

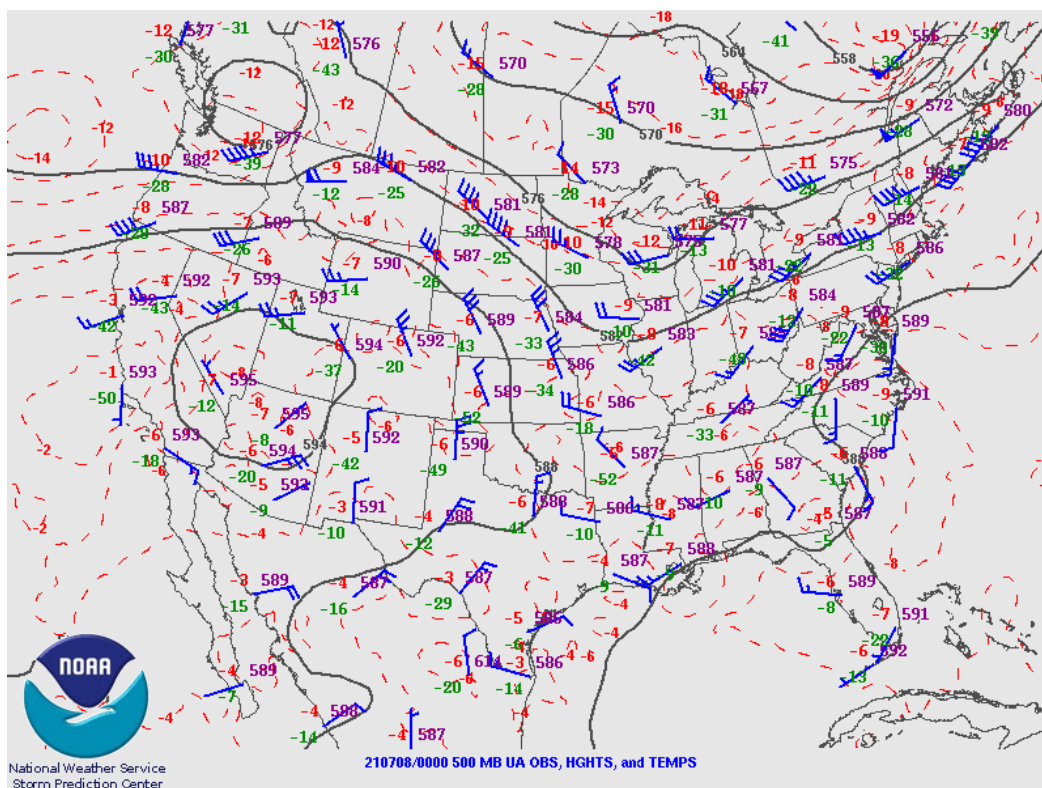
July 2021 Central NC Climate Summary

By Phillip Badgett and James Danco

Tropical Storm Elsa starts the month of July off on a wet note.

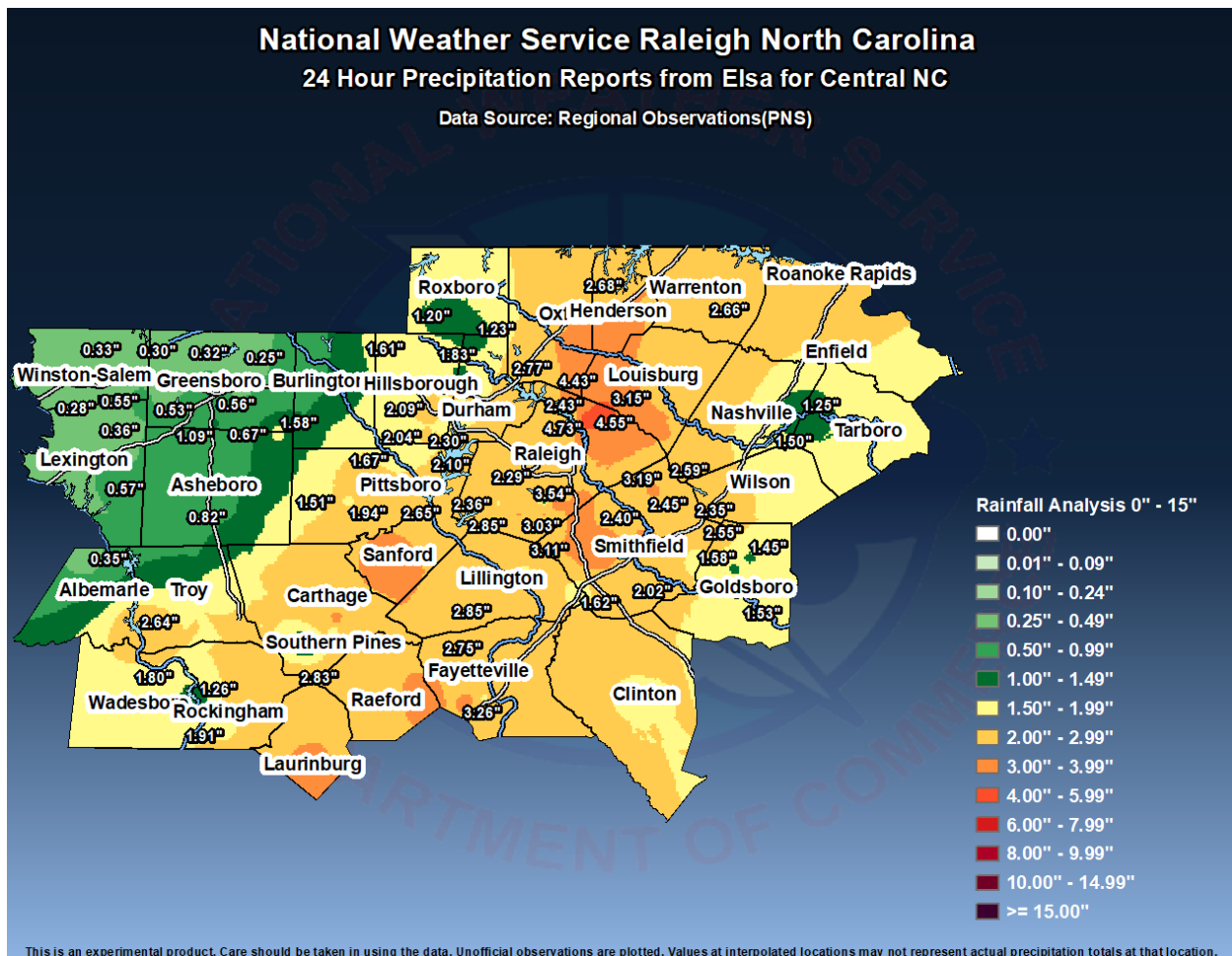
All eyes were on the tropics during the first week of July! Tropical Storm Elsa developed in the Atlantic on July 1, becoming the earliest fifth named storm on record. Elsa moved quickly westward in the tropical Atlantic and reached Category 1 status before weakening and passing just north of Jamaica on July 3. The storm turned NW as forecast on July 4 and 5, pushing across Cuba. As the system reemerged in the eastern Gulf of Mexico, it was able to strengthen to a minimal hurricane west of the Tampa Bay area on July 6. Elsa finally made landfall again over the Florida Panhandle on July 7 as a 65 mph tropical storm, before moving northeastward across the Carolinas on July 8. The storm brought heavy rainfall amounts of 2 to nearly 5 inches to portions of the eastern Piedmont, Sandhills, and Coastal Plain. This set the stage for above-normal rainfall for the month of July. As the month unfolded, several cold frontal passages led to additional showers and thunderstorms, keeping central NC relatively wet. However, much of the month's rainfall fell in the first three weeks of the month, with drier conditions arriving the last 10 days. Figure 1 below shows the upper air pattern on July 8. This pattern allowed Elsa to be steered around the typical Bermuda High offshore northward through the Southeast and Mid-Atlantic states.

Figure 1: 500 mb Observations, Heights, and Temperatures on July 8



The center of Elsa moved northeastward from SC through the Sandhills and Coastal Plain of NC on July 8, with the system maintaining tropical storm strength the whole way thanks to favorable upper-level winds and the nearby warm ocean. Courtesy of the NC State Climate Office, this made 2021 the first year since modern record-keeping began in 1851 in which multiple tropical storms passed through NC before July 15. There was plenty of heavy rainfall through the day over central NC (particularly just left of the track of the center), though the storm's fast movement kept totals lower than they otherwise would have been. RDU Airport totaled 2.52 inches, but the top rainfall amounts of 3 to 5 inches (which fell in about 3-6 hours) occurred just to the east in a corridor from Cumberland, Harnett, and western Johnston counties north through eastern Wake, Franklin, Vance, Granville, and Warren counties. 2.86 inches was measured at the Raleigh NWS office. Some of the highest CoCoRaHS reports included: Wake Forest 4.98 inches, Rolesville 4.55 inches, Raleigh (Brentwood) 4.40 inches, Henderson 3.91 inches, and Franklinton 3.84 inches. A storm total map is shown in Figure 2.

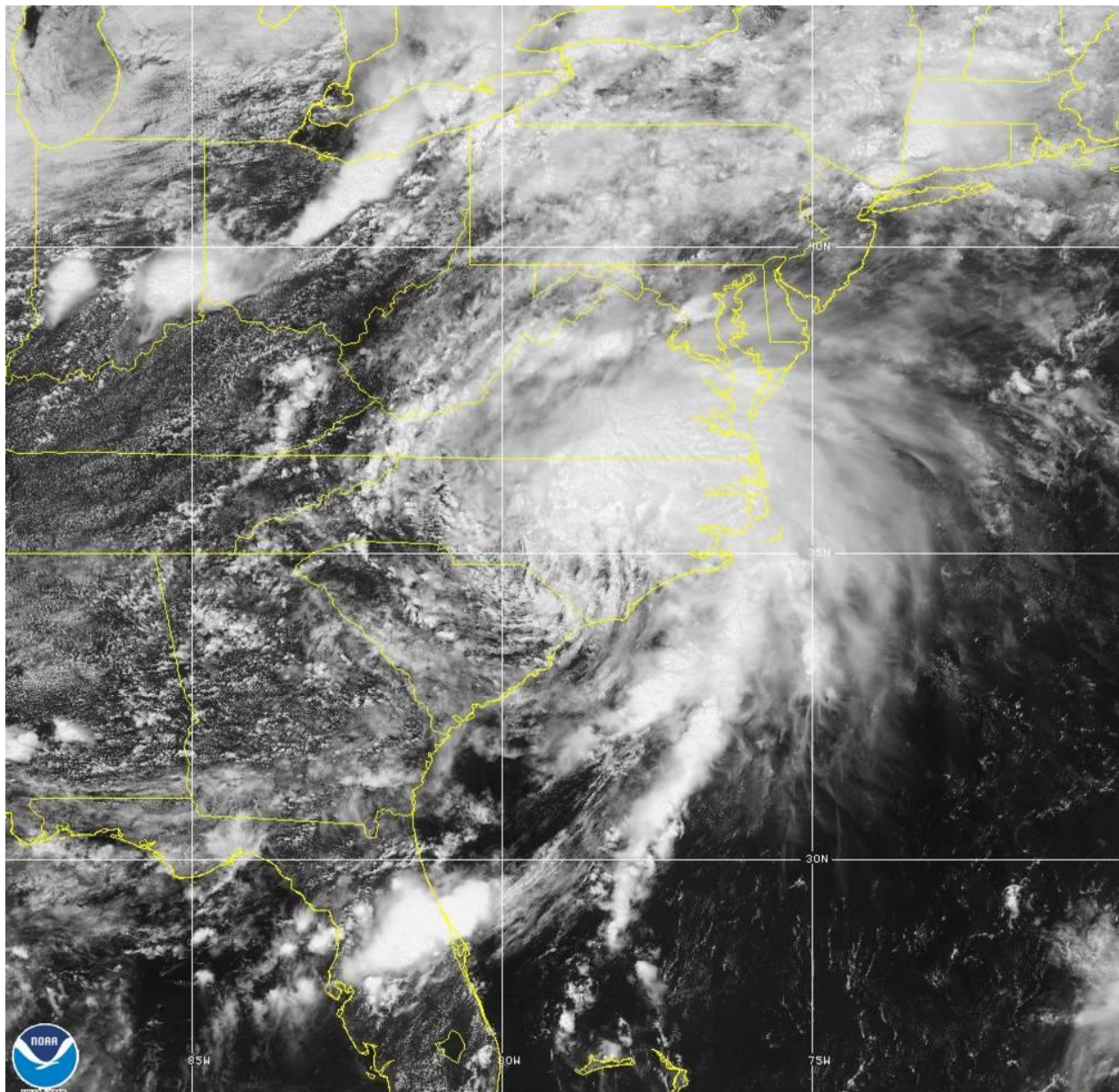
Figure 2: Tropical Storm Elsa Rainfall Totals across Central NC



The strongest tropical storm wind gusts from Elsa were mainly concentrated along the southern NC beaches and coastal waters (east of the track of the storm). Wilmington Airport reported a gust at 44 mph and Wrightsville Beach 54 mph. The highest reported gust in the state

was 58 mph at Sunset Beach. In central NC gusts were limited to the 20-40 mph range, highest in the Sandhills and Coastal Plain. RDU Airport gusted to 31 mph and Fayetteville Airport 38 mph. Figure 3 shows a visible GOES satellite image of Elsa over NC.

Figure 3: Visible GOES Satellite Image of Elsa



08 Jul 2021 17:50Z NOAA/NESDIS/STAR GOES-East Band 02 TS Elsa

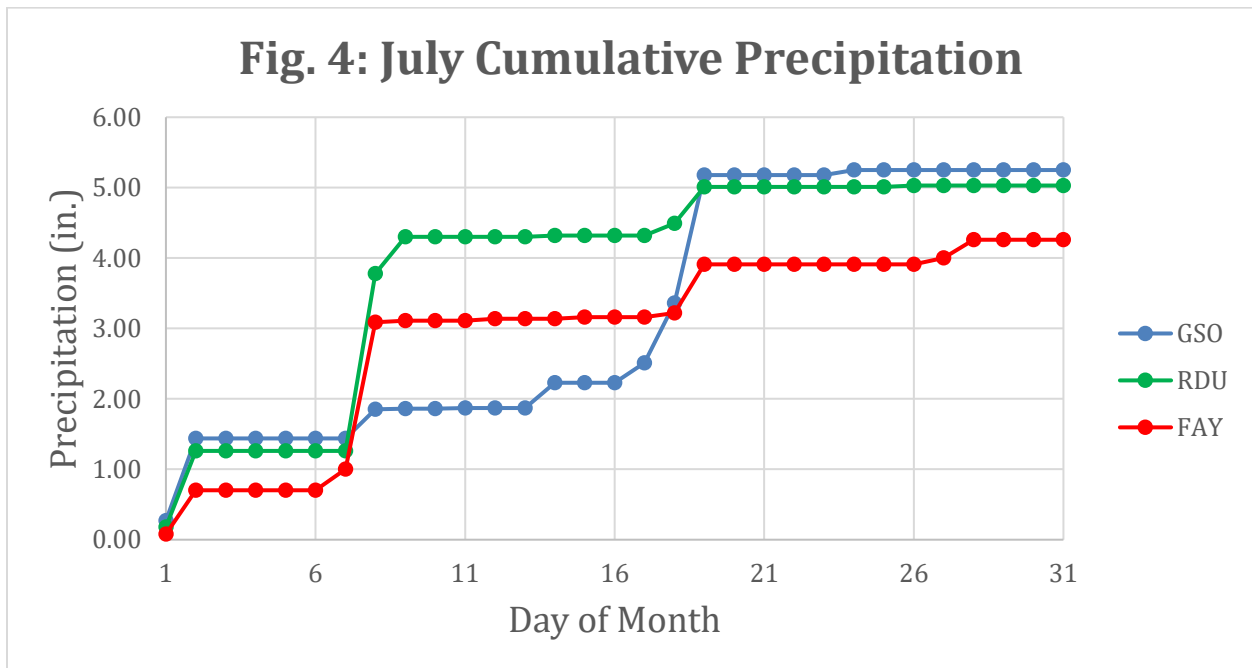
The rest of the month of July was dominated by the typical scattered thunderstorm activity. There were some locally heavy rainfall amounts peppered across the region throughout the month. By month's end rainfall totals included 5.25 inches at Greensboro, 5.03 inches at Raleigh, and 4.26 inches at Fayetteville. Greensboro's total was 126 percent of normal, while Raleigh's total was

almost exactly normal, and Fayetteville’s total was 86 percent of normal. See the monthly rainfall totals in Table 1.

Table 1: Monthly Precipitation Statistics

Site	Total precipitation (in.)	Departure from Normal (in.)	Max Daily Precipitation (in.)
Greensboro (GSO)	5.25	+1.07	1.82 on 7/19
Raleigh-Durham (RDU)	5.03	+0.01	2.52 on 7/8
Fayetteville (FAY)	4.26	-0.69	2.09 on 7/8

The cumulative precipitation at the three climate sites for the month of July is shown in Figure 4. Note the wet first few weeks followed by a dry end of the month.



As displayed by the radar-estimated precipitation and the radar-estimated precipitation departure from normal in Figures 5 and 6, much of central NC was wetter than normal with 5 to 10 inches of rain. Only a few localized areas in the western Piedmont and Sandhills had near to slightly below normal rainfall of 2 to 5 inches.

Fig. 5: Radar-Estimated Monthly Precipitation

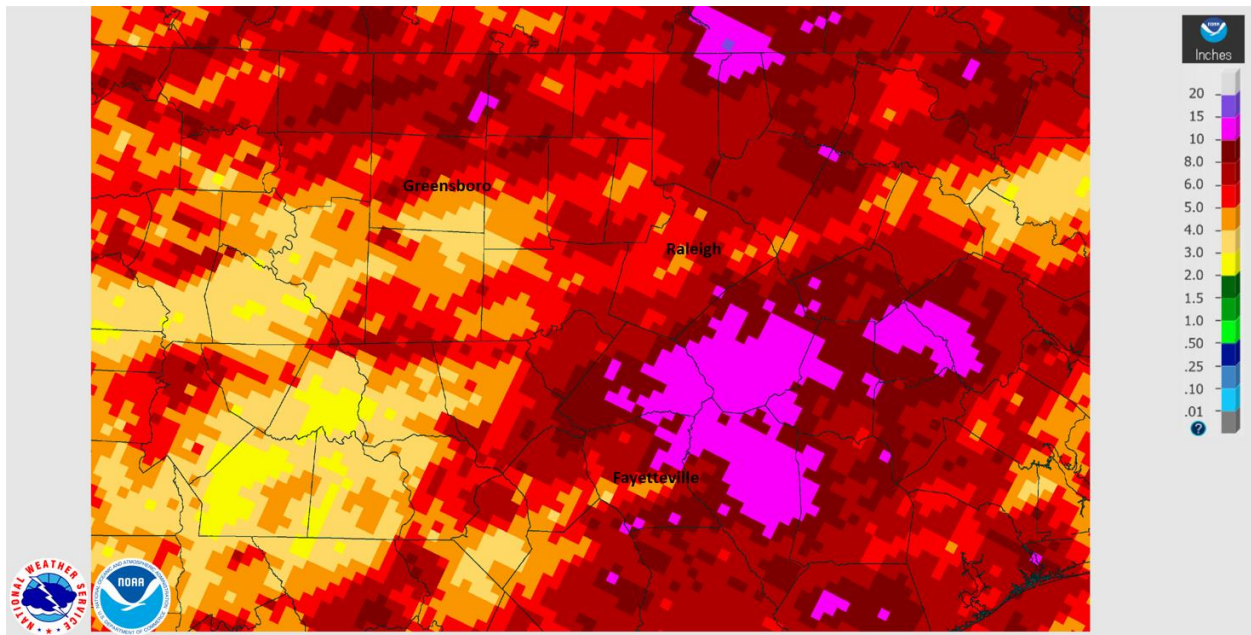
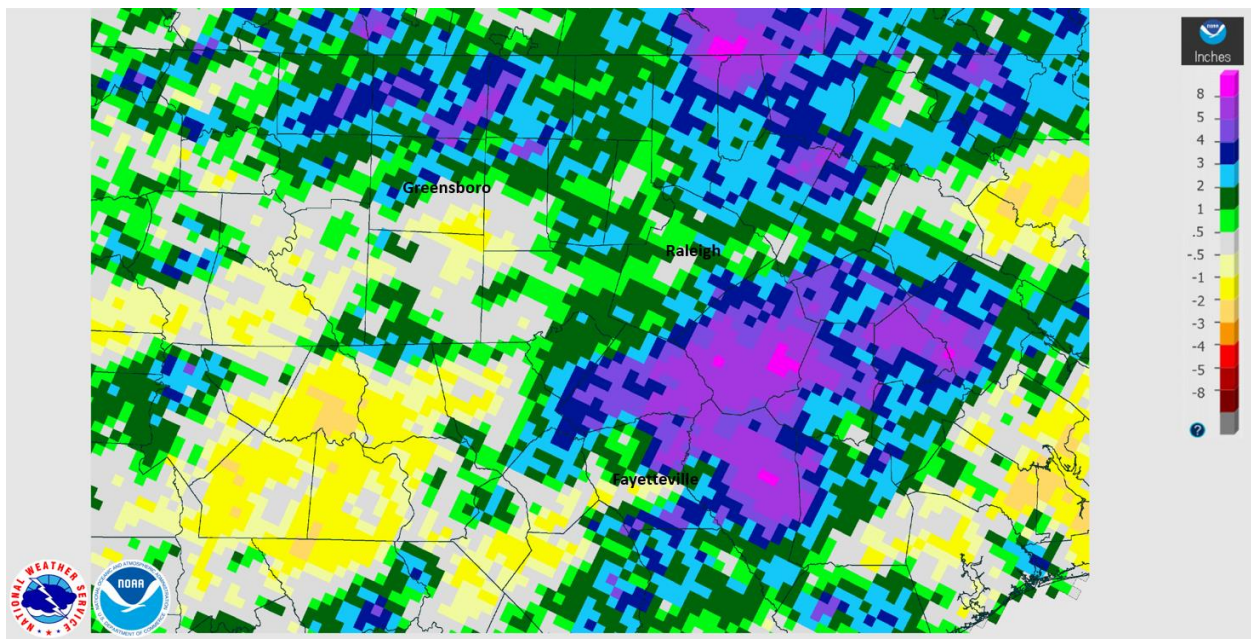


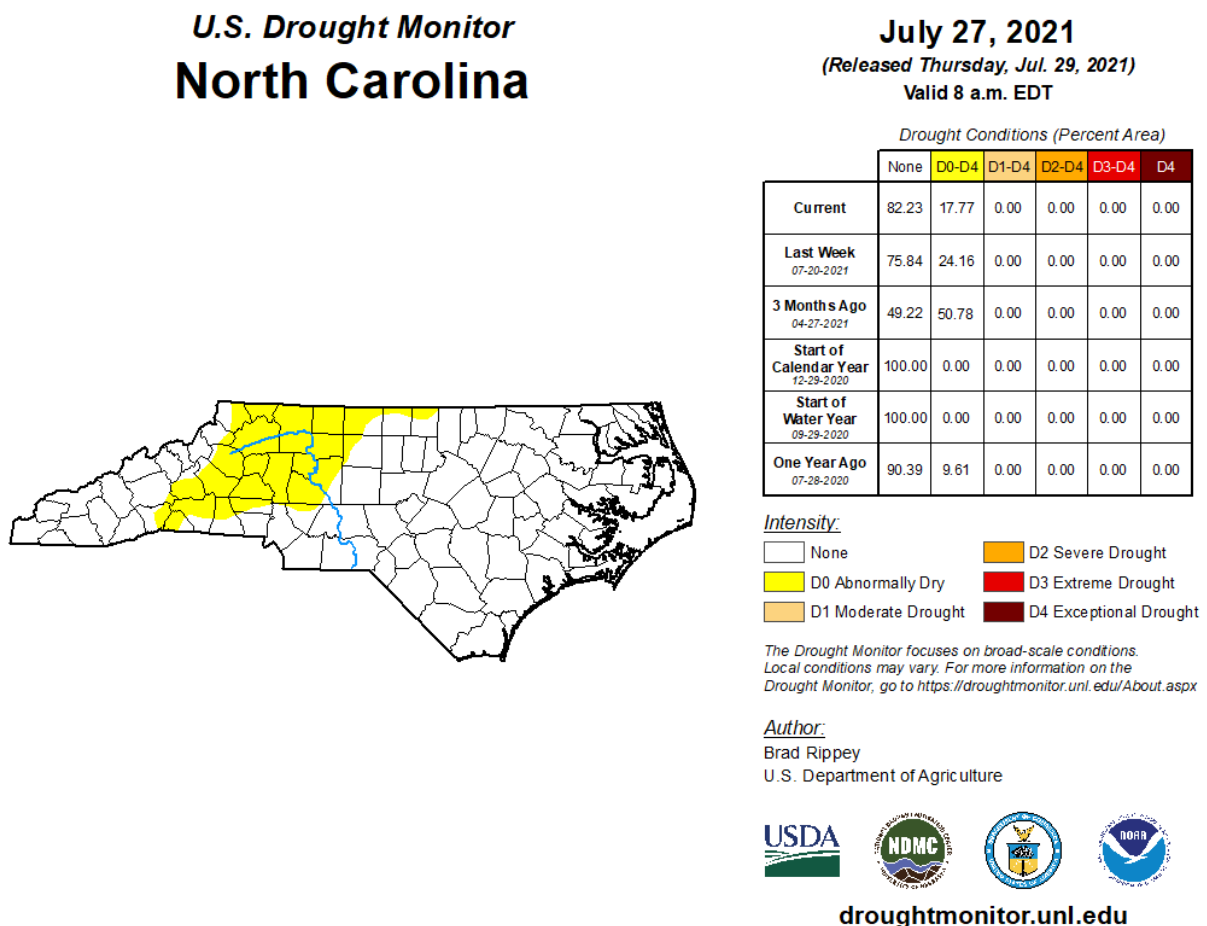
Fig. 6: Radar-Estimated Monthly Departure from Normal Precipitation



Additional selected ASOS or cooperative observations for July 2021: Albemarle (Stanly County) 6.06 inches (1.32 above normal), Winston-Salem (Forsyth County) 7.55 inches (3.31 above normal), Mount Airy (Surry County) 5.23 inches (0.01 below normal), Raleigh (NCSU) 5.97 inches (1.32 above normal), Louisburg (Franklin County) 7.61 inches (2.66 above normal), Rocky Mount (Nash County) 5.80 inches (1.21 above normal), Clinton (Sampson County) 8.51 inches (2.68 above normal), Asheboro (Randolph County) 5.74 inches (1.56 above normal), Yadkinville (Yadkin County) 5.83 inches (0.77 above normal), and Reidsville (Rockingham County) 7.55 inches (3.21 above normal). The ECONet station in Clinton received a whopping 12.46 inches, which was its second-wettest July in 32 years of observations.

The above totals continued to keep any drought concerns at bay. Note the Drought Monitor for NC in late July (Figure 7). Moderate Drought (D1) was completely eliminated, and the only remaining areas with Abnormally Dry (D0) conditions were the western Piedmont (including the Triad region) and Foothills, where the rain that fell was not enough to overcome precipitation deficits since the spring.

Fig. 7: U.S. Drought Monitor for North Carolina on July 27



The wetter weather resulted in more improvements to the soil moisture across NC, as shown in Figure 8. Streamflow was generally above average in eastern NC and near normal in the west (Figure 9).

Fig. 8: NASA SPoRT-LIS 0-100 cm Soil Moisture percentile valid 7/31/21

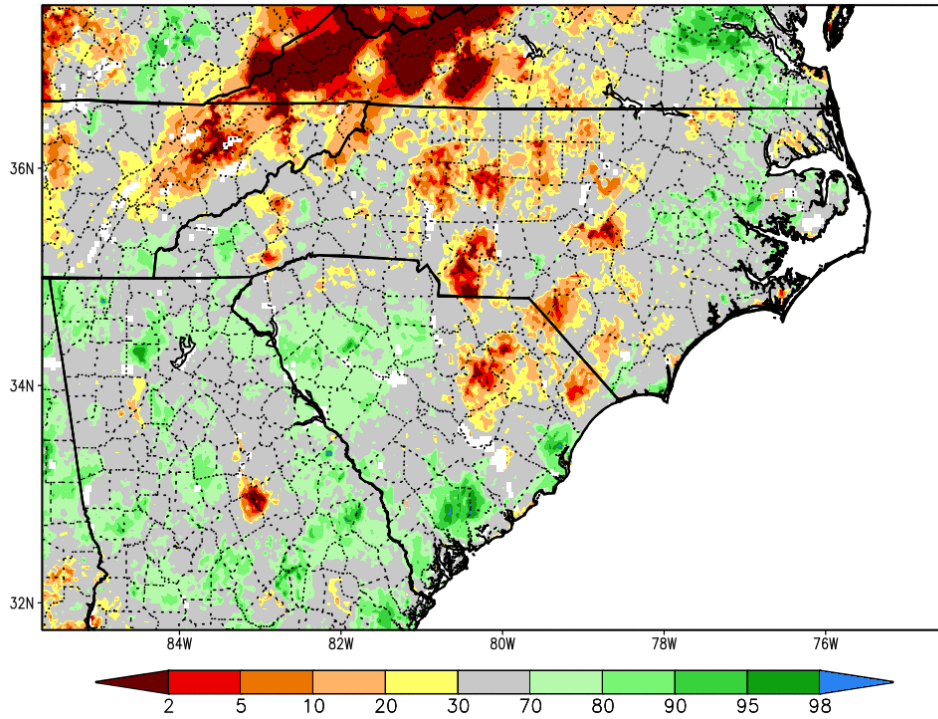
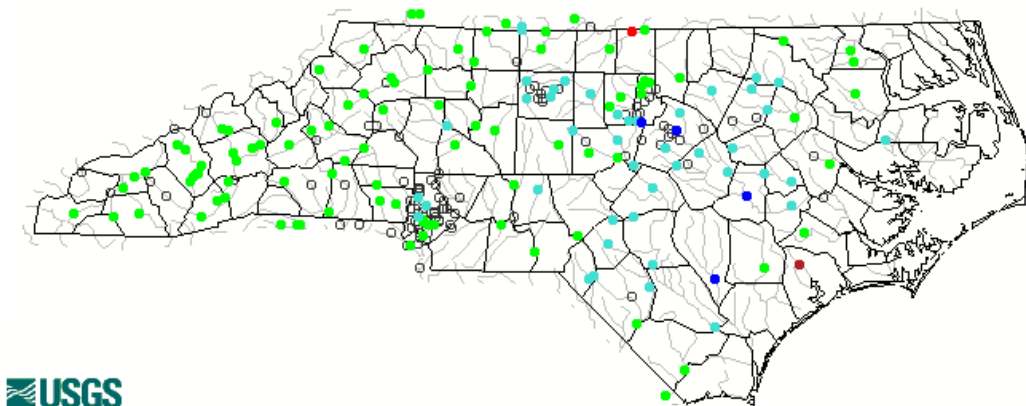


Fig. 9: Monthly Streamflow in North Carolina Compared to Historical Streamflow for July 2021



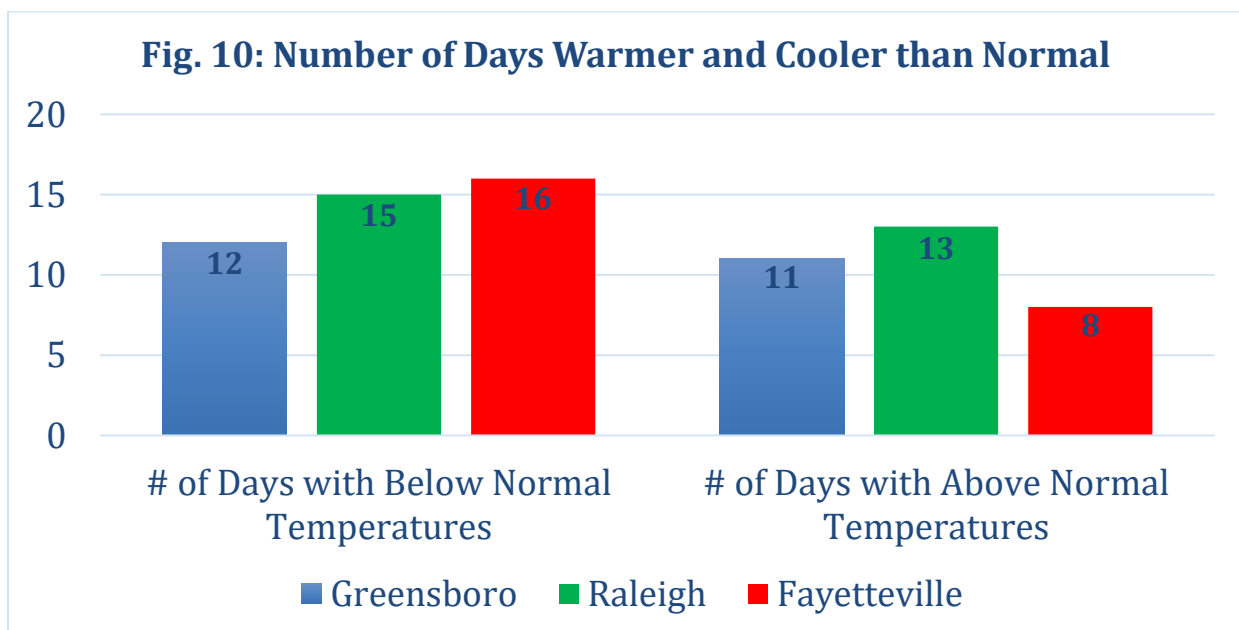
Explanation - Percentile classes							
Low	<10 Much below normal	10-24 Below normal	25-75 Normal	76-90 Above normal	>90 Much above normal	High	Not-ranked

July 2021 continued to be good news for those that don't like very hot temperatures in summer. Along with Elsa and the much-needed rainfall through much of the month of July came milder temperatures, thanks to upper troughing in the eastern US. The July averages ended mostly 1 to 1.5°F below normal. There were a total of 22 days during the month that reached at least 90°F at Fayetteville, 19 such days at Raleigh, and 12 such days at Greensboro. Considering last year's totals of 29, 28, and 22 days of 90+°F readings, respectively, it was definitely "mild" in comparison to 2020. The July monthly average temperatures and their departures from normal at the three climate sites are depicted in Table 2. It was the coolest July at all three climate sites since 2014.

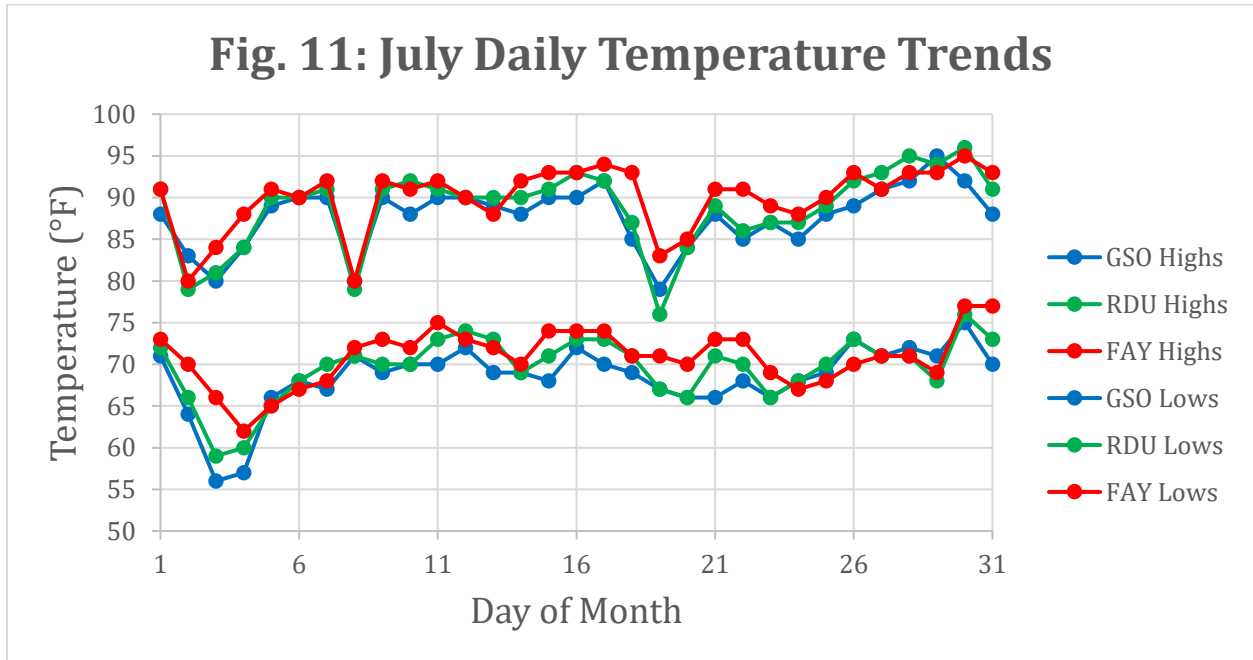
Table 2: Monthly Temperature Statistics

Site	Avg High Temp (°F)	Avg Low Temp (°F)	Avg Temp (°F)	Departure From Normal (°F)	Maximum Temperature (°F)	Minimum temperature (°F)
Greensboro (GSO)	87.7	68.4	78.0	-0.9	95 on 7/29	56 on 7/3
Raleigh-Durham (RDU)	88.7	69.6	79.2	-1.3	96 on 7/30	59 on 7/3
Fayetteville (FAY)	90.0	70.9	80.4	-1.3	95 on 7/30	62 on 7/4

As shown in Figure 10, compared to normal, slightly more days in the month were cooler than warmer at Greensboro and Raleigh. Twice as many were cooler than warmer at Fayetteville.

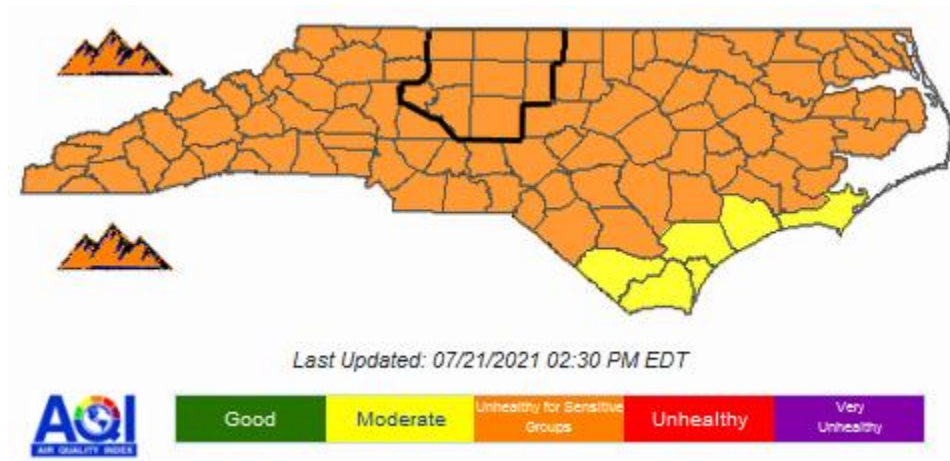


The time series of daily temperature for the month at Greensboro, Raleigh, and Fayetteville can be found in Figure 11. Note the rather unusual dips into the 50s on July 3-4 behind a cold front, along with highs only in the upper-70s to lower-80s on July 8 and July 19-20 thanks to widespread rain events. There were still some “hot” days felt throughout the month, particularly the period from July 28 to 30 when there were widespread highs in the mid-90s. However, Raleigh’s high of 95°F on July 28 was the latest first occurrence of a 95°F reading there since 2001.



Unfortunately, northwesterly flow behind the cold fronts did transport smoke from western US wildfires into NC. As shown in Figure 12, much of the state was under a code orange air quality forecast on July 22 due to fine particulate matter in the smoke, which resulted in hazy skies.

Fig. 12: Air Quality Forecast for NC on 7/22/21



Other notes:

Days with thunderstorms this month:

Greensboro: 9
Raleigh: 7
Fayetteville: 12

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

Greensboro: 1
Raleigh: 1
Fayetteville: 2

Strongest wind gusts and direction:

Greensboro: W at 44 mph on July 17 (thunderstorm)
Raleigh: SW at 48 mph on July 1 (thunderstorm)
Fayetteville: S at 49 mph on July 18 (thunderstorm)

Daily records:

Greensboro:

None.

Raleigh:

A record daily rainfall total of 2.52 inches was set at Raleigh on July 8 with Tropical Storm Elsa. This broke the old record of 1.88 inches set in 1887.

Fayetteville:

None.

Monthly records:

There were no monthly records of note at any of the three climate sites this month.