



NWS Season Outlook and Update

Nick Petro, NWS Raleigh

Eric Seymour, NWS Wakefield, VA

Erik Heden, NWS Newport-Morehead City, NC



Outline

- Part 1: Spring and Summer Season Outlook (Nick)
- Part 2: New Tropical Program Products, Services, and Changes for the 2023 Hurricane Season (Eric S)
- Part 3: Outreach and educational efforts in underserved communities (Erik H)



Part 1

Spring and Summer Season Outlook Nick Petro, NWS Raleigh, NC

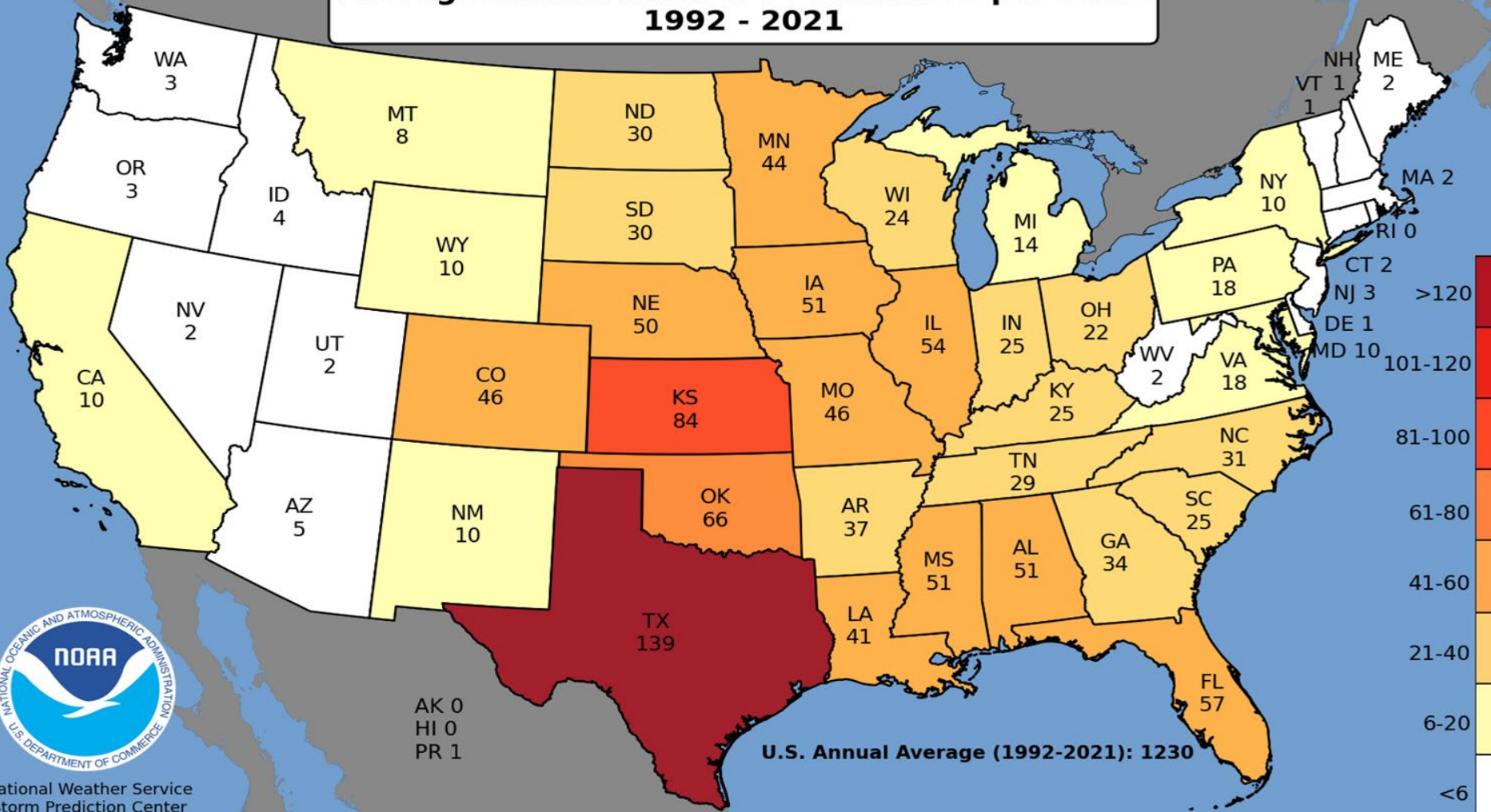




Tornadoes

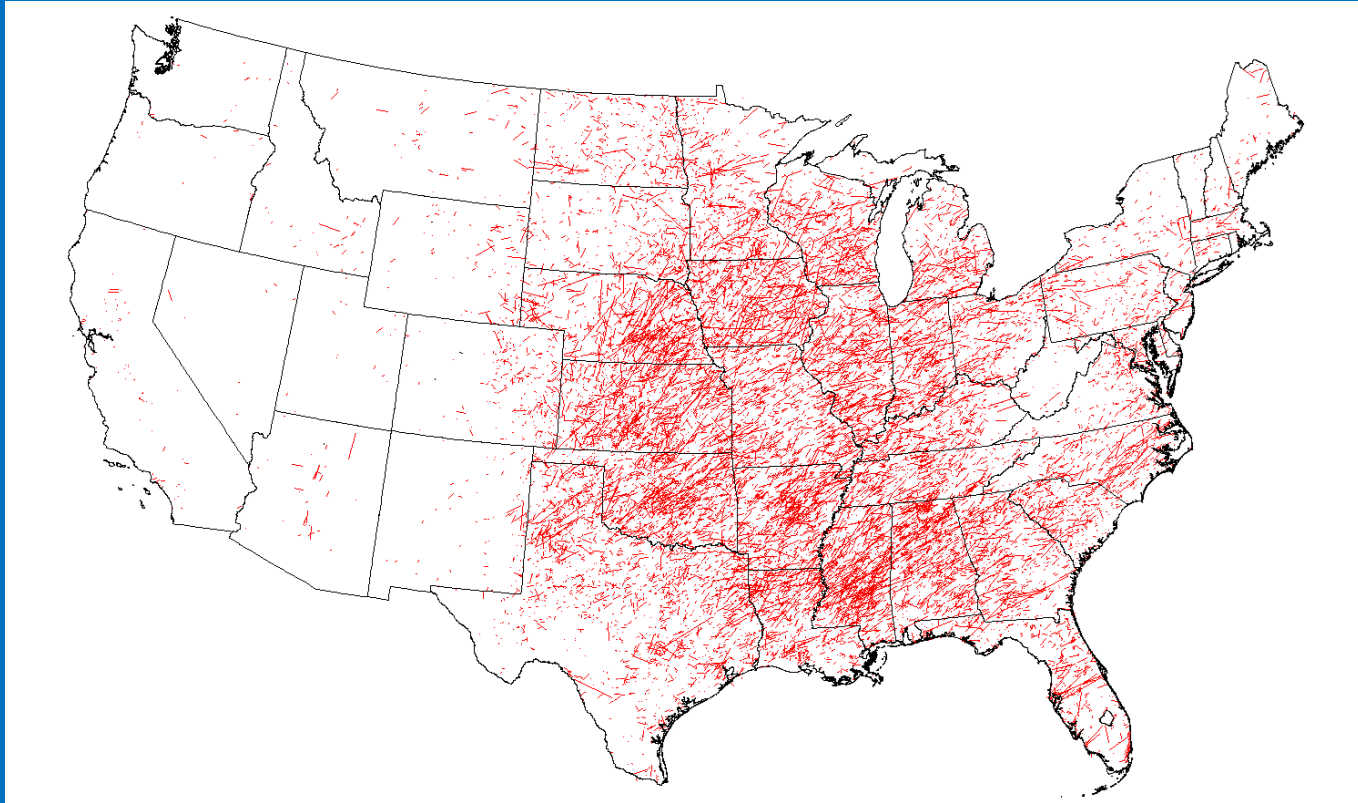


Average Annual Number of Tornadoes per State 1992 - 2021



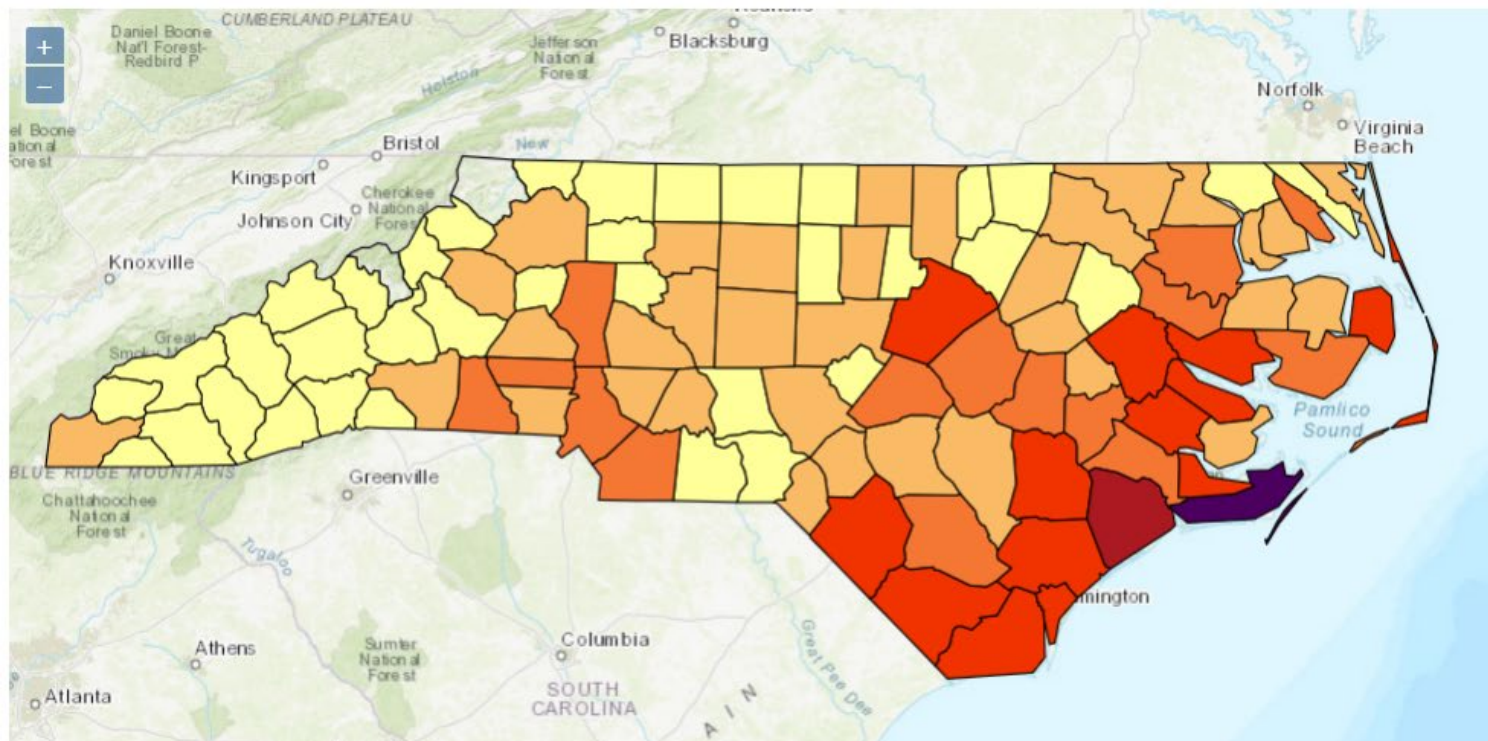


Tornado Tracks 1950-2021





NC Tornadoes 1950-2021



Tornado Reports by County

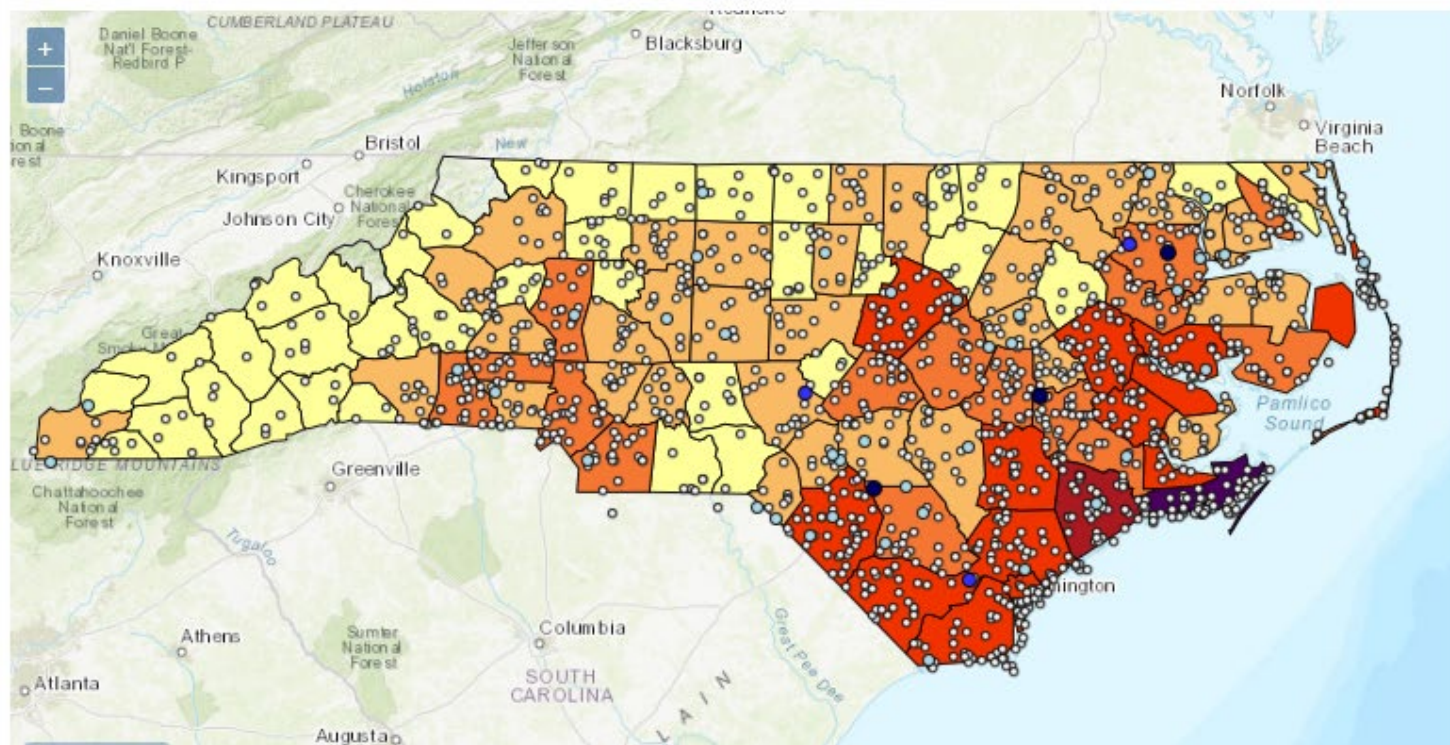
- 1 to 8 reports (37)
- 9 to 16 reports (34)
- 17 to 28 reports (15)
- 29 to 44 reports (11)
- 45 to 64 reports (1)
- ≥ 65 reports (1)





NC Tornadoes & Fatalities

Map of Storm Reports



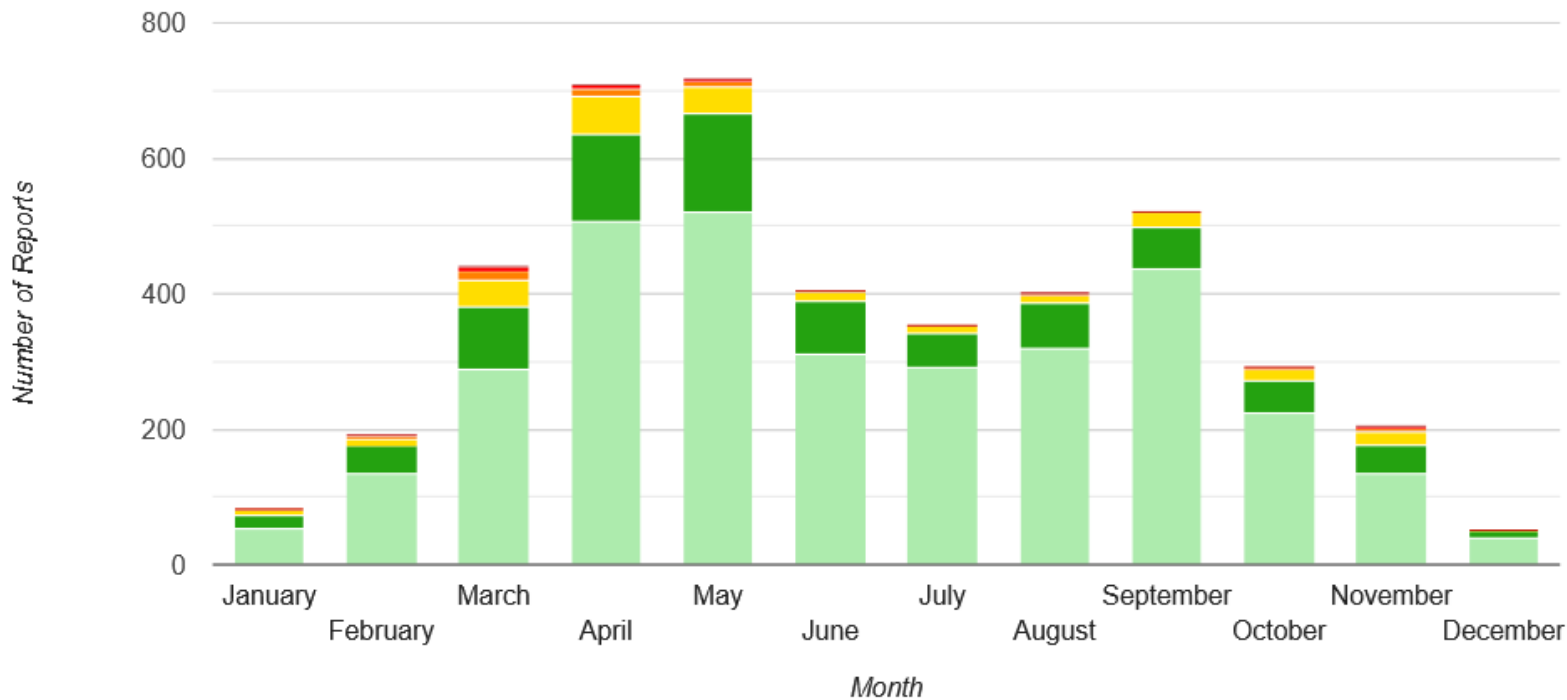
Legend


- Tornado Fatalities**
- 0 fatalities (1408)
 - 1 to 4 fatalities (39)
 - 5 to 9 fatalities (3)
 - 10 to 24 fatalities (3)
 - 25 to 49 fatalities
 - ≥ 50 fatalities
- Tornado Reports by County**
- 1 to 8 reports (37)
 - 9 to 16 reports (34)
 - 17 to 28 reports (15)
 - 29 to 44 reports (11)
 - 45 to 64 reports (1)
 - ≥ 65 reports (1)








Tornado Reports by Month





North Carolina's 6 Largest Tornado Outbreaks



- 
1. April 16, 2011 - 30 tornadoes (24 deaths and over 300 injuries)
 2. May 7, 1998 - 20 tornadoes (western Piedmont and Foothills region & EF4 Caldwell)
 3. April 15, 1996 - 18 tornadoes (all east of I-95)
 4. September 15, 1999 - 17 tornadoes (Floyd)
 5. April 13, 2020 - 16 tornadoes (AM hours)
 6. March 28, 1984 - 14 tornadoes (deadliest - 42 killed)
- 

Damaging Thunderstorm Winds

Can be as powerful as a tornado's winds

40-50 mph



Small branches and debris

50-60mph



Large branches

60-70mph



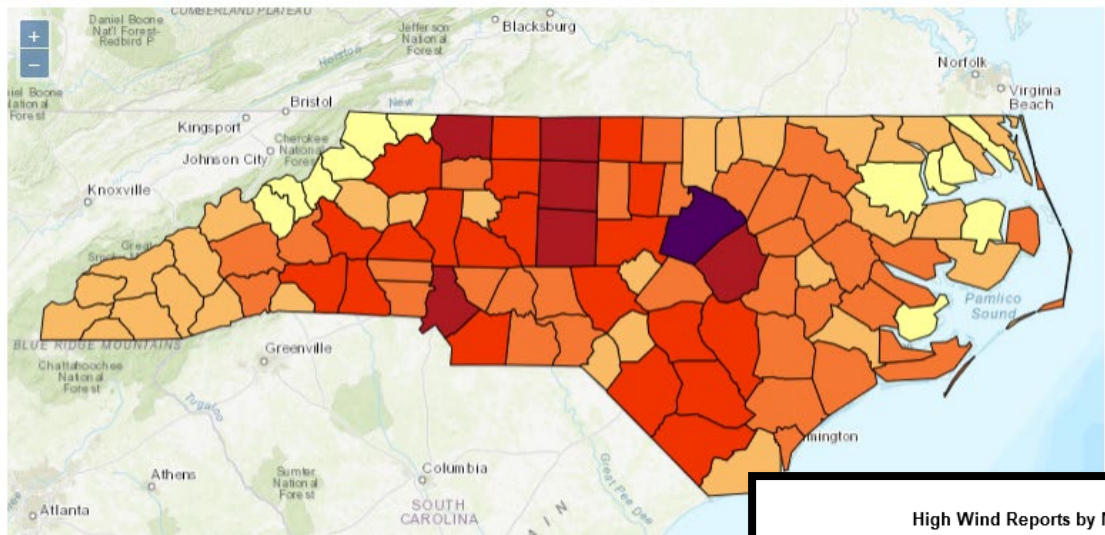
Small structural damage, small trees

>70mph



Significant Property damage

Map of Storm Reports

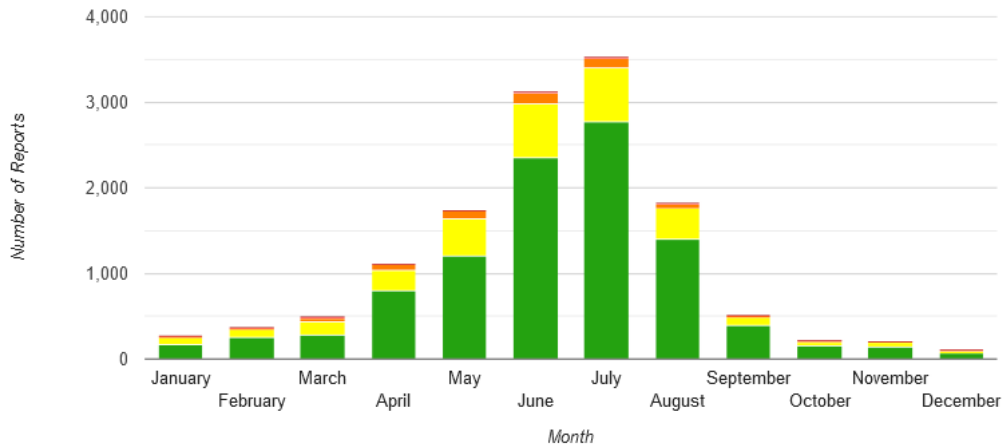


Legend

High Wind Reports by County

- 1 to 48 reports (62)
- 49 to 96 reports (30)
- 97 to 167 reports (31)
- 168 to 262 reports (20)
- 263 to 381 reports (6)
- ≥ 382 reports (1)

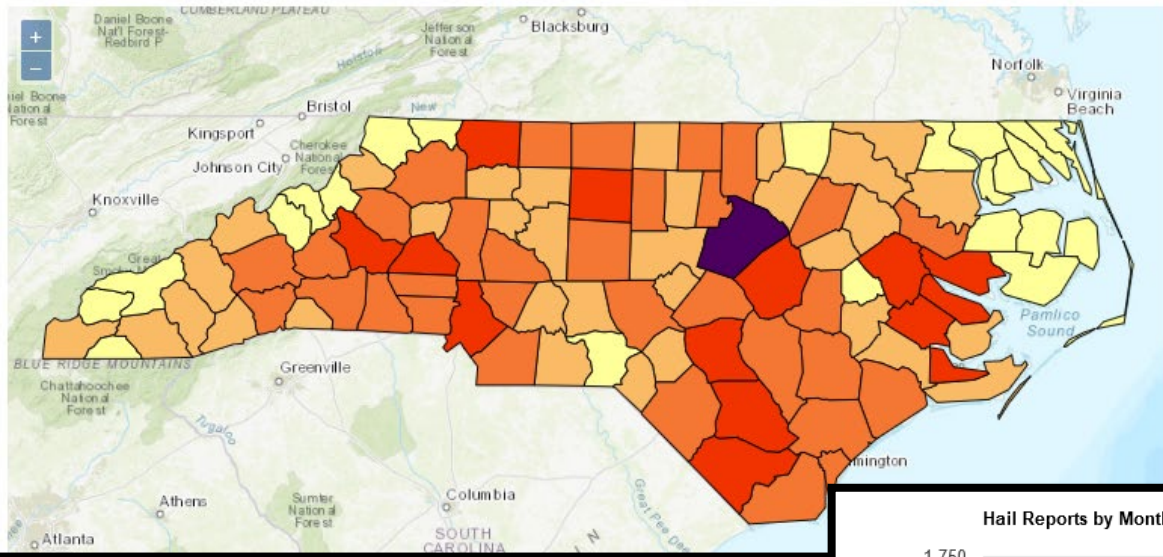
High Wind Reports by Month



Hail Damage Potential



Map of Storm Reports

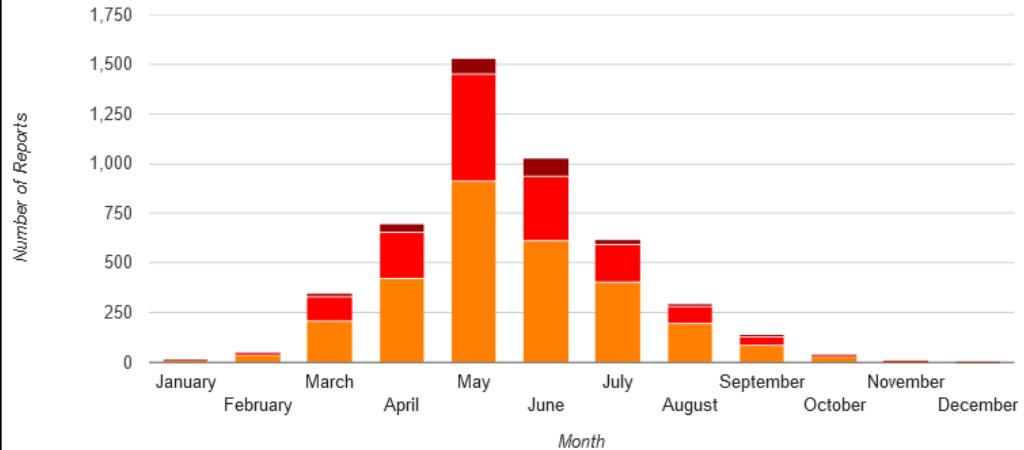


Legend

Hail Reports by County

- 1 to 22 reports (61)
- 23 to 44 reports (33)
- 45 to 77 reports (32)
- 78 to 121 reports (12)
- 122 to 176 reports
- ≥ 177 reports (1)

Hail Reports by Month

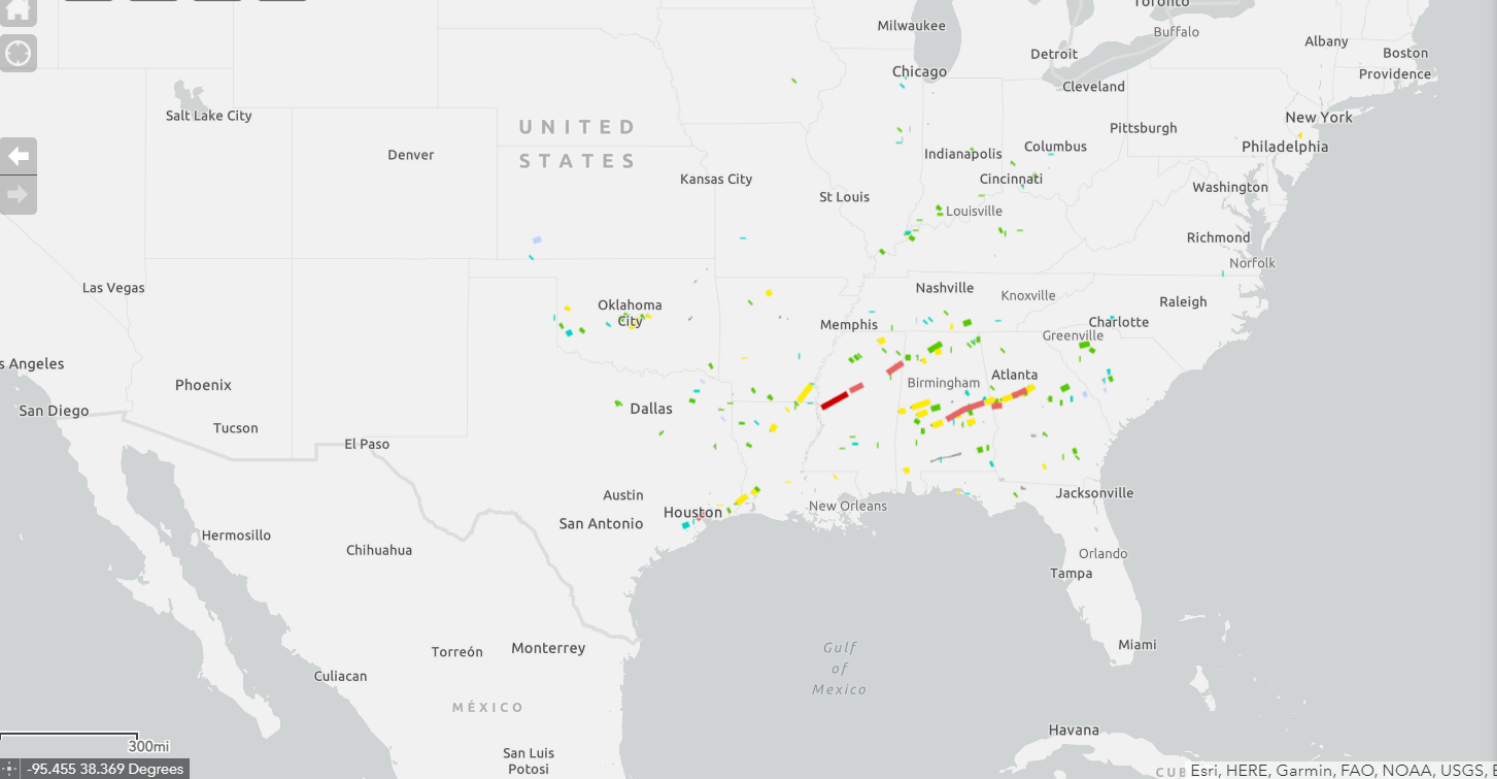




What will this Spring Bring?



Find address or place



Legend

Damage Viewer - Damage Lines SDE

- EF5
- EF4
- EF3+
- EF3
- EF2
- EF1
- EF0
- TSTM/Wind
- N/A

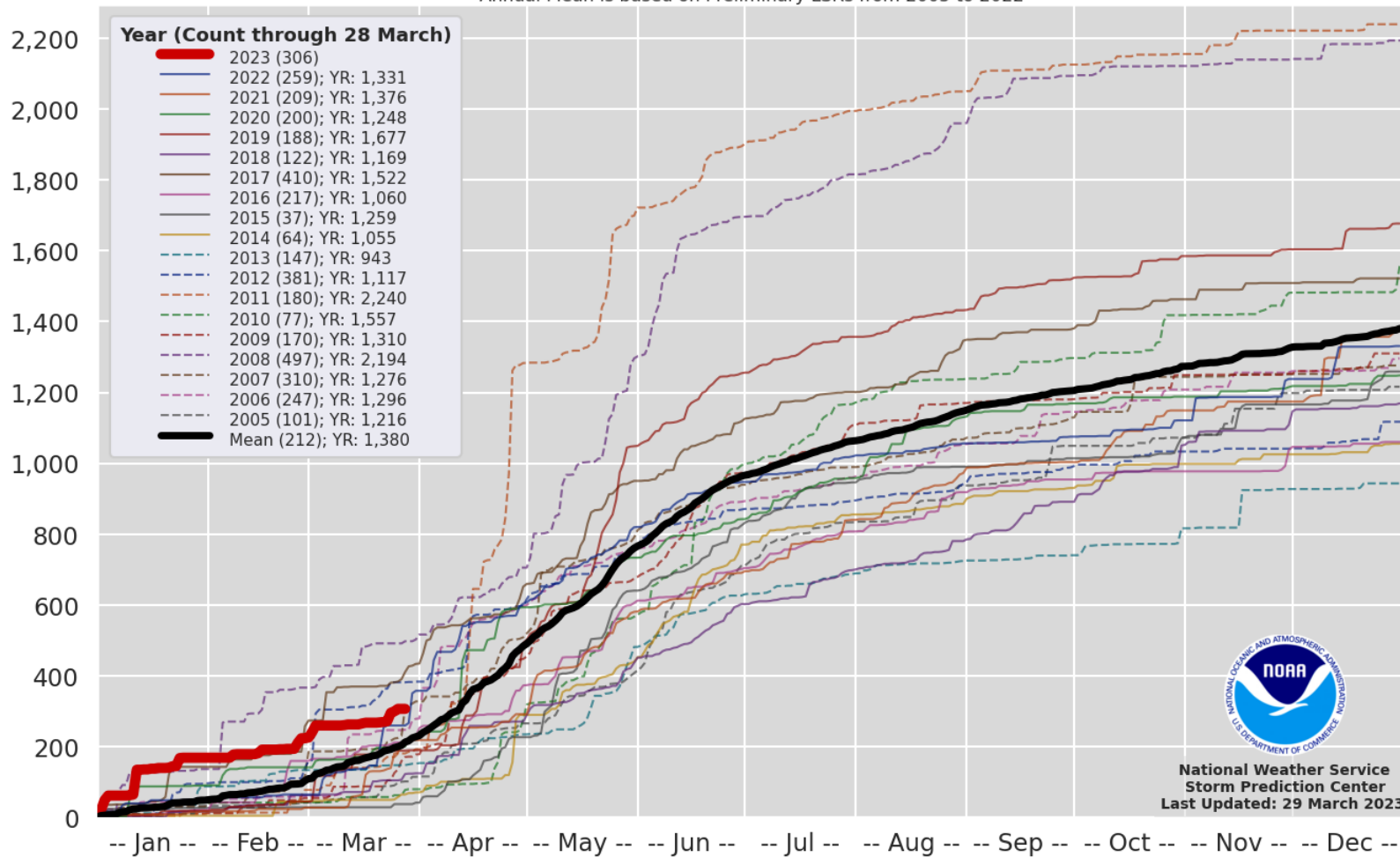
Damage Viewer - Damage Polygons SDE

- EF5
- EF4
- EF3+
- EF3
- EF2
- EF1
- EF0
- TSTM/Wind
- N/A

300mi
-95.455 38.369 Degrees

United States Annual Counts of Tornado LSRs*

*Preliminary sightings/events from NWS Local Storm Reports (LSRs)
Annual Mean is based on Preliminary LSRs from 2005 to 2022



Fatal United States tornadoes in 2023



Approximate touchdown location of killer tornadoes in 2023



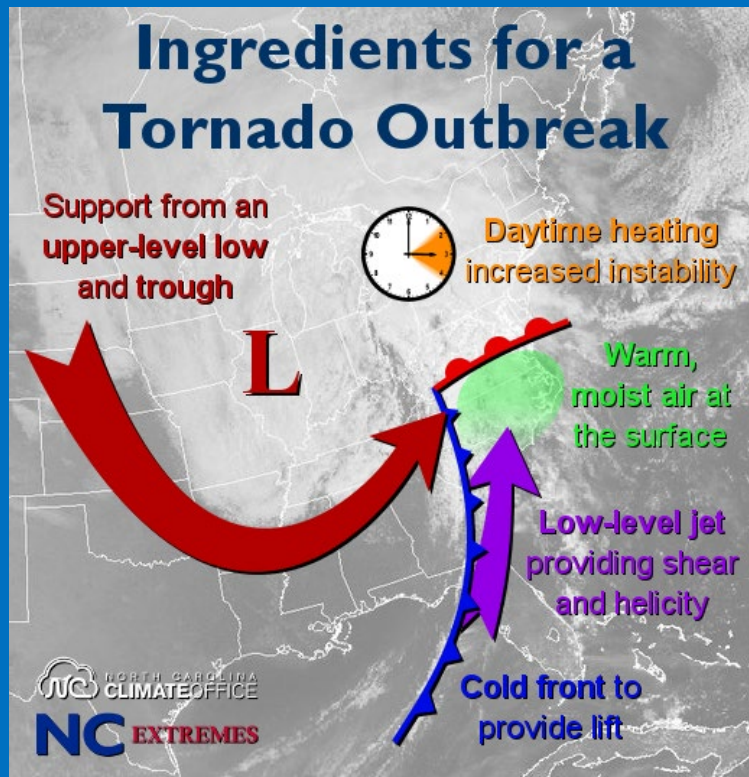
Summary of tornadoes^[4]

- January 12 – Alabama (7 deaths)
- January 12 – Georgia (1 death)
- February 26 – Oklahoma (1 death)
- March 24 – Mississippi (16 deaths)
- March 24 – Mississippi (3 deaths)
- March 24 – Mississippi (2 deaths)
- March 25 – Alabama (1 death)

Total fatalities: 31



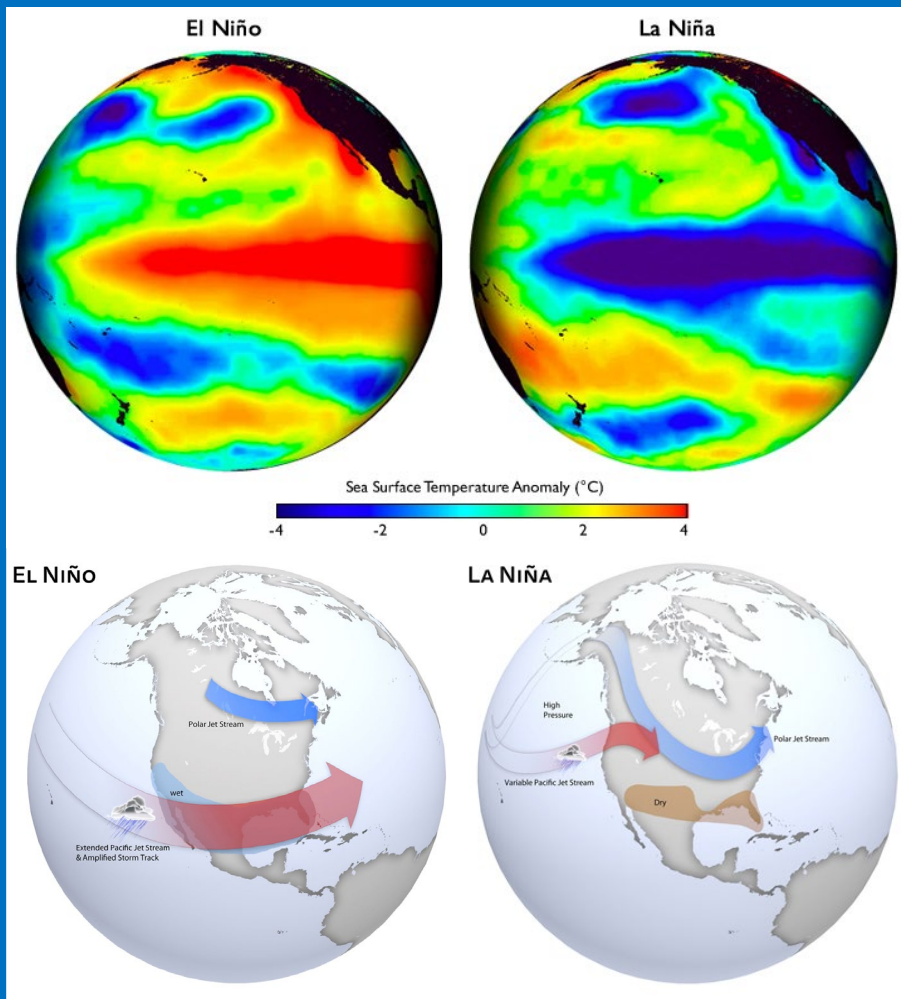
What will this Spring Bring?



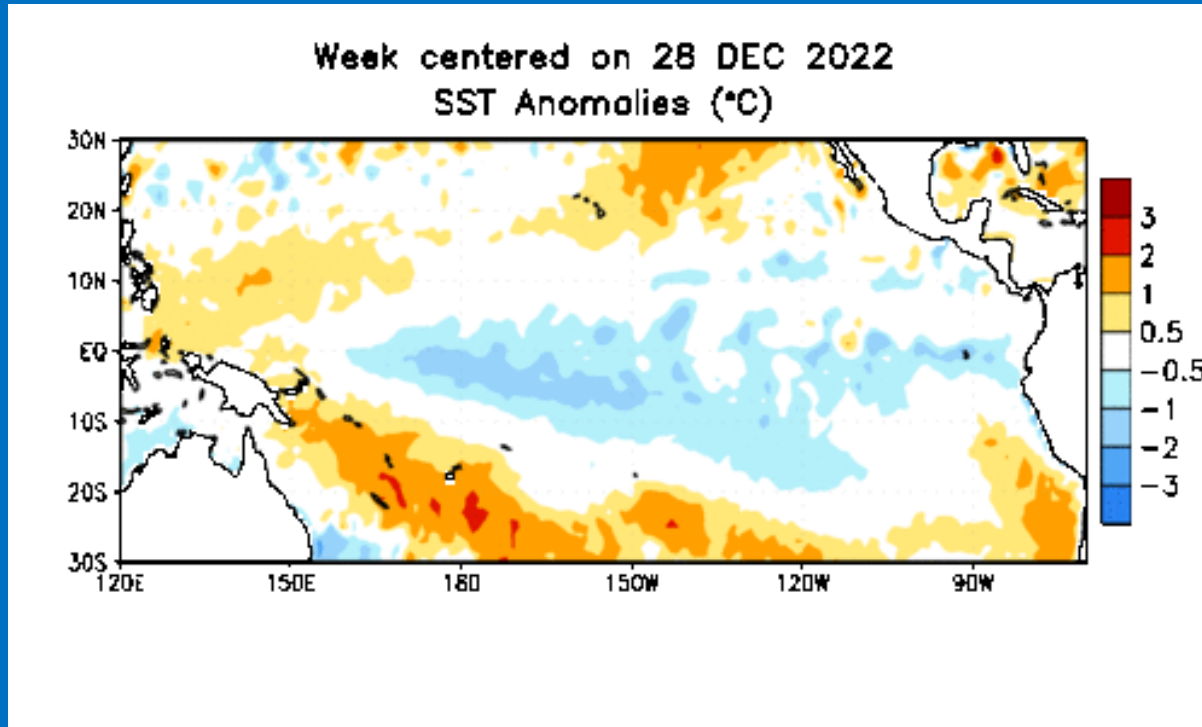


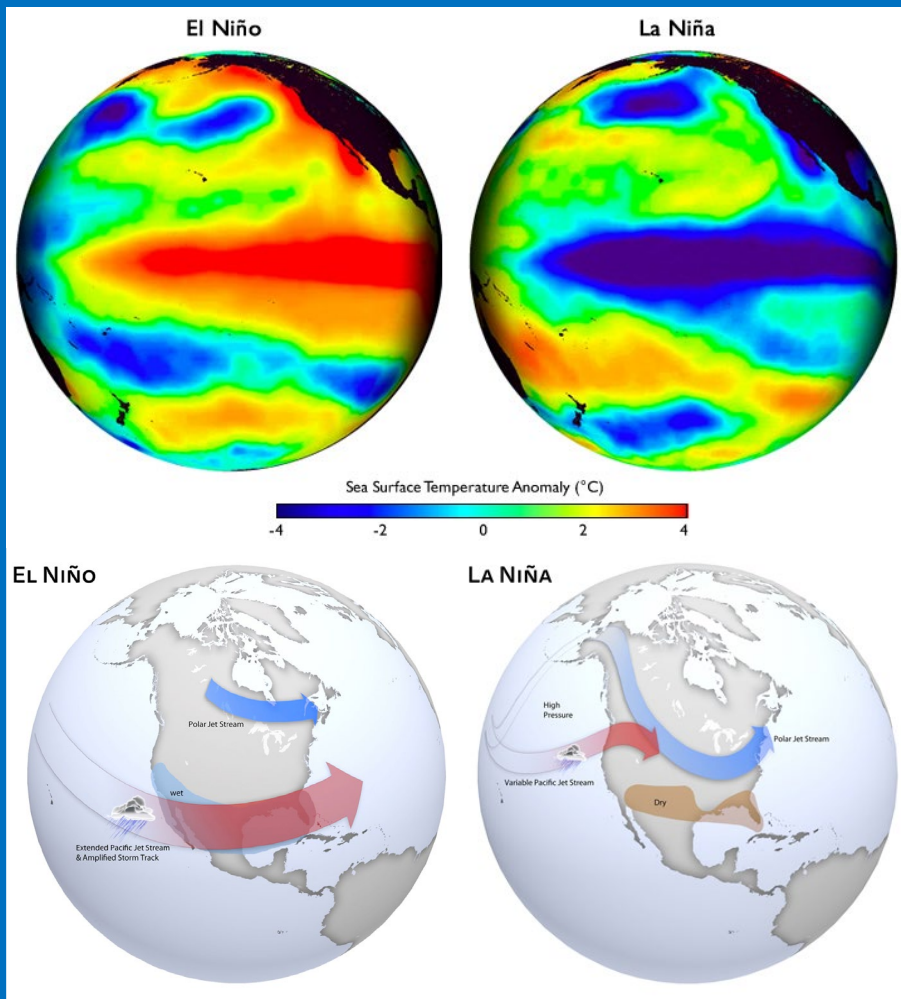
Considerations this Upcoming Hurricane Season?





Current status of ENSO

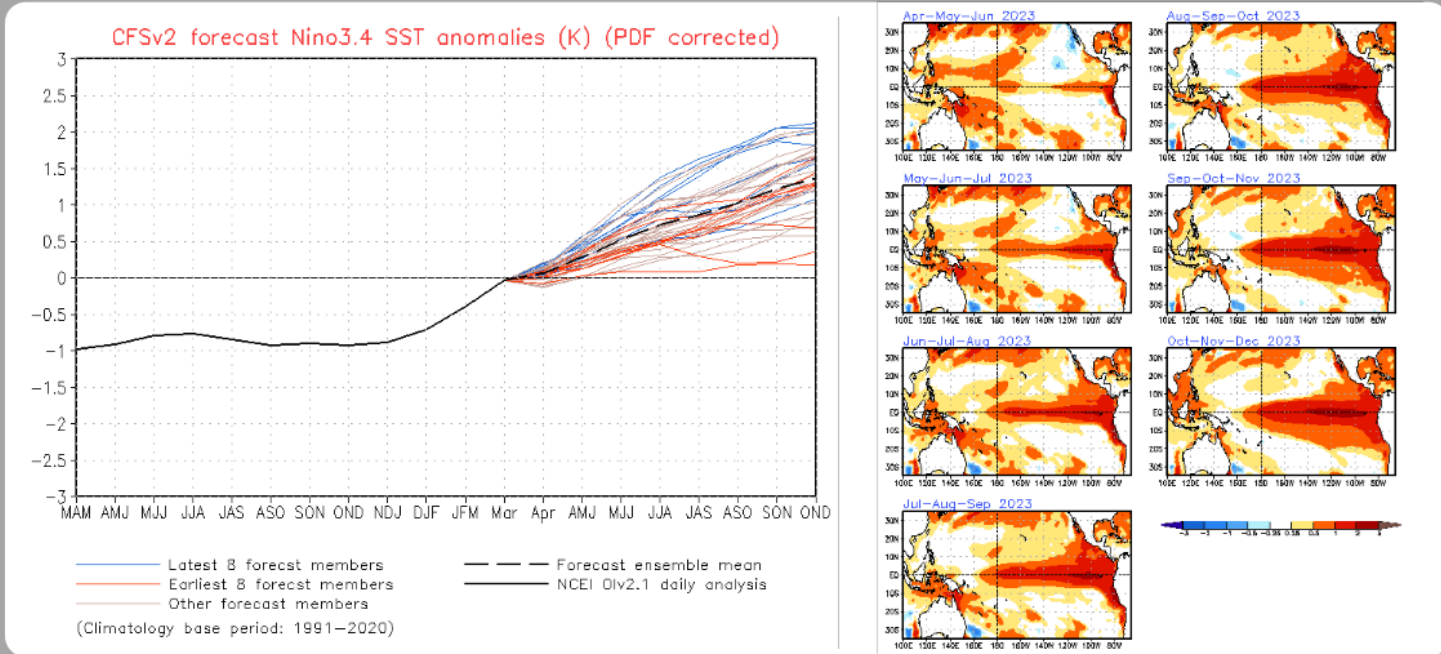




SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)






Issued: 20 March 2023

The CFS.v2 ensemble mean (black dashed line) indicates ENSO-neutral will continue into the Northern Hemisphere early summer, before potentially transitioning to El Niño.





2023 Atlantic Hurricane Season Take-Aways

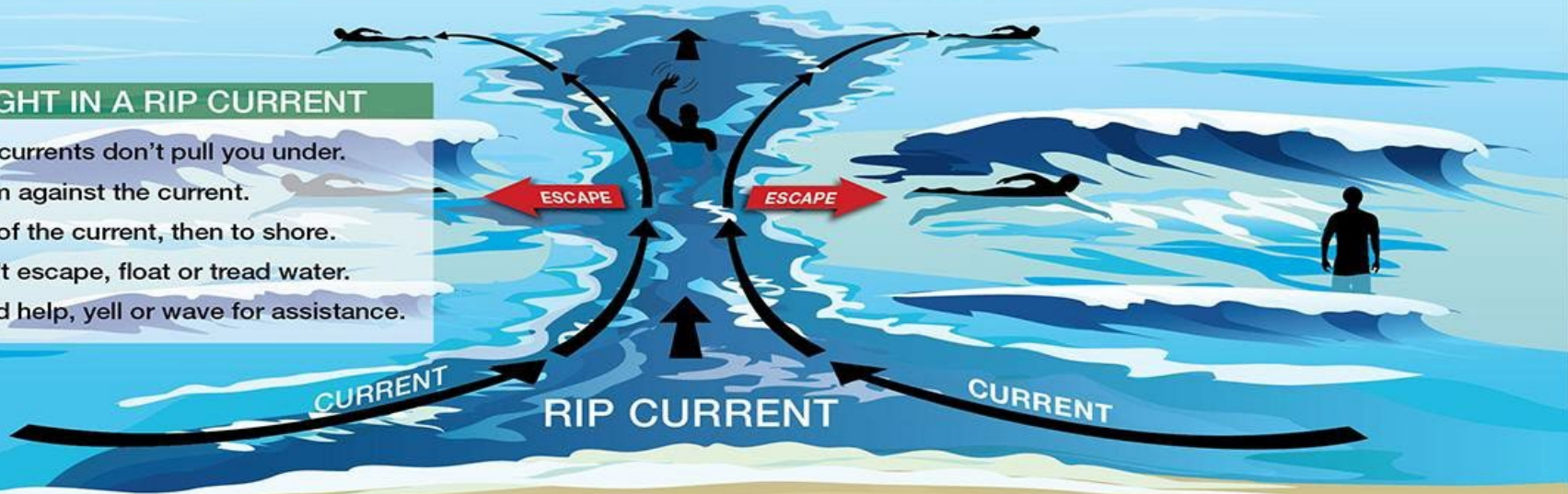
- The official NOAA Hurricane Season Outlook for 2023 will be issued in May
 - La Nina influenced the past three Atlantic hurricane seasons, which were well above normal (2020), above normal (2021), and near normal (2022).
 - A transition to ENSO Neutral is currently happening, with the possibility for El Nino developing later this summer
 - ENSO Neutral conditions, along with other favorable factors, can result in average or perhaps above average number of tropical cyclones in a given season.
 - However, El Nino typically favors below-average hurricane seasons.
 - It's too early to say what this season will be like, but seeing a trend toward El Nino is encouraging.
- 
- 
- 
- 
- 

RIP CURRENTS

KNOW YOUR OPTIONS

IF CAUGHT IN A RIP CURRENT

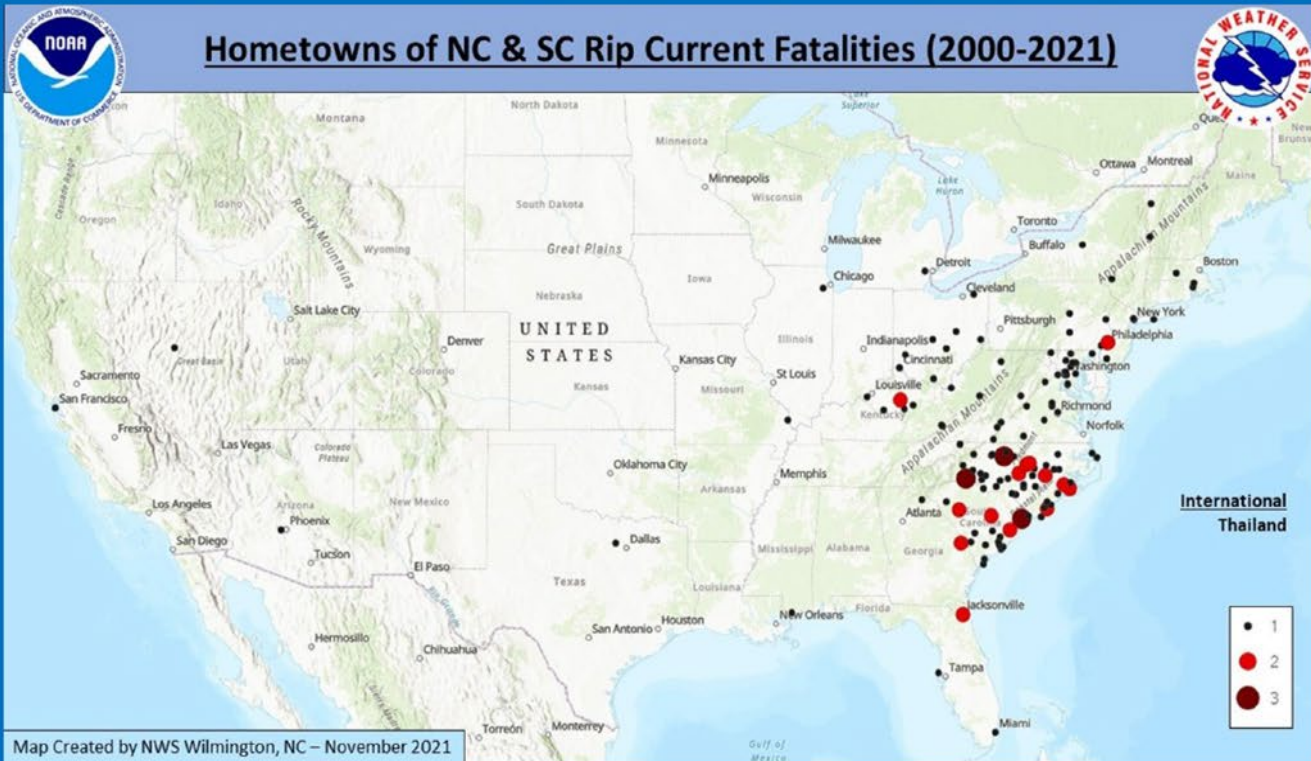
- Relax, rip currents don't pull you under.
- Don't swim against the current.
- Swim out of the current, then to shore.
- If you can't escape, float or tread water.
- If you need help, yell or wave for assistance.



Rip currents are powerful currents of water moving away from shore. They can sweep even the strongest swimmer away from shore. If at all possible, swim near a lifeguard.

Challenges With Messaging

Hometowns of NC & SC Rip Current Fatalities (2000-2021)



- 20% of drowning victims are from coastal areas
- 50% are from outside the Carolinas



Part 2

New Tropical Program Products, Services, and Changes for the 2023 Hurricane Season

Eric Seymour, NWS Wakefield, VA

2023 Atlantic Tropical Storm/Hurricane Name List



2023 Atlantic Tropical Cyclone Names

Arlene
Bret
Cindy
Don
Emily
Franklin
Gert

Harold^{*}
Idalia^{*}
Jose
Katia
Lee
Margot^{*}
Nigel^{*}

Ophelia
Philippe
Rina
Sean
Tammy
Vince
Whitney

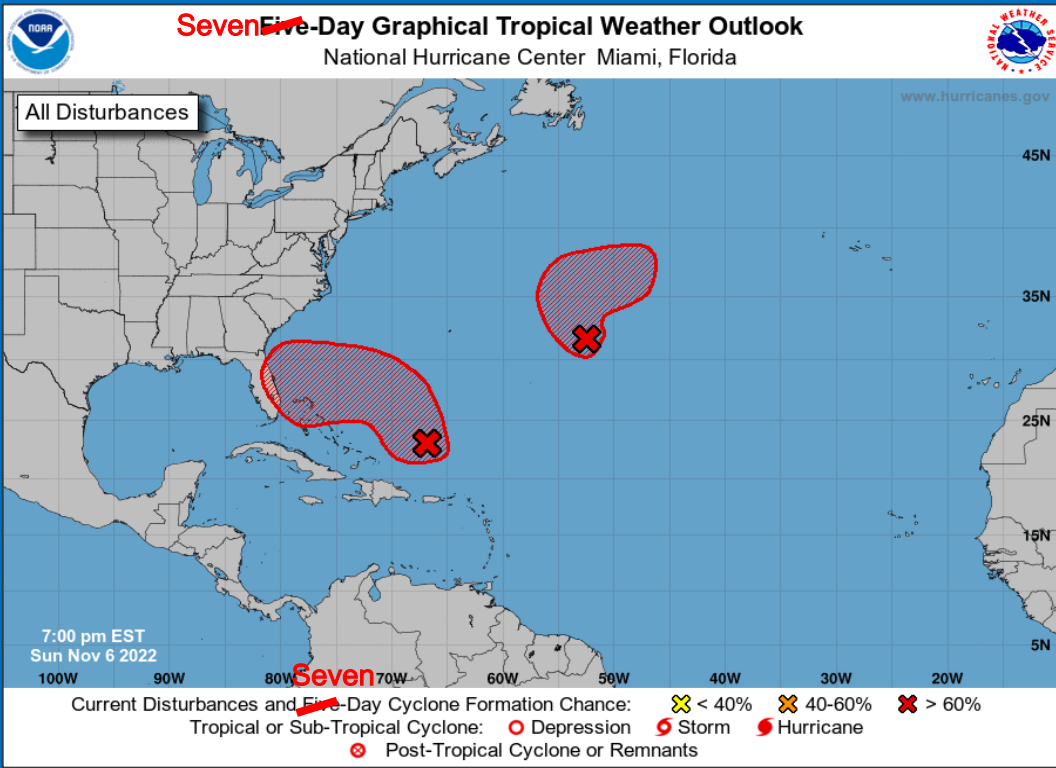
NOAA

Be prepared: Visit hurricanes.gov and follow @NWS and @NHC_Atlantic on Twitter.





Extension of Tropical Weather Outlook to 7 days



The 5-day Tropical Weather Outlook (TWO) and Graphical Tropical Weather Outlook (GTWO) will be extended to 7 days beginning May 15, 2023.

This product will now show the chance for tropical cyclone formation over the next 7 days.

New URL:
<https://www.nhc.noaa.gov/gtwo.php?basin=atlc&fdays=7>

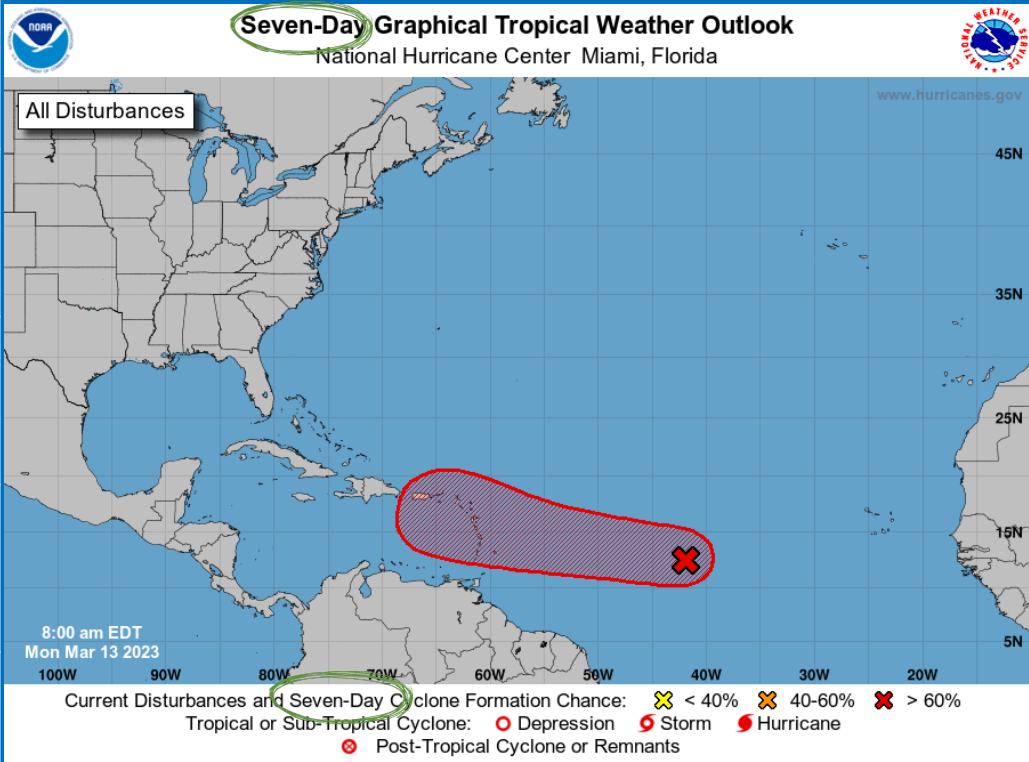
The 2-day (48-hour) TWO/GTWO will remain unchanged.





Extension of Tropical Weather Outlook to 7 days

What does a 7-day TWO mean for messaging pre-genesis disturbances?



Systems likely to be introduced into the outlook sooner

Systems likely to move into the medium and high categories earlier, producing longer lead times

Genesis areas are likely to be larger, especially for systems with a fast forward speed and uncertain formation timing

Outlook Now Includes Invest Numbers* and Geographical Descriptors

Tropical Weather Outlook
NWS National Hurricane Center Miami FL
200 AM EDT Fri Sep 2 2022

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

Active Systems:

The National Hurricane Center is issuing advisories on Tropical Storm Danielle, located about 925 miles west of the Azores.

East of the Leeward Islands (AL91):

Satellite imagery indicates there has been little change in the organization of the area of low pressure located several hundred miles east of the Leeward Islands during the past several hours. Although environmental conditions remain only marginally conducive, any additional development of the system over the next few days would lead to the formation of a tropical depression. The disturbance is expected to move slowly west-northwestward, toward the adjacent waters of the northern Leeward Islands. Regardless of development, locally heavy rains may occur over portions of the Leeward Islands during the next couple of days, and interests in that area should monitor the progress of the system. An Air Force Reserve Hurricane Hunter aircraft is scheduled to investigate the system this afternoon, if necessary. Additional information on this system can be found in High Seas Forecasts issued by the National Weather Service.

* Formation chance through 48 hours...medium...50 percent.

* Formation chance through 7 days...high...70 percent.

Eastern Tropical Atlantic:

Shower activity associated with a broad area of low pressure located just northwest of the Cabo Verde Islands has increased some over the last several hours, but remains poorly organized. This system is moving into an area of less favorable environmental conditions, and significant development is not anticipated.

* Formation chance through 48 hours...low...10 percent.

* Formation chance through 7 days...low...10 percent.

- In 2022, geographic headers were added for disturbances
- Beginning in 2023, invest numbers (AL90-99, EP90-99, & CP90-99) will be included when there is an active invest open in association with the disturbance
- These changes should:
 - Make the text product more readable and scannable
 - Minimizes confusion between multiple systems, especially when it's busy



Reminders about “Invests”

- **Opening an “invest” allows:**

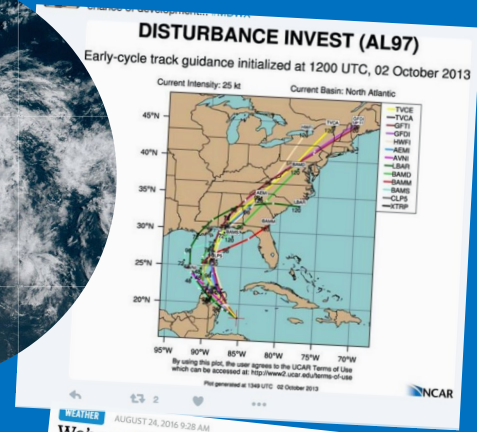
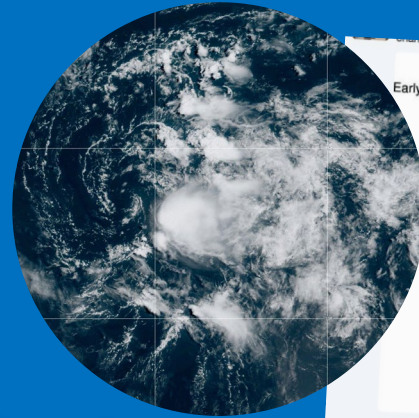
- Monitor disturbances more carefully
- Collect microwave satellite data
- Record “fixes”
- Run model guidance

- **Caveats for “invests”:**

- No standard for opening one – up to forecaster discretion
- Invest information only has to be updated every 12 h
- Guidance typically run when a cloud system center is apparent



- **More meteorological uncertainty associated with invests!**

- Extreme caution should be used when looking at model guidance for invests



Removal of Watches & Warnings from the Tropical Cyclone Forecast/Advisory Product (TCM)

- To expedite the issuance of the Forecast/Advisory, watch and warning information will be removed beginning in 2023.
- Watch and Warning information is available in the *Public Advisory*.
- Forecast/Advisory is a data product that contains all the forecast information.
- Generally used by parsing software to read the forecast.



NATIONAL HURRICANE CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

TROPICAL STORM MICHAEL FORECAST/ADVISORY NUMBER 7
NWS NATIONAL HURRICANE CENTER MIAMI FL AL142018
0900 UTC MON OCT 08 2018

TROPICAL STORM CENTER LOCATED NEAR 20.6N 85.5W AT 08/0900Z
POSITION ACCURATE WITHIN 15 NM

PRESENT MOVEMENT TOWARD THE NORTH OR 360 DEGREES AT 6 KT

ESTIMATED MINIMUM CENTRAL PRESSURE 983 MB
MAX SUSTAINED WINDS 60 KT WITH GUSTS TO 75 KT.
50 KT..... 80NE 80SE 0SW 0NW.
34 KT.....120NE 150SE 90SW 100NW.
12 FT SEAS..135NE 120SE 30SW 60NW.
WINDS AND SEAS VARY GREATLY IN EACH QUADRANT. RADII IN NAUTICAL
MILES ARE THE LARGEST RADII EXPECTED ANYWHERE IN THAT QUADRANT.

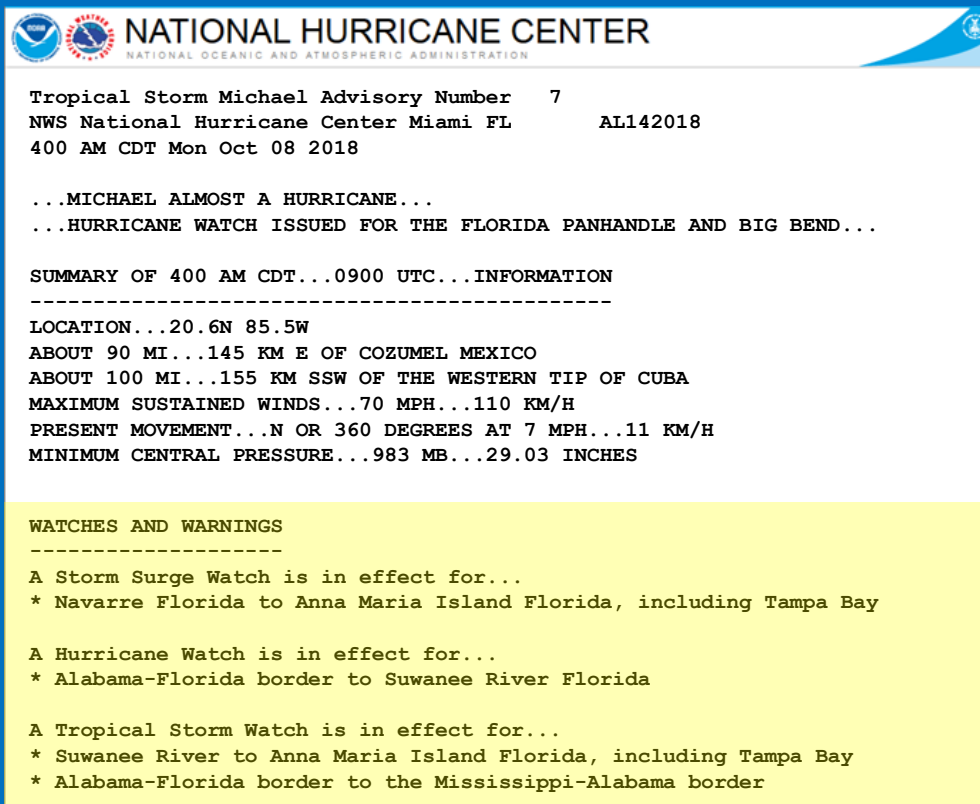
REPEAT...CENTER LOCATED NEAR 20.6N 85.5W AT 08/0900Z
AT 08/0600Z CENTER WAS LOCATED NEAR 20.2N 85.5W

FORECAST VALID 08/1800Z 21.7N 85.6W
MAX WIND 70 KT...GUSTS 85 KT.
64 KT... 30NE 30SE 0SW 0NW.
50 KT... 90NE 90SE 30SW 30NW.
34 KT...130NE 150SE 90SW 120NW.

Removal of Watches & Warnings from the Tropical Cyclone Forecast/Advisory Product (TCM)

Latest Watch and Warning information can be found in the **NHC Public Advisory**, a text product issued every 3 hours whenever watches and warnings are in effect

Tropical Storm and Hurricane Watches and Warnings are also displayed on the NHC Cone and Initial Wind Field graphics.



The image shows a screenshot of a National Hurricane Center (NHC) advisory for Tropical Storm Michael. The header includes the NHC logo and the text "NATIONAL HURRICANE CENTER" and "NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION". The advisory number is 7, issued from Miami, FL, on October 8, 2018, at 4:00 AM CDT. The advisory states that Michael is almost a hurricane and that a hurricane watch is issued for the Florida panhandle and Big Bend area. It provides a summary of information, including the location (20.6N 85.5W), distance from Cozumel, Mexico (90 miles), and from the western tip of Cuba (100 miles). It also lists maximum sustained winds (70 mph), present movement (north at 7 mph), and minimum central pressure (983 mb). The bottom section, titled "WATCHES AND WARNINGS", lists three watches in effect: a storm surge watch for Navarre Florida to Anna Maria Island, a hurricane watch for the Alabama-Florida border to Suwanee River, and a tropical storm watch for Suwanee River to Anna Maria Island.

NATIONAL HURRICANE CENTER
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

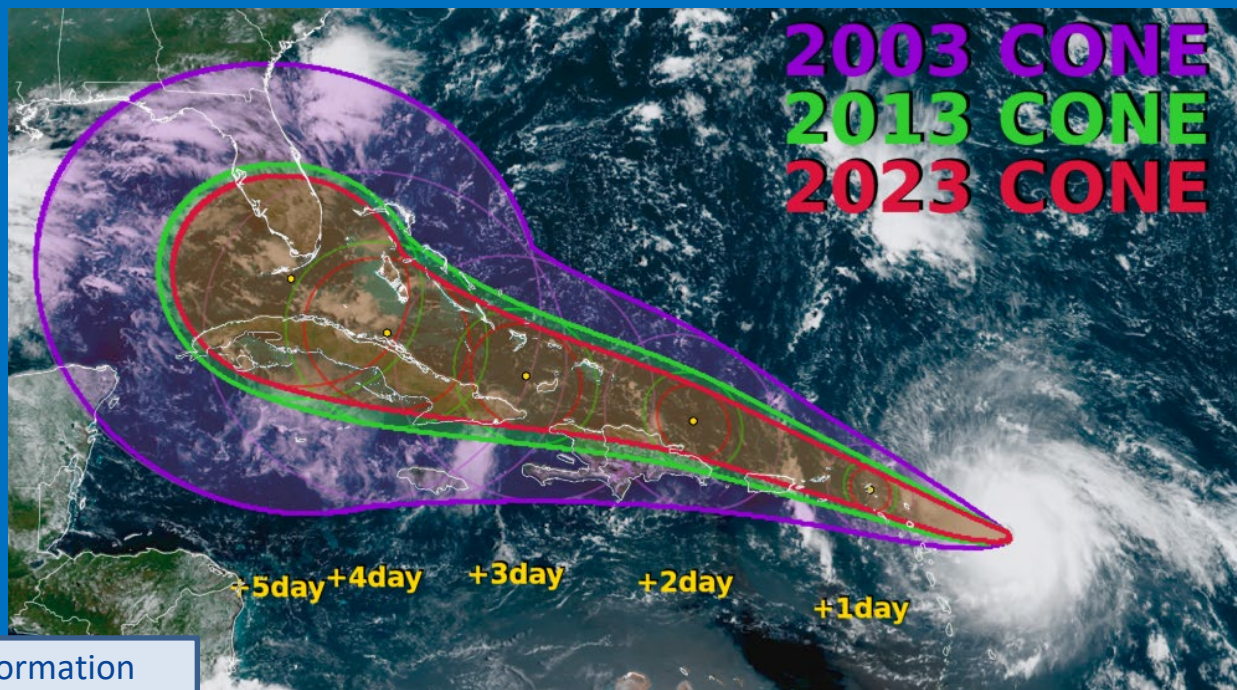
A Storm Surge Watch is in effect for...
* Navarre Florida to Anna Maria Island Florida, including Tampa Bay

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

2023 Update: Latest Cone Size

- Cone is based on circles “drawn” around each forecast point based on the 67th percentile of the NHC track error over the past 5 years
- 2023 cone largely unchanged from the previous several seasons



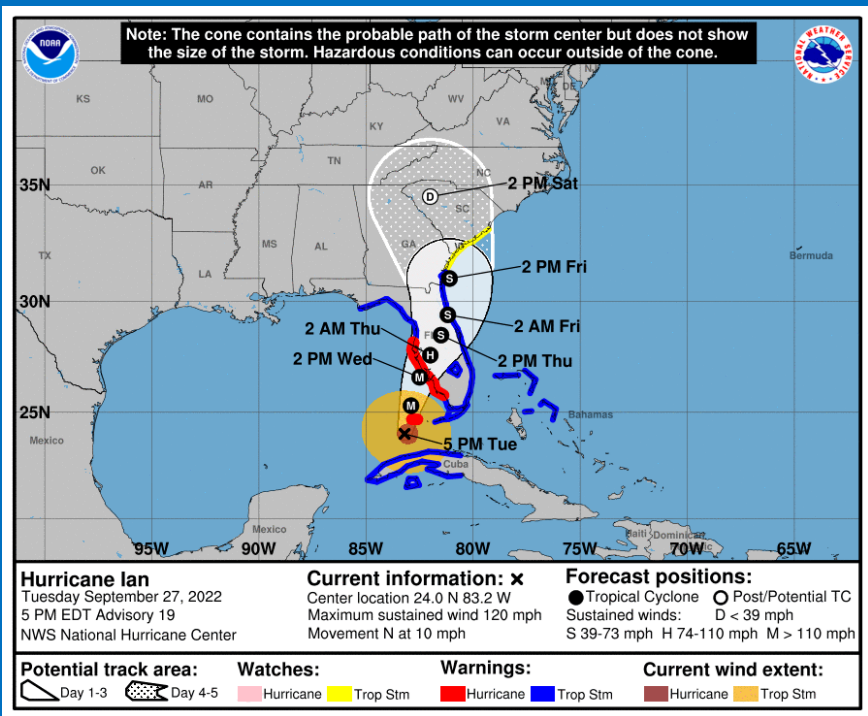
Information
about the NHC
cone and
reminders

Image courtesy: Brian McNoldy, University of Miami





Track Forecast/Cone Graphic



Conveys the most likely track of the center of the storm

Does NOT convey impacts !!!

Based on the 2/3rds track error from the past five years

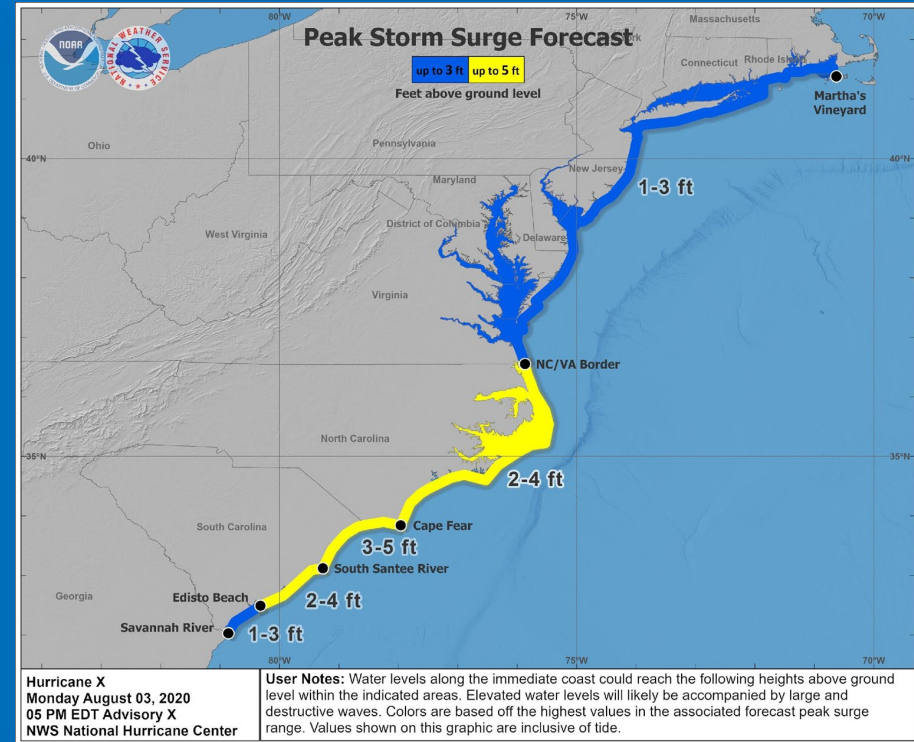


Information about the NHC cone and reminders



Peak Storm Surge Forecast Graphic Becomes Operational

- Peak Storm Surge Forecast Map will become operational in 2023
- The graphic depicts the expected storm surge inundation values for the U.S. Gulf and Atlantic coasts, Puerto Rico, and the U.S. Virgin Islands
- Values match what is shown in the NHC Public Advisory
- Available as a KML file (nhc.noaa.gov/gis)





TCD and TCM Issuance by WPC

The Weather Prediction Center will add the Tropical Cyclone Discussion (TCD) and Tropical Cyclone Forecast/Advisory (TCM) products to their tropical product suite for the 2023 hurricane season

```
ZCZC NFDTCDAT4 ALL
TTAA00 KWNH DDHMM

Post-Tropical Cyclone Ian Discussion Number 38
NWS Weather Prediction Center College Park MD AL092022
1100 PM EDT Sat Oct 01 2022

Key Messages:

1. Ongoing major to record river flooding will continue through next
week across portions of central Florida.

2. Limited flash, urban, and small stream flooding is possible
across portions of West Virginia, Maryland, and southern
Pennsylvania into Sunday morning.

FORECAST POSITIONS AND MAX WINDS

INIT 02/0300Z 37.3N 78.2W 15 KT 15 MPH...DISSIPATING
12H 02/1200Z...DISSIPATED
```

Tropical Cyclone Discussion

```
ZCZC NFDTCMAT4 ALL
TTAA00 KWNH DDHMM

POST-TROPICAL CYCLONE IAN FORECAST/ADVISORY NUMBER 38
NWS WEATHER PREDICTION CENTER COLLEGE PARK MD AL092022
0300 UTC SUN OCT 02 2022

THERE ARE NO COASTAL WATCHES OR WARNINGS IN EFFECT.

POST-TROPICAL CYCLONE CENTER LOCATED NEAR 37.3N 78.2W AT 02/0300Z
POSITION ACCURATE WITHIN 20 NM

PRESENT MOVEMENT TOWARD THE EAST OR 90 DEGREES AT 5 KT

ESTIMATED MINIMUM CENTRAL PRESSURE 1009 MB
MAX SUSTAINED WINDS 15 KT WITH GUSTS TO 20 KT.
WINDS AND SEAS VARY GREATLY IN EACH QUADRANT. RADII IN NAUTICAL
MILES ARE THE LARGEST RADII EXPECTED ANYWHERE IN THAT QUADRANT.

REPEAT...CENTER LOCATED NEAR 37.3N 78.2W AT 02/0300Z
AT 02/0000Z CENTER WAS LOCATED NEAR 37.3N 78.5W

FORECAST VALID 02/1200Z 37.2N 77.5W...POST-TROP/EXTRATROP
MAX WIND 20 KT...GUSTS 30 KT.

FORECAST VALID 03/0000Z...DISSIPATED

REQUEST FOR 3 HOURLY SHIP REPORTS WITHIN 300 MILES OF 37.3N 78.2W

THIS IS THE LAST FORECAST/ADVISORY ISSUED BY THE
WEATHER PREDICTION CENTER ON THIS SYSTEM
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Tropical Cyclone Forecast/Advisory





Part 3

Outreach and Educational Efforts in Underserved Communities

Erik Heden, NWS Newport-Morehead City, NC

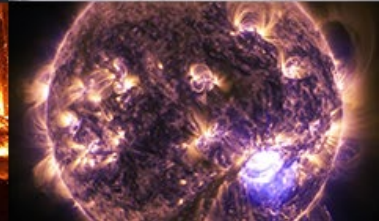
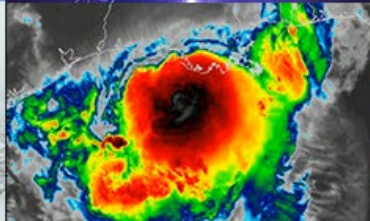




NCEMA 2023

**NATIONAL
WEATHER
SERVICE**

Erik Heden, Warning Coordination Meteorologist NWS Morehead City, NC



Using Social Science to Create More Targeted Local Outreach Programs Focused on Reaching Vulnerable Communities



Ryan Ellis

Isabella Kemp*

Casey Dail

Shane Kearns

National Weather Service Newport
Morehead City, NC

*University of Florida

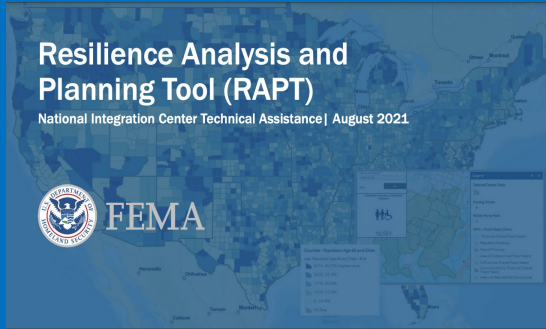


Objectives

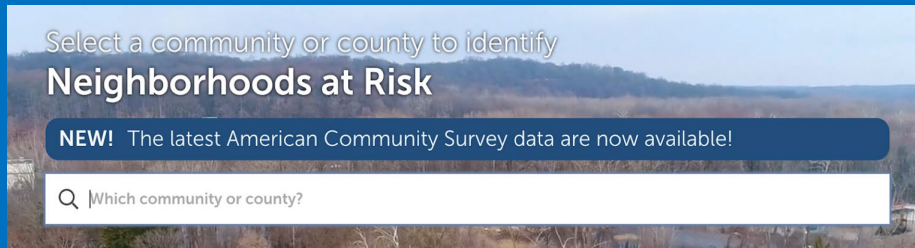


- Define/obtain more knowledge about community vulnerabilities with our forecast area
- Develop a targeted outreach plan for vulnerable communities
- Better understanding of where the forecast can use social science to add value in the forecast process

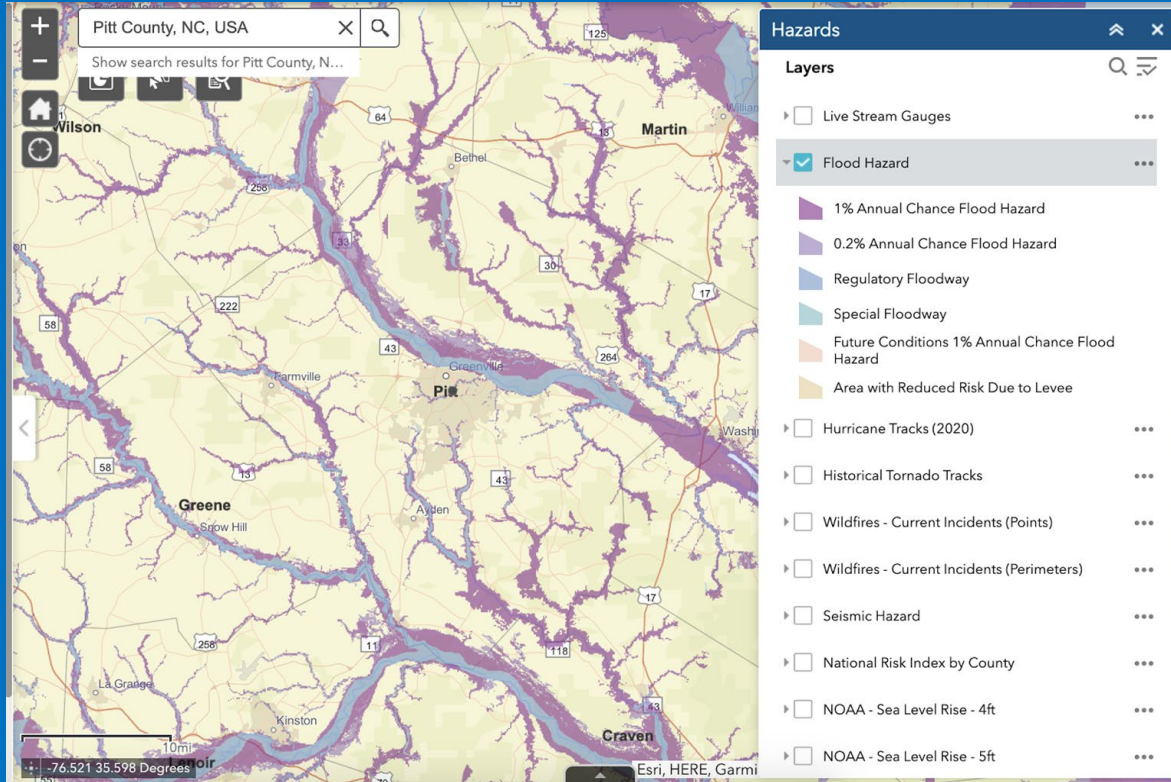
Data Sources



- Electronic Databases
- Forecaster Input
- Forecaster/EM Interaction
- Community Outreach and Interaction
- Storm Surveys



Data Mining for Vulnerabilities



Find at-risk neighborhoods

People

Set criteria: None County Median U.S. Average

Households with no car



Families in poverty



People who don't speak English well



Housing units that are mobile homes



Children under 5 years



People with disabilities



People over 65 years

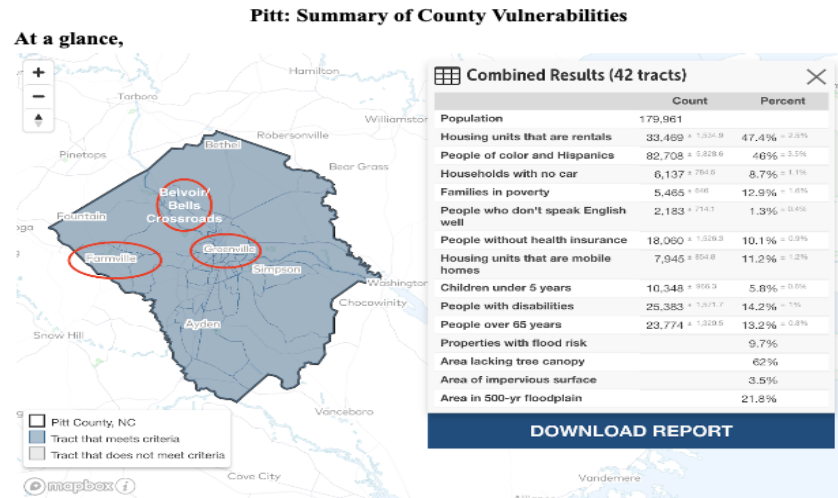


SEE MORE



Data Mining for Vulnerabilities

- Highlights top 3 vulnerable communities for each county
- Includes customized stats from Neighborhoods at Risk
- Includes Forecaster Input
- Includes Emergency Manager / Forecaster Communication
- Includes Community Input



Designated Vulnerable Areas within Pitt County:

- Greenville (southern portions- Census Tract 1.02)
 - Flood risk, poverty (56%), no car (19%)
- Bells Crossroads/Belvoir
 - Flood risk, mobile homes (73%), no car (24%), poverty,
- Farnville
 - Flood risk, poverty (20%), no car (11%), disabilities, elderly

Forecaster Input:

- Higher tornado probability within this county
- Greenville largest city

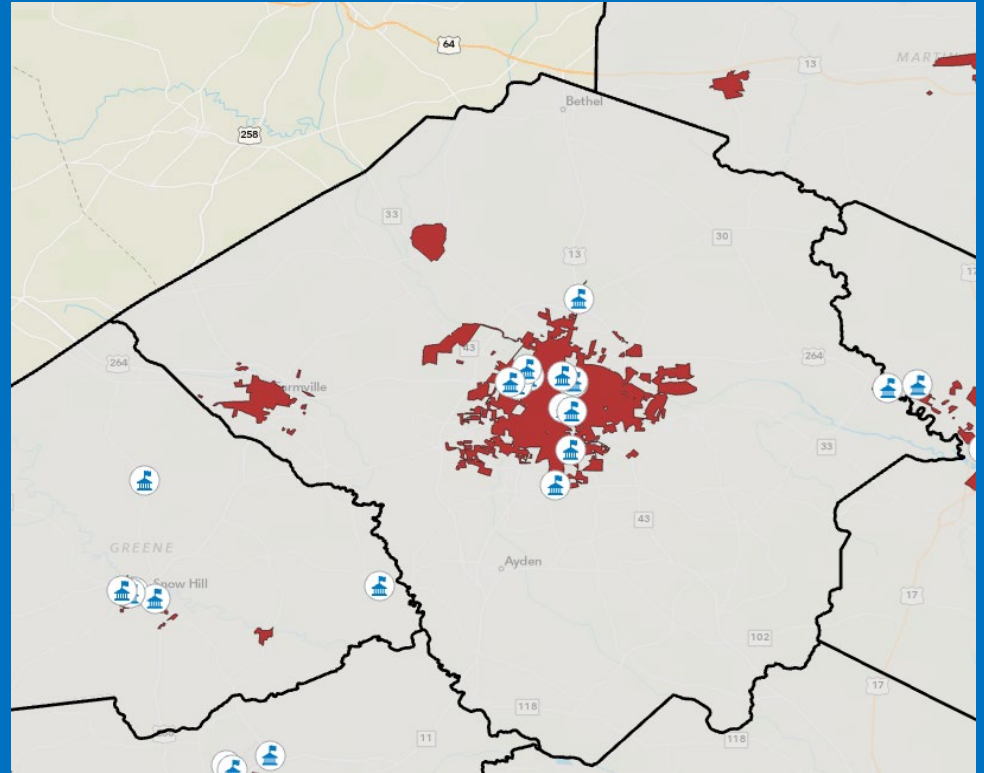
Emergency Manager Input:

- Northern portion of the county considered more vulnerable
- Targeted outreach right now focuses on flood prone areas
- Rural and poor trust towards government officials is a significant vulnerability
- More outreach to build trust within the rural communities and help people understand the Weather Service's role
- Attention to local media (EM's think that the media is sensationalizing weather)

Community Input:

- Want more information on where to go/not to go during floods
- Most people are getting weather information from the local news stations

GIS Vulnerability Tool



Pitt County, North Carolina



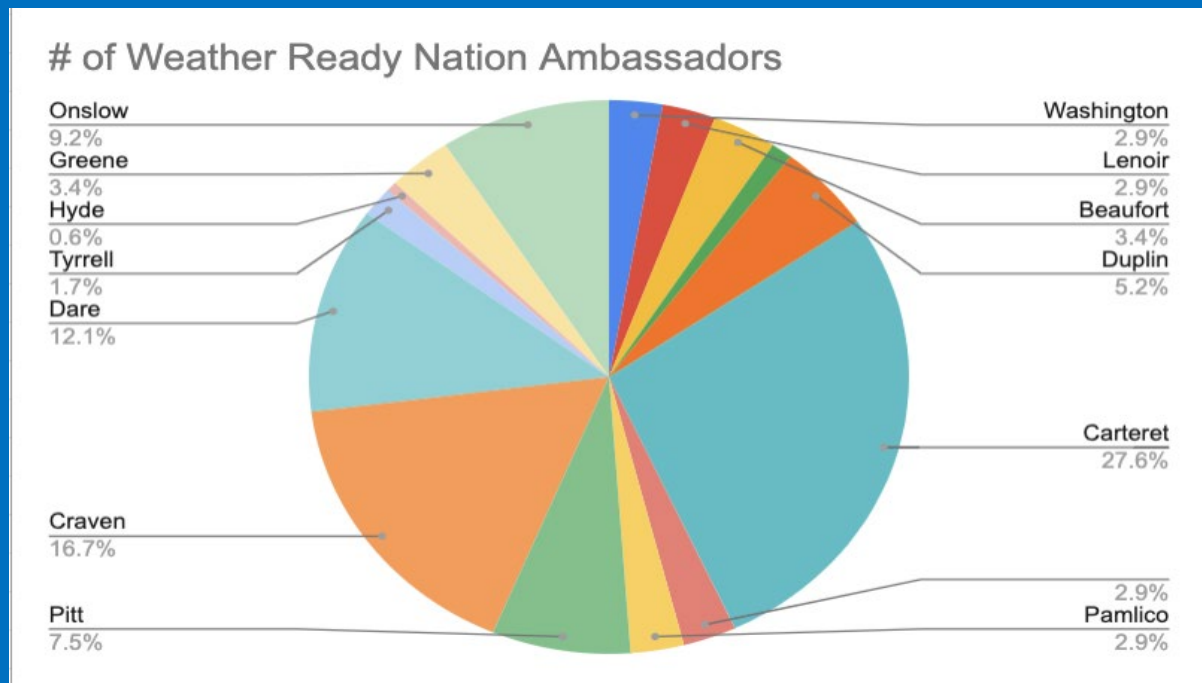
WRN Ambassador
Location



Identified
Vulnerable Community

Weather Ready Nation Ambassadors

- Most WRN Ambassadors were located in Carteret County (where NWS office is)
- Most populous counties not distributed equitably (Onslow and Pitt)
- located.

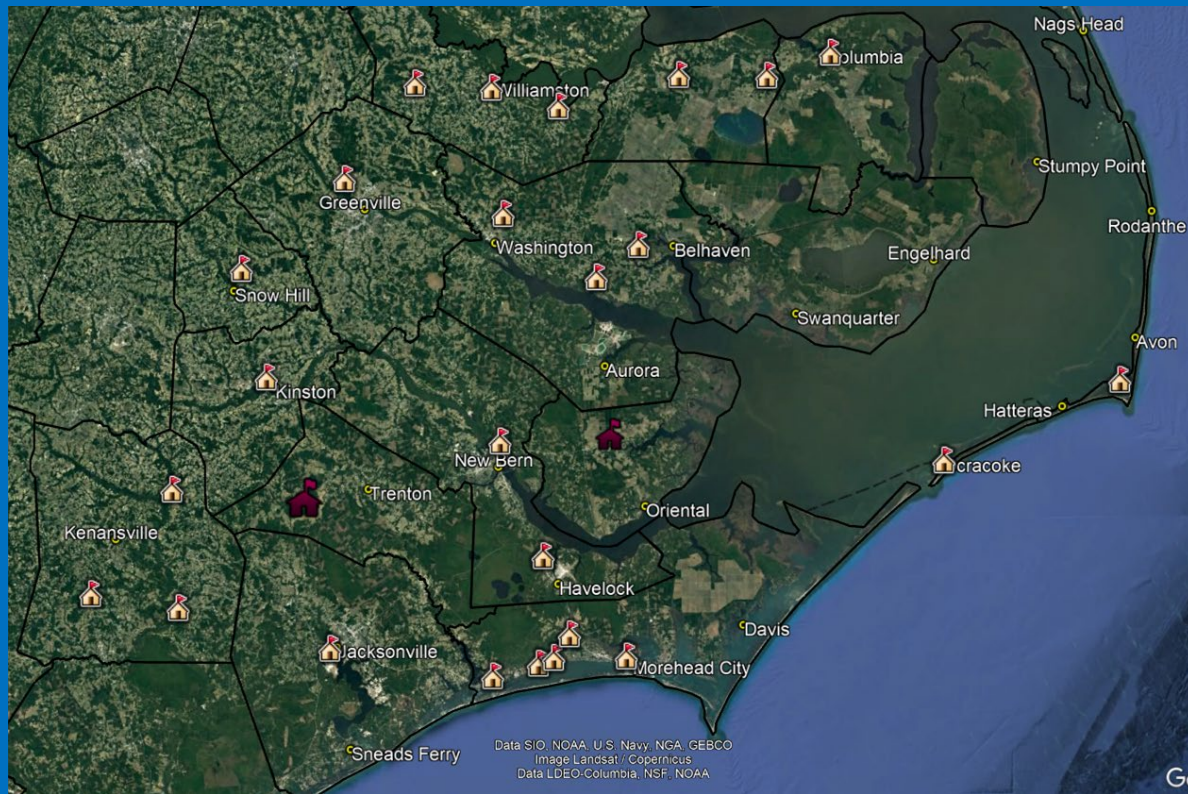


Outreach Plan 2022-23



- Plan/schedule outreach in vulnerable/underserved areas (who to present to....)
- Develop relationships (gain trust...)
- Working with other groups (faith based organizations)
- Tailor outreach

Results So Far....



- Visited at least one school in every county (14)
- Multiple counties had all 5th graders reached
- Almost entirely, first time visits

Results So Far....



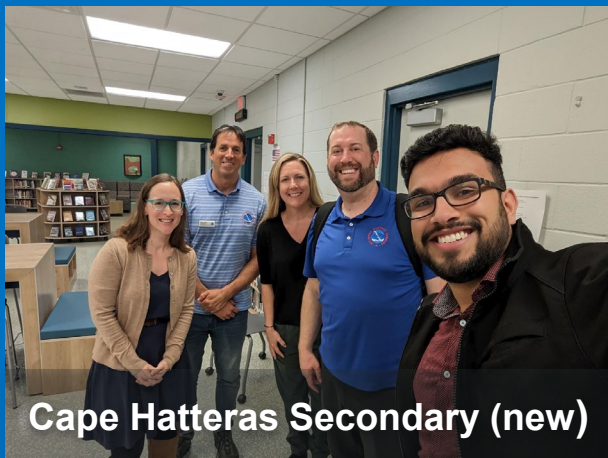
- Over 3,000 school students reached
- Every child received rip current, flooding brochures (*heat and lightning as available)
- Usually 5th grade weather standards

Results So Far....

- Meeting with partners on the way
- Delivering brochures, lightning signs
- Attending meetings
- Interacting IN THE COMMUNITY



Results So Far....



- Visiting WRN Ambassadors, delivering brochures
- Meeting and signing up new ambassadors!

Results So Far....



**Kinston, NC
September 2022
Hurricane Forum
(Faith Based Community Location)**



Results So Far....



**Kinston, NC
September 2022
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Still In Progress/Future



- Staffing model
- Expand hurricane forums to more communities through faith based groups
- Continue school program, expand season
- Incorporate need based groups more (NC VOID, Catholic Charities, etc)

Thank You



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