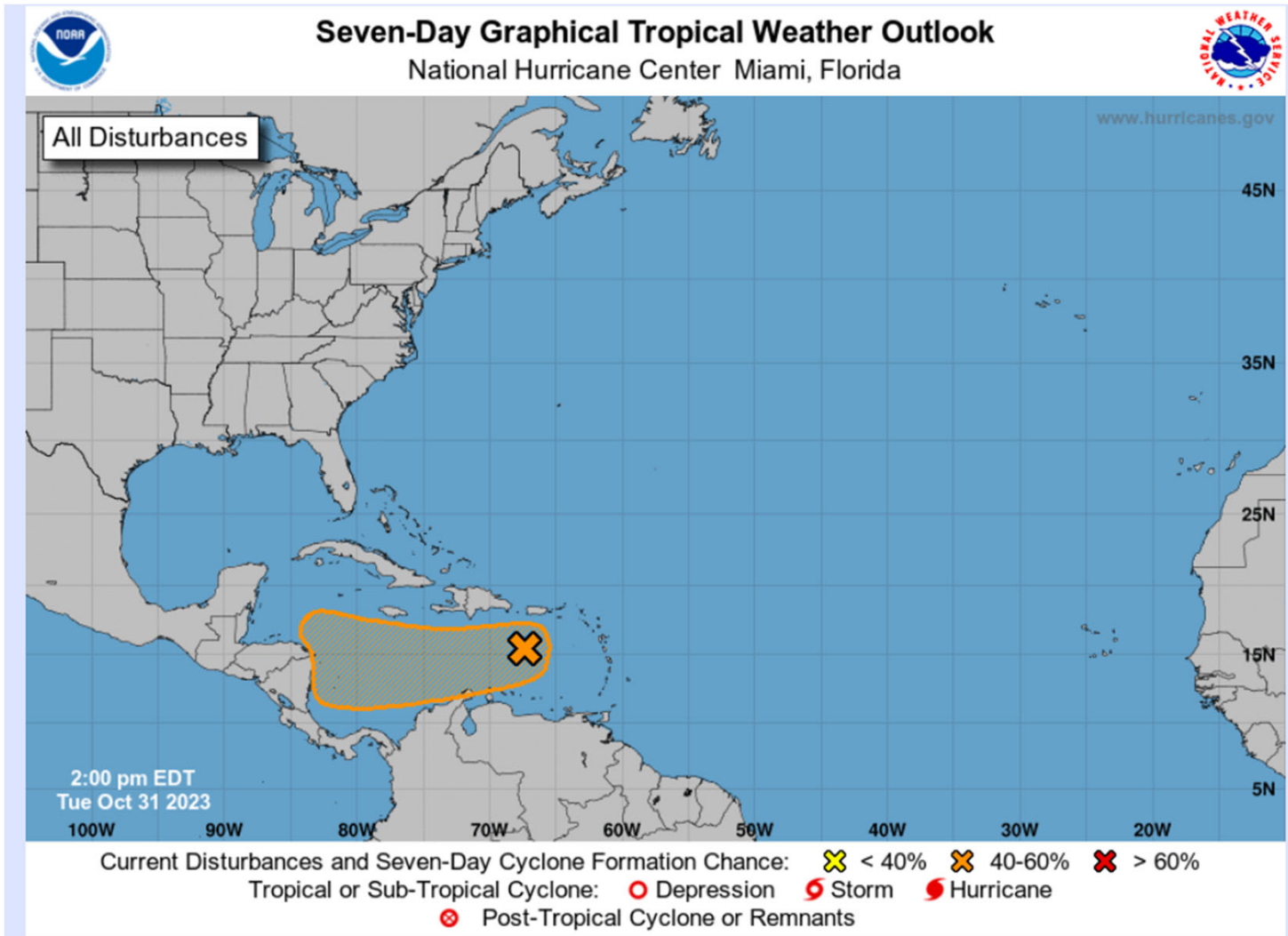


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Tropical Weather Outlook (TWO) addresses:

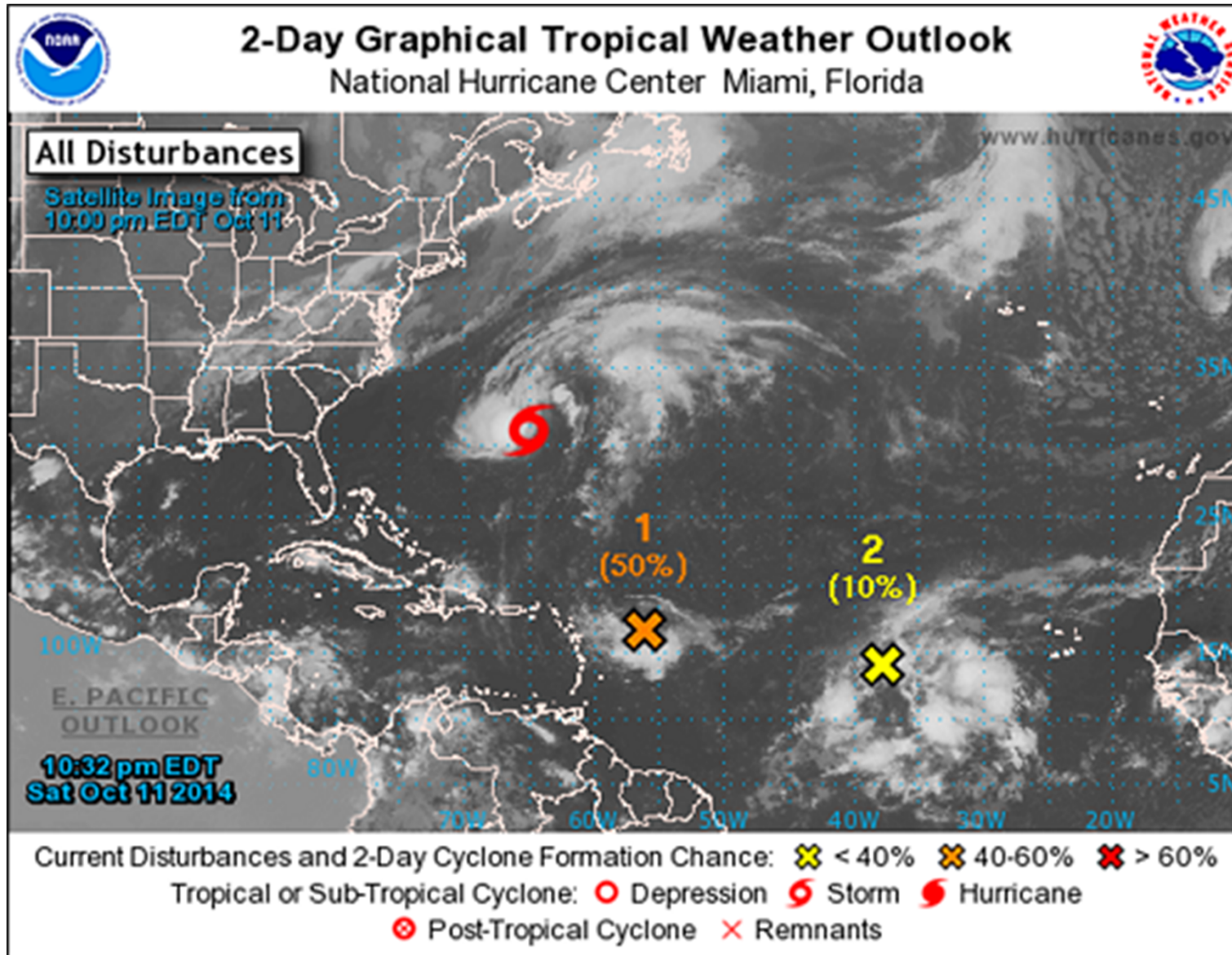
- What's going on in the tropics?
- Any potential for development?
- Should we be concerned?

7-Day TC Formation Potential



- Shows initial location of two disturbances (X), if existing.
- Shading represents the potential formation area within next 7 days.
- What's the chance these areas form in the next 7 days?

2-Day TC Formation Potential



- Identifies the current location of disturbed weather (discussed in the Tropical Weather Outlook)
- Formation chance during the next 48 hours:
 - Categories (Low, Medium, or High)
 - Probabilities

Assessment of Tropical Activity



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

TROPICAL WEATHER OUTLOOK
NWS NATIONAL HURRICANE CENTER MIAMI FL
800 PM EDT MON OCT 20 2014

For the North Atlantic...Caribbean Sea and the Gulf of Mexico:

Showers and thunderstorms associated with an area of low pressure located over the southwestern Bay of Campeche have changed little in organization since this afternoon. This system has the potential to become a tropical cyclone during the next couple of days while it moves slowly eastward across the southern Bay of Campeche. Later in the week, the low is forecast to interact and possibly merge with a frontal system over the southeastern Gulf of Mexico or northwestern Caribbean Sea. An Air Force Reserve reconnaissance aircraft is scheduled to investigate the disturbance tomorrow afternoon, if necessary. Interests in the Yucatan Peninsula should monitor the progress of this system.

- * Formation chance through 48 hours...medium...50 percent.
- Formation chance through 5 days...medium...60 percent.



Forecaster Brown

Potential for development?
Headed where?

Potential for Aerial Surveillance



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Forecaster Brown

 Sending a plane?

Special Tropical Weather Outlook



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

SPECIAL TROPICAL WEATHER OUTLOOK
NWS NATIONAL HURRICANE CENTER MIAMI FL
430 PM EDT MON JUN 30 2014

Special outlook issued to update discussion of the area of low pressure east of Florida.

Updated: An Air Force Reserve unit reconnaissance aircraft is investigating the area of low pressure centered about 110 miles east of Melbourne, Florida. While the low is well defined, the associated thunderstorm activity is just below the organizational threshold required to initiate tropical cyclone advisories. Environmental conditions continue to be favorable for development, and only a slight increase in the organization and persistence of the thunderstorm activity would result in the formation of a tropical depression.

Data from the reconnaissance aircraft indicate that peak sustained winds with the low are about 30-35 mph. The low is moving southwestward at around 5 mph, but is expected to turn westward tonight and northward by Wednesday when it will be near the east coast of Florida. If this system becomes a tropical cyclone, a tropical storm watch could be required for portions of the central or northern Atlantic coast of Florida. A turn toward the northeast near the southeastern U.S. coast is expected by Thursday.

* Formation chance through 48 hours...high...80 percent.


* Formation chance through 5 days...high...80 percent.

Why is it being issued?

Reports from Hurricane Hunter Flights



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What did the aircraft find?

Possibility of Watch/Warning



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← Watches possible?

Tropical Weather Outlook Schedule





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Tropical Weather Outlook schedule:

- 2 am – Tropical Weather Outlook
- 8 am – Tropical Weather Outlook
- 2 pm – Tropical Weather Outlook
- 8 pm – Tropical Weather Outlook

A *Special Tropical Outlook* can be issued at any time for significant or unexpected changes.



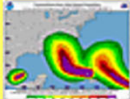
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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION


Hurricane Irma 📡

...IRMA MOVING THROUGH THE SOUTHEASTERN BAHAMAS AS AN EXTREMELY DANGEROUS CATEGORY 4 HURRICANE...

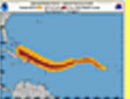
5:00 AM EDT Fri Sep 8 Location: 21.7°N 73.8°W Moving: WNW at 16 mph Min pressure: 925 mb Max sustained: 155 mph	Public Advisory #37 500 AM EDT	Aviso Publico #37 500 AM EDT	Forecast Advisory #37 0900 UTC	Forecast Discussion #37 500 AM CDT	Wind Speed Probabilities #37 0900 UTC
	NWS Local Products 613 AM CDT	US Watch/Warning 452 AM EDT			



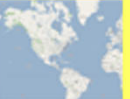
Wind Speed Probabilities




Experimental Arrival Time of Winds




Wind History




Warnings/Cone Interactive Map




Warnings/Cone Static Images



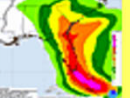
Warnings and Surface Wind



Storm Surge Inundation



Storm Surge Watch/Warning



U.S. Rainfall Potential



Public Advisory addresses:

- How strong is the storm?
- What are the hazards?
- Are there any warnings?
- When is new information available?
- When is a good time for a conference call?

Public Advisory – Issued for...



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Public Advisories issued for:

Tropical Cyclones

- Tropical Depressions
- Tropical Storms (TS)
- Hurricanes

Post-Tropical Cyclones

- Remains a threat to land (e.g., Sandy & Hermine)



Potential Tropical Cyclones

- Systems not yet a tropical cyclone
- Threat of TS-force winds to land within 48 hours (Introduced in 2017)

Public Advisory - Example



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Tropical Storm Michael Advisory Number 7
NWS National Hurricane Center Miami FL AL142018
400 AM CDT Mon Oct 08 2018

...MICHAEL ALMOST A HURRICANE...
...HURRICANE WATCH ISSUED FOR THE FLORIDA PANHANDLE AND BIG BEND...

SUMMARY OF 400 AM CDT...0900 UTC...INFORMATION

LOCATION...20.6N 85.5W
ABOUT 90 MI...145 KM E OF COZUMEL MEXICO
ABOUT 100 MI...155 KM SSW OF THE WESTERN TIP OF CUBA
MAXIMUM SUSTAINED WINDS...70 MPH...110 KM/H
PRESENT MOVEMENT...N OR 360 DEGREES AT 7 MPH...11 KM/H
MINIMUM CENTRAL PRESSURE...983 MB...29.03 INCHES

WATCHES AND WARNINGS

A Storm Surge Watch is in effect for...
* Navarre Florida to Anna Maria Island Florida, including Tampa Bay

A Hurricane Watch is in effect for...
* Alabama-Florida border to Suwanee River Florida



A Tropical Storm Watch is in effect for...
* Suwanee River to Anna Maria Island Florida, including Tampa Bay
* Alabama-Florida border to the Mississippi-Alabama border

- Plain-language text
- Originally intended as “rip and read”

Public Advisory – Location



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Tropical Storm Michael Advisory Number 7
NWS National Hurricane Center Miami FL AL142018
400 AM CDT Mon Oct 08 2018

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A Tropical Storm Watch is in effect for...
* Suwanee River to Anna Maria Island Florida, including Tampa Bay
* Alabama-Florida border to the Mississippi-Alabama border



Public Advisory – Strength



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Tropical Storm Michael Advisory Number 7
NWS National Hurricane Center Miami FL AL142018
400 AM CDT Mon Oct 08 2018

...MICHAEL ALMOST A HURRICANE...
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MINIMUM CENTRAL PRESSURE...983 MB...29.03 INCHES

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A Hurricane Watch is in effect for...
* Alabama-Florida border to Suwanee River Florida



A Tropical Storm Watch is in effect for...
* Suwanee River to Anna Maria Island Florida, including Tampa Bay
* Alabama-Florida border to the Mississippi-Alabama border

How strong is the storm?

Public Advisory – Watches/Warnings



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Tropical Storm Michael Advisory Number 7
NWS National Hurricane Center Miami FL AL142018
400 AM CDT Mon Oct 08 2018

...MICHAEL ALMOST A HURRICANE...
...HURRICANE WATCH ISSUED FOR THE FLORIDA PANHANDLE AND BIG BEND...

SUMMARY OF 400 AM CDT...0900 UTC...INFORMATION

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WATCHES AND WARNINGS

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A Tropical Storm Watch is in effect for...
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Public Advisory – Track Forecast



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

DISCUSSION AND OUTLOOK

At 400 AM CDT (0900 UTC), the center of Tropical Storm Michael was located by an Air Force Reserve Hurricane Hunter aircraft near latitude 20.6 North, longitude 85.5 West. Michael is moving toward the north near 7 mph (11 km/h). A northward motion at a slightly faster forward speed is expected through Tuesday night, followed by a northeastward motion on Wednesday and Thursday. On the forecast track, the center of Michael will move northward across the Yucatan Channel later today, and then across the eastern Gulf of Mexico this evening through Wednesday. Michael is expected to move inland over the Florida Panhandle or Florida Big Bend area on Wednesday, and then move northeastward across the southeastern United States Wednesday night and Thursday.

Data from the Hurricane Hunter aircraft indicate that maximum sustained winds have increased to near 70 mph (110 km/h) with higher gusts. Additional strengthening is forecast, and Michael is expected to become a hurricane later today. Michael is forecast to be near or at major hurricane strength when it reaches the northeastern Gulf of Mexico Tuesday night and Wednesday.

Tropical-storm-force winds extend outward up to 175 miles (280 km) from the center.



The minimum central pressure based on aircraft data is 983 mb (29.03 inches).



Public Advisory – Wind Intensity Forecast



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Tropical-storm-force winds extend outward up to 175 miles (280 km) from the center.

The minimum central pressure based on aircraft data is 983 mb (29.03 inches).



Covers a 3-day period

Forecast to
weaken?
Strengthen?

Public Advisory – Surge Forecast



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HAZARDS AFFECTING LAND

STORM SURGE: The combination of a dangerous storm surge and the tide will cause normally dry areas near the coast to be flooded by rising waters moving inland from the shoreline. The water has the potential to reach the following heights above ground if peak surge occurs at the time of high tide...

Indian Pass to Crystal River...7-11 ft
Crystal River to Anclote River...4-6 ft
Okaloosa/Walton County Line to Indian Pass...4-7 ft
Anclote River to Anna Maria Island including Tampa Bay...2-4 ft
Navarre to Okaloosa/Walton County Line...2-4 ft

WIND: Hurricane conditions are expected across the far western part of the Cuban province of Pinar del Rio later today. Tropical storm conditions are expected across the remainder of the warning areas in Cuba and the Yucatan Peninsula later today.



Hurricane conditions are possible within the hurricane watch area along the U.S. Gulf coast by Wednesday, with tropical storm conditions possible by Tuesday night or early Wednesday. Tropical storm conditions are possible within the tropical storm watch area by Tuesday night or early Wednesday.

How much storm surge is forecast?

Public Advisory – Rain Forecast



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HAZARDS AFFECTING LAND

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Hurricane conditions are possible within the hurricane watch area along the U.S. Gulf coast by Wednesday, with tropical storm conditions possible by Tuesday night or early Wednesday. Tropical storm conditions are possible within the tropical storm watch area by Tuesday night or early Wednesday.

RAINFALL: Michael is expected to produce the following rainfall amounts through Wednesday night...

Florida Panhandle and Big Bend into southern Georgia...4 to 8 inches, with isolated maximum amounts of 12 inches. This rainfall may lead to life threatening flash floods.

Florida Keys...2 to 4 inches.



Yucatan Peninsula...1 to 2 inches.



How much rain is forecast?

Intermediate Public Advisory



  **NATIONAL HURRICANE CENTER**
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Tropical Storm Michael Intermediate Advisory Number 7A
NWS National Hurricane Center Miami FL AL142018
700 AM CDT Mon Oct 08 2018

...MICHAEL EXPECTED TO BECOME A HURRICANE VERY SOON...

SUMMARY OF 700 AM CDT...1200 UTC...INFORMATION

LOCATION...20.9N 85.1W
ABOUT 70 MI...115 KM S OF THE WESTERN TIP OF CUBA
MAXIMUM SUSTAINED WINDS...70 MPH...110 KM/H
PRESENT MOVEMENT...N OR 5 DEGREES AT 7 MPH...11 KM/H
MINIMUM CENTRAL PRESSURE...982 MB...29.00 INCHES

WATCHES AND WARNINGS

SUMMARY OF WATCHES AND WARNINGS IN EFFECT:
A Storm Surge Watch is in effect for...
* Navarre Florida to Anna Maria Island Florida, including Tampa Bay

A Hurricane Watch is in effect for...
* Alabama-Florida border to Suwannee River Florida

A Tropical Storm Watch is in effect for...
* Suwannee River to Anna Maria Island Florida, including Tampa Bay
* Alabama-Florida border to the Mississippi-Alabama border


**Similar content but issued
3 hours after complete
advisory package**

✓ Watch or Warning in effect

Tropical Cyclone Update



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Hurricane Michael Tropical Cyclone Update
NWS National Hurricane Center Miami FL AL142018
1200 PM CDT Wed Oct 10 2018

...EYEWALL OF MICHAEL COMING ASHORE...

With the landfall of Michael's eye imminent, everyone in the landfall area is reminded not to venture out into the relative calm of the eye, hazardous winds will increase quickly as the eye passes!

A weather station at the Gulf County Emergency Operations Center in Port St. Joe recently reported a wind gust of 106 mph (171 km/h). A Weatherflow station in St. Andrew Bay recently reported a sustained wind of 62 mph (100 km/h) and a wind gust of 77 mph (124 km/h). The Apalachicola airport recently reported sustained winds of 63 mph (102 km/h) with a gust of 89 mph (143 km/h).

Water levels continue to rise quickly along the Florida Panhandle coast. A National Ocean Service water level station at Apalachicola recently reported over 6.5 feet of inundation above ground level.

SUMMARY OF 1200 PM CDT...1700 UTC...INFORMATION

LOCATION...29.9N 85.7W
ABOUT 15 MI...25 KM WSW OF MEXICO BEACH FLORIDA
MAXIMUM SUSTAINED WINDS...150 MPH...240 KM/H
PRESENT MOVEMENT...NNE OR 15 DEGREES AT 14 MPH...22 KM/H
MINIMUM CENTRAL PRESSURE...919 MB...27.14 INCHES

\$\$
Forecaster Brown/Brennan

NNNN

- Unexpected changes occur in the cyclone

- Cyclone landfall

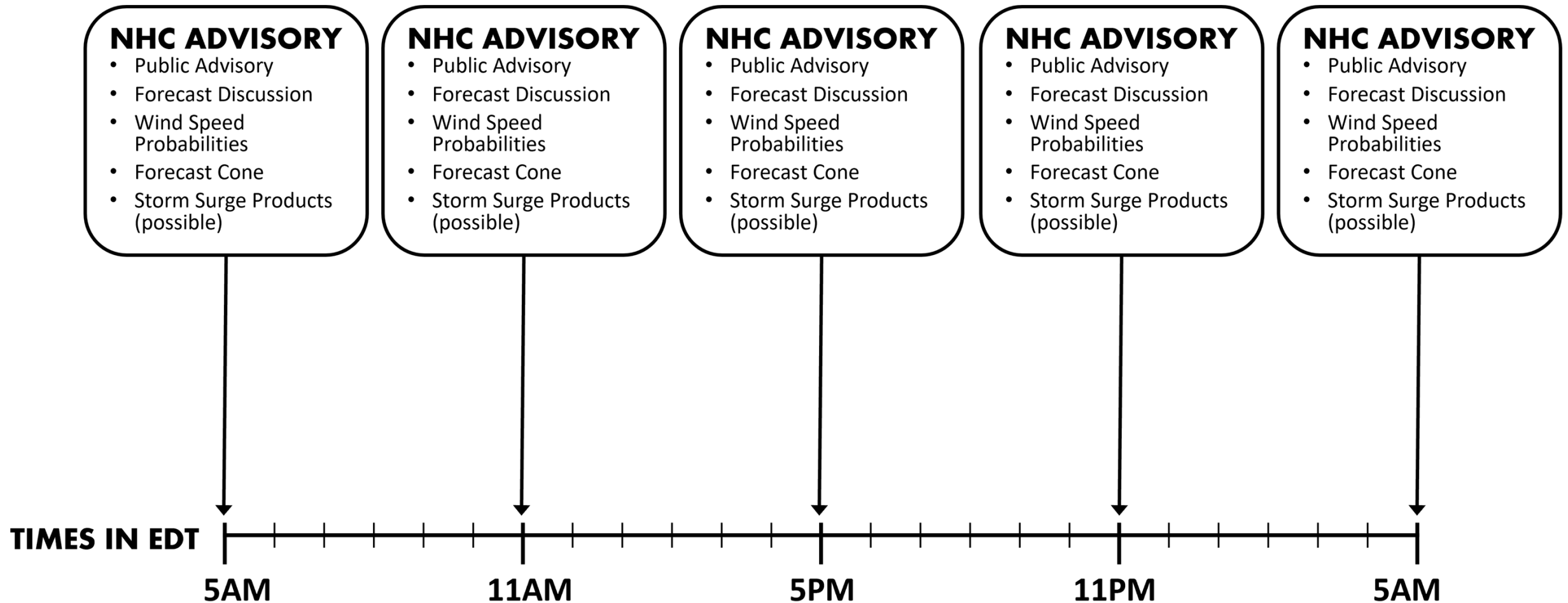
- Issuing international watches and warnings

- 1-hourly position estimates when a cyclone with an eye is nearing land

Scheduled Updates



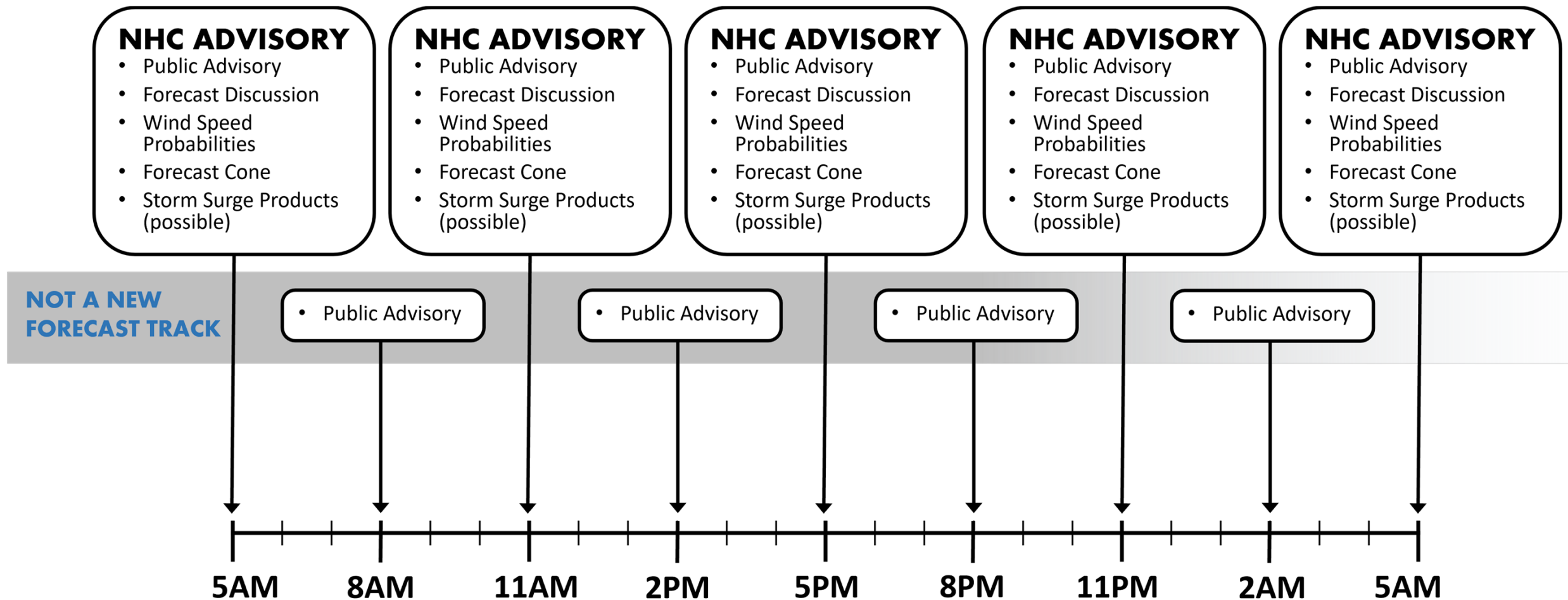
No Watches/Warnings



Scheduled Updates – W/W



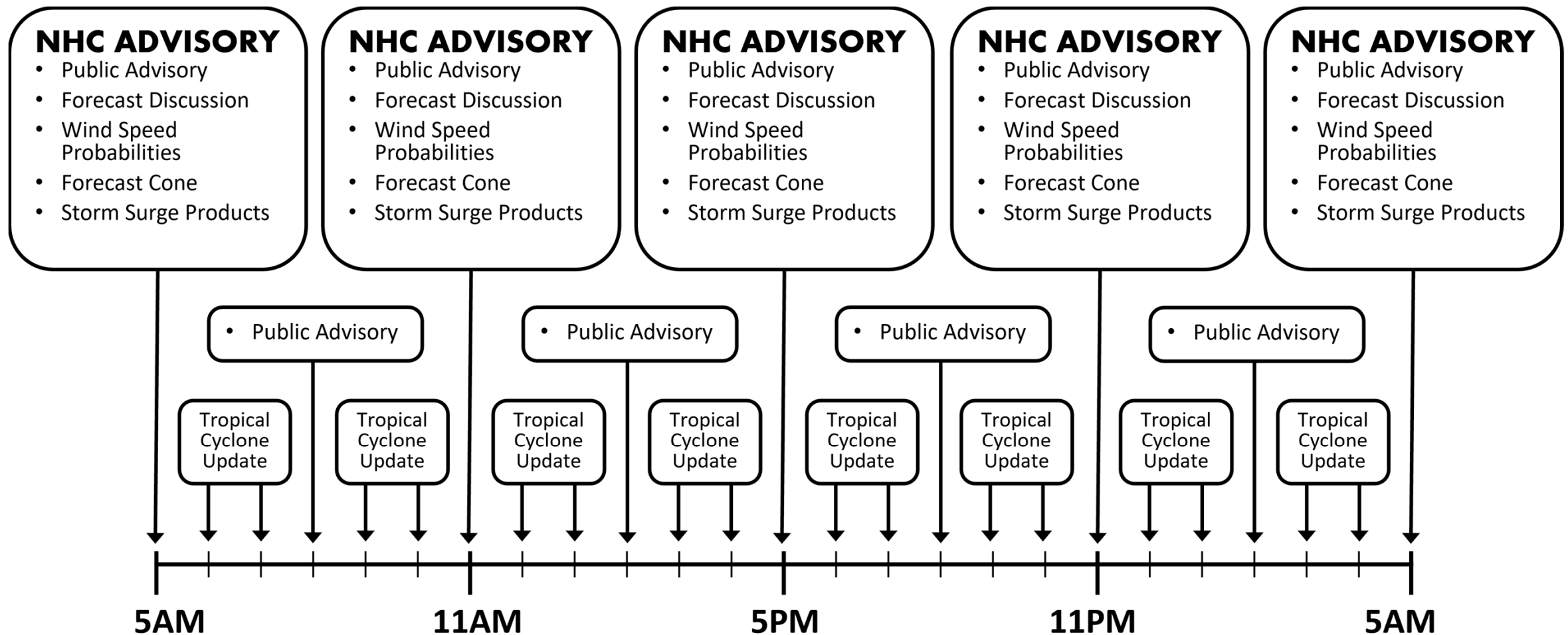
Watches/Warnings in effect



Scheduled Updates – Eye Tracked



Watches/Warnings in effect and eye tracked by radar



Forecast Discussion



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Forecast Discussion addresses:

- How confident are the forecasters?
- Key messages?

Reasoning? Confidence? Scenarios?



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Tropical Storm Michael Discussion Number 7
NWS National Hurricane Center Miami FL AL142018
400 AM CDT Mon Oct 08 2018

An Air Force Reserve Hurricane Hunter aircraft made several passes through the system and found that the central pressure has fallen to about 983 mb and maximum winds have increased to near 60 kt. This increase in intensity indicates that despite the shear, Michael has by definition rapidly intensified during the past 24 hours. Decreasing vertical shear and very warm sea surface temperatures are expected to support continued strengthening, and due to the favorable conditions, the NHC intensity forecast follows a blend of the IVCN consensus and the HCCA model. This new official forecast brings the intensity to just below major hurricane strength in 48 hours, and since the storm will still be over water for a time between 48 and 72 hours, there is a real possibility that Michael will strengthen to a major hurricane before landfall.



Nearly all of the track models have shifted westward after 24 hours, which left the previous forecast near the eastern edge of the guidance envelope. Due to this shift, the new NHC track forecast has also been adjusted westward close to the consensus aids. Overall the track guidance is in fairly good agreement up until landfall along the Florida Panhandle or Florida Big Bend, which has yielded a fairly confident track forecast.

- Forecast reasoning
- Relevant Observations
- Model Guidance
- Forecast Uncertainties

Key Messages



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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Key Messages:

1. Hurricane conditions are expected over portions of western Cuba, where a hurricane warning is now in effect. Tropical storm conditions are expected over the northeastern Yucatan Peninsula and the Isle of Youth today.
2. Michael is expected to produce heavy rainfall and flash flooding over portions of western Cuba and the northeastern Yucatan Peninsula of Mexico during the next couple of days.
3. Michael is forecast to be a hurricane, and possibly a major hurricane, when it reaches the northeastern Gulf Coast by mid-week, and storm surge and hurricane watches are now in effect for portions of the area. Some areas along the Florida Gulf Coast are especially vulnerable to storm surge, regardless of the storm's exact track or intensity. Residents in the watch areas should monitor the progress of this system and follow any advice given by local officials.

Key Messages

- Forecast Confidence
- Highlight Threats

Forecast Error Cone



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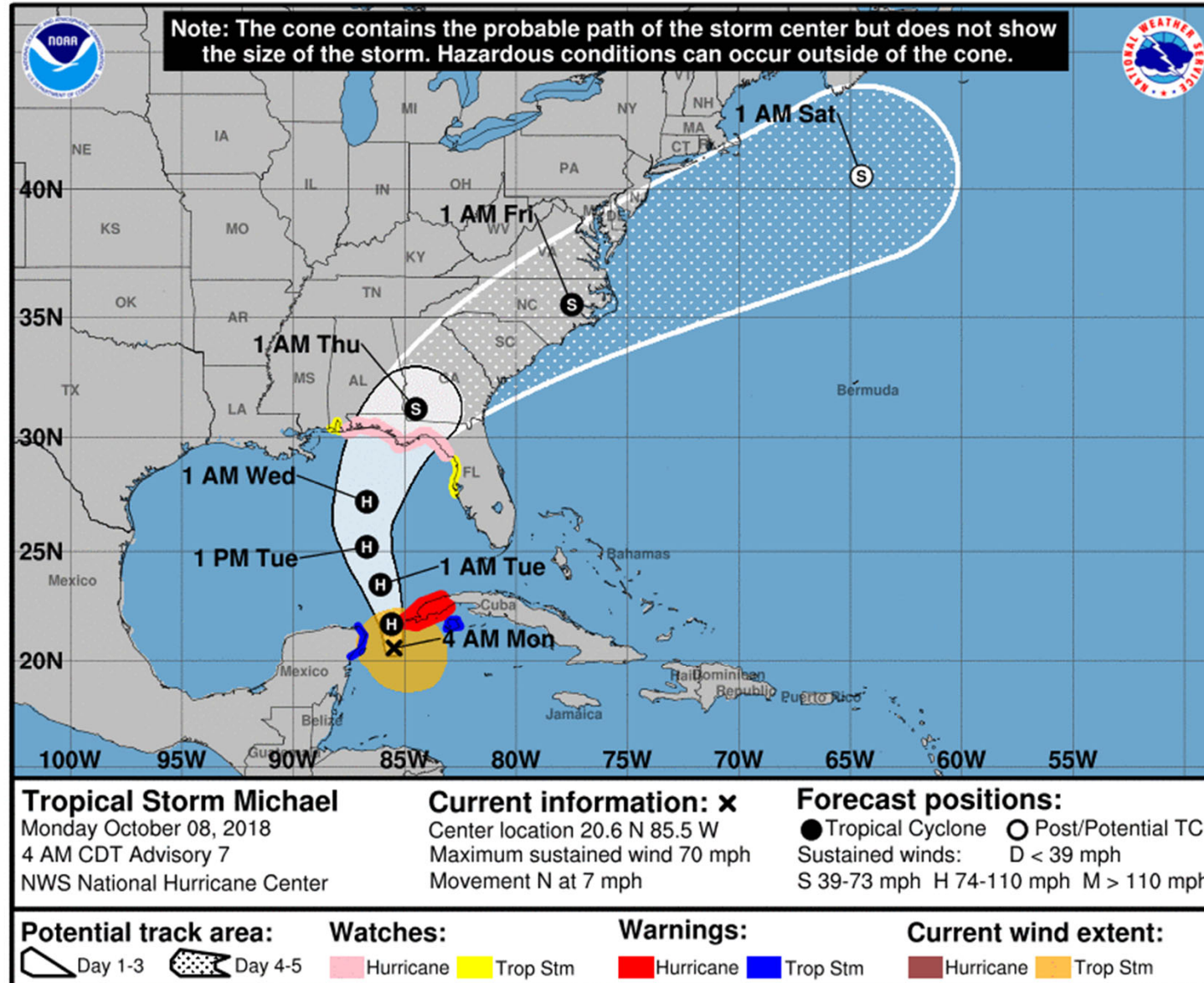
Forecast Error Cone addresses:

- What is the official NHC-issued forecast storm track?
- How can I see this in non-text format?

Forecast Error Cone



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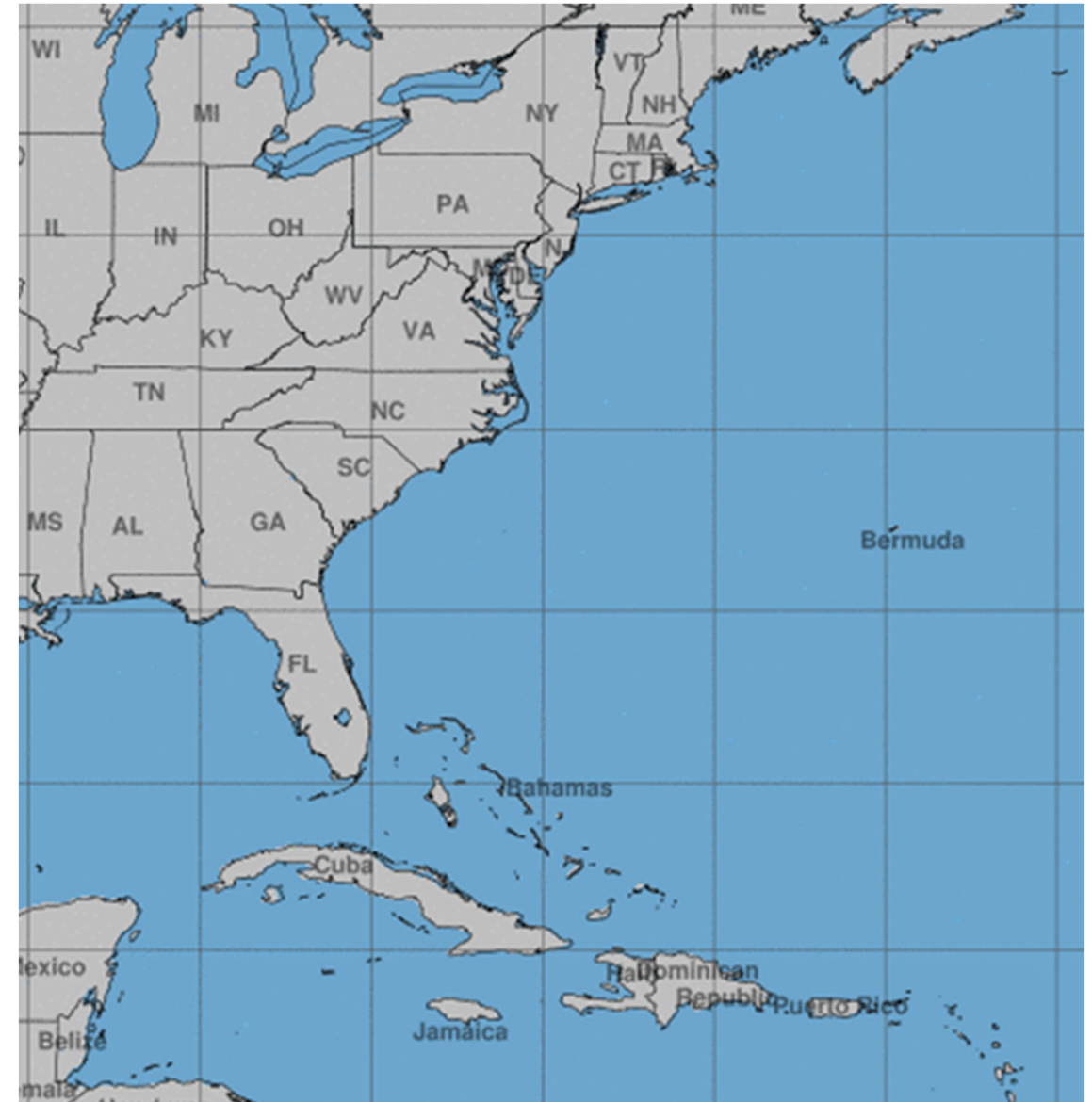
Cure For The Skinny Black Line?



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ERROR CONE

- Probable track of the center of the tropical cyclone.
- Formed by connecting circles centered on each forecast point.
- Each circle uses NHC historical (5-year) track errors.
 - Actual storm position will be within the circle 67% of the time.



Not In The Cone: No Worries?



FEMA

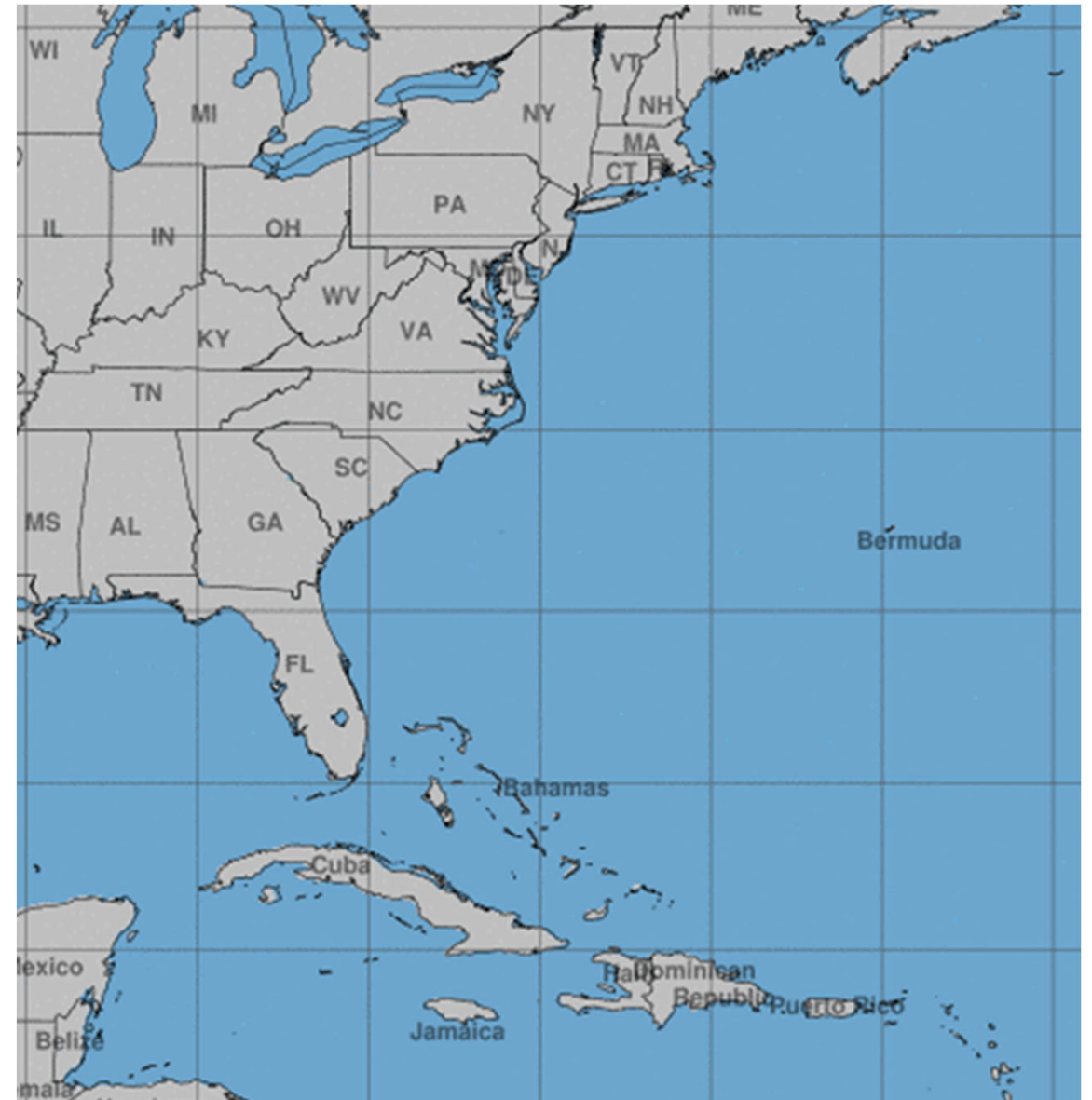
ERROR CONE

Only displays information about track uncertainty

- Nothing about specific impacts

Impacts can occur well outside the area enclosed by the cone

- Center is expected to be outside the cone about 1/3 of the time



Wind Speed Probabilities



FEMA

Wind Speed Probabilities address:

- Chance for some effects?
- How can I better see forecast wind impacts?
- Are staging areas at risk?

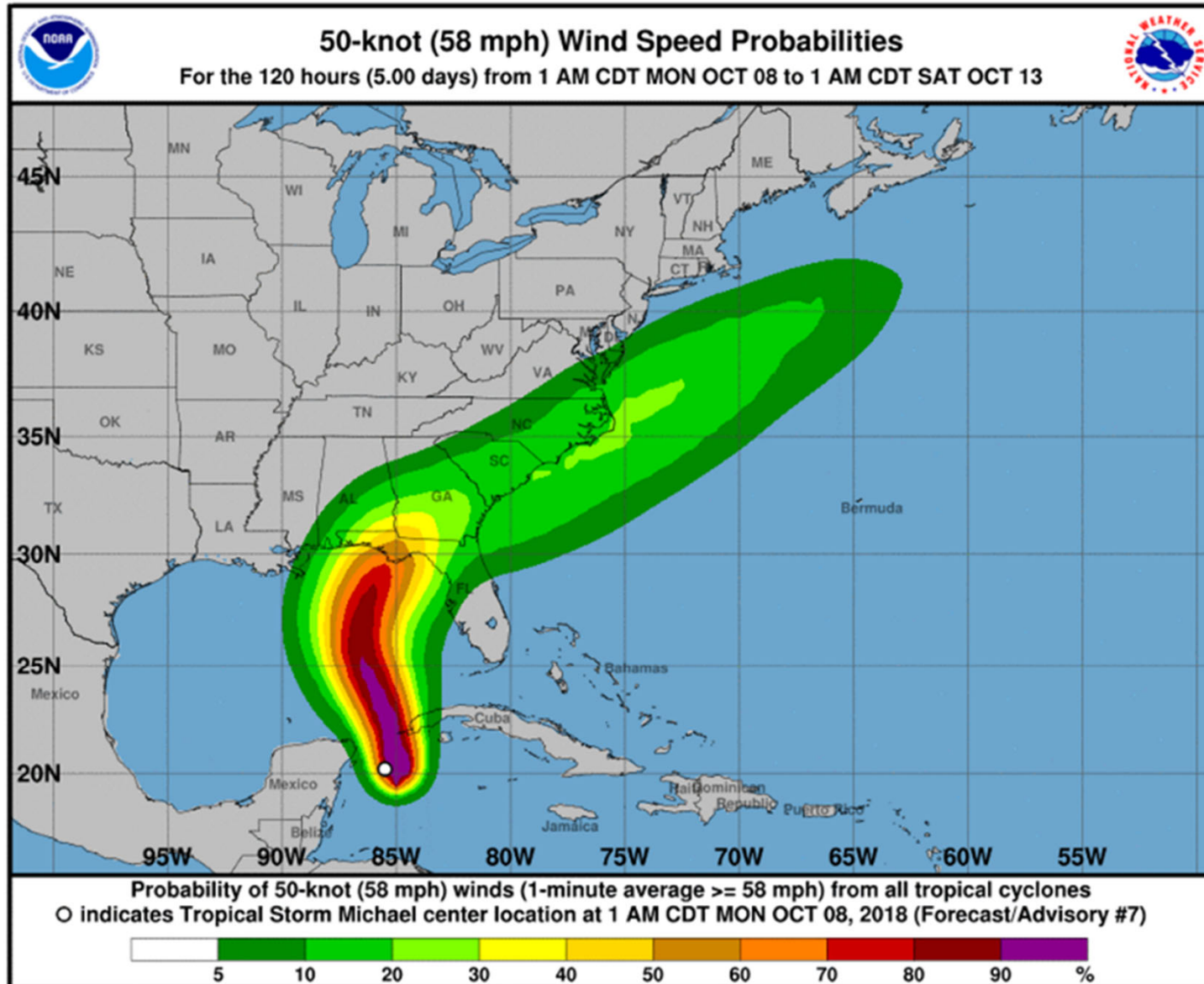
5-Day Cumulative Graphic: TS-Force



Location-specific Probabilities

- Tropical Storm-Force
- 58 mph (“Strong” Tropical Storm)
- Hurricane-Force

5-Day Cumulative Graphic: 'Strong' TS-Force



Location-specific Probabilities

- Tropical Storm-Force
- 58 mph ("Strong" Tropical Storm)
- Hurricane-Force

5-Day Cumulative Graphic: Hurricane-Force



Location-specific Probabilities

- Tropical Storm-Force
- 58 mph (“Strong” Tropical Storm)
- Hurricane-Force

Arrival Times



FEMA

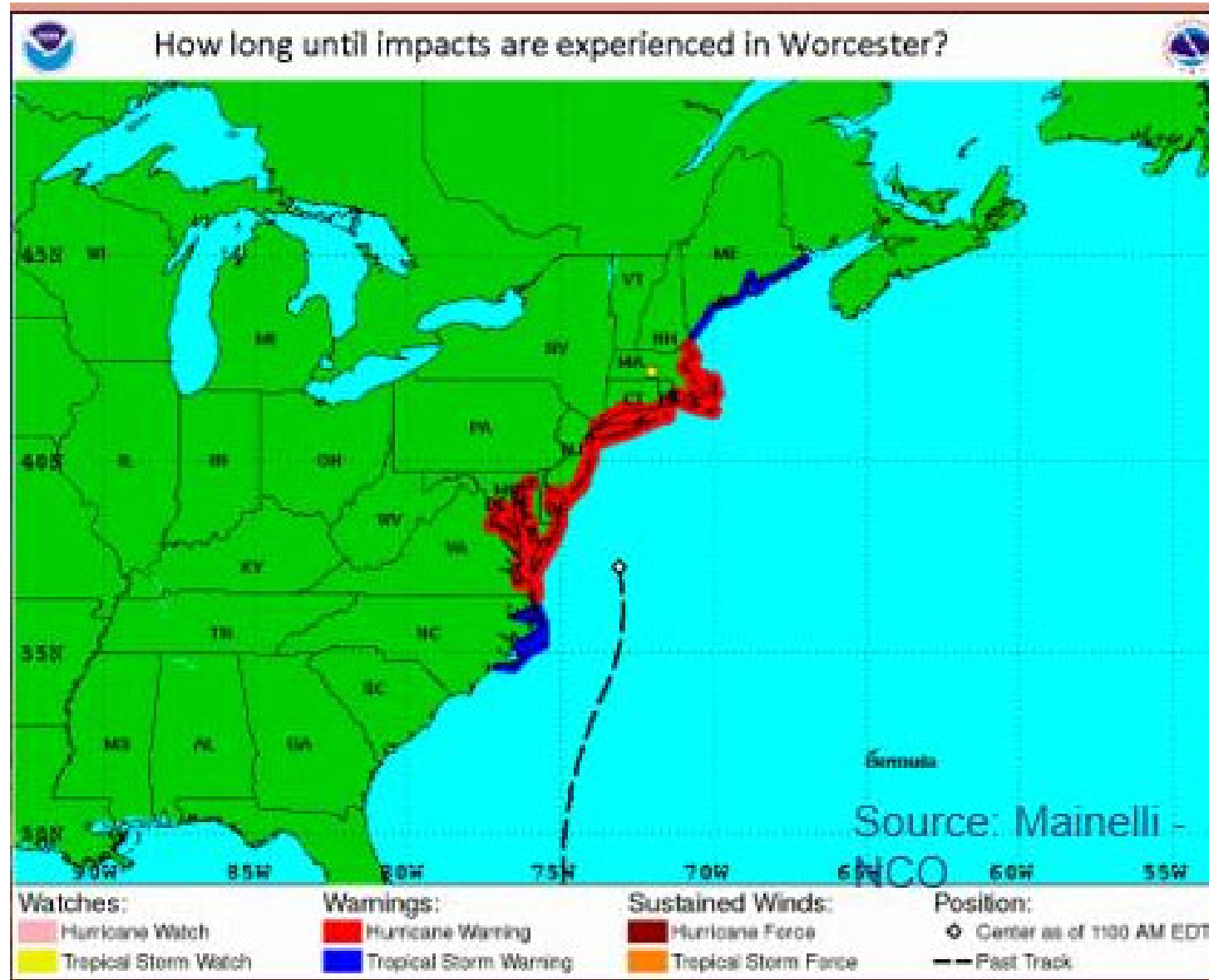
Arrival Times address:

- When is the earliest TS winds could begin?

1938 Hurricane Demonstration



FEMA



Earliest Reasonable Onset of TS Winds



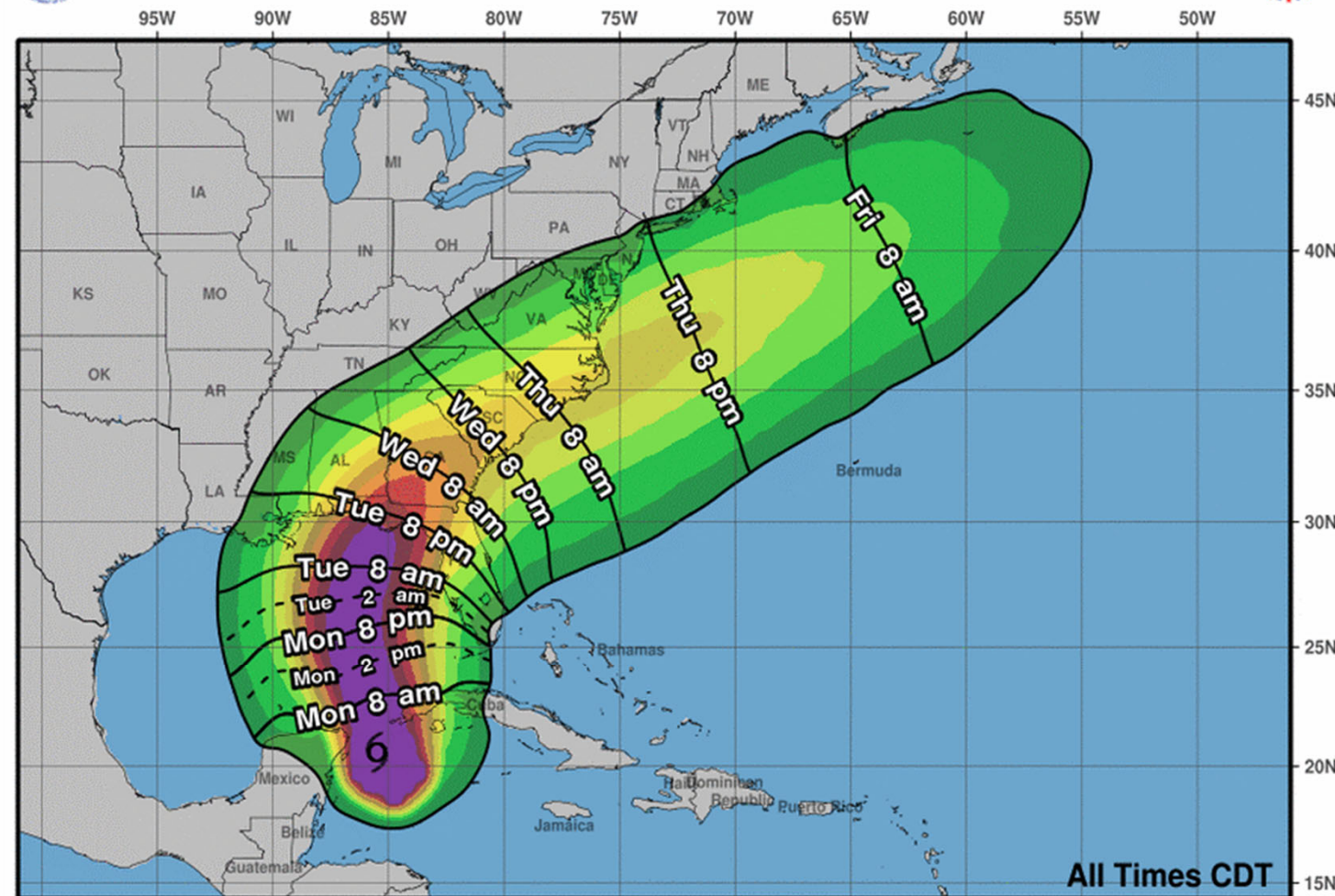
FEMA

Earliest Reasonable

- 10% chance of onset (Most conservative timing)
- Black Contours: Arrival time of TS winds
- Color fill: 5-day cumulative TS probabilities



Earliest Reasonable Arrival Time of Tropical-Storm-Force Winds



Tropical Storm Michael
Mon. Oct. 8, 2018 4 am CDT
Advisory 7

Storm Location ○ < 34 kt (39 mph)
 & ○ 34-63 kt (39-73 mph)
 Wind Speed ● ≥ 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 %

All Times CDT

Most Likely Onset of TS Winds



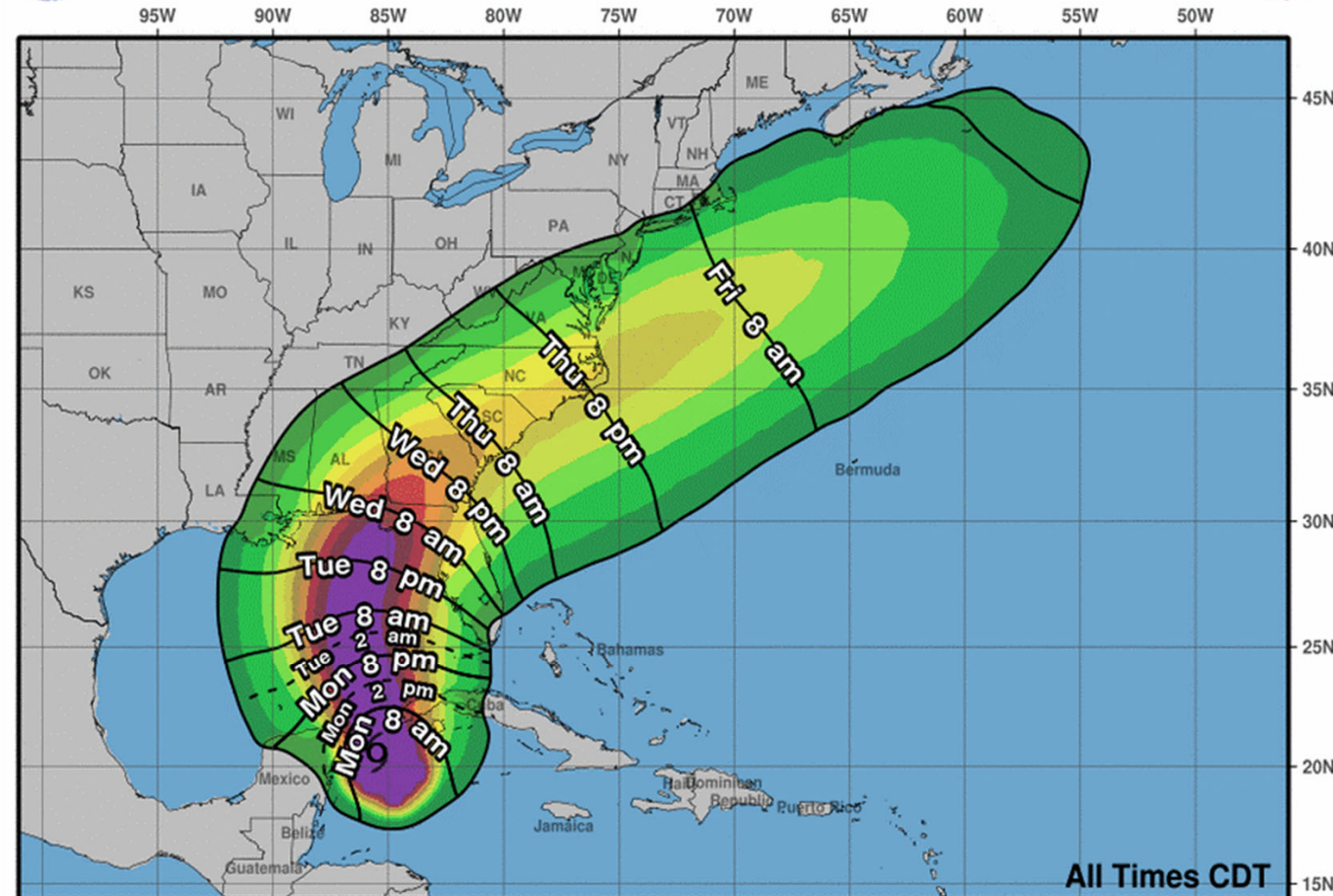
FEMA

Most Likely

- 50% chance of onset (Equally likely to occur before as after)
- Black Contours: Arrival time of TS winds
- Color fill: 5-day cumulative TS probabilities



Most Likely Arrival Time of Tropical-Storm-Force Winds



Tropical Storm Michael

Mon. Oct. 8, 2018 4 am CDT

Advisory 7

Storm Location ○ < 34 kt (39 mph)
& ○ 34-63 kt (39-73 mph)
Wind Speed ● ≥ 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 %

Timing Uncertainty

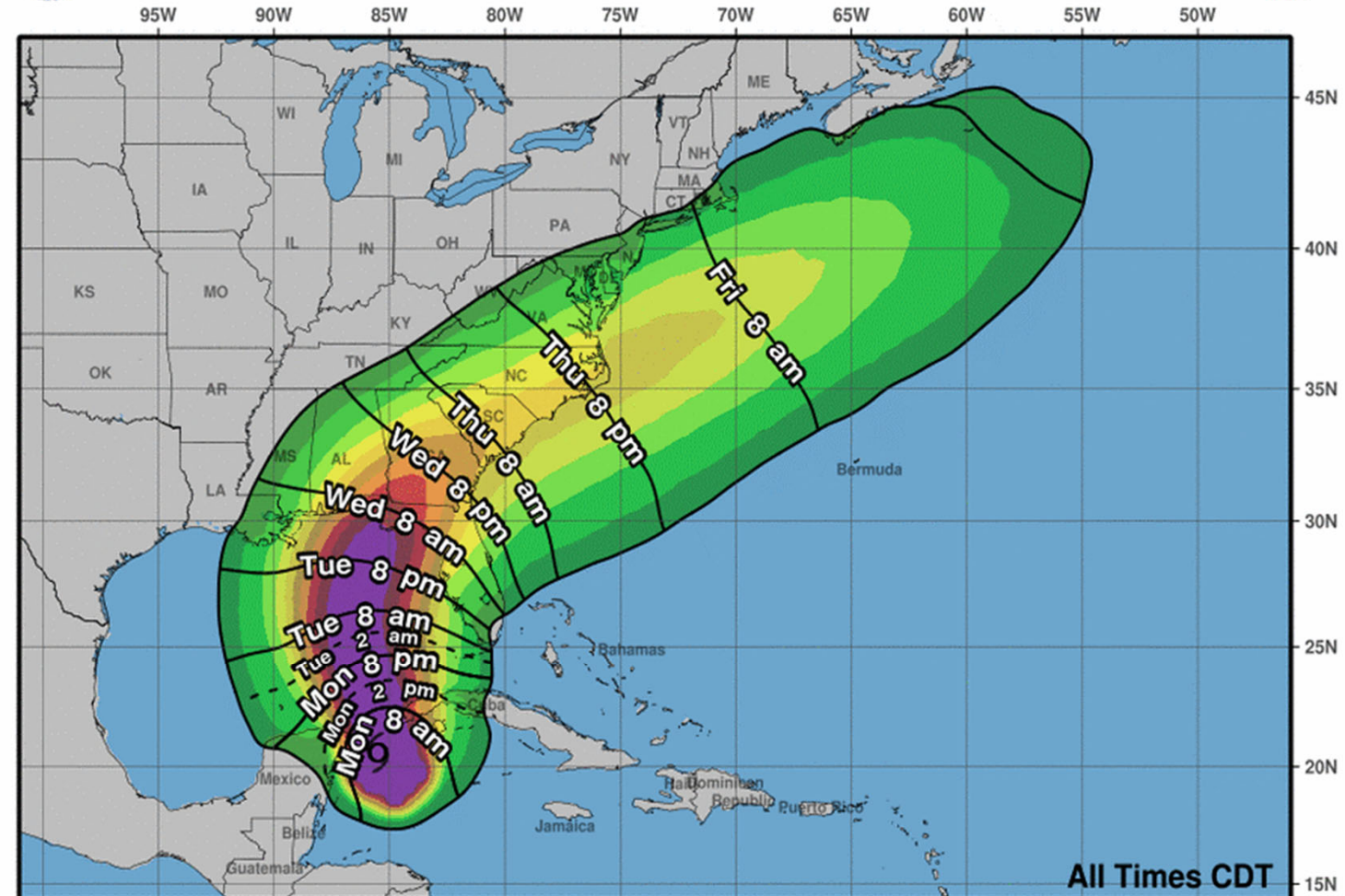


FEMA

- **Earliest Reasonable**
 - 10% chance of onset
 - Most conservative timing
 - Tuesday 8 p.m.
- **Most Likely**
 - 50% chance of onset
 - Equally likely before as after
 - Wednesday 8 a.m.
- **Range of wind arrival: 12 h**
 - Tuesday 8 p.m.–Wed 8 a.m.



Most Likely Arrival Time of Tropical-Storm-Force Winds



Tropical Storm Michael
Mon. Oct. 8, 2018 4 am CDT
Advisory 7

Storm Location ○ < 34 kt (39 mph)
& ○ 34-63 kt (39-73 mph)
Wind Speed ● ≥ 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 %

Wind Watches and Warnings



FEMA

Wind Watches and Warnings address:

- Where is the greatest concern?
- When will hurricane hazards begin?

Hurricane Watches/Warnings



FEMA

The lead time for Tropical Storm and Hurricane Watches and Warnings are tied to the anticipated arrival time of tropical storm-force winds.

Hurricane Watch

- Hurricane conditions are **possible** within the Watch area, generally within 48 hours.

Hurricane Warning

- Hurricane conditions are **expected** within the Warning area, generally within 36 hours.



Tropical Storm vs. High Wind Watches/Warnings



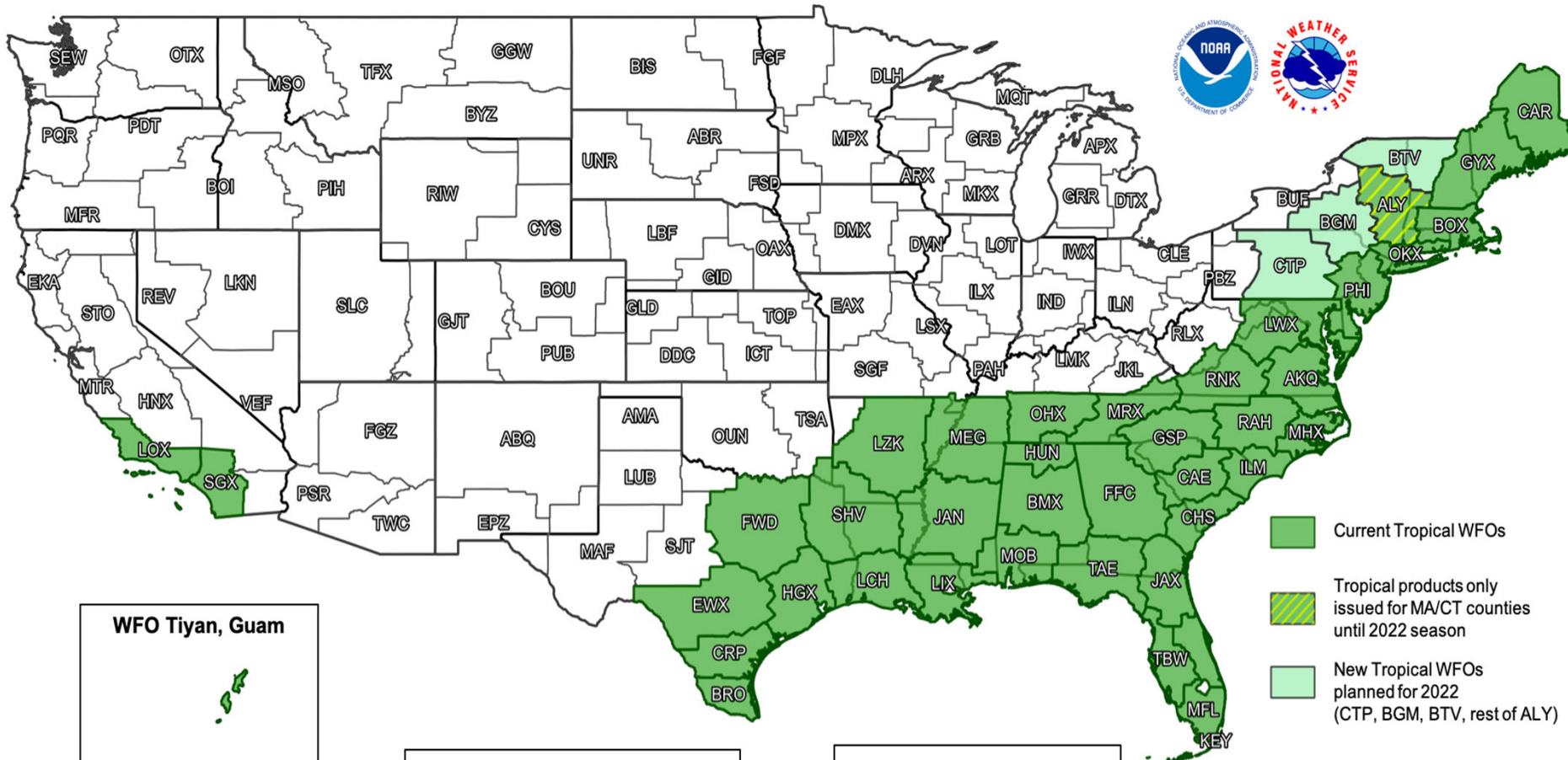
• Tropical Storm Watches/Warnings

- Issued for tropical storm-strength wind speeds (sustained winds of 39 to 74 mph).
- Watches issued when tropical storm winds are **possible** within **36 to 48 hours**.
- Warnings issued when tropical storm winds are **expected** within **36 hours**.
- Will be issued for inland counties covered by WFOs designated to issue Tropical Cyclone Products (based on historical return periods for tropical storm winds).

• High Wind Watches/Warnings

- Issued for wind speeds that meet or exceed locally defined Warning criteria (typically sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration)
- Watches issued when high winds are **possible** within **12 to 48 hours**.
- Warnings issued when high winds are **expected** within **12 hours**.
- Will be issued for inland counties covered by WFOs that are not designated as “tropical.”

Which NWS Offices Will Issue Tropical Storm vs High Wind Watches/Warnings?



Green/Teal = you will receive Tropical Storm or Hurricane Watches/Warnings for inland wind hazards.

White = you will receive High Wind Watches/Warnings for inland wind hazards.

- Current Tropical WFOs
- Tropical products only issued for MA/CT counties until 2022 season
- New Tropical WFOs planned for 2022 (CTP, BGM, BTV, rest of ALY)

WFO Tiyan, Guam

Including Micronesia (Republic of the Marshall Islands, Federated States of Micronesia, Republic of Palau)

WSO Pago Pago, American Samoa
Including Swains Island

WFO Honolulu, Hawaii

WFO San Juan, Puerto Rico

Tornado Watches & Warnings



Tornado WATCH

- Conditions are favorable for severe thunderstorms and tornadoes. It does not mean tornadoes will occur, but they are possible.

Tornado WARNING

- A tornado has been spotted or indicated by weather radar, meaning a tornado is occurring or expected soon.

Tornado EMERGENCY

- A special type of Tornado Warning issued for exceedingly rare situations when a severe threat to human life and catastrophic damage due to a confirmed violent tornado is imminent or occurring.

Storm Surge Products



FEMA

Storm Surge Products address:

- Where might storm surge occur?
- What are the possible impacts of storm surge?

SLOSH MOMs and MEOWs - MOMs



FEMA

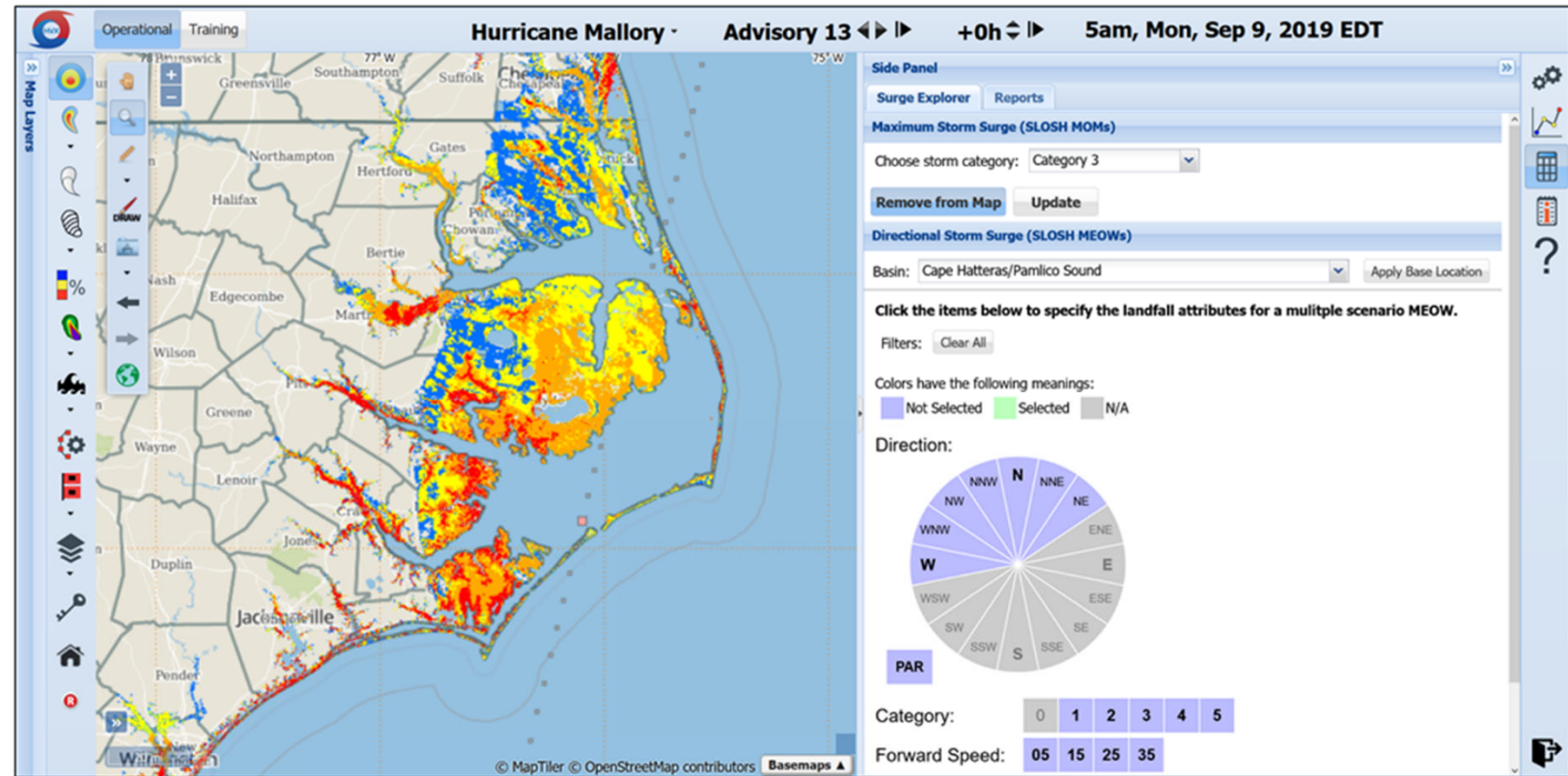
MOMs - Maximum of Maximums

Worst-case for a particular category storm

Combination of many scenarios

- Forward speed
- Angle of approach
- Size (Radius of maximum wind)
- Initial tide level

No single hurricane will produce the regional flooding depicted in a MOMs.



SLOSH MOMs and MEOWs - MEOWs



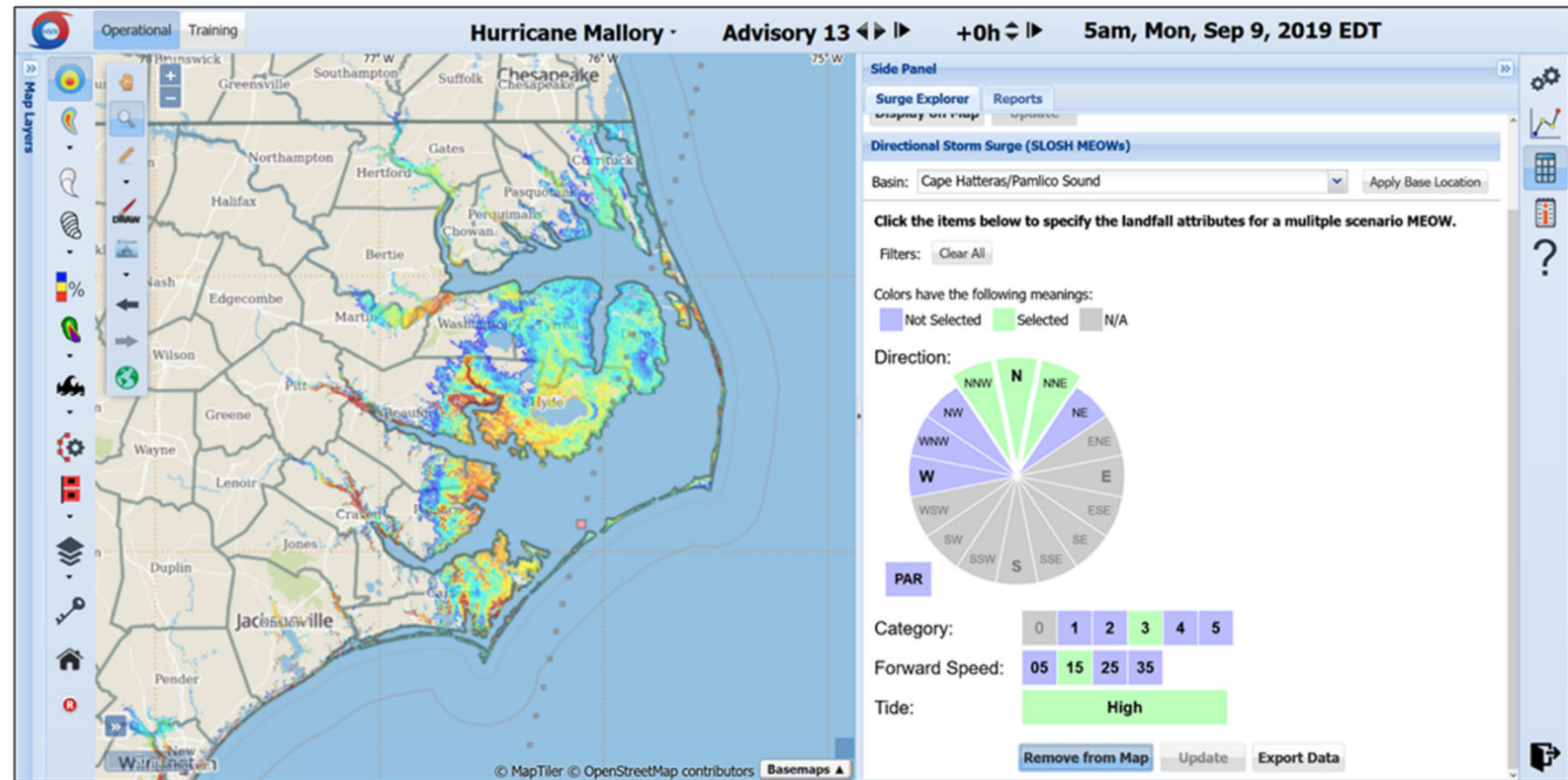
FEMA

MEOWs – Maximum Envelope of Water

Composite of the maximum storm surge for a given set of parameters (by basin)

Used as guidance of planning and operations

- Category (Cat 3)
- Landfall direction (NW,N, NE)
- Forward speed (15 mph)
- Initial tide (High)

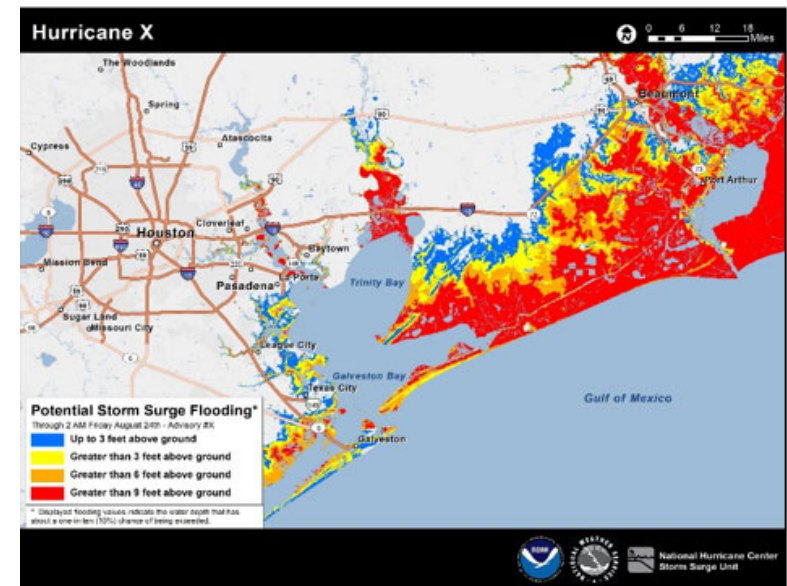
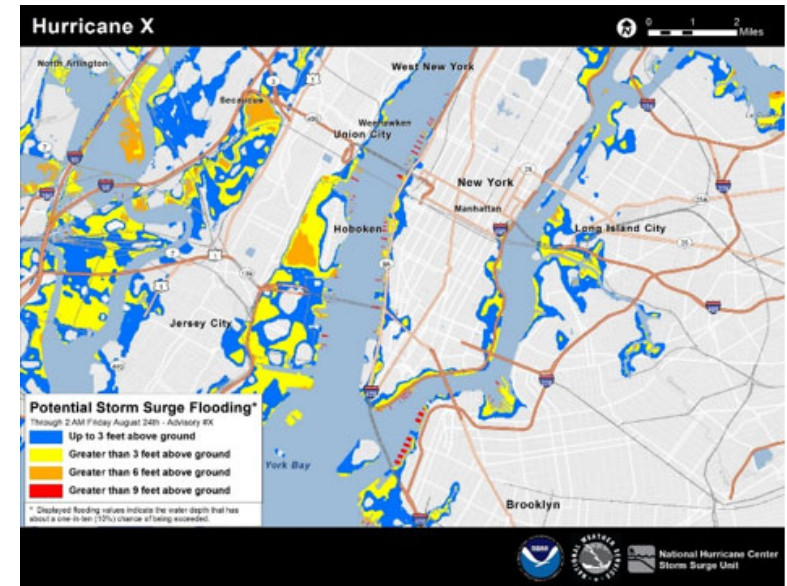


Potential Storm Surge Flooding Map



Inundation Map

- Height above ground that the water could reach
 - Reasonable worst-case scenario for any individual location
 - Values have a 10% chance of being exceeded
- Issued with Hurricane Watch
 - Sometimes with Tropical Storm Watch
- Available 60+ minutes after the advisory release



Storm Surge Watches/Warnings



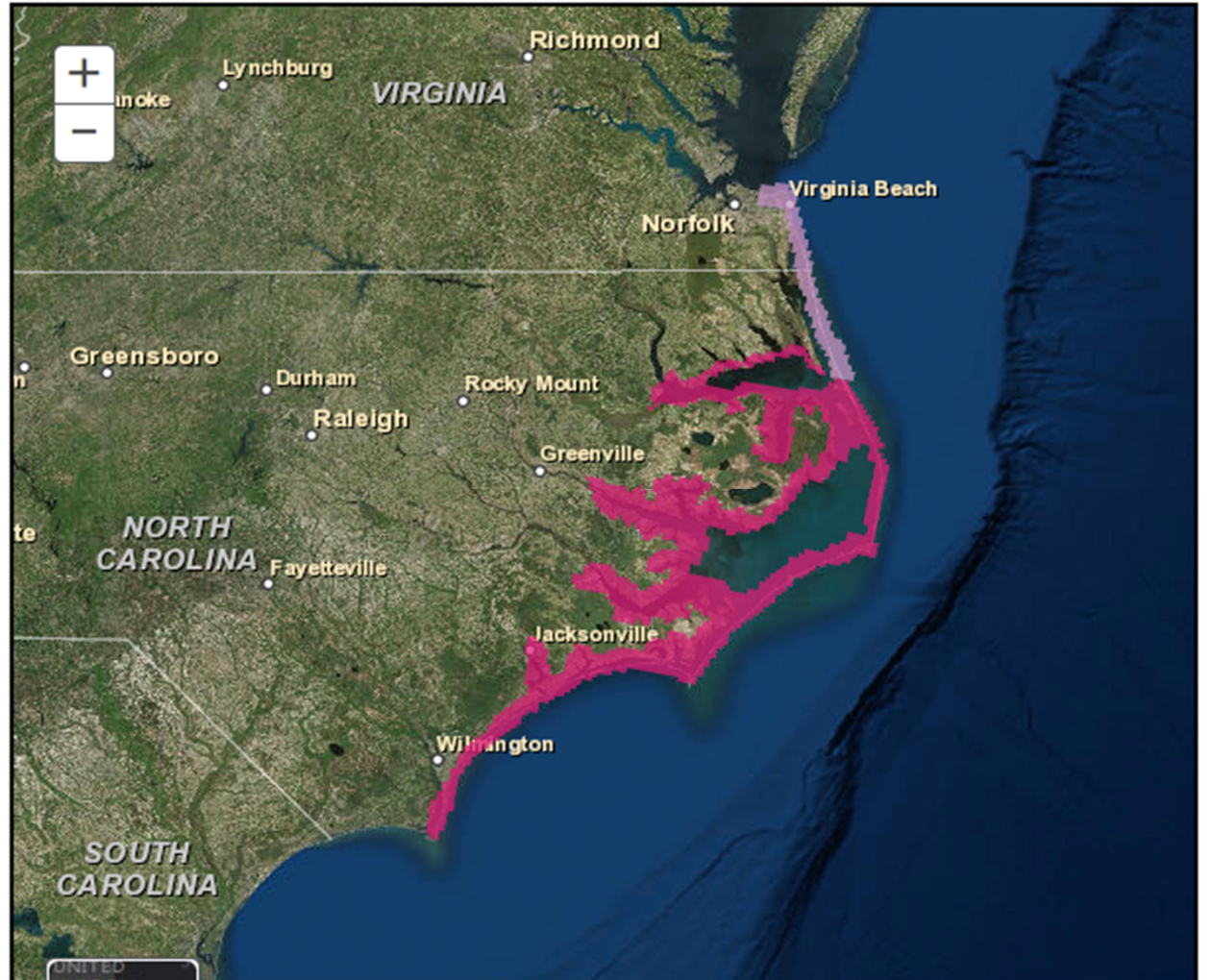
FEMA

Storm Surge Watch

- There is the possibility of life-threatening inundation, generally within 48 hours.

Storm Surge Warning

- There is a danger of life-threatening inundation, generally within 36 hours.

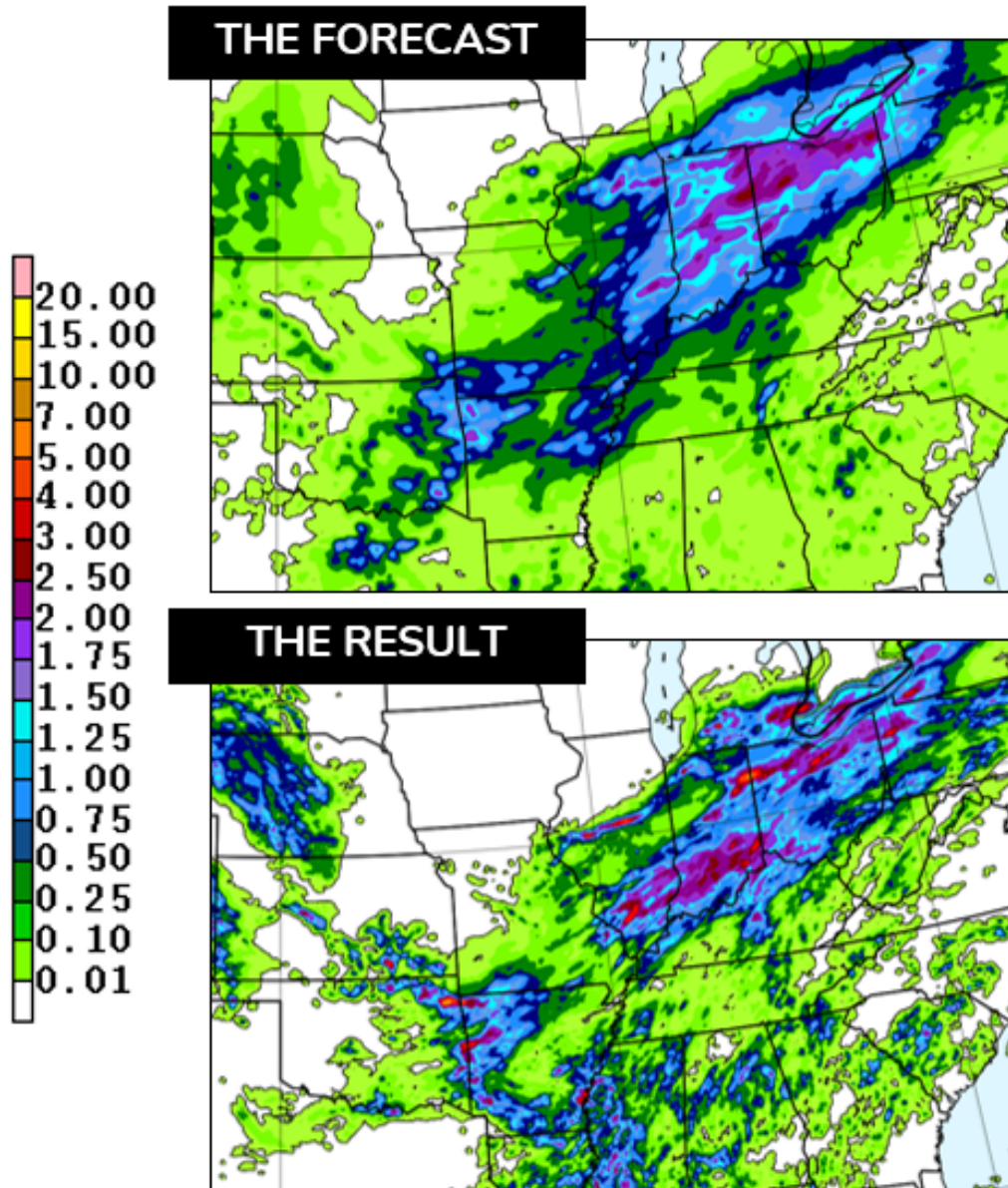




Rainfall & Inland Flooding Products address:

- How much rain is forecast?
- What areas will flood?
- How do wireless emergency alerts work?

Quantitative Precipitative Forecast (QPF)



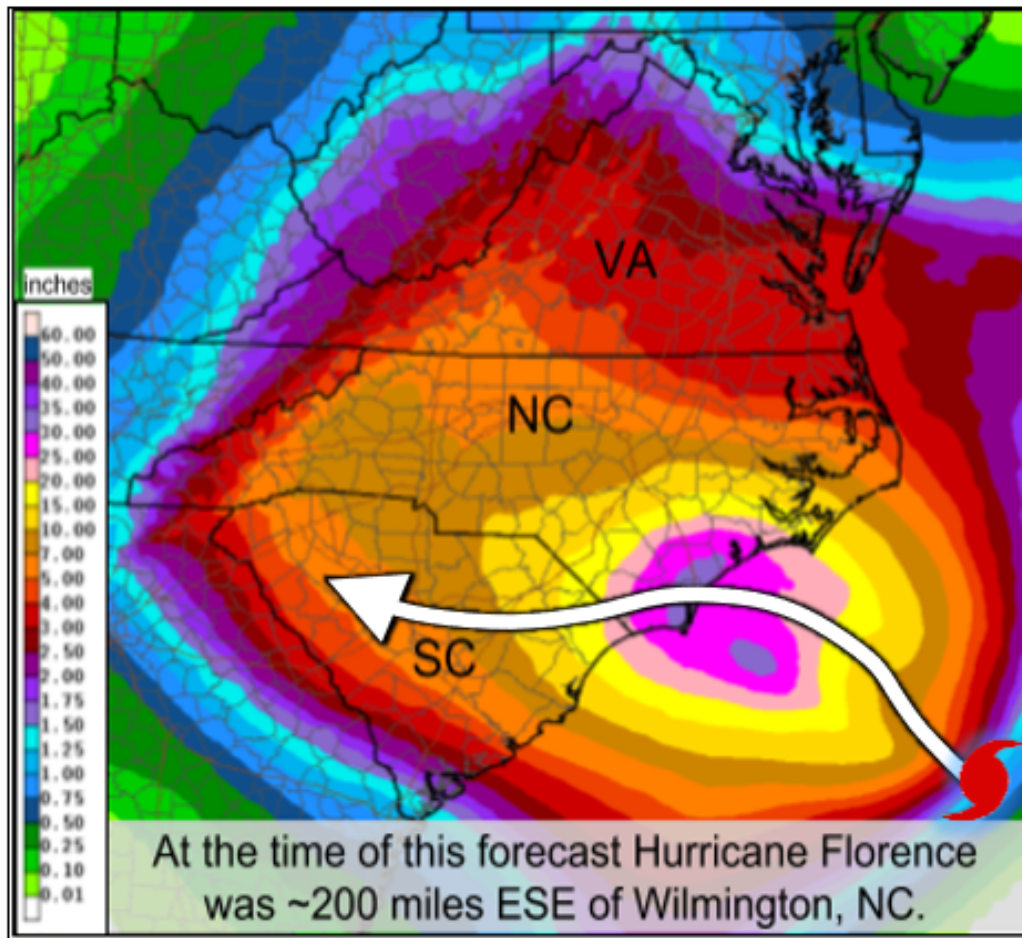
- Forecast precipitation over a given period of time for tropical cyclones.
- The forecast depicts average amounts over a large area; does not capture localized minimum or maximum.
- More accurate in situations with large, organized weather systems.

Hurricane Florence (2018)

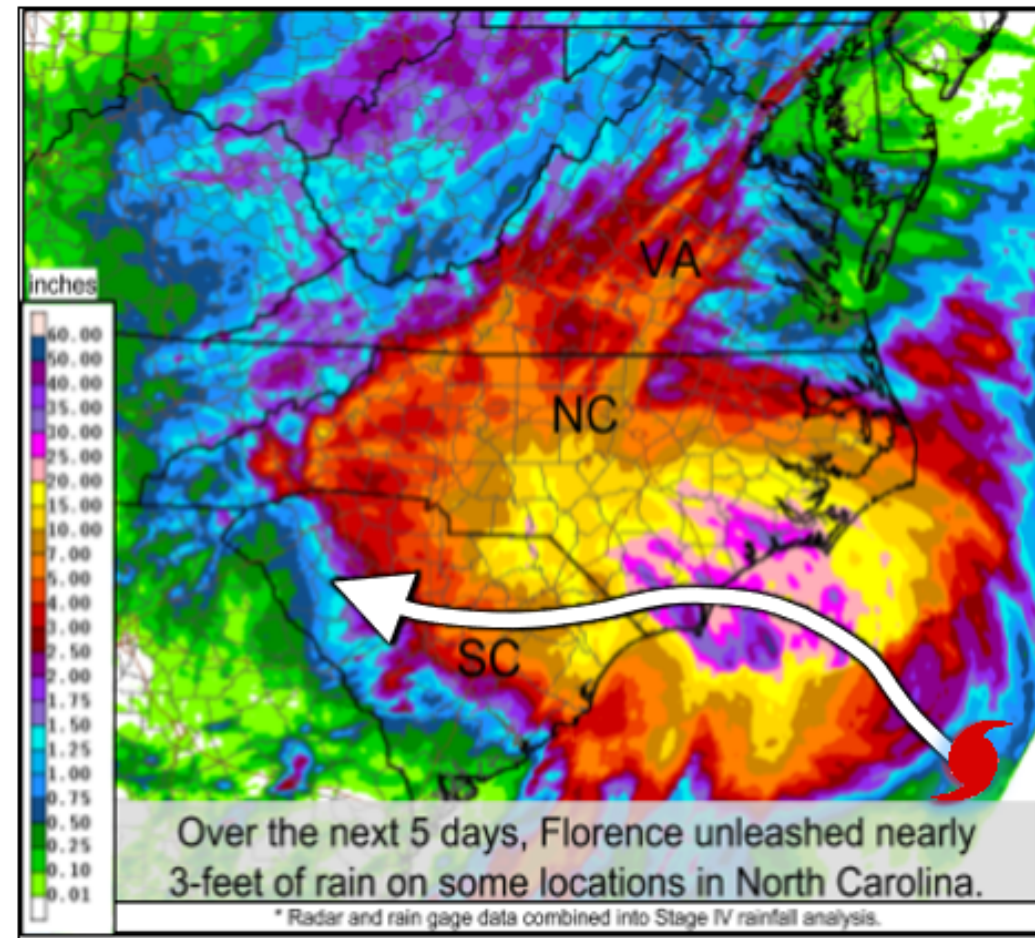


FEMA

5-Day Forecast vs. Observed Rainfall



5-day Rainfall Forecast - Issued Sep 13, 2018



5-day Rainfall - Sep 13-18, 2018

Rainfall Forecast

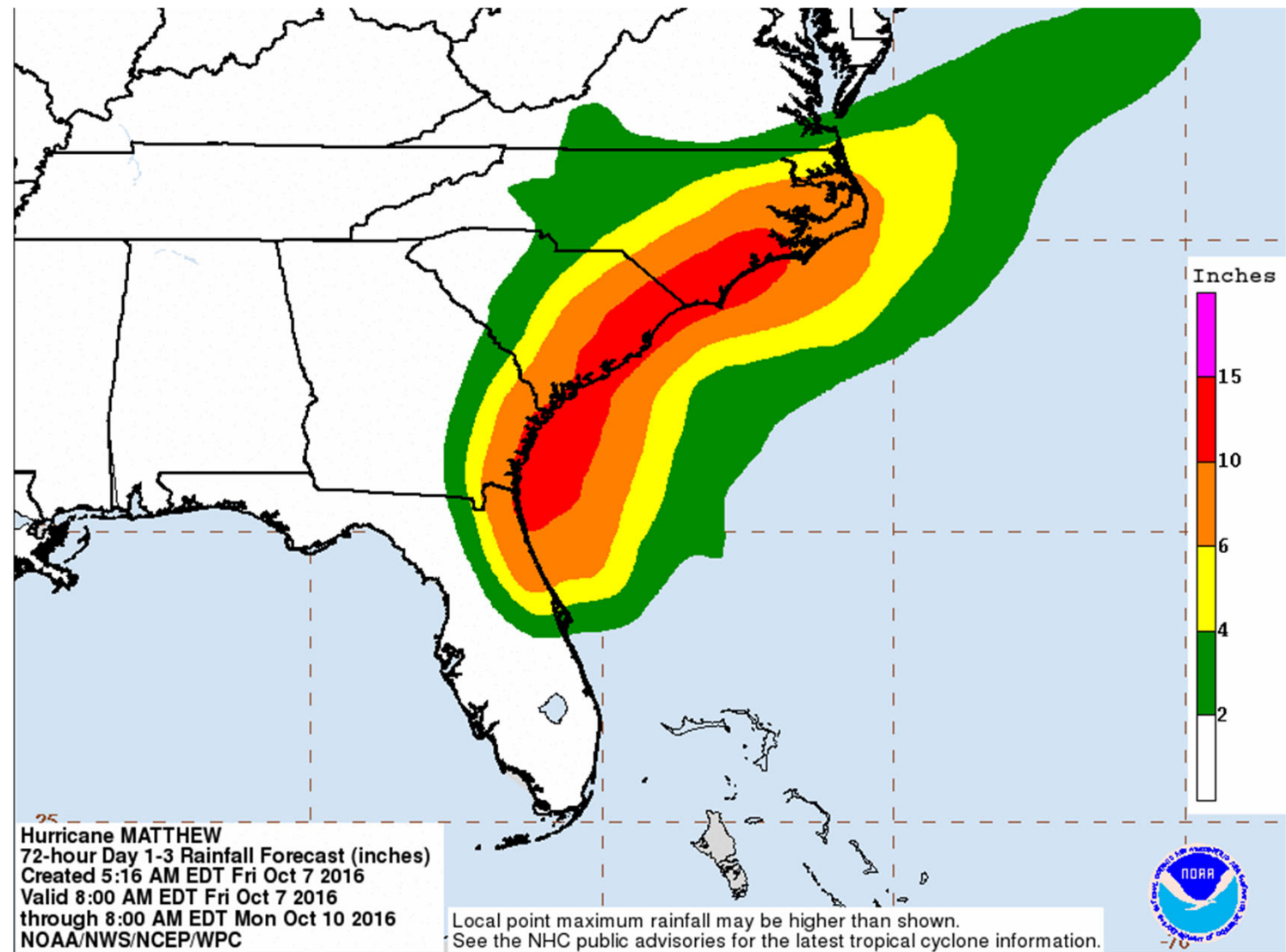


FEMA

WPC issues *storm-specific* rainfall forecast graphic.

- Simplified scale

This is the version included with the NHC Public Advisory forecast package.



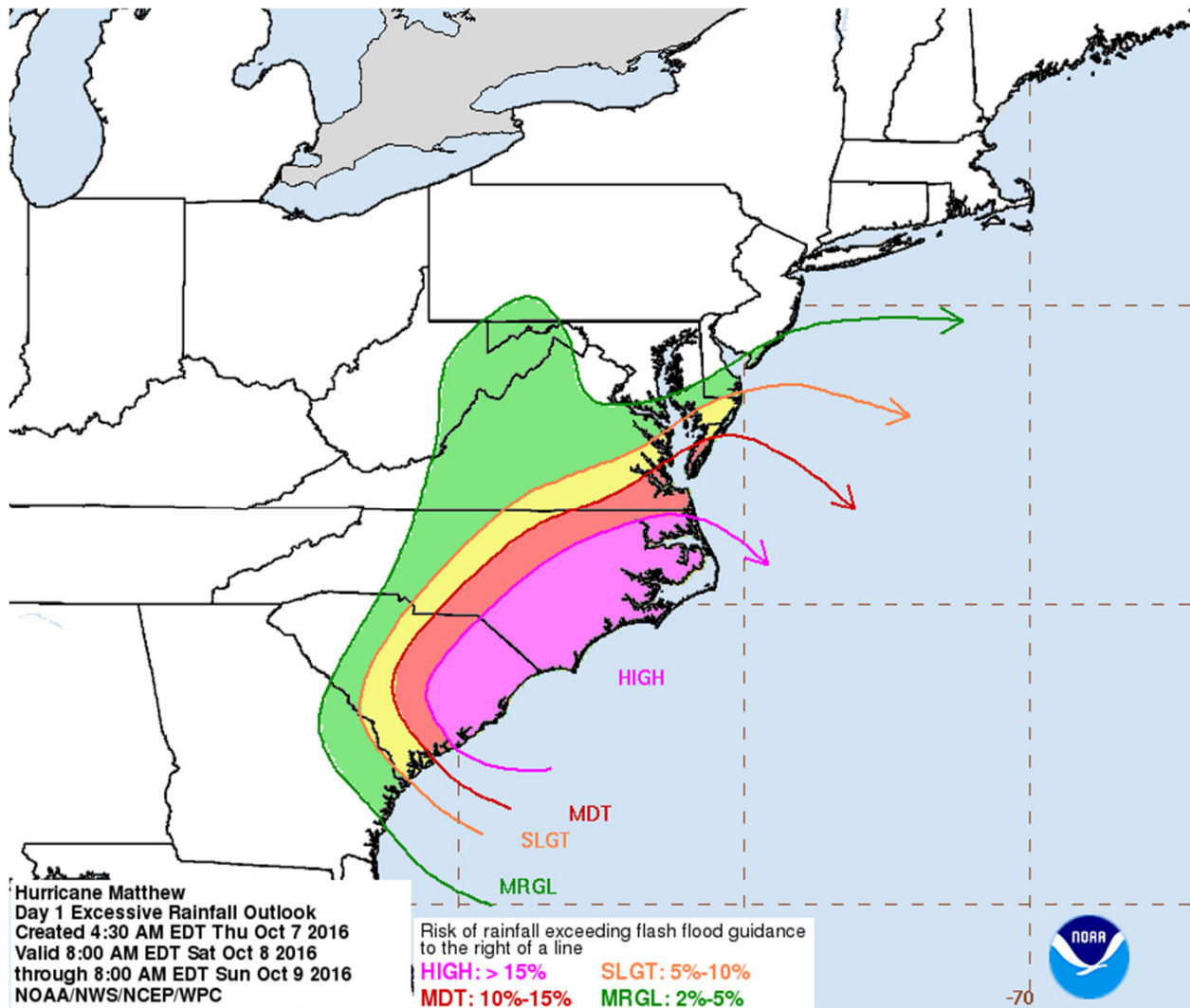
Rainfall Forecasts

Context Matters:

A forecast of 1 inch has different impacts if the rain falls over 24 hours vs. 10 minutes.



Excessive Rainfall Outlook (ERO)



- Chance that rainfall can cause flash flooding
- 5-day outlook
- A situational awareness and planning tool
- Accounts for some uncertainty
- Summaries large-scale risk factors
- Does NOT
 - Account for longer-term flooding on mainstem rivers
 - Forecast flash flooding at specific locations

Excessive Rainfall Categories



FEMA

Understanding WPC Excessive Rainfall Risk Categories					
<p>No Area/Label</p> <p>Flash floods are generally not expected.</p> <p>www.wpc.ncep.noaa.gov @NWSWPC</p>	<p>MARGINAL (MRGL)</p> <p>Isolated flash floods possible</p> <p>Localized and primarily affecting places that can experience rapid runoff with heavy rainfall.</p>	<p>SLIGHT (SLGT)</p> <p>Scattered flash floods possible</p> <p>Mainly localized. Most vulnerable are urban areas, roads, small streams and washes. Isolated significant flash floods possible.</p>	<p>MODERATE (MDT)</p> <p>Numerous flash floods likely</p> <p>Numerous flash flooding events with significant events possible. Many streams may flood, potentially affecting larger rivers.</p>	<p>HIGH (HIGH)</p> <p>Widespread flash floods expected</p> <p>Severe, widespread flash flooding. Areas that don't normally experience flash flooding, could. Lives and property in greater danger.</p>	
<p>Flash flooding near me?</p>	<p>Flash Flooding</p> <p>NO Flash Flooding</p>				
<p>WEATHER PREDICTION CENTER</p>					

Excessive Rainfall Outlook 1



High Risk Days

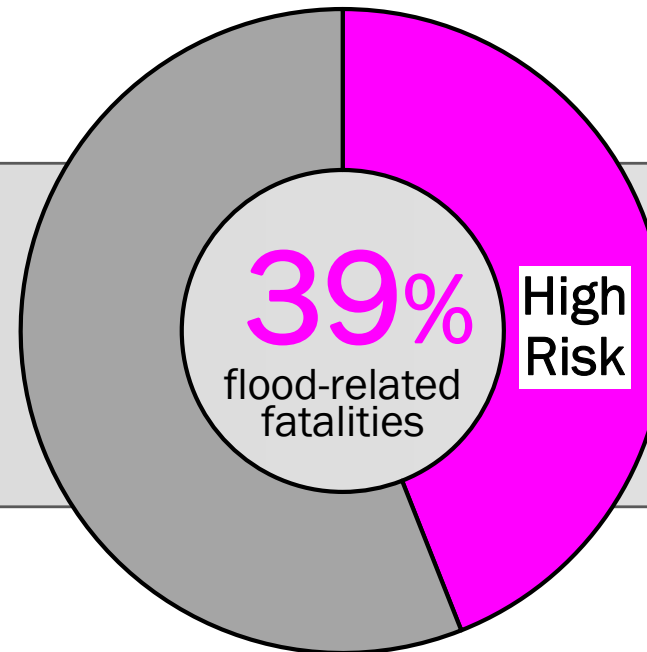
- About 4% of days
(Includes tropical and non-tropical events)

High Risk Accounts for:

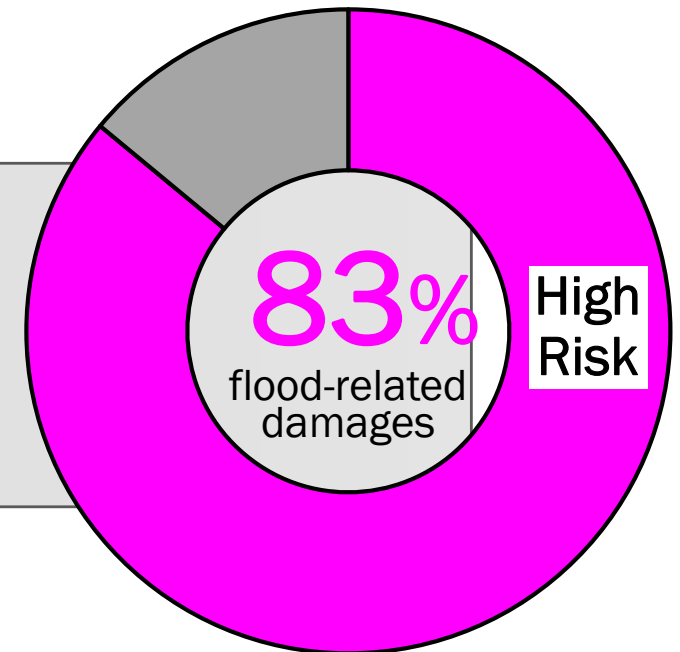
- 39% of Flood Fatalities
- 83% of Flood Damages

Stats from 2010 to 2018

Fatalities



Damages



Excessive Rainfall Outlook 2



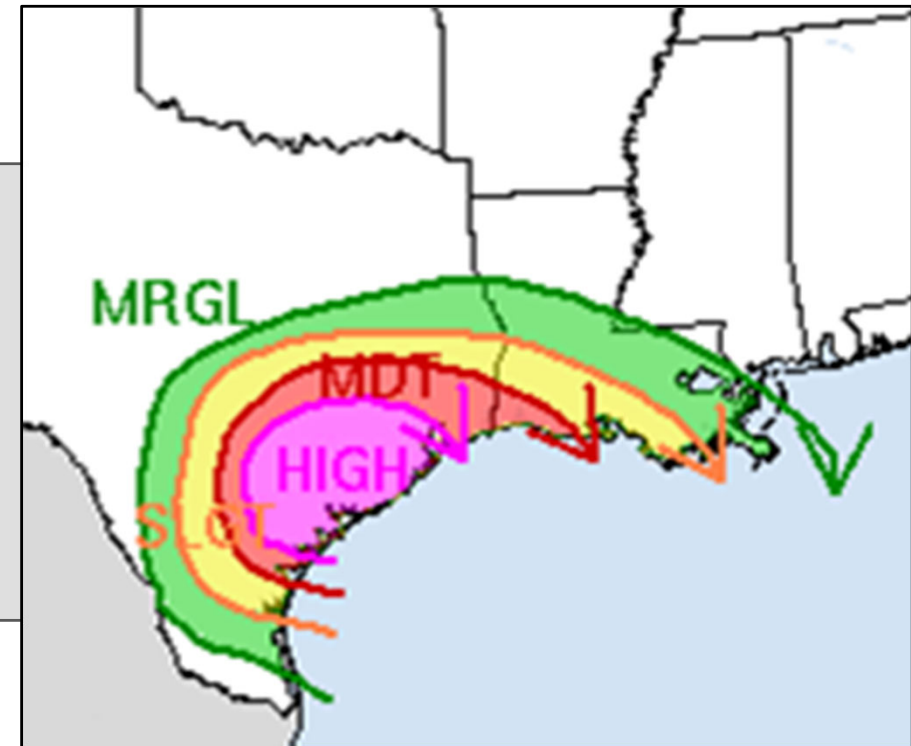
High Risk Days

- About 4% of days
(Includes tropical and non-tropical events)

What happens during High Risk days?

- 46% have at least 1 fatality or injury
Compared to 23% for Moderate Risk Days
- 62% have at least \$1 million in damages
Compared to 33% for Moderate Risk Days

Stats from 2010 to 2020



Excessive Rainfall Outlook 3

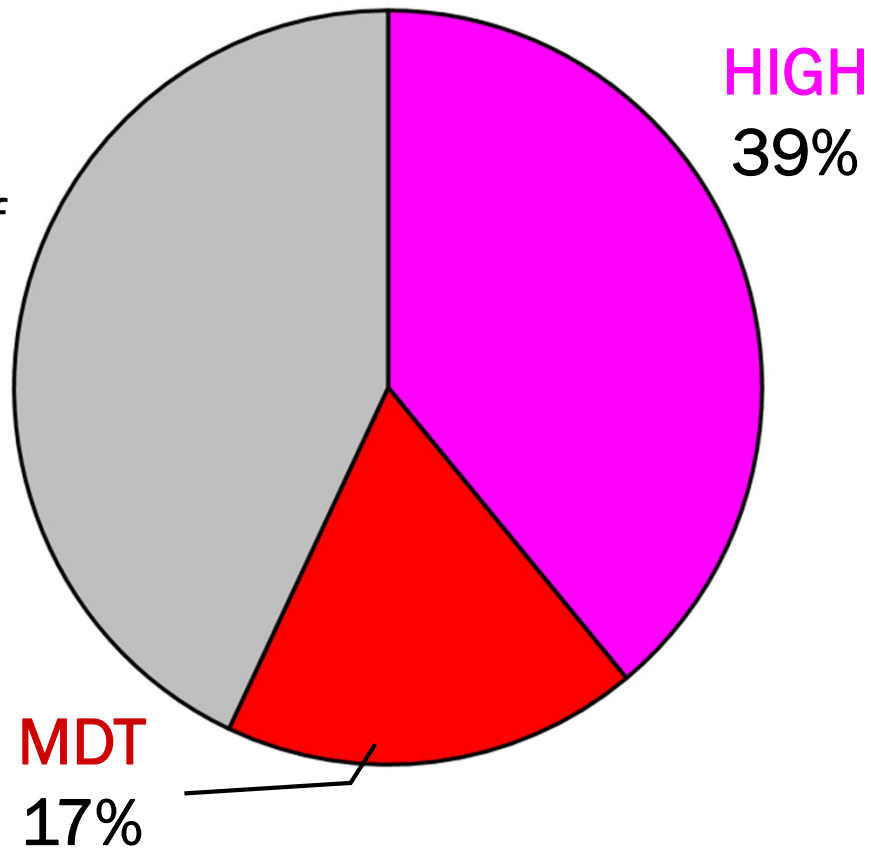


FEMA

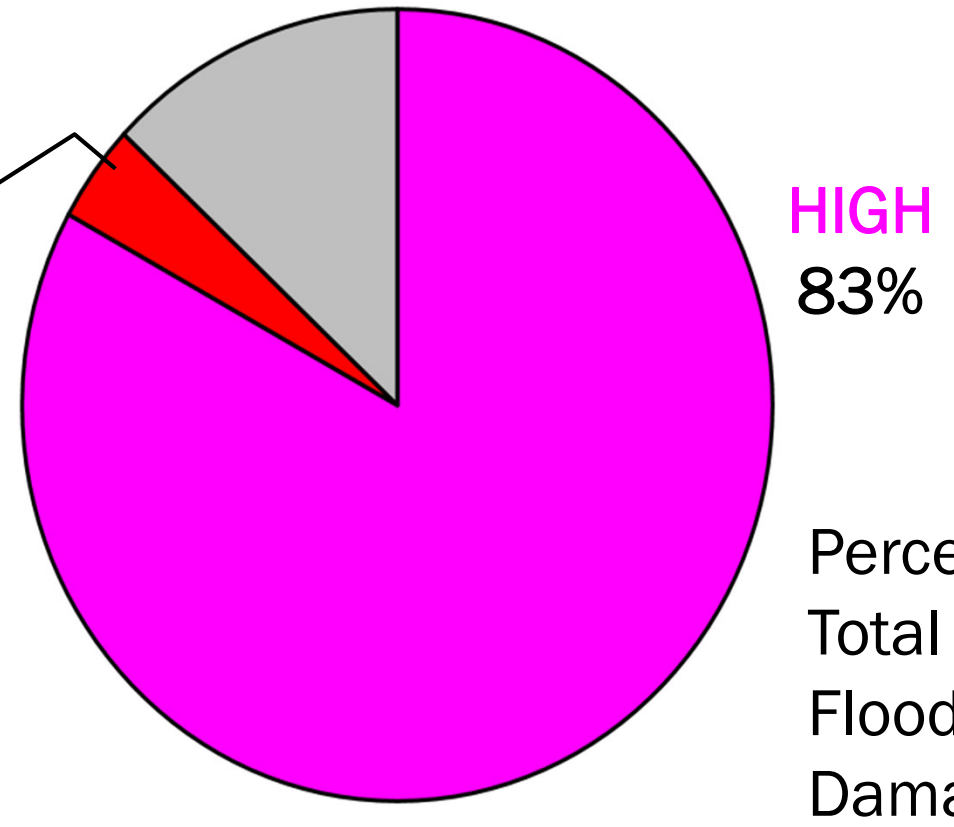
2/5 of ALL Flood-related Fatalities

4/5 of ALL Flood-related Damages

Percent of Total US Flood Fatalities



MDT
4%



Percent of Total US Flood Damages

¹ From 2010 to 2020. 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. Damage estimate used for Montecito debris flow.

Excessive Rainfall Outlook 4



Hurricane Matthew SAR;
FEMA Photo

**Based on records over the past
11 years, we can say:**

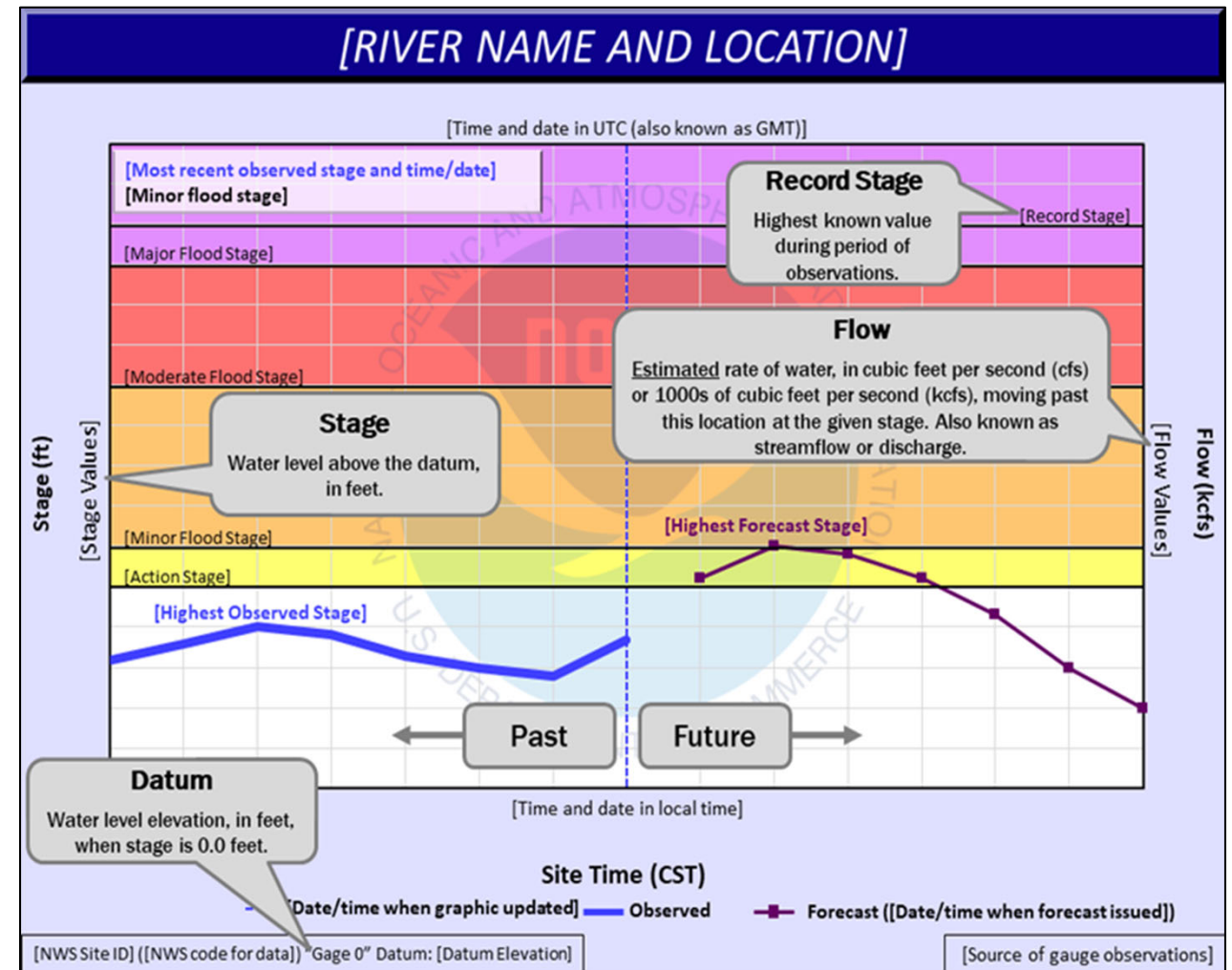
**WPC High Risks are a strong indicator of
a potentially deadly and damaging flash
flood day!**

Hydrographs



FEMA

- Display water-level information over time.
- Hydrograph Plot
 - May display stage, streamflow, and sometimes both.
- Hydrographs visualize water-level observations and forecasts on a single graphic.
- Forecast hydrographs are great for assessing potential mainstem river flooding ahead of impact, but not great for assessing flash flood potential.



River Gauges



FEMA

Monitor the volume of water flowing through streams.

Typical measurements include stage and discharge (flow):

- Stage: The water level above a reference elevation, called a datum.
 - Not the same as depth!
- Discharge (flow): The rate of water moving past a location.



AHPS Demonstration



Instructor-Led Demonstration of AHPS (Advanced Hydrologic Prediction Service) Website

Time: 5 minutes

Goal: Explore the [AHPS website](#)

1. Layout of the interface
2. Locations of key information
3. How to view:
 - Hydrographs, Impact tables, Crest records, Hydro watches/warnings in effect, Links to FIM and probabilistic models, Other Data about the gage

Monitoring Rivers Demo 1



National Oceanic and Atmospheric Administration's National Weather Service

Site Map News Organization

Local forecast by "City, ST"

National Observations

Warnings & Forecasts Graphical Forecasts National Maps Radar Water Air Quality Satellite Climate

River Observations River Forecasts Long-Range River Flood Risk Precipitation River Download Other Information

Auto Refresh: OFF

Print this map Permalink Bookmark and Share

All Locations

Switch Basemap Reset View

Click on the map or select one of the data views below:

- United States
- NWS Weather Forecast Offices
- NWS River Forecast Centers
- Water Resources Regions

Probability and forecasts available
 Observations only available
 Forecasts available

8989 total gauges
 Show all locations in flood (268)

- 33 Gauges: Major Flooding
- 61 Gauges: Moderate Flooding
- 174 Gauges: Minor Flooding
- 245 Gauges: Near Flood Stage
- 5228 Gauges: No Flooding
- 2489 Flood Category Not Defined
- 13 At or Below Low Water Threshold
- 602 Gauges: Observations Are Not Current
- 144 Gauges: Out of Service

Alaska Hawaii Puerto Rico

USGS science for a changing world

POWERED BY esri

Last map update: 03/19/2019 at 11:01:55 am CDT 03/19/2019 at 15:01:55 UTC

National Weather Service Advanced Hydrologic Prediction Service

Home News Organization Search for:

National Observations National Forecasts WFO Forecast

Local weather forecast by "City, ST"

ALERT!! A Flood Warning and Flood Advisory are in effect for portions of the area.

View all valid statements/warnings or choose a specific point or river to get the details for that location.

Weather Forecast Office Memphis, TN Lower Mississippi River Forecast Center Southeast River Forecast Center

River Observations River Forecasts Long-Range Flood Risk Precipitation Download

Auto Refresh: OFF

Print this map Permalink Bookmark and Share

Maximum Forecast Flood Category Through: 04/01/2019 15:38:31 UTC

Day 1 2 3 4 5 6 7 8 9 10 11 12 13 **Entire Period**

185 total gauges 32 gauges in flood

Switch Basemap Reset View

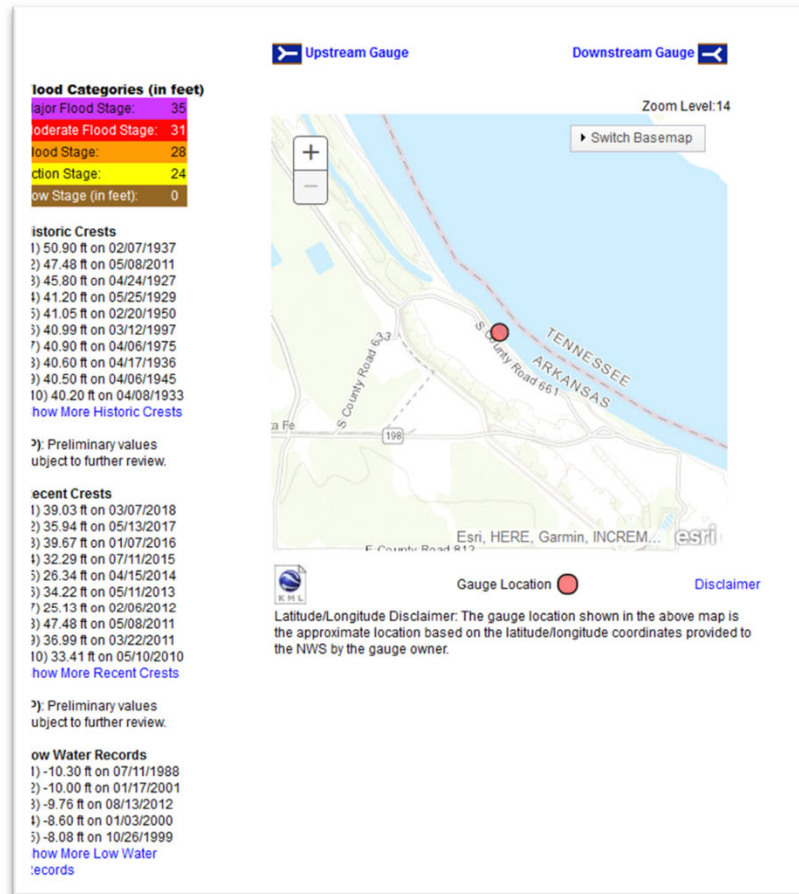
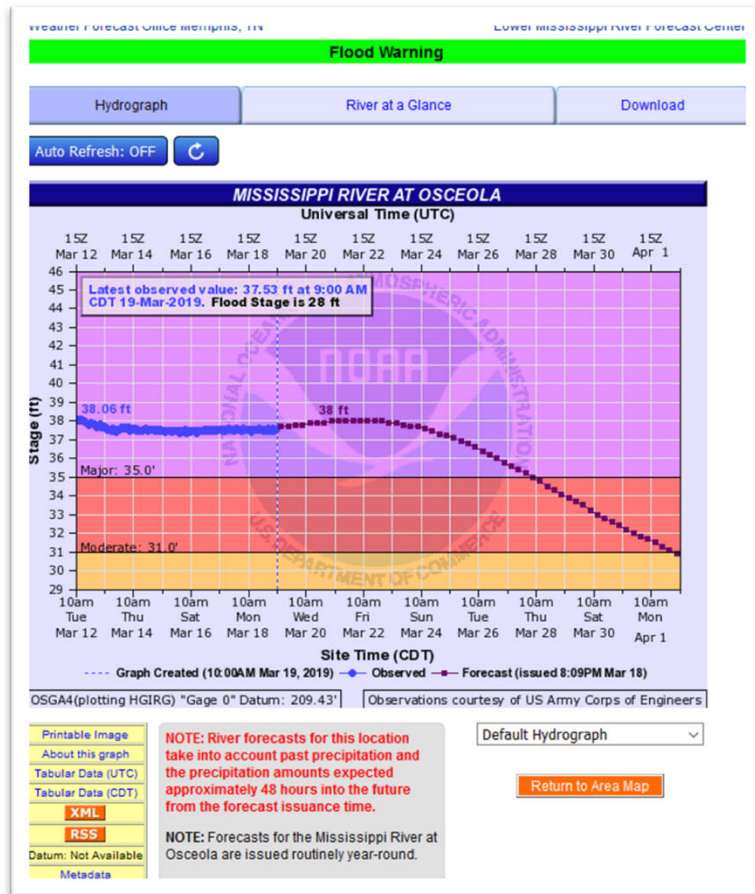
Forecast available
 Probability and forecasts available
 Major Flooding
 Moderate Flooding
 Minor Flooding
 Near Flood Stage
 No Flooding
 Forecasts Are Not Current
 No Forecast Within Selected Timeframe
 Out of Service
 Flood Category Not Defined
 At or Below Low Water Threshold

Last map update: 03/19/2019 at 10:36:37 am CDT 03/19/2019 at 15:36:37 UTC

What is UTC time? Map Help

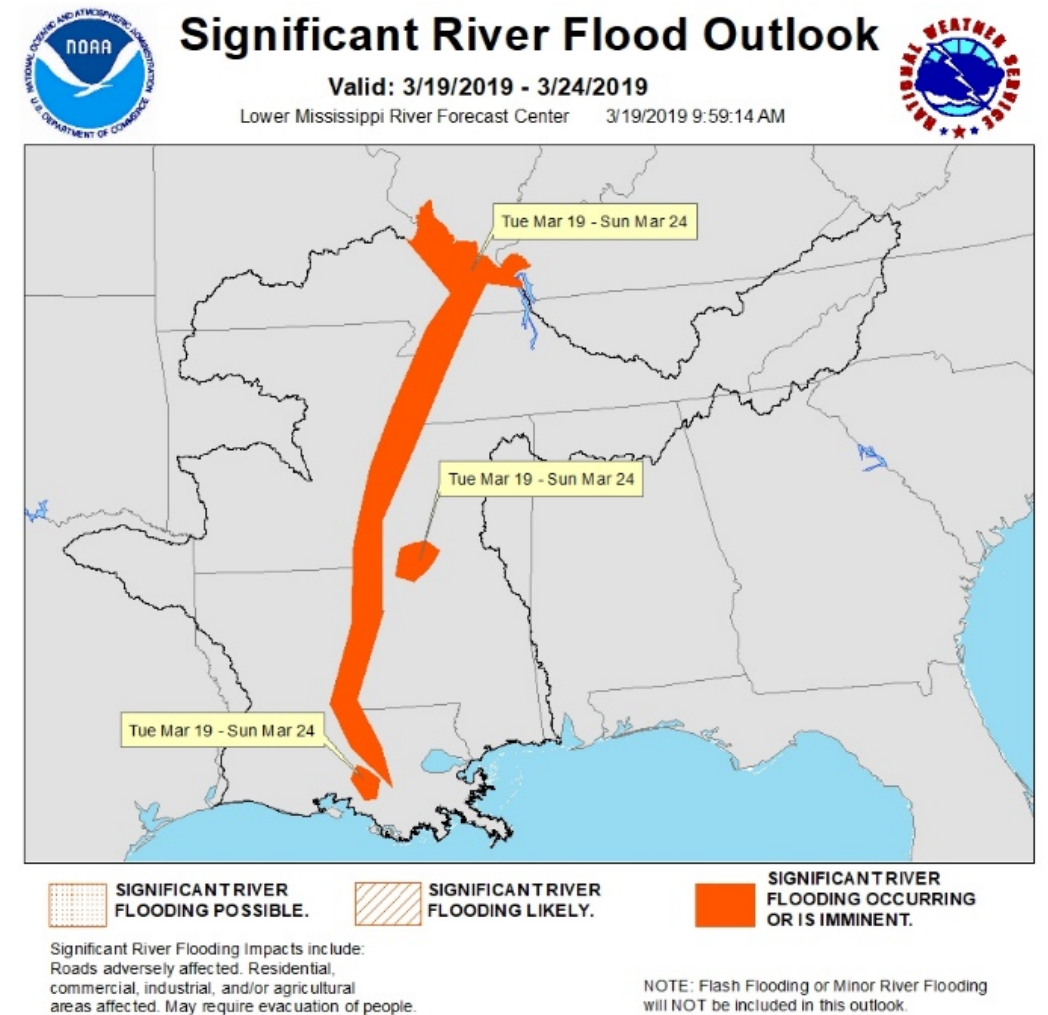
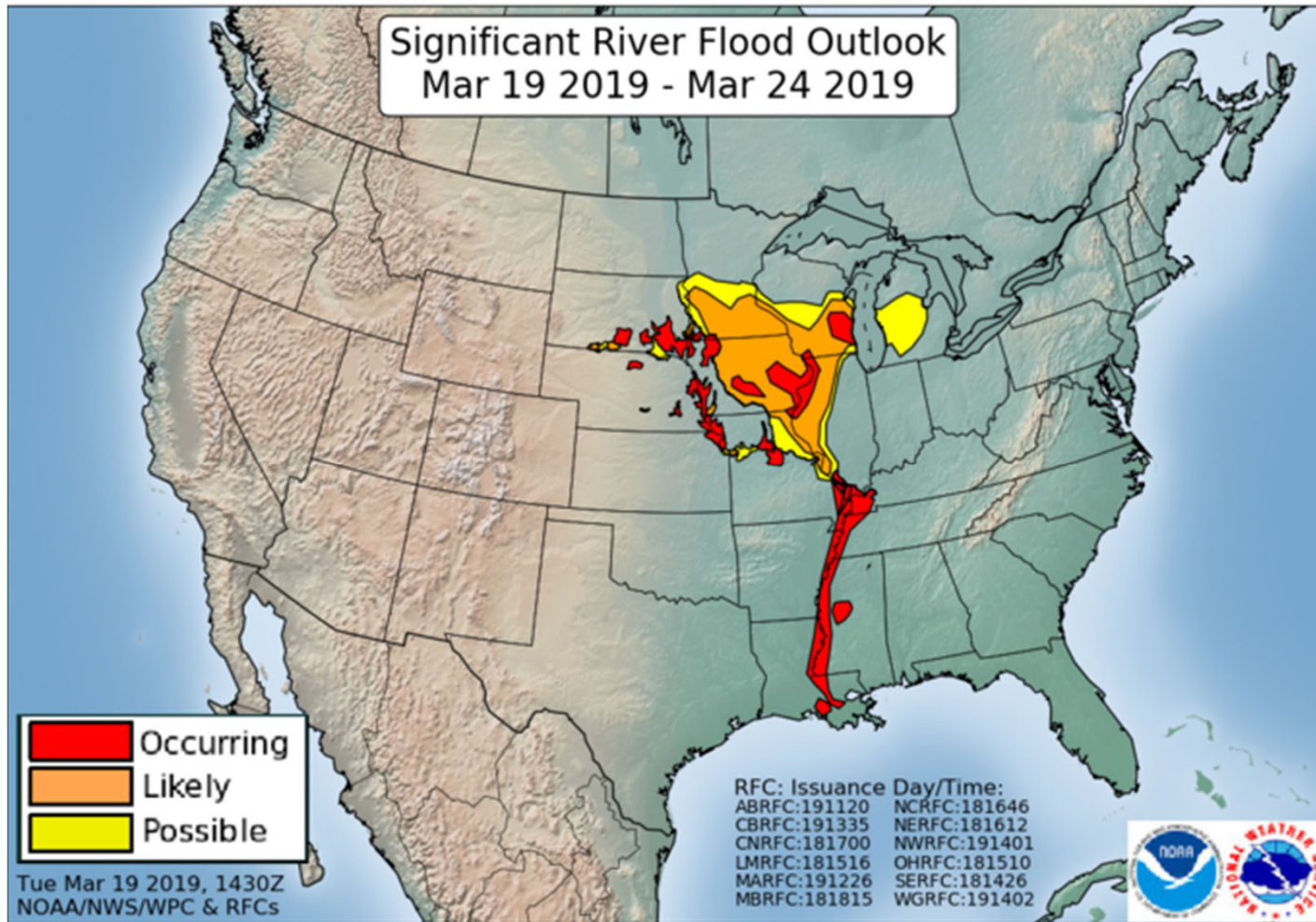
WHEN FLOODED TURN AROUND DON'T DROWN

Monitoring Rivers Demo 2



- Flood Impacts & Photos
- If you notice any errors in the below information, please contact our Webmaster
- 50 All land east of the Arkansas Levee to the Tennessee Bluffs is under 10 to 25 feet of water.
 - 49 Highway 87 is flooded just east of Fulton, Tennessee.
 - 47 Farm headquarters near the intersection of Coon Valley and Herring Hill Roads, Tennessee is being flooded.
 - 46 Water is very high on the Arkansas Levee. All homesteads along Crawford Road West in Tennessee are flooded.
 - 45 Farmstead on Island 37, Tennessee is totally flooded.
 - 44 In Tennessee, camp on Sunrise Towhead is almost all covered. All fields in the Barfield Point area are awash.
 - 43 In Tennessee, all houses along Route 19 are awash. Camp on west side of Island 34 is completely flooded. Water has crept into buildings on the west side of Ballard Slough Road. Many sections of Herring Hill Road are now in deep water.
 - 42 In Tennessee, the house at the south end of Outbounds Road is awash. Fields are flooding north of the Hatchie River east past Ft. Pillow State Prison. Herring Hill Road is flooding just north of the Shelby County Line.
 - 41 In Tennessee, stilt house north of Fullen Landing is being flooded. Houses at the south end of Outbounds Road are flooding as is the homestead at the northeast end of Outbounds Road right on Open Lake. Most of Highway 19 is awash. Most all homesteads north of Fort Pillow are under water. Island 35 is essentially all covered. Bottomland south of Richardson's Landing is under water. In Arkansas, Sans Souci Road is flooding inside the levee. Terminal elevator at Osceola is flooding.
 - 40 In Tennessee, Highway 19 is flooding near the bluff. Water is overflowing a house on Sunk Lake Road. Houses east of Outbounds Road and west of Conner Road are flooding. Houses all along Highway 19 are being covered. Centennial Island is completely flooded. In Arkansas, elevator at Osceola is flooding.
 - 39 In Tennessee, Highway 19 is flooded at Conner Road cutting off evacuations west of that intersection. Crawford Road East is under water at places. Trailer settlement south of Coker Slough is covered. House on east end of Outbounds Road is flooding. Moore Farmstead is being covered. Houses on Cash Road are flooding. Hunting camp on Sunrise Towhead is beginning to flood. Farmstead on Sniper Island west of Herring Hill road is going under water. In Arkansas, farmstead at Tomato is under water.
 - 38 In Tennessee, homesteads between Johnston Road and Sunk Lake Road on Highway 19 west are flooding. House at south end of Oscar Griggs Road is flooding. Ashport is flooding. Flooding is occurring near the north end of Sunk Lake Road. Settlement between Coker Slough and Highway 19 is flooded. Water is overflowing the farm headquarters just north of the Sunk Lake Road and Long Hole Road Junction.

Significant River Flood Outlooks



Flood-Related Watches & Warnings



- **Flood Watch**
 - Conditions are favorable for flash flooding or mainstem river flooding. It does not mean flooding will occur, but it is possible.
- **Flood Warning**
 - Mainstem river flooding is imminent or occurring.
- **Flash Flood Warning**
 - Flash flooding is imminent or occurring. Some roads will be flooded. Homes and businesses may flood.
- **Flash Flood Emergency**
 - A special type of Flash Flood Warning issued for exceedingly rare situations when a severe threat to human life and catastrophic damage from a flash flood is imminent or occurring. At risk individuals should evacuate to higher ground immediately. Travel is discouraged unless the individual is under an evacuation order.

Flash Flood Warnings



FEMA

The National Weather Service in Mount Holly has issued a

- * Flash Flood Warning for...
Northwestern New Castle County in northern Delaware...
Southeastern Berks County in eastern Pennsylvania...
Chester County in southeastern Pennsylvania...
Western Delaware County in southeastern Pennsylvania...
Central Montgomery County in southeastern Pennsylvania...
- * Until 700 PM EDT.
- * At 253 PM EDT, Doppler radar indicated thunderstorms producing heavy rain across the warned area. Between 0.5 and 1 inch of rain has fallen. Flash flooding is ongoing or expected to begin shortly. Additional rainfall is expected over the next couple hours.

HAZARD...Flash flooding caused by thunderstorms.

SOURCE...Radar.

IMPACT...Flooding of small creeks and streams, urban areas, highways, streets, and underpasses as well as other drainage and low lying areas.

- * Some locations that may experience flash flooding include...
Wilmington, Newark, West Chester, Norristown, Pottstown, Phoenixville, Lansdale, West Norriton, East Norriton, Coatesville, Westtown, and Downingtown.

This includes the following highways...
Pennsylvania Turnpike between mile markers 298 and 331.
Interstate 95 in Delaware between mile markers 0 and 19.
Interstate 76 in Pennsylvania between mile markers 327 and 330.
Northeast Extension between mile markers 23 and 30.

This includes the following streams and drainages...
Chester-Sassafras, Crosswicks-Neshaminy, Brandywine-Christina, Schuylkill, Lower Delaware, and Lower Susquehanna.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Turn around...don't drown when encountering flooded roads. Most flood deaths occur in vehicles.

[Block of lat lon coordinates would appear here]

FLASH FLOOD...RADAR INDICATED

General Location

How long the hazard will last

Situation & Flood Type

Potential/Expected Impacts

More Specific Locations
(Towns, roadways,
streams/basins, etc.)

Tags

Flash Flood Emergencies



FEMA

...**FLASH FLOOD EMERGENCY** FOR MONTGOMERY COUNTY...

...FLASH FLOOD WARNING REMAINS IN EFFECT UNTIL 845 PM EDT THIS EVENING FOR NORTHEASTERN CHESTER, NORTHWESTERN DELAWARE, AND MONTGOMERY COUNTIES...

At 621 PM EDT, Thunderstorms are producing heavy rain in Northern Chester County and Southern Montgomery County. Between 3 and 4.5 inches of rain have fallen. Additional rainfall amounts of 1.5 to 3 inches are possible in the warned area. Flash flooding is already occurring. **Over 30 water rescues are ongoing in portions of Montgomery County.**

This is a **FLASH FLOOD EMERGENCY** for Montgomery County. **This is a PARTICULARLY DANGEROUS SITUATION. SEEK HIGHER GROUND NOW!**

HAZARD...**Life threatening** flash flooding caused by thunderstorms.

SOURCE...Emergency management reported.

IMPACT...This is a **PARTICULARLY DANGEROUS SITUATION. SEEK HIGHER GROUND NOW! Life threatening** flash flooding of low water crossings, small creeks and streams, urban areas, highways, streets, and underpasses.

Some locations that may experience flash flooding include...
West Chester, Norristown, Pottstown, Phoenixville, Lansdale, West Norriton, East Norriton, Westtown, Downingtown, Souderton, Ambler, and Collegeville.

This includes the following highways...
Pennsylvania Turnpike between mile markers 307 and 333.
Interstate 76 in Pennsylvania between mile markers 327 and 330.
Interstate 476 in Pennsylvania between mile markers 17 and 19.
Northeast Extension between mile markers 21 and 38.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

Move to higher ground now! This is an extremely dangerous and life-threatening situation. Do not attempt to travel unless you are fleeing an area subject to flooding or under an evacuation order.

Turn around...don't drown when encountering flooded roads. Most flood deaths occur in vehicles.

Motorists should not attempt to drive around barricades or drive cars through flooded areas.

[Block of lat lon coordinates would appear here]

FLASH FLOOD...OBSERVED
FLASH FLOOD DAMAGE THREAT...**CATASTROPHIC**

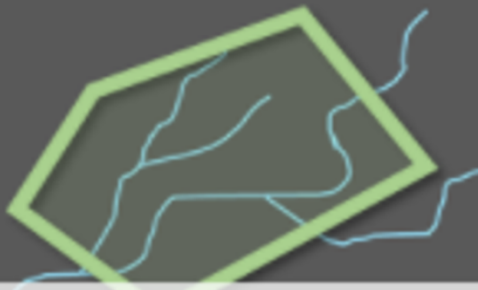
Red lettering, bolding and underlining added for emphasis.

“Tagging” Flash Flood Warnings for WEAs.



FEMA

Flash Flood Warnings will be tagged based upon expected severity.



FLASH FLOOD... OBSERVED
FLASH FLOOD DAMAGE THREAT... CONSIDERABLE



Wireless
Emergency
Alert (WEA)

Flash Flood Severity

Lowest

Highest

Flash Flood Warning

Flash Flood Warning
“**CONSIDERABLE**” Damage Tag



Flash Flood Emergency
“**CATASTROPHIC**” Damage Tag



Flood Warnings for Mainstem Rivers



FEMA

Current flood stage
and/or forecast flood
stage

How long the
flooding will last

Impacted river and
communities

Impacts

Additional
Details

```

ARC067-147-271600-
/O.EXT.KLZK.FL.W.0003.000000T0000Z-220128T1200Z/
/PTTA4.2.ER.220103T0945Z.220109T1530Z.220127T0600Z.NO/
952 AM CST Wed Jan 26 2022

...FLOOD WARNING NOW IN EFFECT FROM THIS MORNING THROUGH LATE
THURSDAY NIGHT...

* WHAT...Minor flooding is occurring and minor flooding is forecast.
* WHERE...Cache River Near Patterson.
* WHEN...Until Friday morning.
* IMPACTS...At 9.0 feet, Low swampy timberland along the river
begins to flood. Flood gates should be closed and equipment moved
out of the low grounds along the river and tributaries.
* ADDITIONAL DETAILS...
- At 9:15 AM CST Wednesday the stage was 9.2 feet.
- Forecast...The river is expected to fall below flood stage
just after midnight tonight and continue falling to 6.3 feet
Monday morning.
- Flood stage is 9.0 feet.
- http://www.weather.gov/safety/flood

&&

      Fld   Observed      Forecast 12 PM      Crest
Location Stg   Stg Day/Time  Thu  Fri  Sat  Crest Time  Date
Cache River
Patterson 9.0   9.2  Wed 9 AM  8.8  8.5  7.8      Falling
    
```




Local NWS Weather Forecast Office addresses:

- More detailed localized forecast information?

Hurricane Local Statements



FEMA

 **NATIONAL HURRICANE CENTER**
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

HURRICANE WILMA LOCAL STATEMENT ADVISORY NUMBER 32
NATIONAL WEATHER SERVICE MIAMI FL AL242005
530 AM EDT SUN OCT 23 2005

THIS PRODUCT COVERS MAINLAND SOUTH FLORIDA

EXTENSIVE TO DEVASTATING DAMAGE AND LIFE-THREATENING CONDITIONS EXPECTED AS HURRICANE WILMA MOVES NORTHEAST ACROSS SOUTH FLORIDA

NEW INFORMATION

* CHANGES TO WATCHES AND WARNINGS:
- A HURRICANE WATCH HAS BEEN UPGRADED TO A HURRICANE WARNING FOR MIAMI-DADE...BROWARD...PALM BEACH...COLLIER...GLADES AND MONROE COUNTIES

* CURRENT WATCHES AND WARNINGS:
- A HURRICANE WARNING IS IN EFFECT FOR MIAMI -DADE...BROWARD...PALM BEACH...COLLIER...HENDRY...GLADES AND MAINLAND MONROE COUNTIES

* STORM INFORMATION:
- ABOUT 405 MI SW OF NAPLES FL
- 22.1N 86.6W
- STORM INTENSITY 100 MPH WITH HIGHER GUSTS
- MOVING NORTHEAST AT 3 MPH

SITUATION OVERVIEW

EXTREMELY DANGEROUS HURRICANE WILMA IS EXPECTED TO IMPACT SOUTH FLORIDA BEGINNING THIS EVENING. THE MAIN CONCERN IS FOR LIFE-THREATENING INUNDATION IN SURGE-PRONE AREAS OF COLLIER/MAINLAND

Issued by local NWS office

- Hurricane (Tropical Storm) Watch/Warning in effect



Situation overview

- Watch/warning information
- Potential impact information
- Preparedness actions

Hurricane Local Statements: Where is affected?



FEMA

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What is the
affected area?

Hurricane Local Statements: Any changes?



FEMA



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Are there any
changes since
the last update?

NWS Email Briefings & Webinars



Most NWS Weather Forecast Offices (WFOs) and River Forecast Centers (RFCs) issue routine briefings for hazardous weather.

These briefings provide information on:

- Timing and Location of Hazards
- Range of Outcomes
- Expected Impacts
- Relevant Forecast Graphics
- Watches/Warnings/Advisories
- Forecast Challenges / Uncertainty / Confidence Levels
- Additional Information

Offices send briefing information to core partners

- EMs, other public safety officials, school officials, etc.

Contact your WFO and RFC to ask about being added to their email/webinar briefing list!

Heavy Rain Possible Next Week
Central Pennsylvania
WEATHER FORECAST OFFICE

OVERVIEW:

- Hurricane Isaias (ees-ah-EE-ahs) is expected to move north along the east coast and bring the potential for heavy rain in east-central PA early next week.
- The storm is still several days away. Please continue to monitor the forecast as a westward shift in the track could mean more significant impacts in Central PA.

TIMING & LOCATION	<ul style="list-style-type: none"> ▪ The current forecast track brings the storm along the east coast, with impacts being felt in Pennsylvania as early as Monday night and as late as Wednesday morning.
HAZARDS & IMPACTS	<ul style="list-style-type: none"> ▪ Heavy rainfall appears to be the most significant threat at this time, with the westward extent of impacts still uncertain. ▪ Gusty winds are also possible, especially in eastern PA.
FORECAST CHALLENGES	<ul style="list-style-type: none"> ▪ Small tweaks to the storm track and intensity are likely over the next few days. Continue to monitor the forecast. ▪ The interaction between Isaias and a cold front approaching from the west will determine the extent and intensity of heavy rainfall.
ADDITIONAL INFORMATION	<ul style="list-style-type: none"> ▪ Note that the forecast cone represents the probable track of the CENTER of a tropical cyclone. ▪ Impacts often occur well outside of the cone.
NEXT BRIEFING	<ul style="list-style-type: none"> ▪ By 6PM Saturday 8/1

ISSUED: 7/31/2020 3:31 PM
www.weather.gov/ctp/tropical

Post-Storm Reports



FEMA

Post-storm reports address:

- What information is available after the storm?
- Where can I find summary information?

Tropical Cyclone Reports

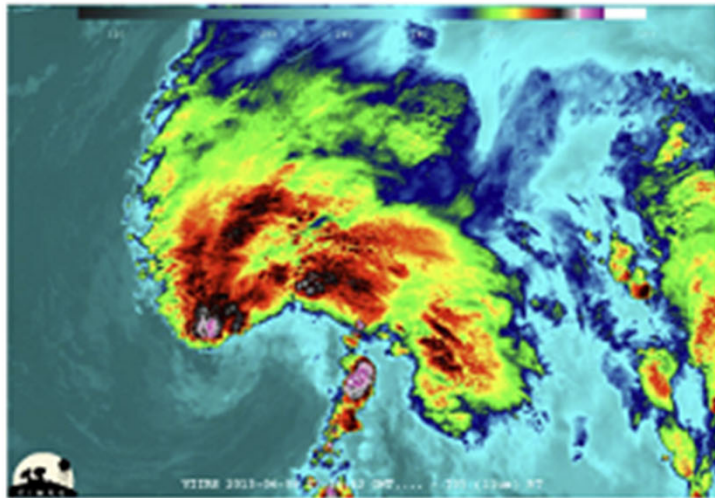


NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

TROPICAL STORM ANDREA
(AL012013)

5 – 7 June 2013

John L. Beven II
National Hurricane Center
22 August 2013



Andrea was a tropical storm that made landfall on the northwest coast of the Florida Peninsula. It became a gale-force extratropical low over the southeastern United States.

Summary Report

Available on the NHC website weeks to months after storm

Provides a complete summary report for every Atlantic and East Pacific storm

- Final track, intensity, and size information
- Damage and casualty figures
- Forecast critique

NWS Products – When is Key Info Available?



FEMA

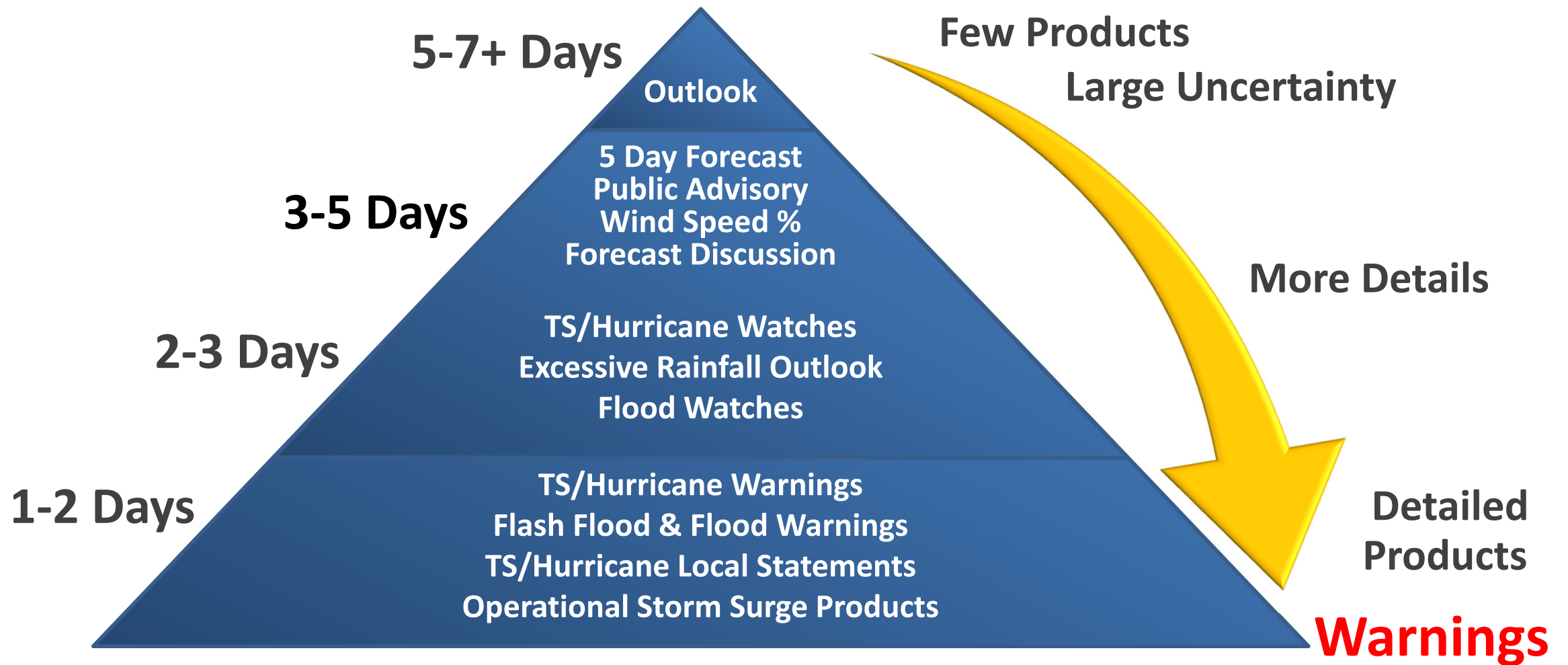
Year Round	Hurricane Season	120hr - 72hr	72hr - 48hr	48hr - 36hr	36hr - Onset of TS Winds	Post Landfall
Hurricane Evacuation Study (HES) products (Surge MOMs, Surge Maps, Evacuation Zones, Clearance times, other planning data)						
Flood Inundation Mapping (FIM) – for select river stretches						
Flood Insurance Studies and FEMA Hazard Risk Areas						
Tropical Weather Outlook						
		Public Advisory				
		Forecast Discussion				
		Wind Speed Probabilities				
		Track and Cone				
		Probabilistic wind timing via Hurrevac				
		QPF Rainfall forecasts				
		Wind timing via Hurrevac				Extreme Wind Warnings
		Surge MEOs				Tide Gauges/ USGS
		Excessive Rainfall Outlooks				Flash Flood Warnings
		River Forecasts				River Flood Warnings
				TS/Hurricane Watches	TS/Hurricane Warnings	
				Hurricane Local Statements		
				Storm Surge Probabilities & Inundation Map		
				Storm Surge Watch	Storm Surge Warning	
						Tornado Watches & Warnings



Tropical Cyclone NWS Products Timeframe



FEMA



Questions/Comments?



FEMA

A composite image showing a screenshot of the National Hurricane Center website on the left and a blue "EVACUATION ROUTE" sign with a right-pointing arrow on the right. The website screenshot includes the title "National Weather Service National Hurricane Center", navigation tabs for "Home", "News", "Organization", and "Search", and a "Top News of the Day" section with several bullet points. Below the news is a map titled "Atlantic Tropical Cyclone Activity" showing the Atlantic Ocean and the eastern United States, with a red dot labeled "ARTHUR" off the coast. The sign is circular with a hurricane icon and the text "EVACUATION ROUTE" in white on a blue background, with a rectangular sign below it showing a white arrow pointing right on a blue background. The background of the entire image is a faded satellite image of a hurricane.