October 2021 Central NC Climate Summary

By Phillip Badgett and James Danco

October 2021 was the fifth-warmest October on record for central NC.

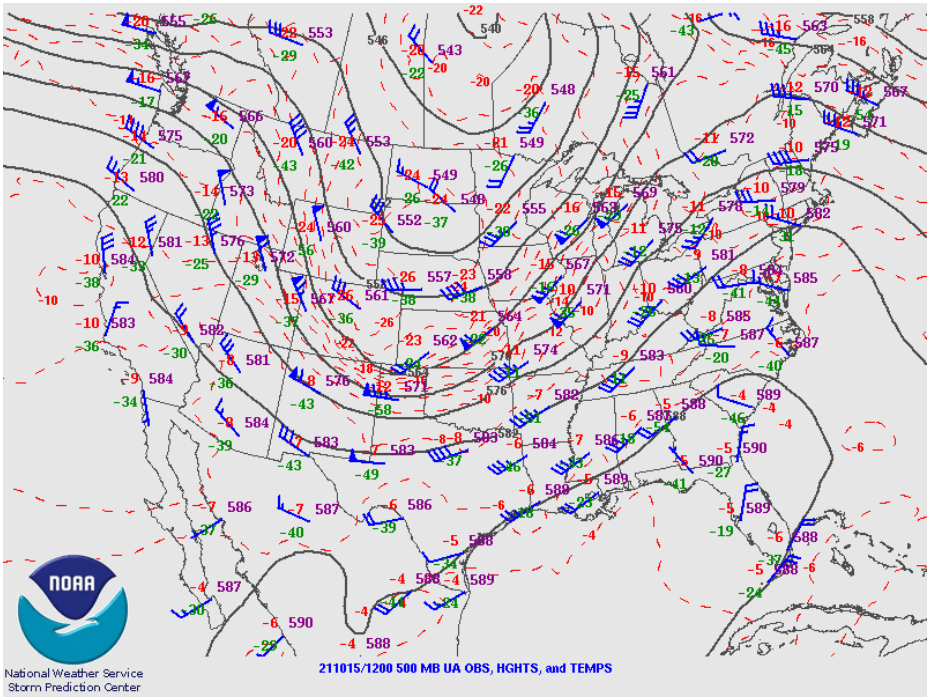
October 2021 turned out to be much warmer than normal across central NC. Most sites averaged 4 or more degrees above the 30-year average. The October monthly average temperatures and their departures from normal at the three climate sites are depicted in Table 1. The month went down in the record books as the fifth-warmest October at Greensboro, Raleigh, and Fayetteville. Even with the warmth, there were no daily record high temperatures and no additional 90+°F days at the three climate sites. Instead, the warmth came from persistence, with a ridge of high pressure parked over the southeastern United States for much of the month, resulting in many sunny days with temperatures 5-10 degrees above normal. See Figure 1.

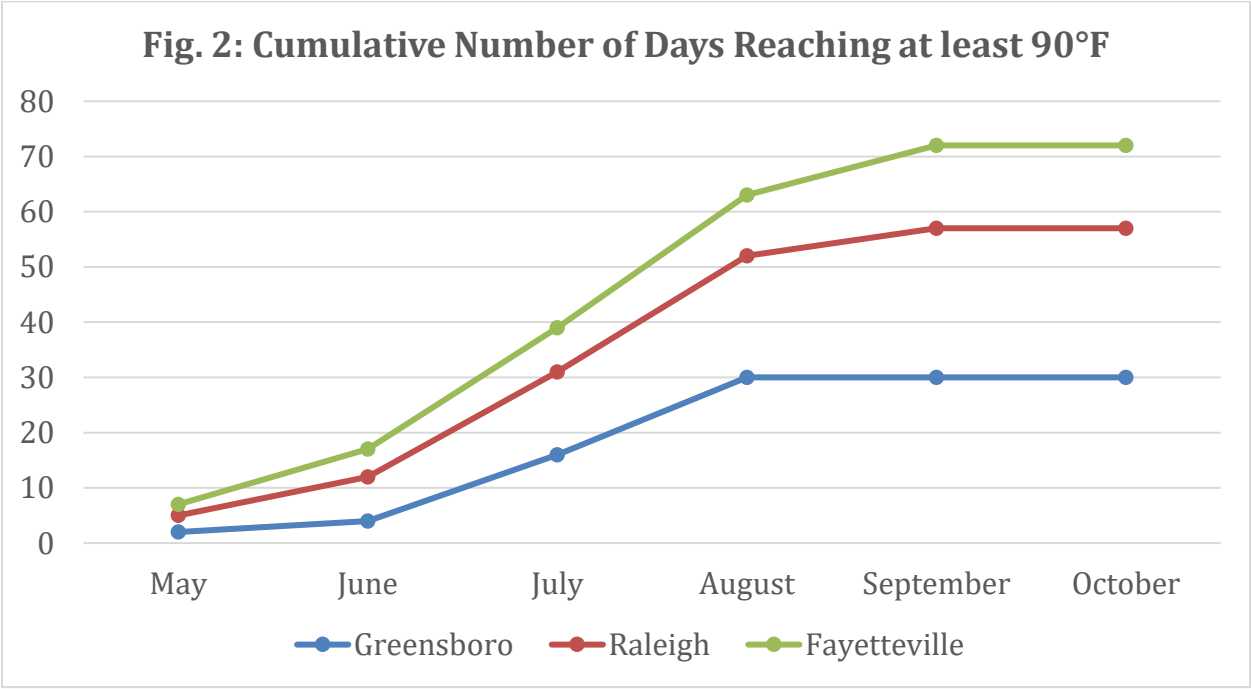
Table 1: Monthly Temperature Statistics

Site	Avg High Temp (°F)	Avg Low Temp (°F)	Avg Temp (°F)	Departure From Normal (°F)	Maximum Temperature (°F)	Minimum temperature (°F)
Greensboro (GSO)	73.9	54.5	64.2	+4.0	83 on 10/15	42 on 10/18 and 10/27
Raleigh-Durham (RDU)	76.8	55.5	66.1	+4.4	88 on 10/4 and 10/5	42 on 10/18 and 10/19
Fayetteville (FAY)	78.7	57.1	67.9	+4.1	89 on 10/16	43 on 10/19

The number of 90+°F days recorded at each climate site from May through October is depicted in Figure 2. Fayetteville was the "winner" as the hottest location with 72 such days. The totals dropped off over the Piedmont with Raleigh recording 57 and Greensboro 30. Note the jump in occurrences in July and August then the tailing off in September and October with autumn.

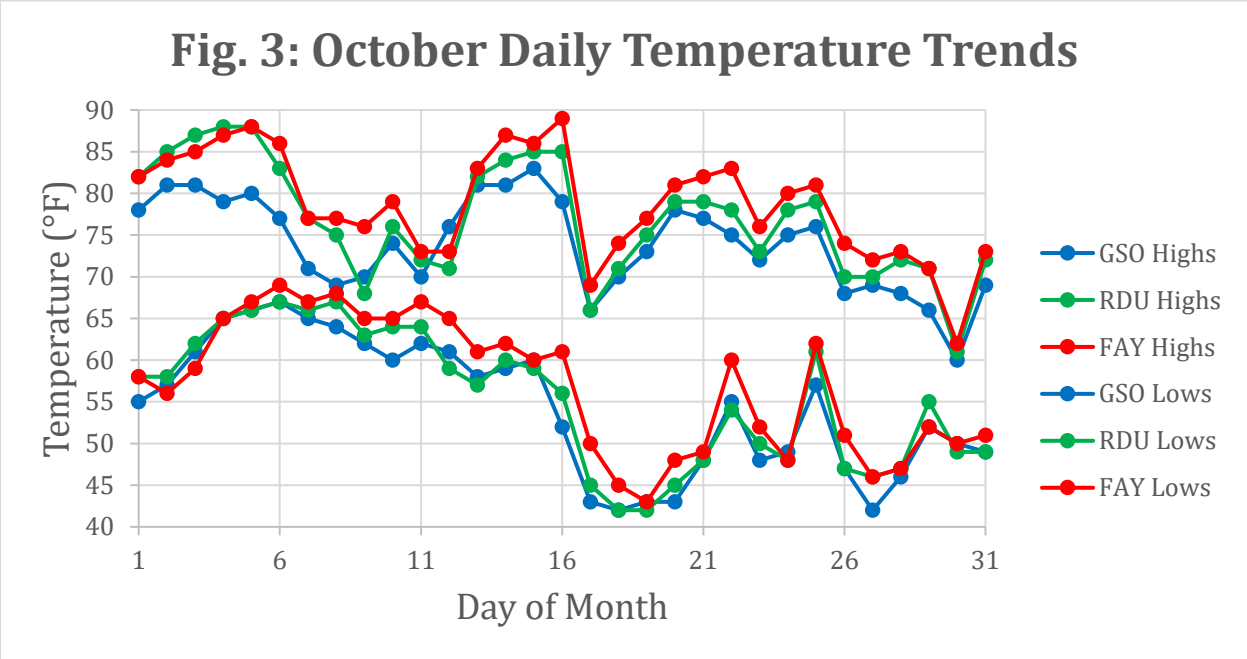
Fig. 1: 500 mb Observations, Heights, and Temperatures on 10/15



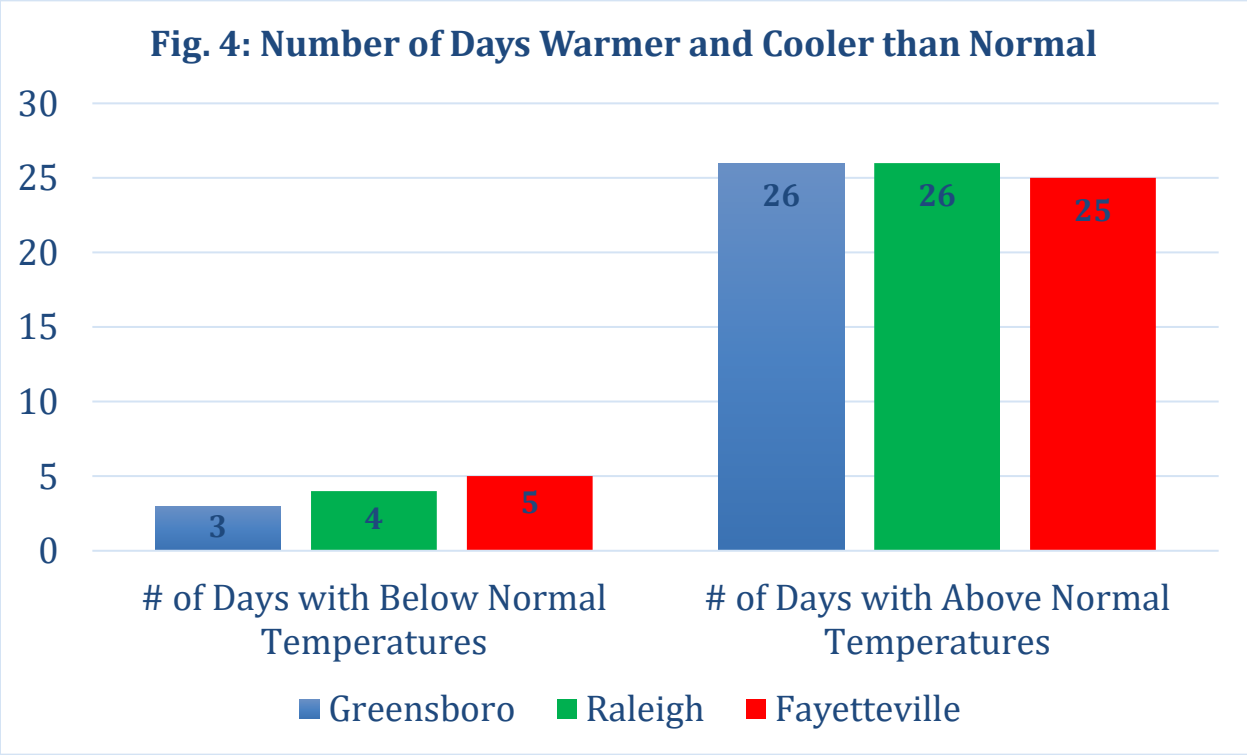


The time series of daily temperature for the month at Greensboro, Raleigh, and Fayetteville can be found in Figure 3. Note the three cold frontal passages, when the coldest days of the month occurred, with the strongest cooling behind the cold frontal passage on the 17th, when high

temperatures were close to 20°F cooler than the day before, and when the coldest temperatures of the month (lower-40s at all three climate sites) occurred.

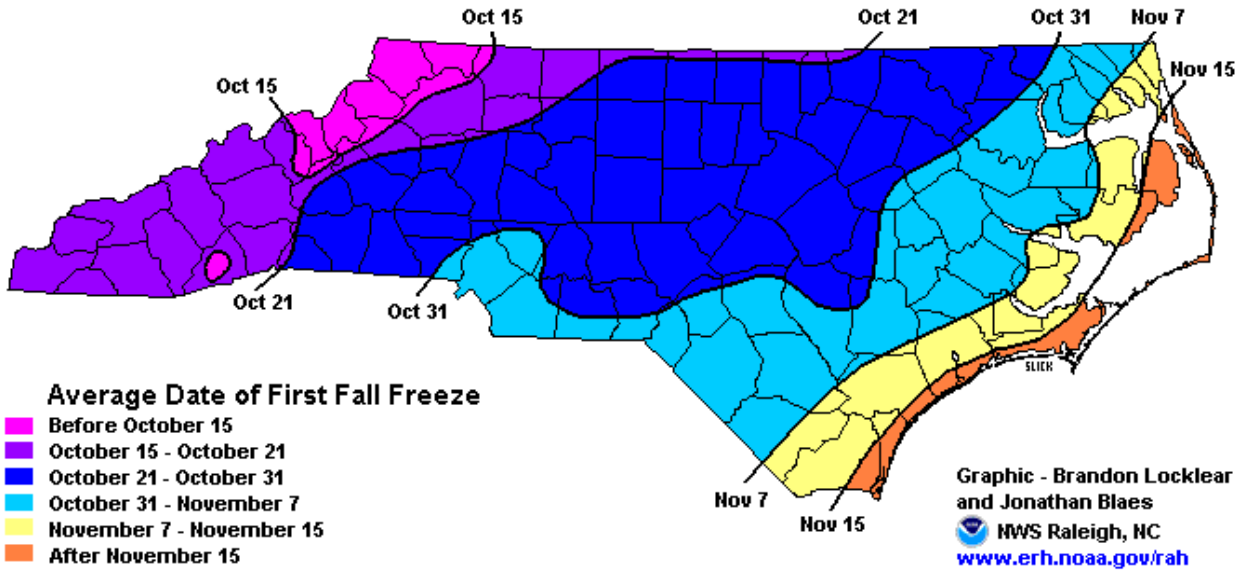


As shown in Figure 4, the vast majority of days in the month (over 80%), including the first 16 days in a row, were warmer than normal.



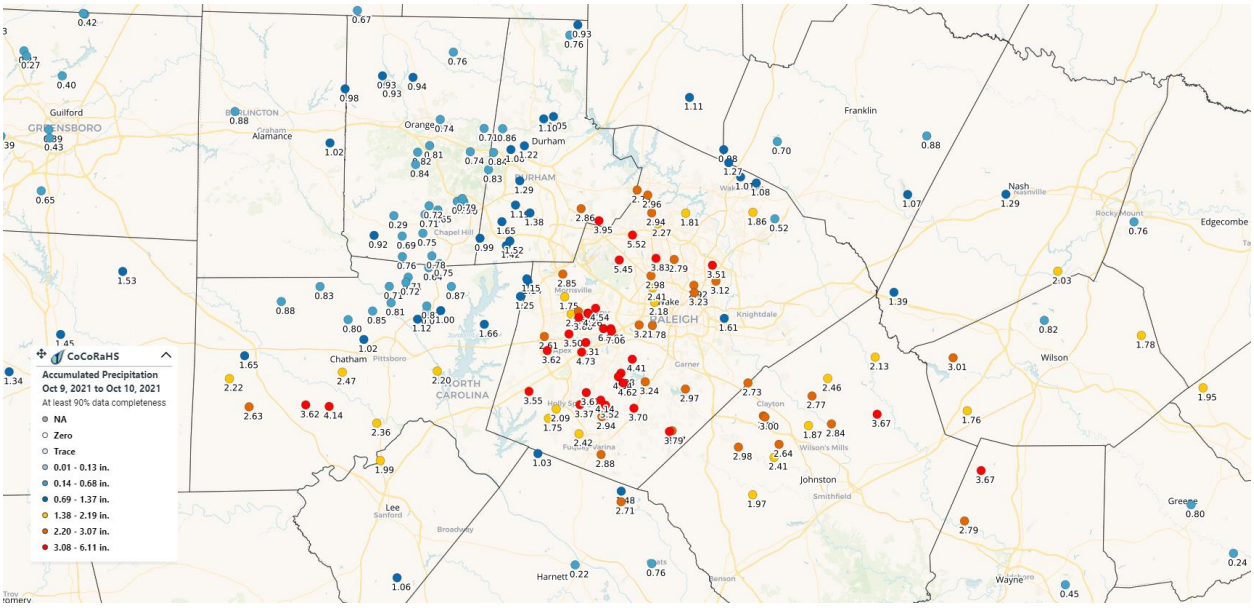
October was so warm that there were very few opportunities for the first freeze or frost of the season, as the lowest temperatures at the three climate sites were in the lower-40s. The average first 32°F occurrences are typically by late October over much of the Piedmont, with early November over the Coastal Plain (Figure 5).

Fig. 5: Average Date of First Fall Freeze in NC



Rainfall events in October were hard to come by given the persistent high pressure often parked nearly overhead. There were some exceptions, mainly during the periods between October 4 and 9, and between October 25 and 30, when significant rains occurred. It should be noted that the most significant rain this month fell October 5-8 over western NC in the mountains and foothills, where localized flooding and landslides occurred. More isolated significant heavy rain fell when showers and thunderstorms associated with a cold frontal passage developed over the central and eastern Piedmont into the central part of the Coastal Plain from early morning through the afternoon on October 9. Raleigh tallied a daily record of 4.96 inches of rainfall on October 9. This was the largest daily rainfall at Raleigh since Hurricane Matthew produced 6.45 inches on October 8, 2016, and it tied for Raleigh's eighth-wettest calendar day ever. The heavy rain during the October 9 event occurred from Randolph and Chatham counties east through the Triangle to Clayton and Smithfield in Johnston County, with Wake County being the bullseye. This heavy rain can be seen on the total CoCoRaHS map of precipitation totals beginning around 700 AM on October 8 and ending around 700 AM on October 10, with this rain mainly falling on October 9 (Figure 6). There were numerous reports of flash flooding including some stalled cars and flooded apartments, particularly in Wake County.

Fig. 6: CoCoRaHS Cumulative Precipitation on October 8-9

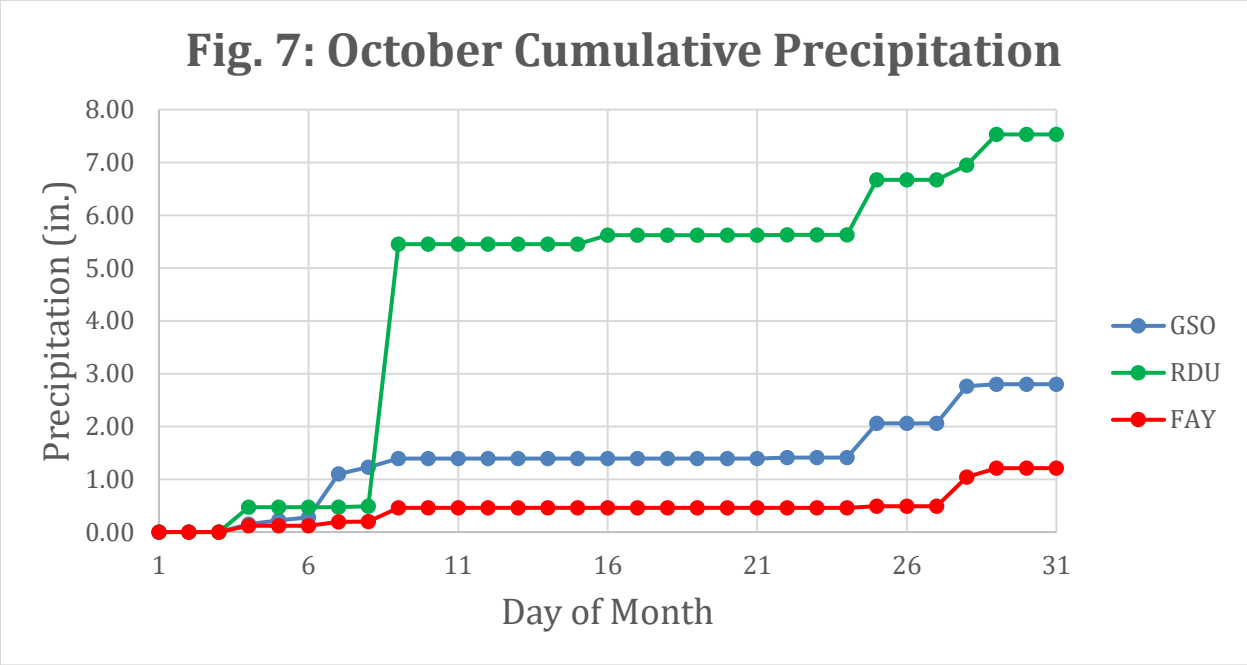


The lack of rainfall events and the sporadic nature of showers and thunderstorms when they occurred led to widely variable rainfall totals for the month. As shown in Table 2, even though Raleigh was very wet with 7.53 inches for the month (most of that falling from the October 9 event), monthly totals were 2.80 inches at Greensboro (0.30 inches below normal) and only 1.21 inches at Fayetteville (2.02 inches below normal).

Table 2: Monthly Precipitation Statistics

Site	Total precipitation (in.)	Departure from Normal (in.)	Max Daily Precipitation (in.)
Greensboro (GSO)	**2.80**	**-0.30**	**0.82 on 10/7**
Raleigh-Durham (RDU)	**7.53**	**+4.16**	**4.96 on 10/9**
Fayetteville (FAY)	**1.21**	**-2.02**	**0.55 on 10/28**

From the cumulative precipitation graph in Figure 7, a large portion of the month was very dry, after the heavy rainfall early on and before it started to get wetter by the end. In fact, from October 10-24, only 0.02 inches fell at Greensboro, 0.18 inches at Raleigh, and a trace at Fayetteville.



Additional selected ASOS or cooperative observations for October 2021 (note the wetness favored the Triangle while dryness was more widespread elsewhere):

Albemarle (Stanly County) 6.72 inches (3.13 above normal), Winston-Salem (Forsyth County) 2.09 inches (1.19 below normal), Mount Airy (Surry County) 1.45 inches (2.09 below normal), Raleigh (NCSU) 6.69 inches (3.09 above normal), Louisburg (Franklin County) 3.16 inches (0.50 below normal), Rocky Mount (Nash County) 4.22 inches (1.06 below normal), Clinton (Sampson County) 2.59 inches (0.68 below normal), Asheboro (Randolph County) 4.64 inches (1.14 above normal), Yadkinville (Yadkin County) 1.96 inches (1.40 below normal), and Reidsville (Rockingham County) 1.86 inches (1.65 below normal).

As displayed by the radar-estimated precipitation and the radar-estimated precipitation departure from normal in Figures 8 and 9, monthly rainfall totals varied widely across central NC as they largely came from sporadic showers and thunderstorms. They ranged from just 1-2 inches (1-3 inches below normal) in the Sandhills to as much as 4-8 inches (1-5 inches above normal) from Chatham County east into the Triangle and Johnston County.

Fig. 8: Radar-Estimated Monthly Precipitation

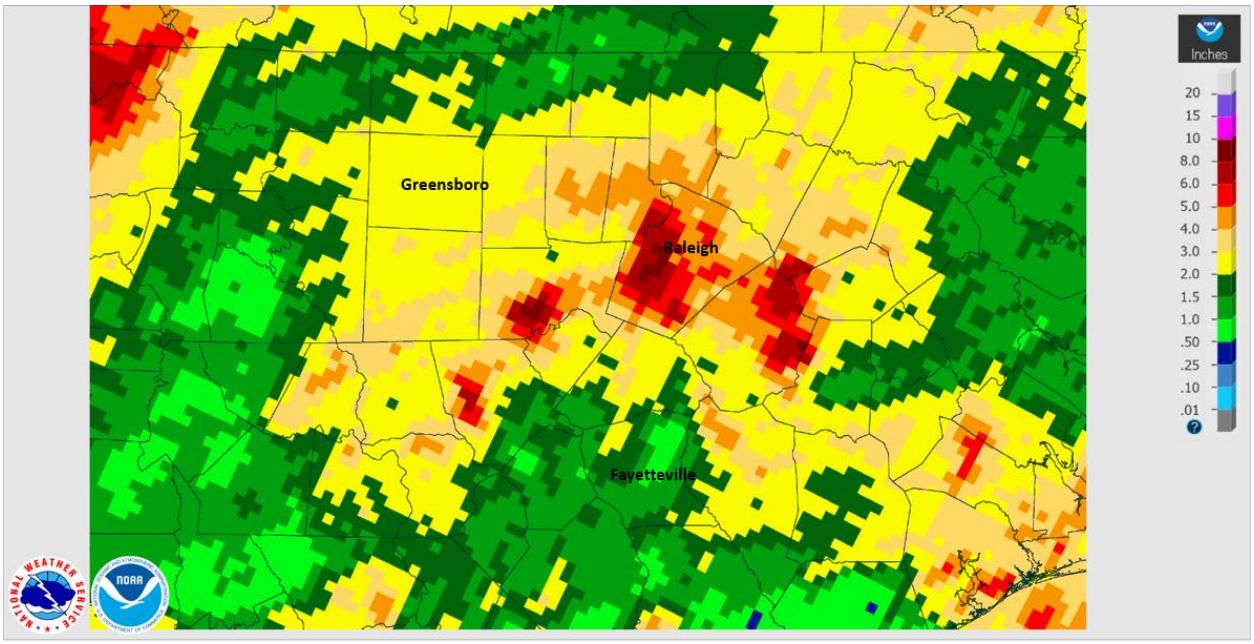
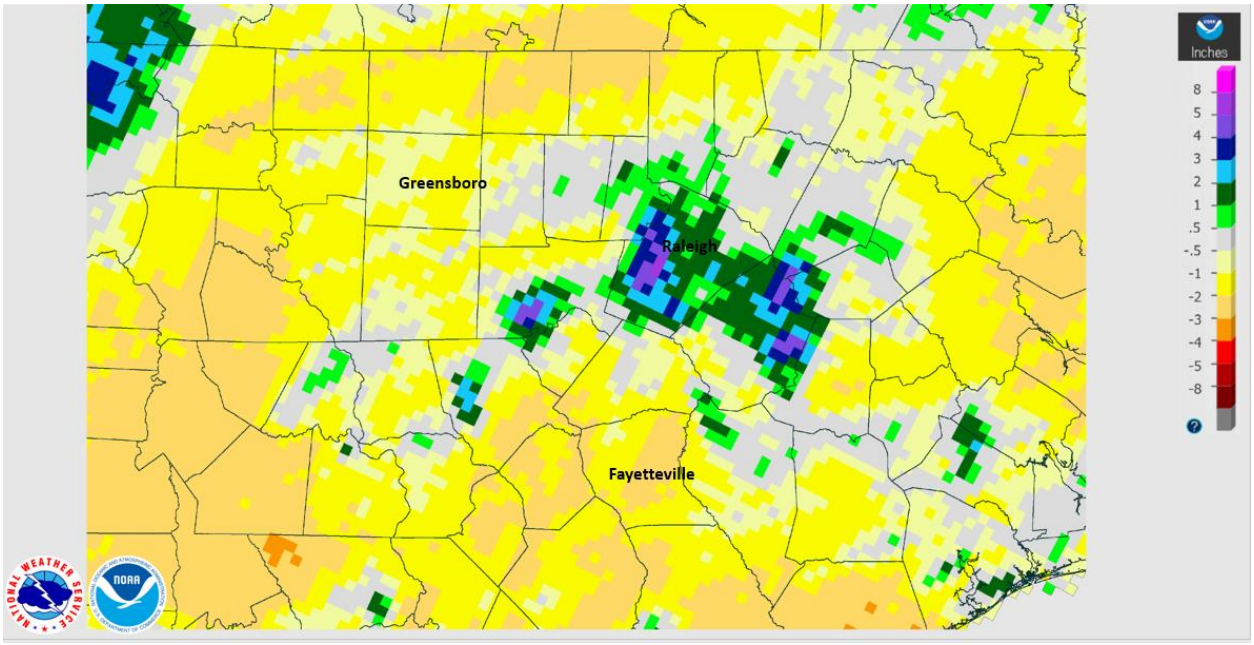
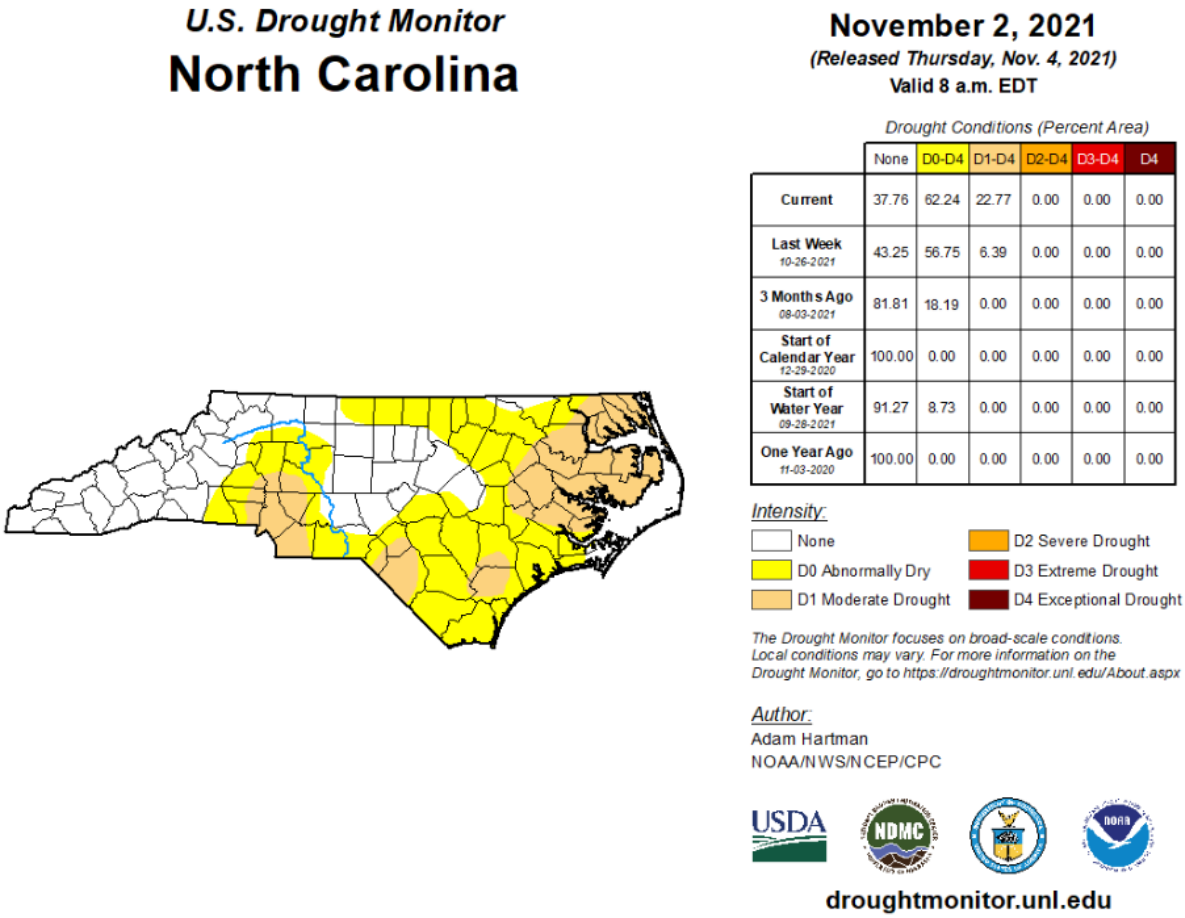


Fig. 9: Radar-Estimated Monthly Departure from Normal Precipitation



With the lack of widespread rainfall events, Abnormally Dry (D0) and even some Moderate Drought (D1) conditions expanded over much of eastern NC and the southwestern Piedmont, covering over 60% of the state in total. See Figure 10 (Drought Monitor).

Fig. 10: U.S. Drought Monitor for North Carolina on November 2



The drier weather resulted in lower soil moisture and streamflow across the Coastal Plain, Sandhills, and southwestern Piedmont compared to September, as displayed in Figures 10 and 11. The only parts of NC with above-normal soil moisture and streamflow were in the mountains and a small area centered over Wake County (thanks to the October 9 event).

Fig. 10: NASA SPoRT-LIS 0-100 cm Soil Moisture percentile valid 10/31/21

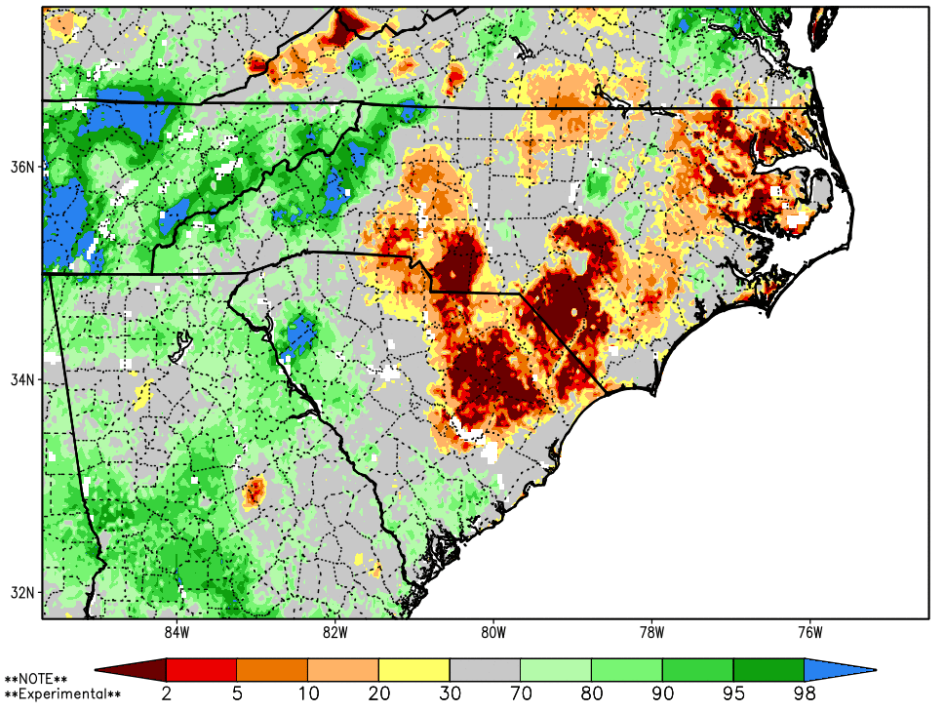
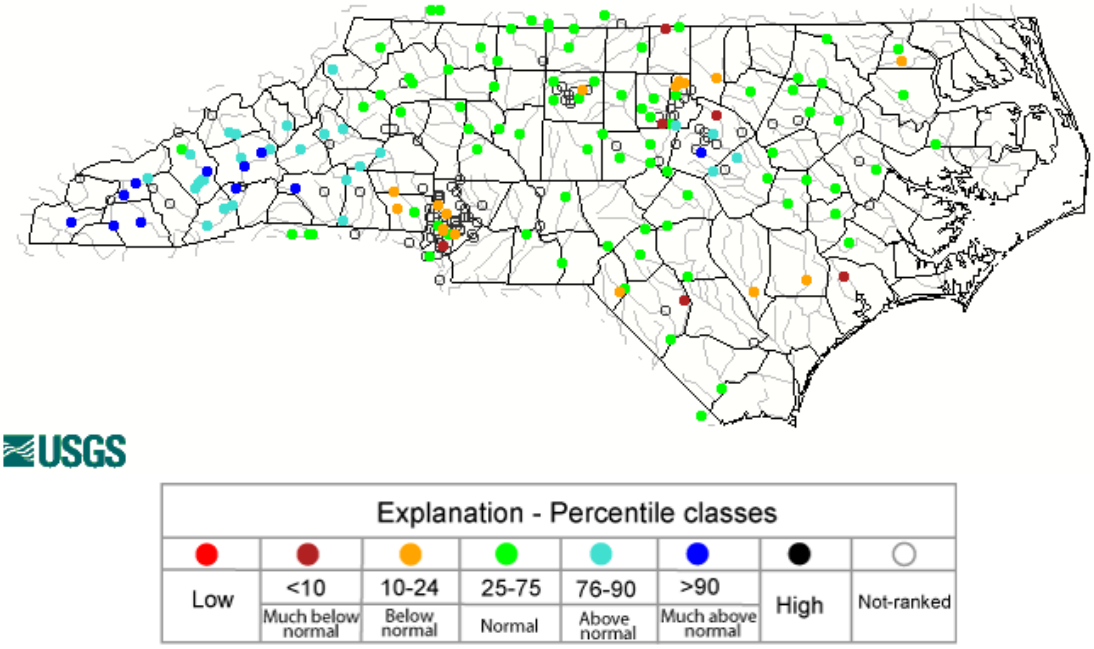


Fig. 11: Monthly Streamflow in North Carolina Compared to Historical Streamflow for October 2021



Other notes:

Days with thunderstorms this month:

Greensboro: 4
Raleigh: 3
Fayetteville: 1

Days with dense fog (visibility of ¼ mile or less):

Greensboro: 0
Raleigh: 0
Fayetteville: 3

Strongest wind gusts and direction:

Greensboro: W at 37 mph on October 25 and NW at 37 mph on October 26 (both thunderstorms)
Raleigh: SW at 33 mph on October 16 (thunderstorm)
Fayetteville: N at 33 mph on October 16 (thunderstorm)

Daily records:

Greensboro:

None.

Raleigh:

A daily record rainfall of 4.96 inches was set on October 9. This broke the old daily record of 3.97 inches set in 1894.

A daily record high minimum temperature of 61°F was tied on October 25. This record was last set in 2010.

Fayetteville:

None.

Monthly records:

Greensboro:

October 2021 was tied with 2019 for the fifth-warmest October on record with an average temperature of 64.2°F.

Raleigh:

October 2021 was the fifth-warmest October on record with an average temperature of 66.1°F.

October 2021 was tied with 1971 for the fifth-wettest October on record with 7.53 inches recorded.

October 9, 2021 was tied with September 6, 1996 for the eighth-wettest calendar day ever recorded, with 4.96 inches. The record wettest day is 6.45 inches on October 8, 2016 associated with Hurricane Matthew.

Fayetteville:

October 2021 was the fifth-warmest October on record with an average temperature of 67.9°F.