

Modern Measurement Systems

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ATMS 320

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What do we usually measure?

- Which variables are routinely measured in operational meteorological networks?
 - Wind speed, typically at 10 meters
 - Temperature and relative humidity, typically at 1.5 meters
 - Barometric pressure
 - Precipitation
- What else do we need?
 - Power source
 - 12V battery, solar panel, or AC
 - Data storage and transmission equipment
 - Datalogger and radio antenna/receiver
 - Long-term data storage

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Automated Surface Observing System (ASOS)

- Fully automated observing system developed by the National Weather Service, Federal Aviation Administration, and Department of Defense
- Designed to replace human observations
- ASOS provides the basic surface observations at airports nationwide

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ASOS Sensor Suite

Automated Surface Observing System

- Ceilometer (cloud height sensor; 1–3 per site)
- Visibility Sensor (1–3 per site)
- Precipitation Identification Sensor
- Freezing Rain Sensor (not for warm climates)
- Lightning Sensor (selected sites)
- Pressure Sensors
 - 3 at large airports
 - 2 at small airports
- Ambient/Dewpoint Temperature Sensor
- Anemometer (wind speed and direction)
- Precipitation Accumulation Sensor (heated tipping bucket gauge)

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ASOS Sensor Suite

Automated Surface Observing System

Parameter	Range	Accuracy
Pressure	16.9" Hg to 31.5" Hg	0.1" Hg
Temperature	-65 to +150°F	1°F
Dewpoint	-30 to +96°F	1°F
Windspeed	0 to 125 knots	1 knot
Wind direction	0 to 360°	10°
Visibility (Forward scatter)	<0.25 to 10 miles	<0.25 to 3 miles*
Cloud height	0 to 12,650 ft.	100 ft.*
Precipitation	≥0.01 inches	0.01 inches*
Freezing rain	≥0.01 inches	99%*

*Actually a resolution, and is commonly incremental.
*Actually a resolution.
*As long as there is at least 0.01" of ice accumulation.

Left image source: T. DeFolice, 1998. An Introduction to Meteorological Instrumentation and Measurement, Florida Hall.
Photo: Joel Siegel

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ASOS Sensor Suite: Asheville, NC

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ASOS Sensor Suite: Millinocket, ME



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Climate Reference Network

- National network of climate stations
- Goal: Long-term homogeneous observations of temperature and precipitation that can be coupled to long-term historical observations for the detection and attribution of present and future climate change
- 114 stations nationwide



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Climate Reference Network

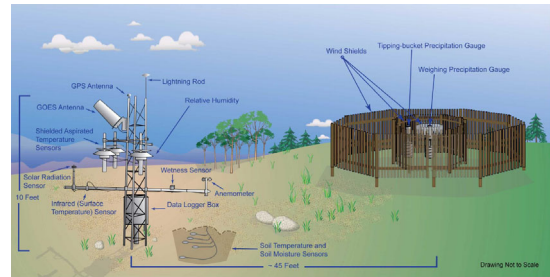


North Carolina Arboretum (Bierbaum Site)

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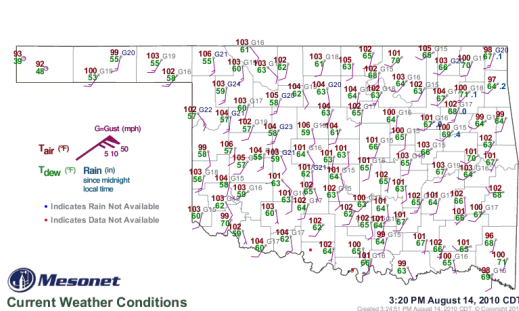
Climate Reference Network



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Oklahoma Mesonet



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Oklahoma Mesonet

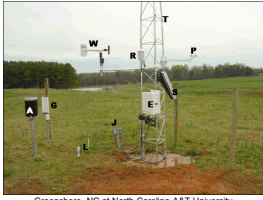
- Each site has a set of instruments located on or near a 10-m tower
- Measurements are packaged into 5-minute observations and transmitted to a central facility every 15 minutes
- The Oklahoma Climatological Survey verifies the data, verifies data quality, and provides the data to Mesonet customers



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North Carolina Environment and Climate Observing Network (NC ECONET)



Greenboro, NC at North Carolina A&T University



- A: All season rain gauge
- T: Tower section
- P: Radiometers
- S: Solar panel
- E: Electronics enclosure
- W: 2-m temperature and relative humidity
- G: Evapotranspiration gauge
- J: Phone jack
- L: Soil moisture/temperature at 6 levels

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Mobile Platforms: Mobile Mesonet Vehicles



Source: NBSL

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Mobile Platforms: Mobile Doppler Radars

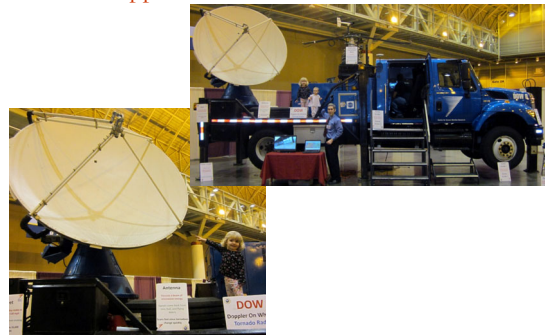


Photo: C. Godfrey

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Mobile Platforms: Mobile Doppler Radars



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Upper-air measurements



Photo: C. Godfrey



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