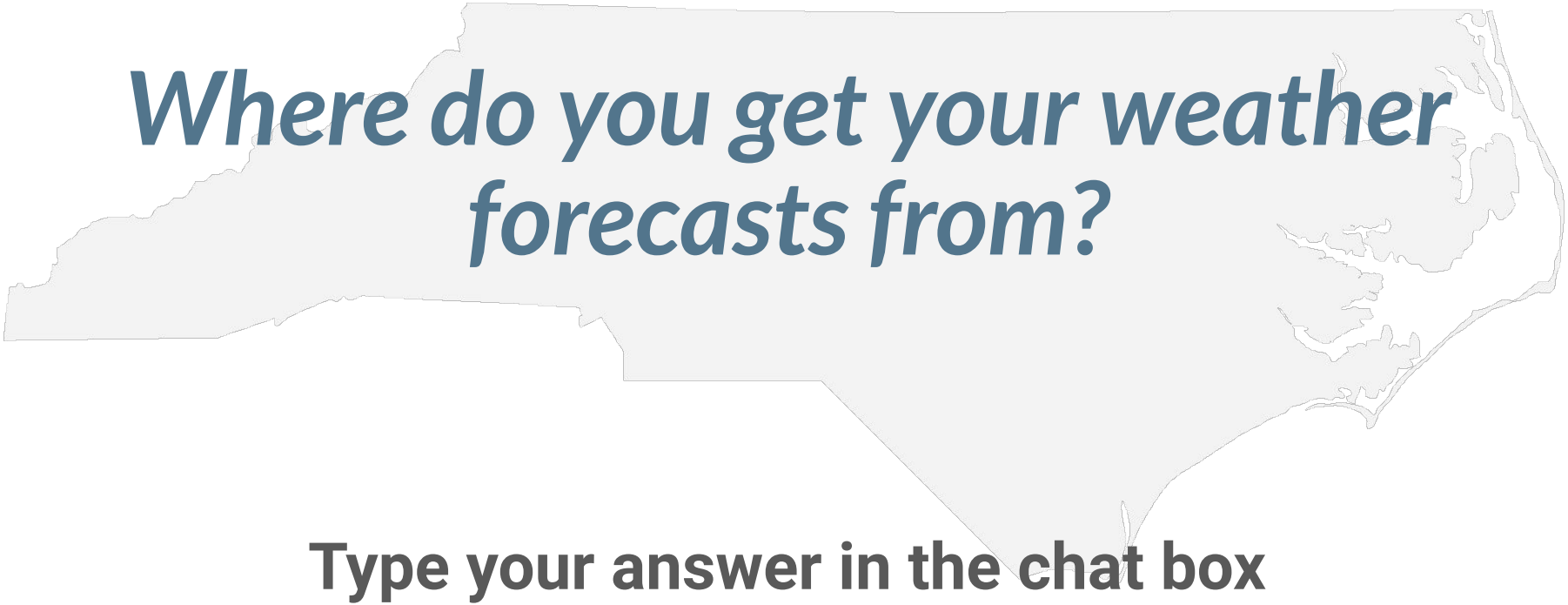


Where do you get your weather forecasts from?

Type your answer in the chat box

Forecasting History

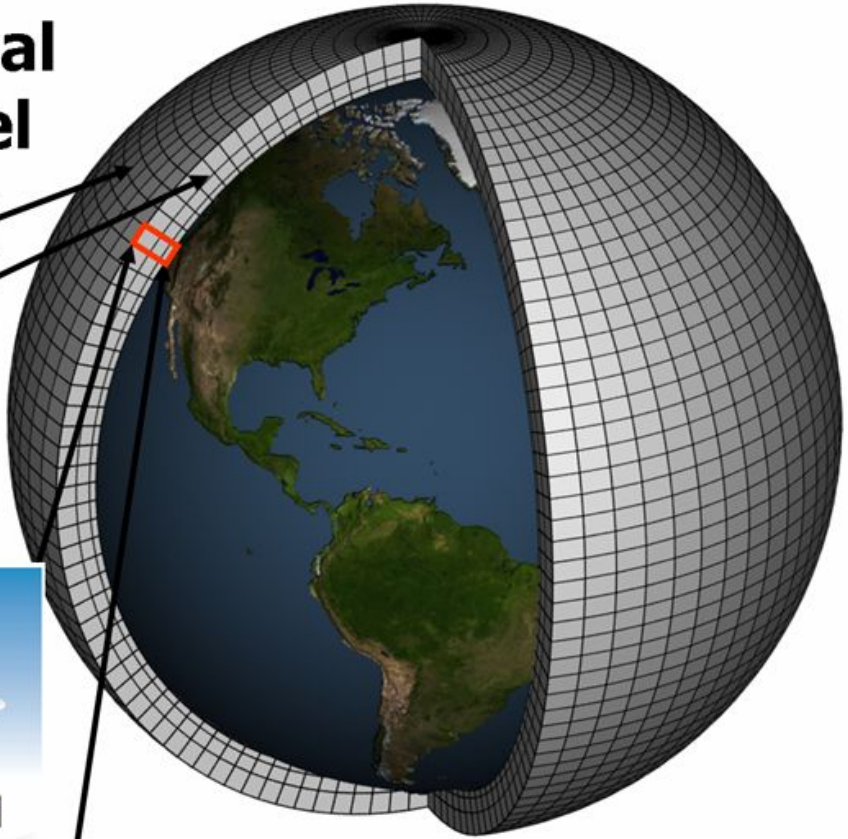
Short-Range Forecasts *(0-7 Days)*

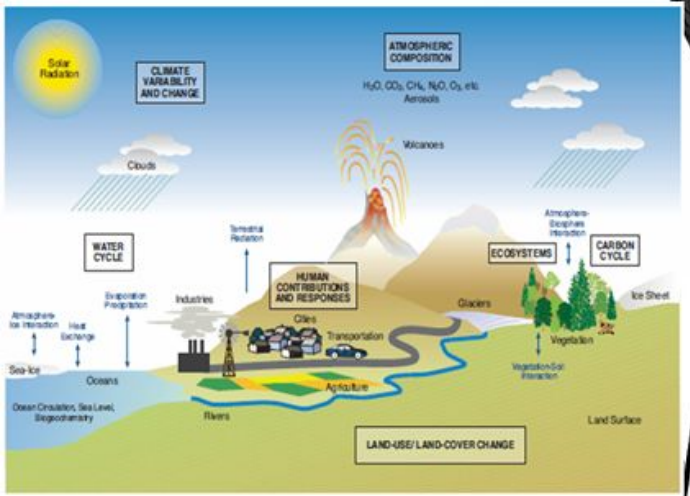
- Mostly based on **weather forecasting models**
  - Start with current observations as initial conditions
  - Use physics to simulate changes in the weather
- Exact forecasts may be adjusted by the provider
  - NWS, private services, local media, etc.

Schematic for Global Atmospheric Model

Horizontal Grid (Latitude-Longitude)

Vertical Grid (Height or Pressure)

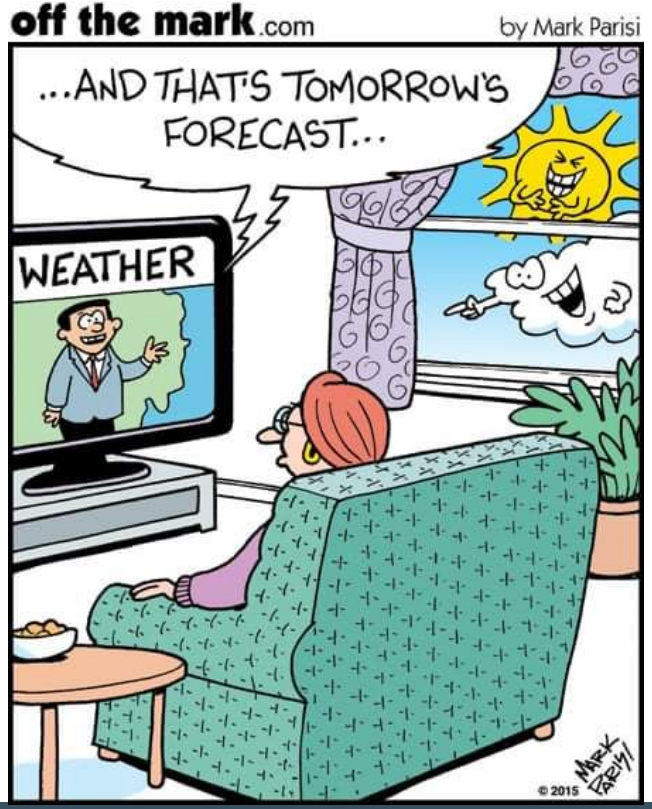




From the Center for Multiscale Modeling of Atmospheric Processes

Causes of Model Error

- Initial conditions are off or incomplete
- Models lack resolution
- Errors beget errors
- Chaos in nature

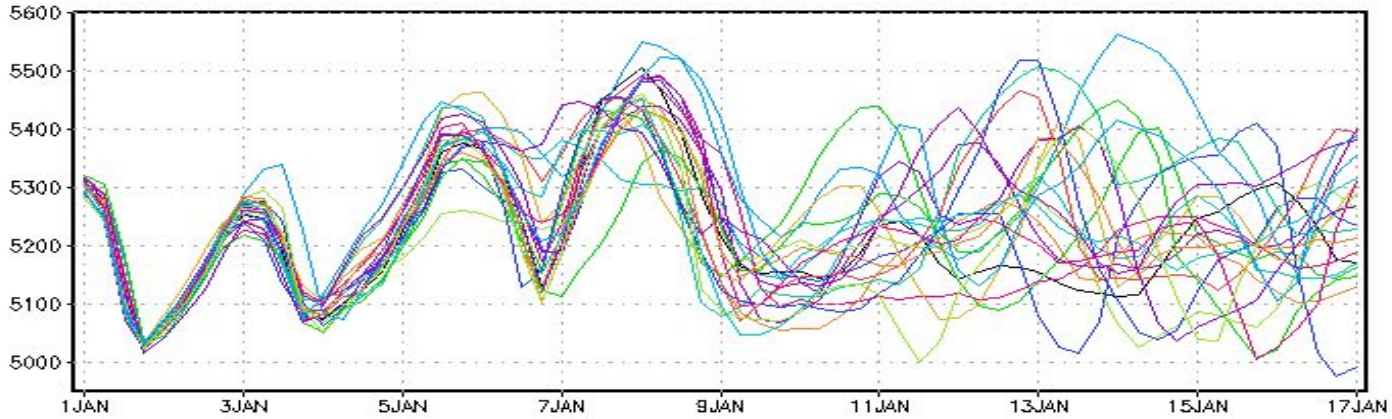


Medium-Range *(1-4 Weeks)*

- Beyond most weather models' skillful ability
- Instead, ***climate forecast models*** are often used
  - Lower resolution, but run for a longer time
  - Simulate processes in the ocean and atmosphere
  - Forecasts are given as ***probabilities*** instead of exact temperatures or precip. amounts

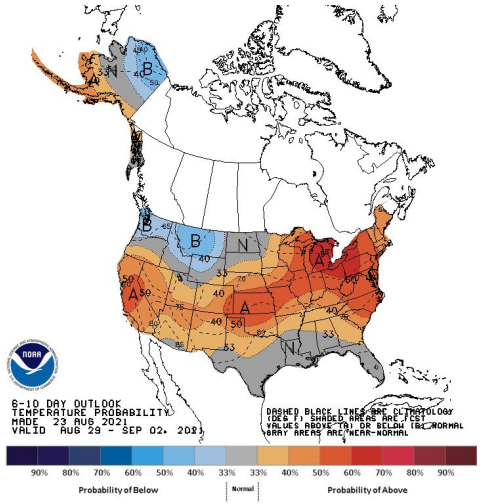
Ensemble Forecasting

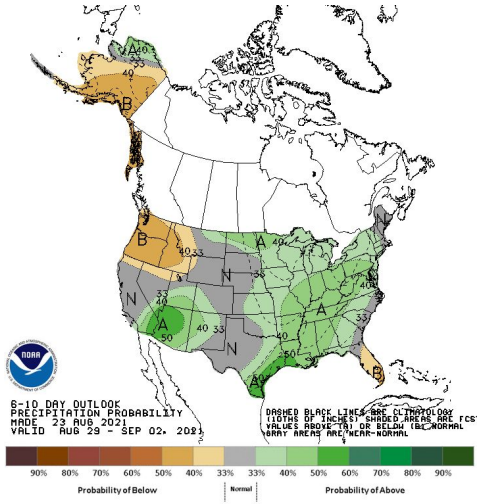
- Climate models are often run in ***ensembles***
  - A set of models with slightly different initial conditions



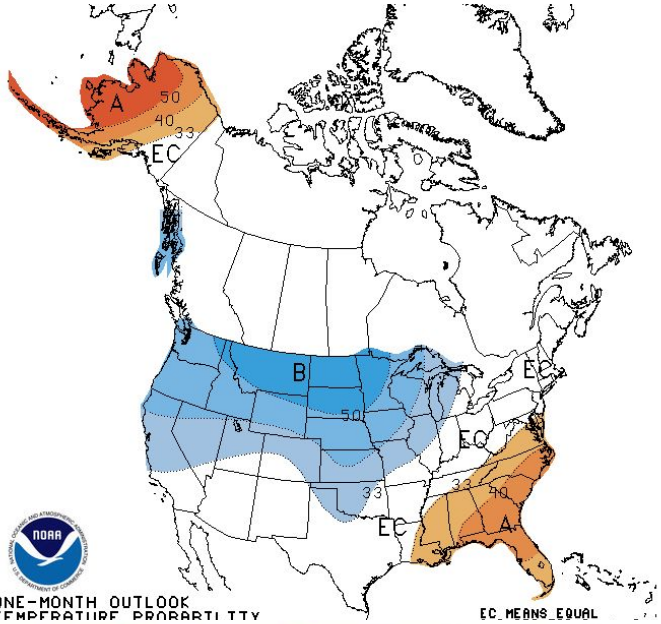
CPC Outlooks

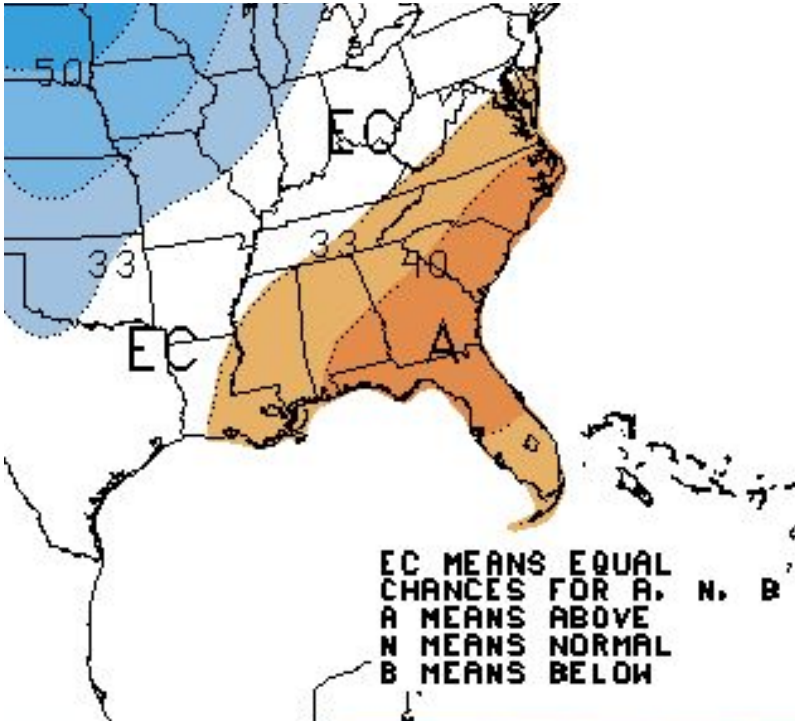
- The NWS **Climate Prediction Center** issues temperature and precipitation outlooks for:
  - 6 to 10 days
  - 8 to 14 days
  - 3 to 4 weeks
  - 1 month
  - 3 months

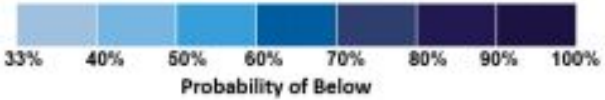


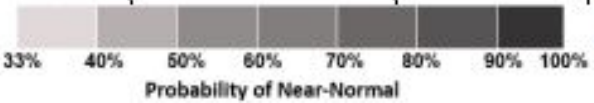


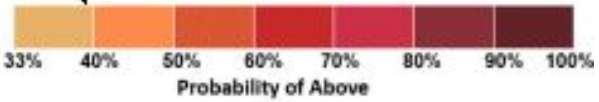
CPC Outlooks



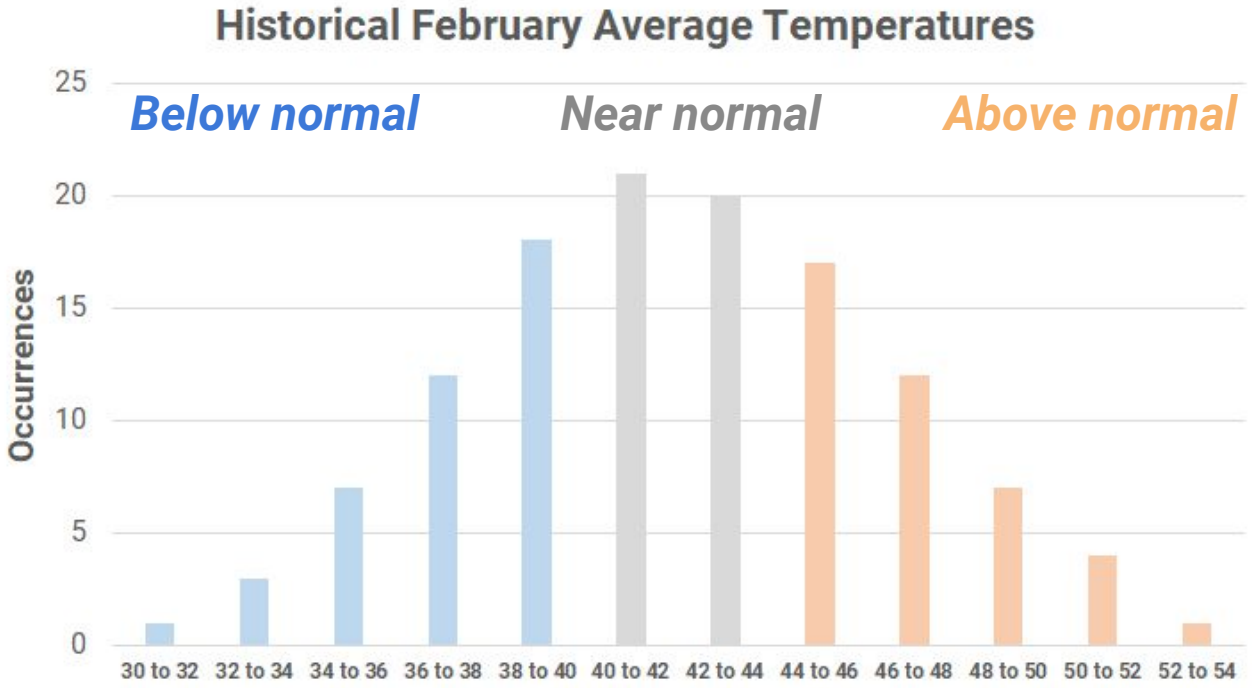






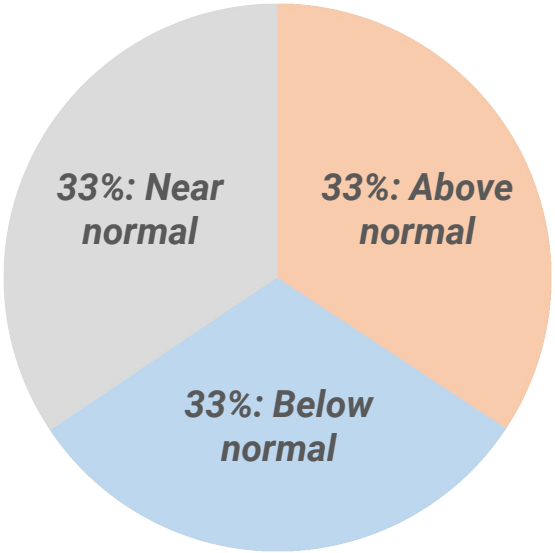


Interpreting CPC Outlooks

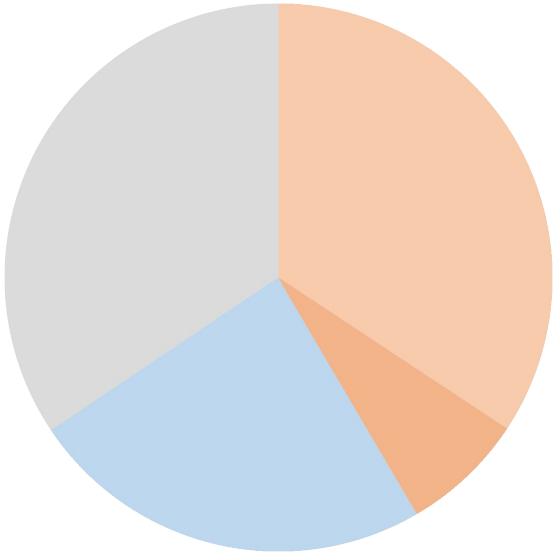


Interpreting CPC Outlooks

Equal Chances



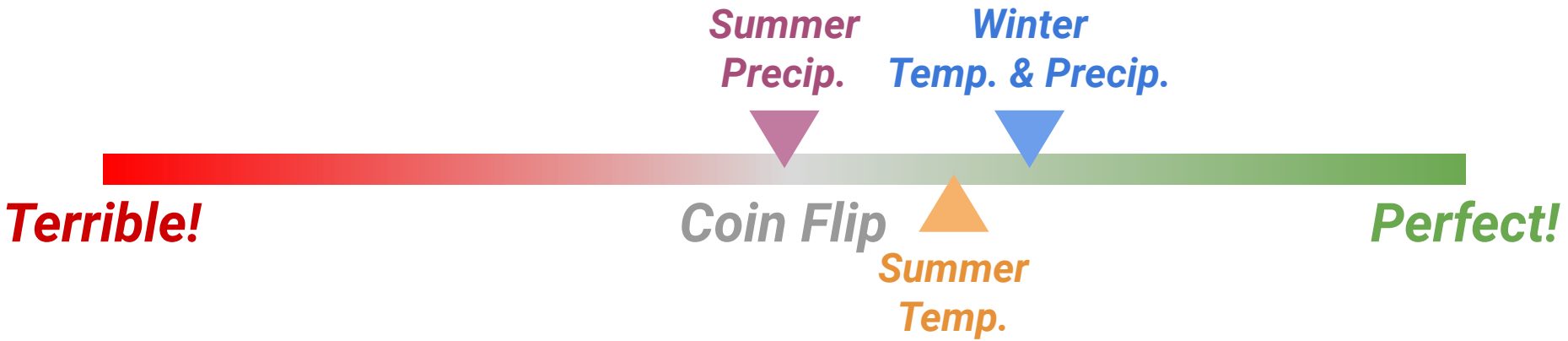
40% Chance of Above-Normal



Long-Range *(1-6 Months)*

- Typically based on:
  - Climate forecast models
  - ENSO phase, mainly in winter
  - Trends in recent years (warming temperatures)
  - Persistence

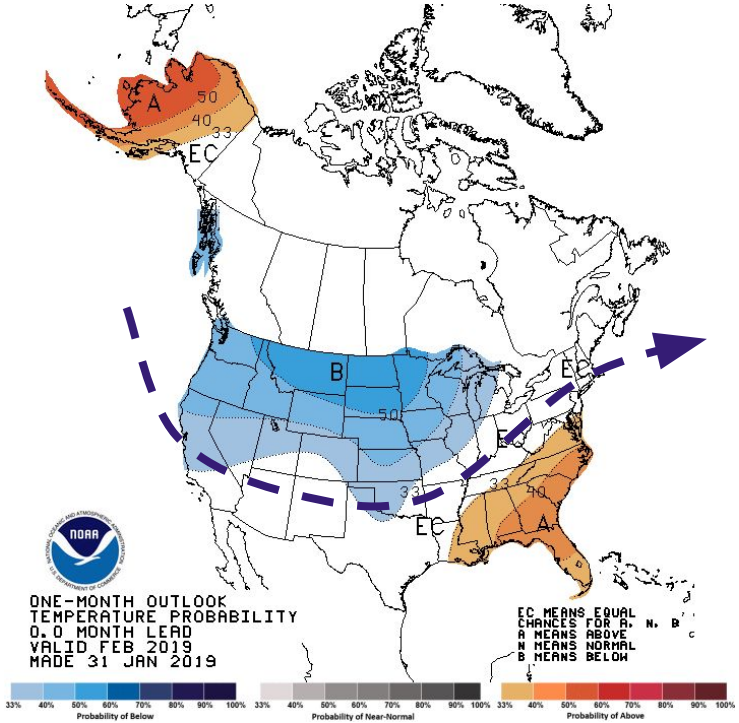
Seasonal Outlook Accuracy

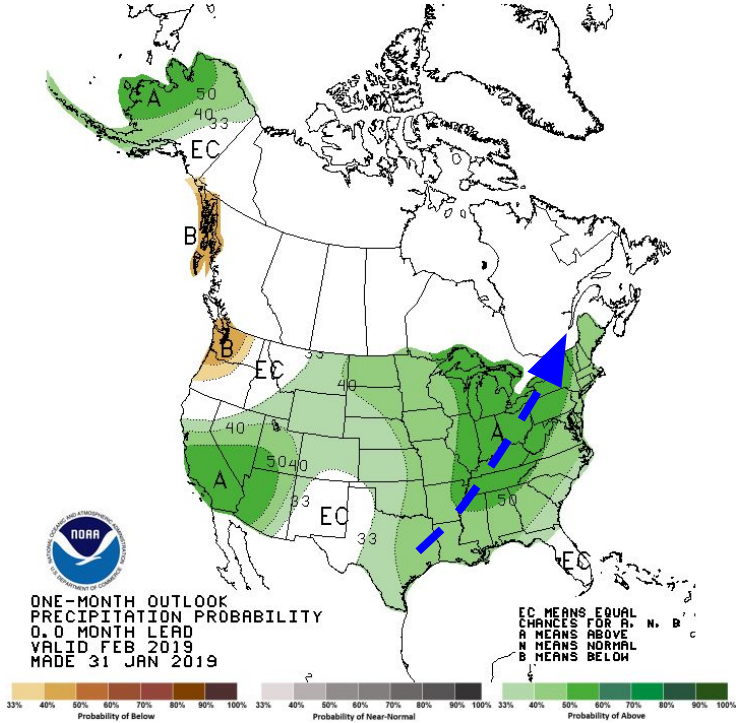


What *Can* CPC Outlooks Tell Us?

- The **change in likelihood** of above- or below-normal temps/precip.
  - Compared to climatology (33% chance)
- Factors driving those changes
  - From Prognostic Discussions
- What the large-scale patterns may look like

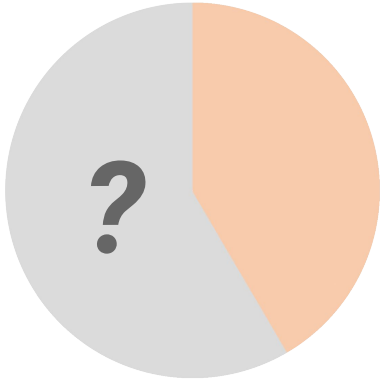
Long-Range Outlook Example





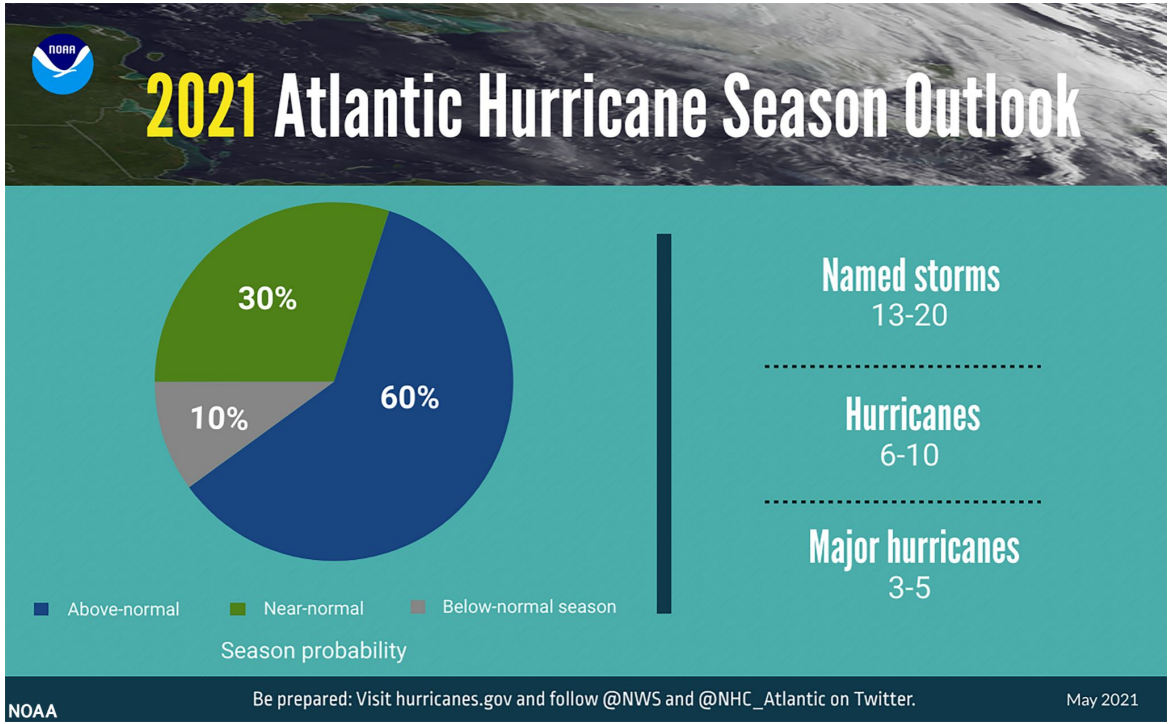
What *Can't* CPC Outlooks Tell Us?

- The **intensity** of above/below normal conditions
- The odds of less-likely outcomes
- Variability within a given period
- How to act in response to an outlook



40% chance of above normal

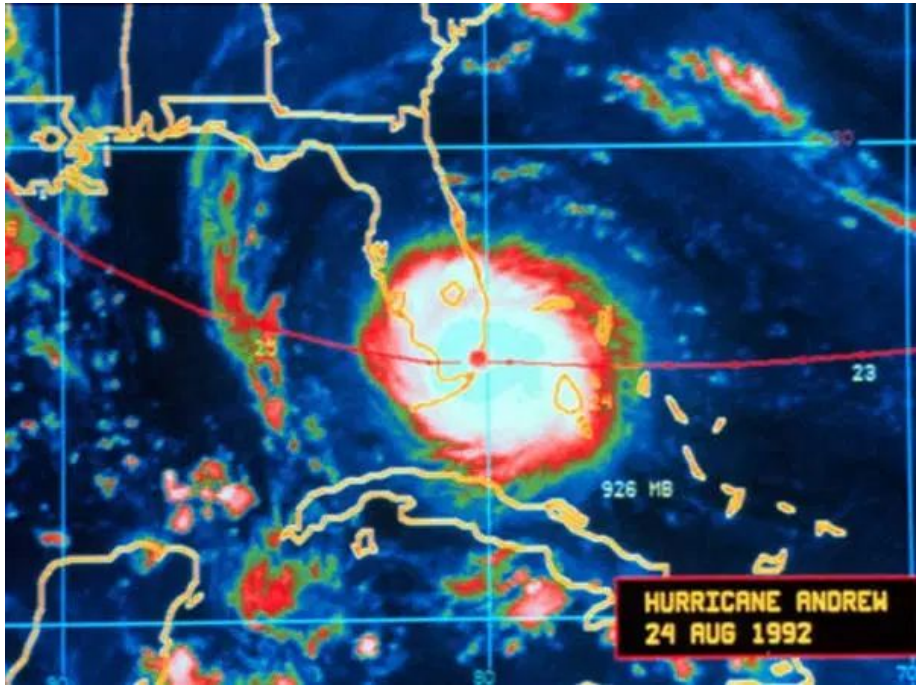
Seasonal Hurricane Outlooks



Important Caveats

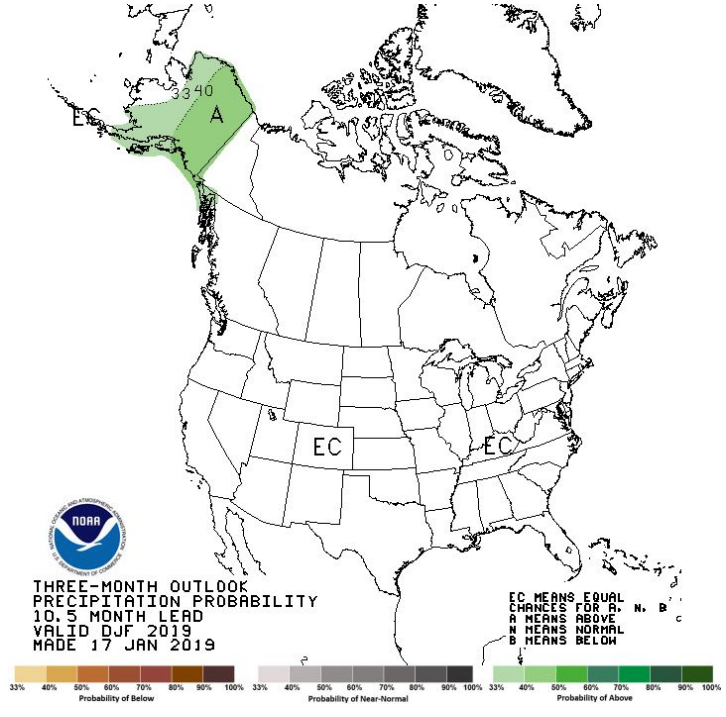
*These forecasts can't say whether a storm will affect **you**!*

*All it takes is **one storm** to make it a memorable season!*



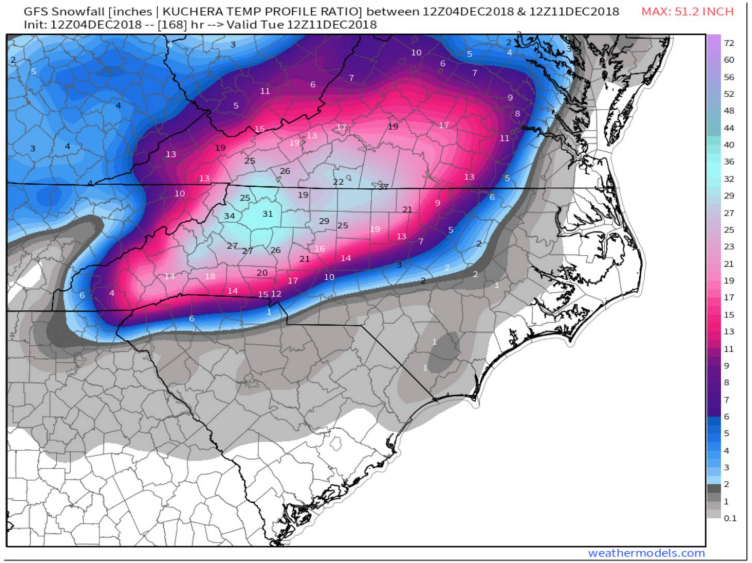
Extended Range *(6+ Months)*

- Often based on the predicted ENSO pattern or recent trends vs. climatology
- Typically limited skill or useful guidance

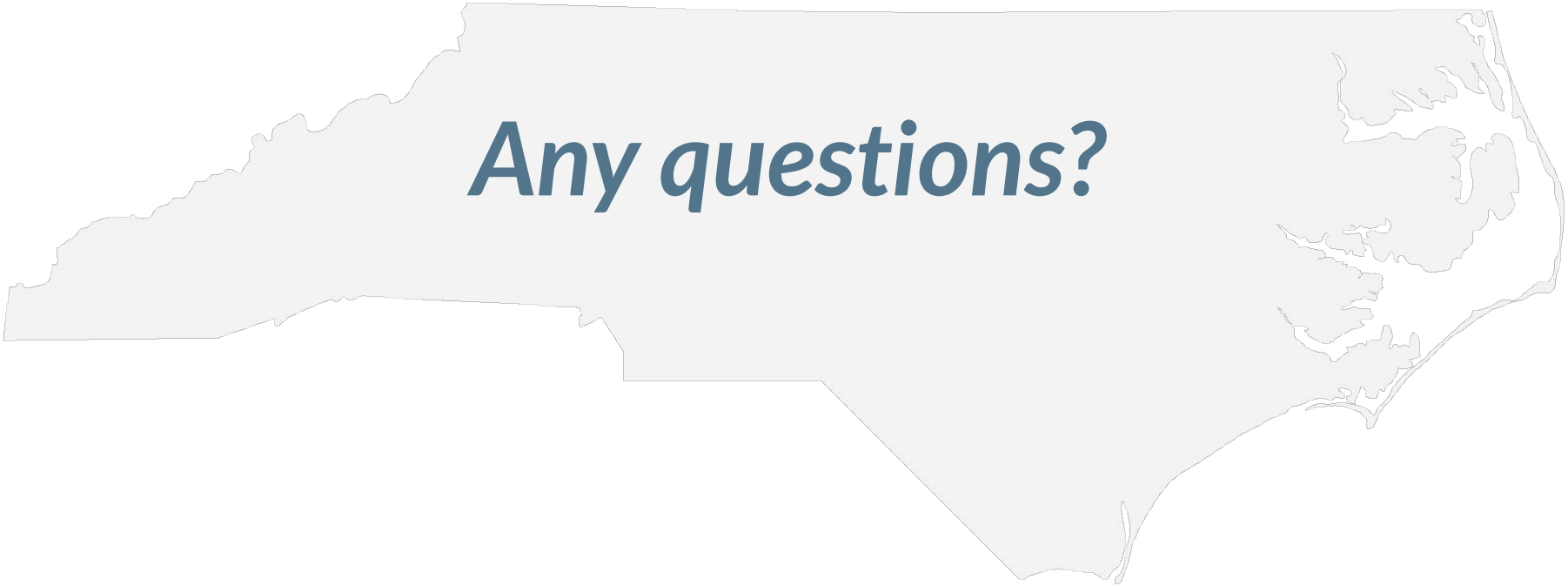


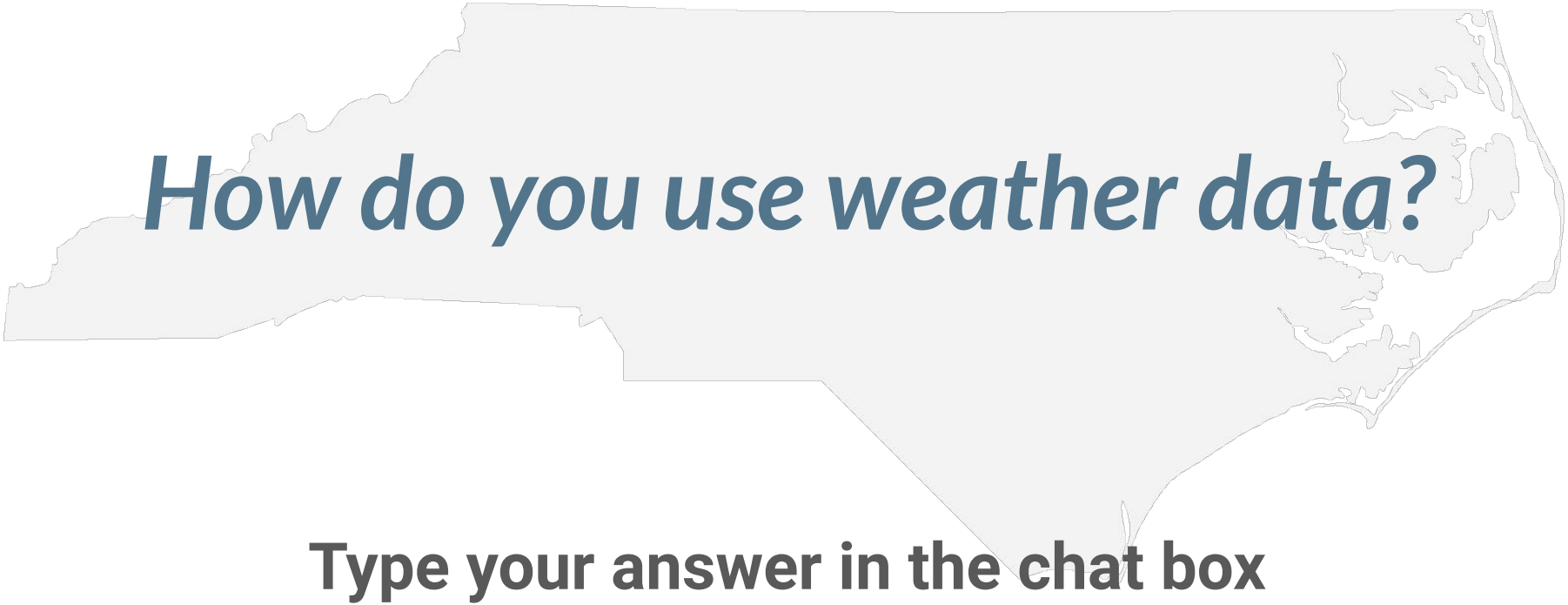
What to Trust

- **Short-range forecasts** from trusted providers such as NWS
- **Medium-range/seasonal outlooks** in the cool season based on solid science
- Our **quirky weather** in North Carolina will continue!



Understanding weather forecasts

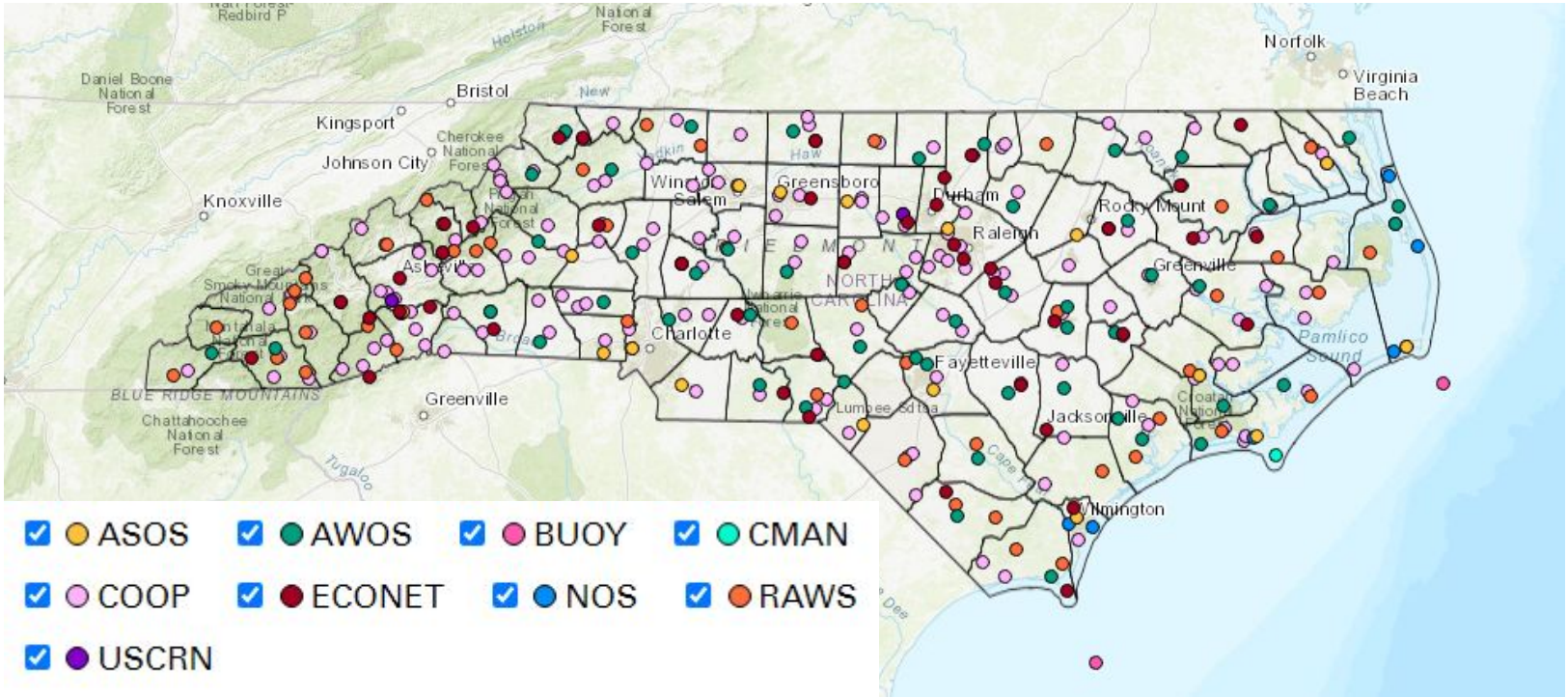




How do you use weather data?

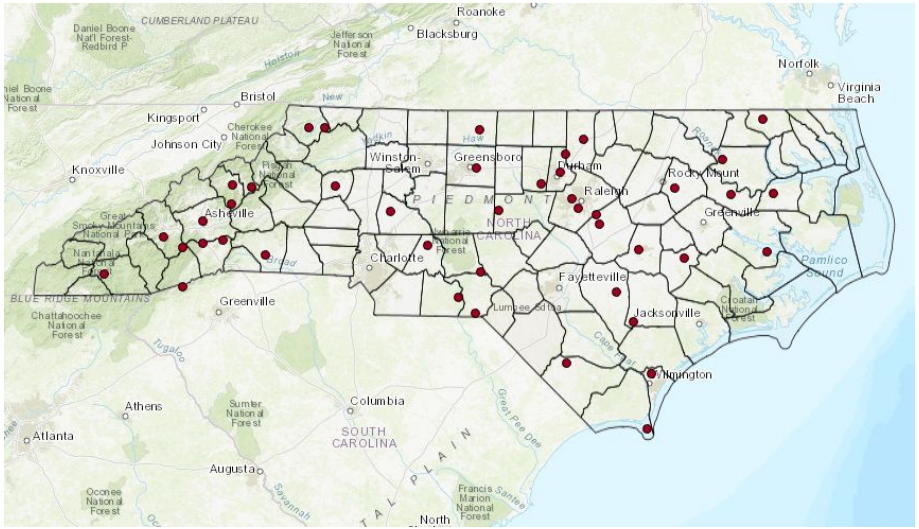
Type your answer in the chat box

Weather Stations in NC



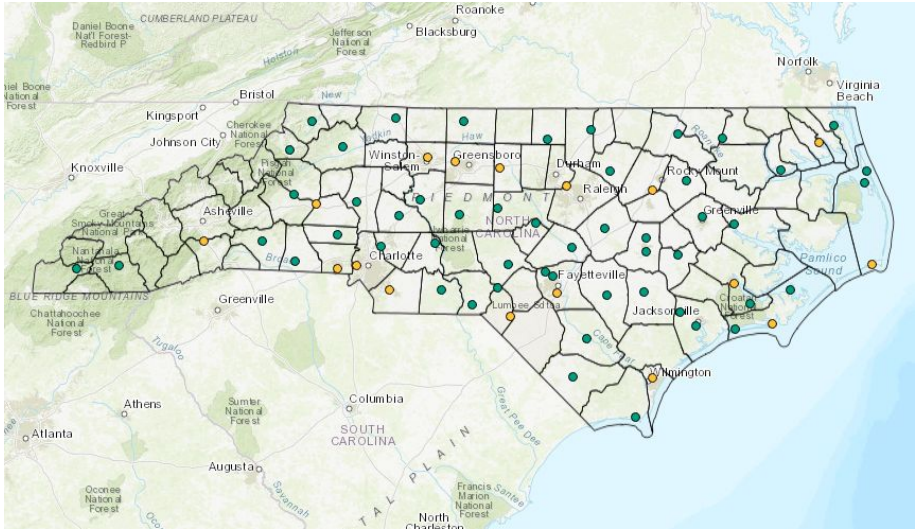
ECONet

- SCO's monitoring network
- 43 research-grade stations
- Measurements every one minute



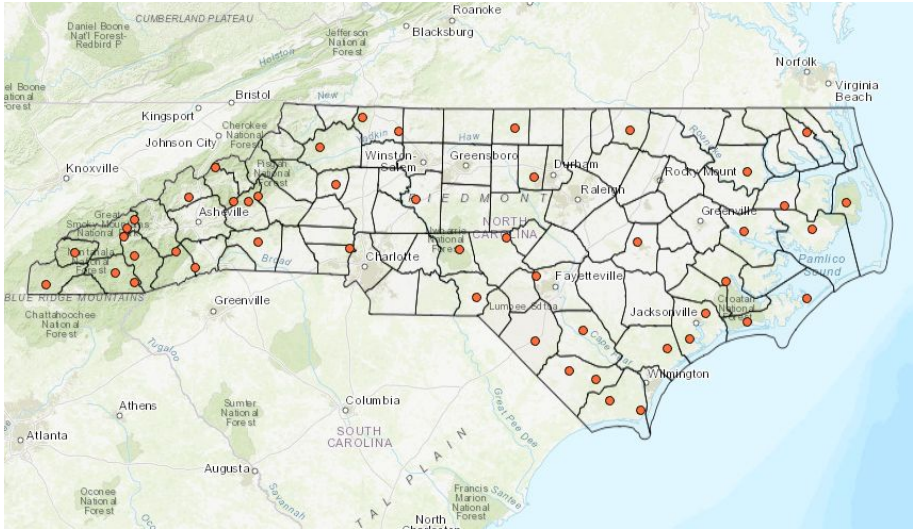
ASOS/AWOS

- Based at airports
- Includes the NWS's primary reporting sites *(e.g., RDU, ILM)*
- Hourly observations, some since 1940s



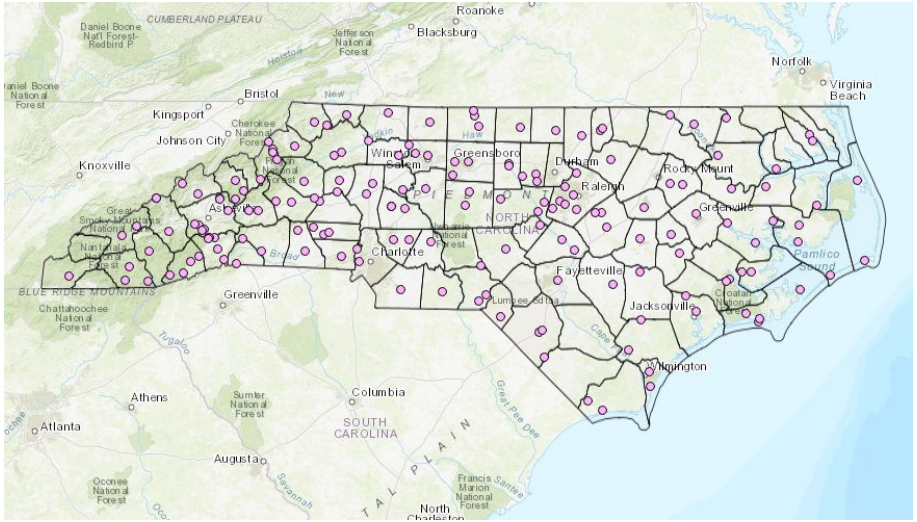
RAWS

- Forestry and fire weather monitoring stations
- Hourly observations
- Winds measured at 20 ft. *(vs. 33 ft.)*



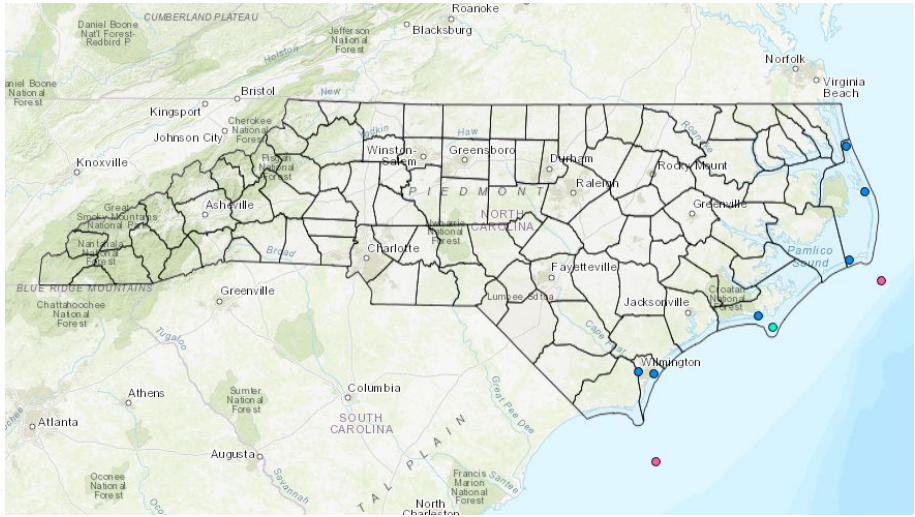
COOP

- NWS Cooperative Observer network
- Sensors record daily temperature and precipitation data
- Many long-term sites

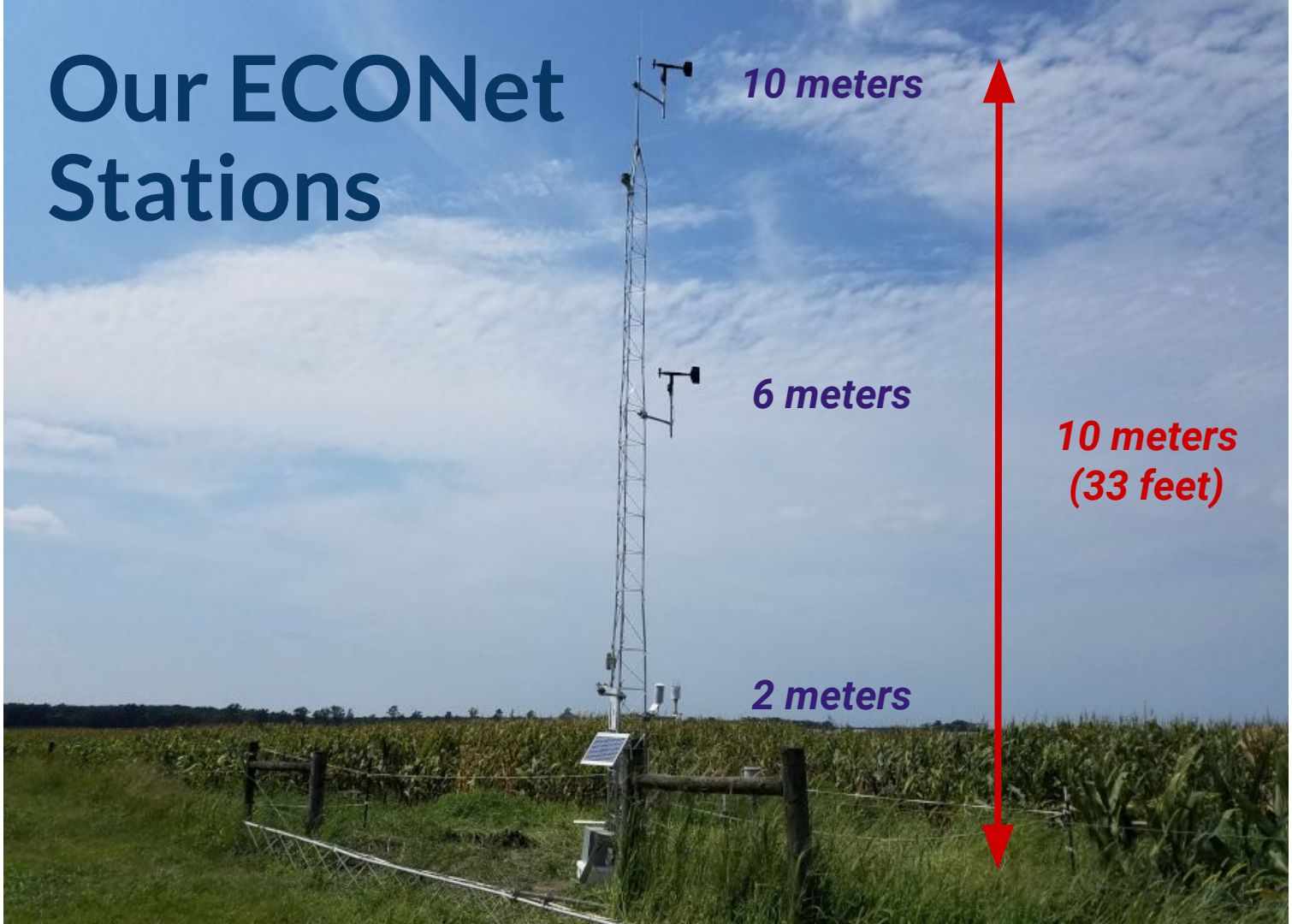


Coastal/Offshore Networks

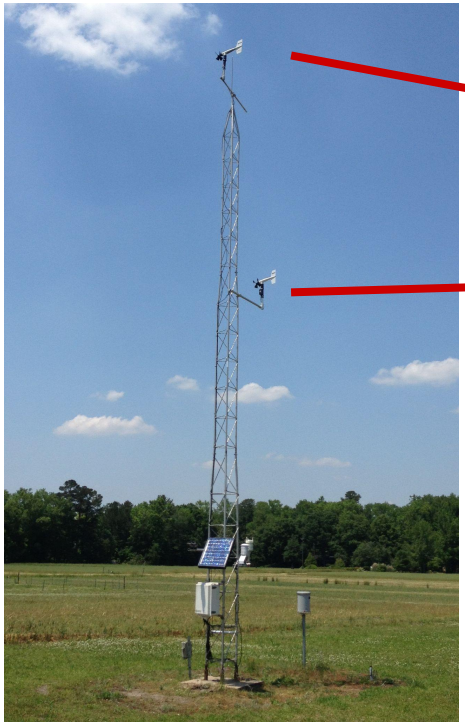
- Includes buoy, NOS, and CMAN sites
- Hourly observations for basic weather variables *(temp., winds, pressure)*



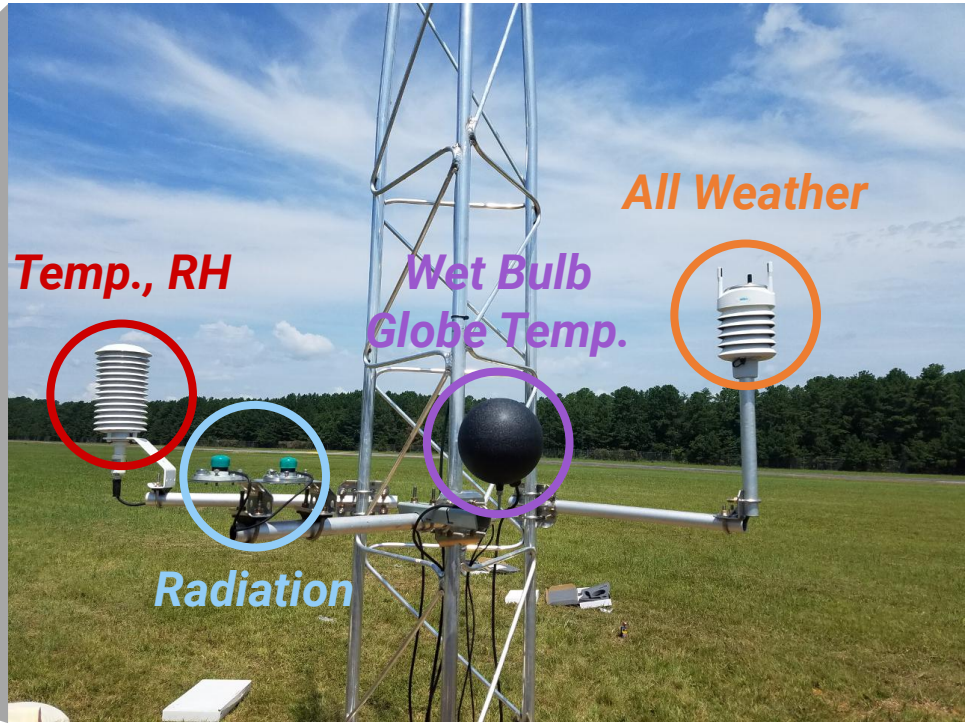
What *Don't* We Collect?


Our ECONet Stations
10 meters
6 meters
2 meters
10 meters
(33 feet)

Wind Sensors



2-Meter Instrumentation

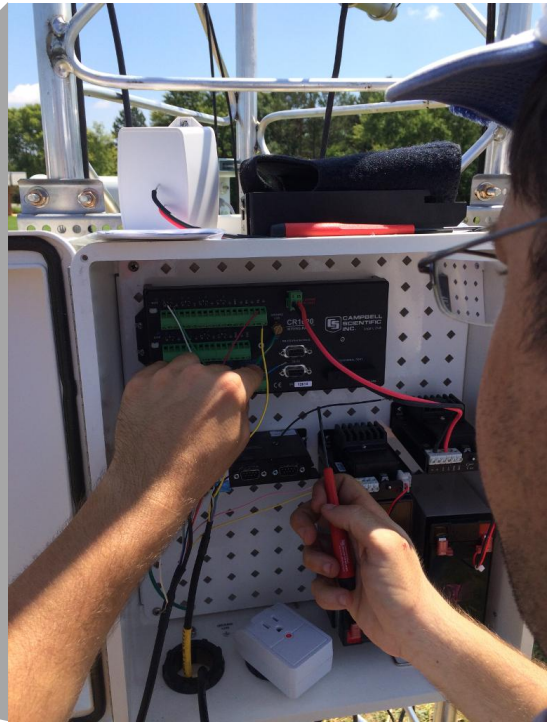


Tipping Bucket Rain Gauge

Leaf Wetness Sensor

Soil Temp./Moisture Sensors

Data Communication



ECONet Data Overview

43 stations

× **20** variables per observation

× **60** observations per hour

× **24** hours per day

1,238,400 data points per day!

NC STATE UNIVERSITY

climate.ncsu.edu

RESOURCES search ncsu.edu

College of Sciences →

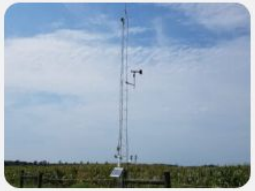
North Carolina State Climate Office

About | People | Monitoring | Education | Data + Products | Research | News

Iris 'Harmony' at JC Raulston Arboretum in Raleigh

From The Mountains To The Outer Banks

The North Carolina State Climate Office serves as the primary scientific extension resource for weather and climate science for the state of North Carolina. The office achieves its mission through climate science monitoring, education, extension, and research.



Monitoring

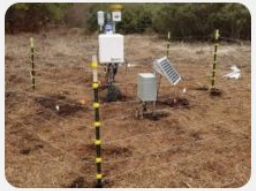
Our office hosts the North Carolina Environment and Climate Observing Network (ECONet). Learn more about the 43-site network here.

Education

The office provides curricula and other educational resources on North Carolina's weather and climate.

Data + Products

Use and explore our data and tools for understanding North Carolina's climate



Research

The office conducts original research on many aspects of North Carolina weather and climate. Learn more about our projects

Products | North Carolina State Climate Office

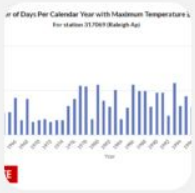
Products

Data

Access and retrieve station observation data from across North Carolina

Weather

Find and explore our products that explore past weather events



Climate

View our products that examine the climate of an area

Agriculture

View all available products developed for the agriculture community

Products | North Carolina State Climate Office

Data Access

Cardinal Data Retrieval System

Obtain and view climate data. For more information, click here

Request Data

NCSCO ID Login Required

Use Cardinal's step-by-step Request Builder to retrieve climate data

Station Scout

No account required

Explore and view recent data for stations across North Carolina with Cardinal's Scout tool

CLOUDS API

Ideal for advanced users

CLOUDS API

NCSCO ID Login Required

For advanced users, access our data using the CLOUDS API

Search for Stations

- (●) Find stations near a location: (detect my location)
  - Wilmington, NC
- ( ) Find stations by name or ID:
  - Enter part of the station name or ID
- ( ) Find stations in a county:

SEARCH

Show: (●) Active stations only ( ) All stations

Filter by station network: (show all) (hide all) (what are these?)

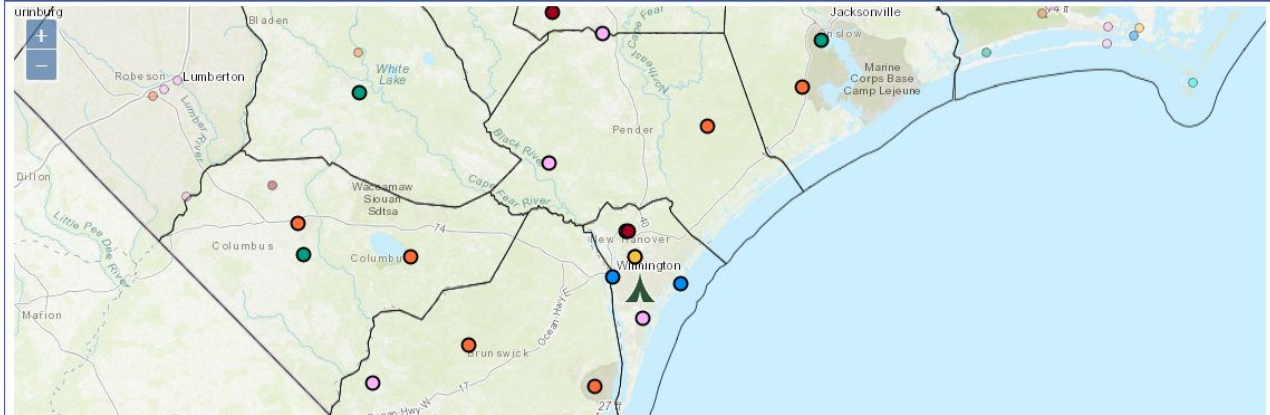
- [x] ASOS
- [x] AWOS
- [x] BUOY
- [x] CMAN
- [x] COOP
- [x] ECONET
- [x] NOS
- [x] RAWS
- [x] USCRN

Search Results

Results near Wilmington, NC:

Network	ID	Station Name	Distance	Per. of Record
COOP	319457	Wilmington Intl Ap	4.0 mi.	1933-2021
NOS	WLON7	8658120- Wilmington NC	4.0 mi.	2014-2021
ASOS	KILM	Wilmington International...	4.1 mi.	1948-2021
COOP	319461	Wilmington 7 Se	4.7 mi.	2008-2021
NOS	JMPN7	8658163- Johnny Mercer P...	5.8 mi.	2014-2021
ECONET	CAST	Horticultural Crops Res Stn	7.8 mi.	1983-2021
COOP	319467	Wilmington 7 N	7.9 mi.	1949-2021
RAWS	SUNN7	Sunny Point	15.6 mi.	2002-2021
COOP	315820	Moores Creek Nb	21.3 mi.	2000-2021
AWOS	KSUT	Brunswick County Airport	22.3 mi.	2002-2021
RAWS	BKIN7	Back Island	24.2 mi.	2002-2021

Station Map



Ambient Conditions

From **CAST - Horticultural Crops Res Stn** in Castle Hayne, NC
on September 7 at 12:00 pm (5 minutes ago)

Air Temperature

84.4°F

Winds (at 10m)

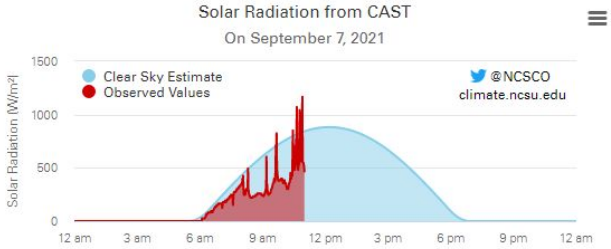
5 MPH

From the northeast

Gusts to 8 mph

Dew Point:	73.7°F
Relative Humidity:	70%
Heat Index:	91.4°F
Barometric Pressure:	1014.8 mb (29.97 in Hg)
Sea Level Pressure:	1016.3 mb (30.01 in Hg)
Soil Temperature (at 10cm):	80.6°F
Soil Moisture (at 20cm):	0.179 m³/m³

Sky Conditions



Today's Sunrise:	6:49 am (5 hours, 15 minutes ago)
Today's Sunset:	7:29 pm (7 hours, 25 minutes from now)

Yesterday's Weather

From **CAST - Horticultural Crops Res Stn** in Castle Hayne, NC
for the 24 hours ending on September 7 at 12:00 am

Max/Min Temperatures

89.2°F

65.3°F

Total Precipitation

Trace

Maximum Relative Humidity:	100%
Minimum Relative Humidity:	40%
Maximum Wind Speed (at 10 meters):	11 mph

Year-to-Date Conditions

From **CAST - Horticultural Crops Res Stn** in Castle Hayne, NC
as of September 7 at 12:00 pm

Total Precipitation:	49.27 inches	Plot
Growing Degree Days: (Base 50 °F)	4122.2	Plot

Cardinal: Station Scout › CAST - Horticultural Crops Res Stn

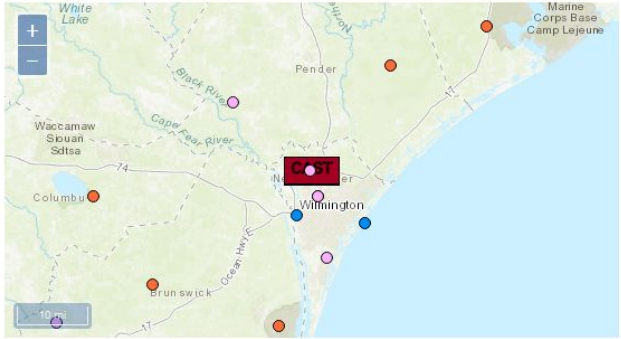
Current Conditions | **Station Information** | Data Availability | Recent Data

Summary

Station ID:	CAST
Station Name:	Horticultural Crops Res Stn
City:	Castle Hayne, NC
Elevation:	43 feet above sea level
Network:	ECONET (about)
Supported By:	NC Agricultural Research Service

Location

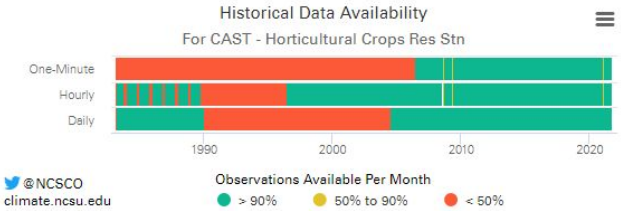
Latitude: 34.32105°N Longitude: 77.91614°W



Nearby Active Stations:

History

Data Begins:	March 17, 1983
Data Ends:	September 7, 2021
One-Minute Data:	Available (since Dec 20, 2000)
Hourly Data:	Available (since Mar 17, 1983)
Daily Data:	Available (since Mar 17, 1983)



Geography

County:	New Hanover County (show)
Agronomy Region:	Region 4 (show)
Climate Division:	Southern Coastal Plain (NC06) (show)
Hydrologic Units:	
Basin (HUC 6):	Cape Fear (030300) (show)
Subbasin (HUC 8):	↳Northeast Cape Fear. North Carolina. (03030007) (show)

Network Overview

The ECONet is the NC State Climate Office's flagship network for research-grade weather observations. These stations measure all standard weather variables, along with parameters such as solar radiation, soil moisture and temperature, and leaf wetness, designed to aid with agricultural condition monitoring. ECONet data is processed each hour using rigorous quality control routines to flag potentially bad data and alert technicians of sensors that may need to be fixed or replaced.

Network Operated By:	NC State Climate Office
Data Provider:	NCSCO
Sensors in this Network:	From the State Climate Office
More About this Station:	From the State Climate Office

Network Photo

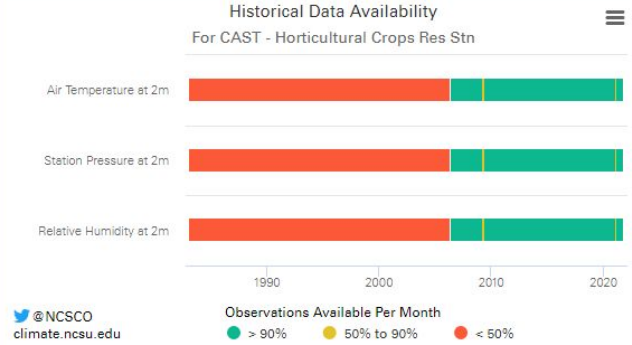
The ECONet station in Plymouth, NC. (Photo by State Climate Office staff)

Parameters Measured

Observation Frequency: ◉ One-Minute ○ Hourly ○ Daily

Parameter	Level	Plot
Air Temperature	2m	⊖
Air Temperature (Secondary Sensor)	2m	⊕
Station Pressure	2m	⊖
Relative Humidity	2m	⊖
Relative Humidity (Secondary Sensor)	2m	⊕
Total Precipitation	1m	⊕
Total Precipitation (Impact Sensor)	2m	⊕

Parameter Timelines



Cardinal: Station Scout › CAST - Horticultural Crops Res Stn

Current Conditions | Station Information | Data Availability | Recent Data

Select a Time Period

Observation Frequency

- (•) Hourly
- ( ) Daily
- ( ) Monthly

Period Length

- (•) Past 2 days
- ( ) Past week
- ( ) Past 2 weeks
- ( ) Past month
- ( ) Past 2 months

Need data over a longer or historical period? Request it from Cardinal.

Select a Parameter

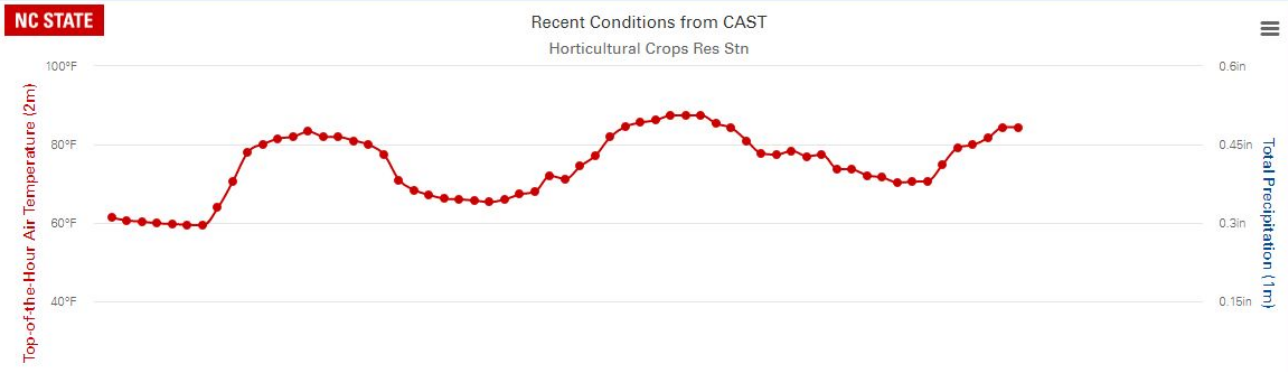
Clear Plot | Update Plot (2 selected)

- Air Temperature
- Air Pressure
- Humidity
- Precipitation

Parameter	Level	Plot
Total Precipitation	1m	☑
Total Precipitation (Impact Sensor)	2m	☐

- Wind Speed & Direction
- Wind Gust
- Solar Radiation
- Soil Temperature

Plot of Recent Data



Our Climate Blog

- Monthly climate summaries
- Recent event recaps
- Historical event reviews
- Other weather & climate tidbits

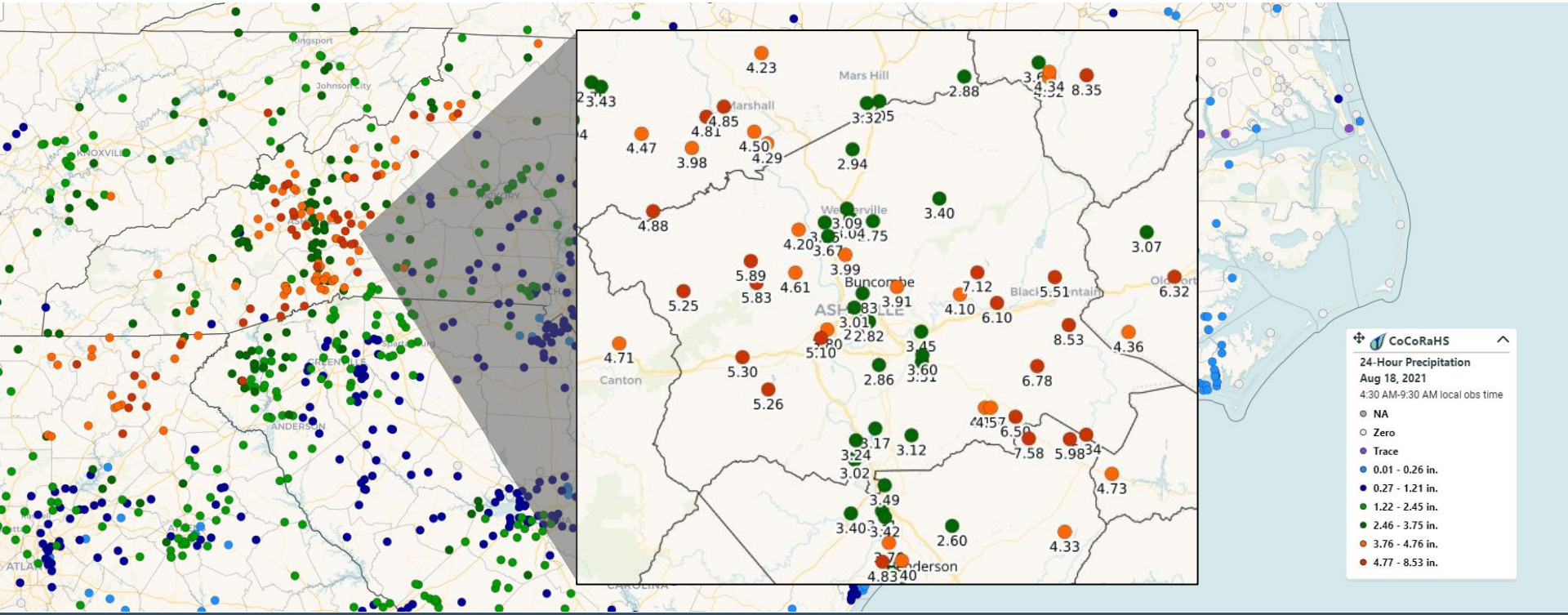
climate.ncsu.edu/climateblog

Weather data collection and access

CoCoRaHS

Community Collaborative Rain, Hail, & Snow Network

CoCoRaHS Reports on Aug. 18



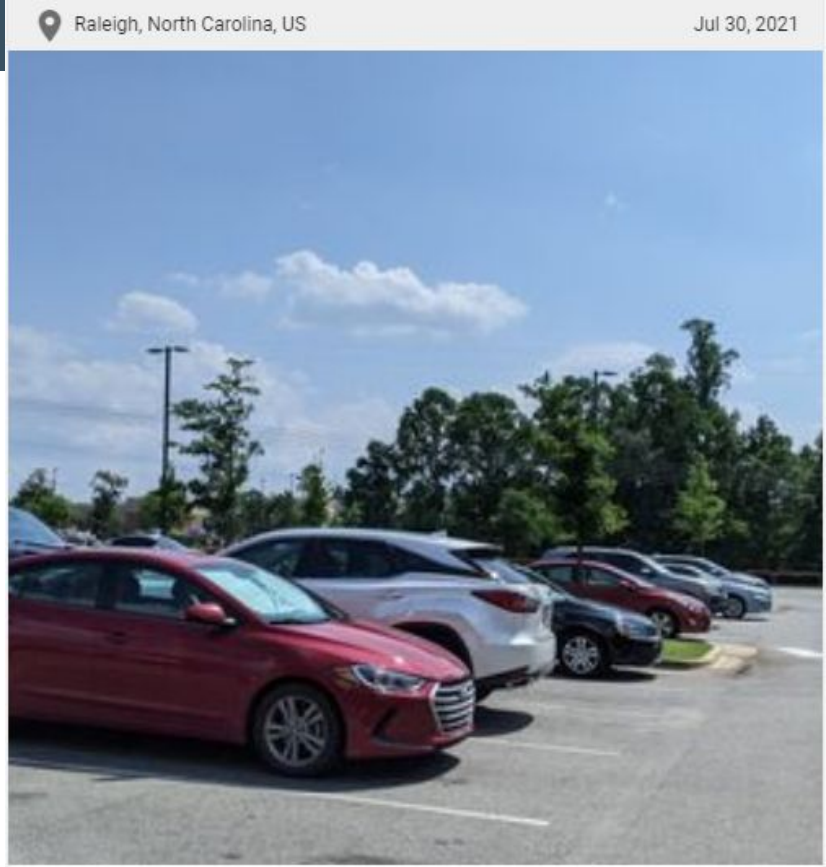
CoCoRaHS Condition Monitoring

- Observers send weekly-ish descriptions of conditions in their area
- Highlight signs of wetness/dryness to the landscape, and any recent changes

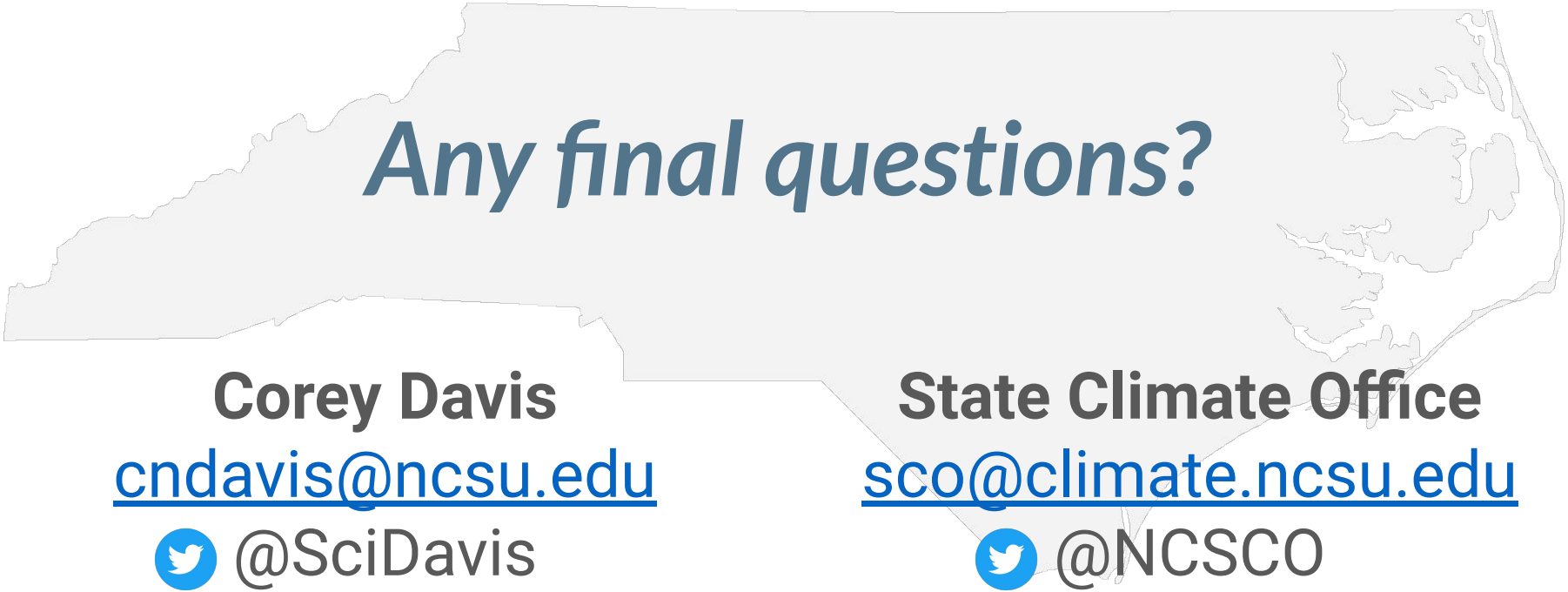
iSeeChange.org

I SEE CHANGE
COMMUNITY CLIMATE & WEATHER JOURNAL

- Observers note climate impacts in their areas
  - Weather, wildlife, and landscape
- Community reports can help identify local issues and concerns



Thanks for joining!



Any final questions?

Corey Davis
cndavis@ncsu.edu
@SciDavis

State Climate Office
sco@climate.ncsu.edu
@NCSCO