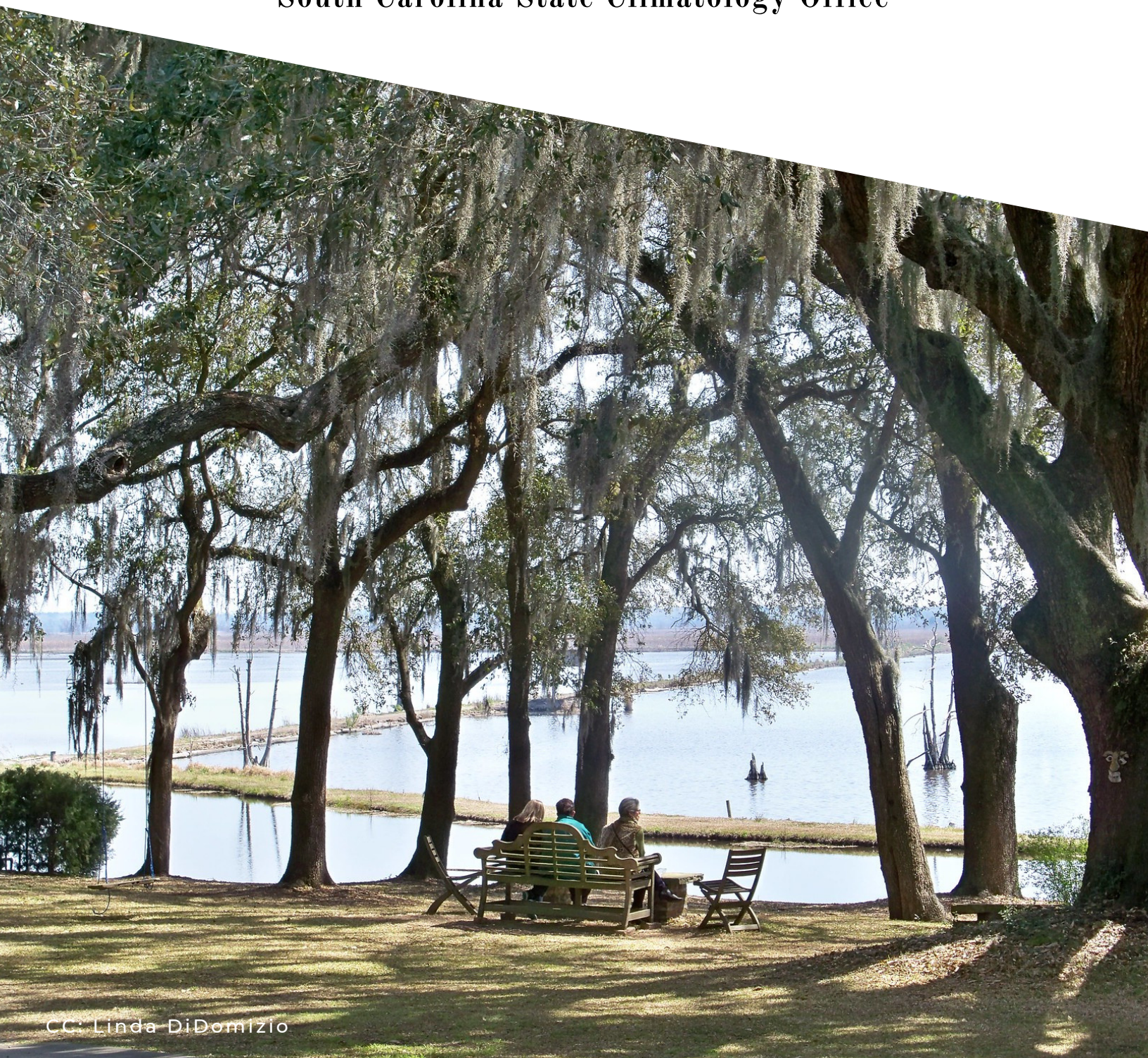
2019 SOUTH CAROLINA YEAR IN REVIEW

South Carolina State Climatology Office



CC: Linda DiDomizio

TIMELINE

Dry Winter Months

With the exception of the Upstate region, South Carolina experienced a dry start to the year.

Spring Tornadoes

Several strong thunderstorms had enough instability to result in 17 confirmed tornadoes, the majority of which occurred on March 3 and April 19.

Flash Drought

An early season heat wave in May combined with a sharp decline in soil moisture launched a flash drought.

July Cold Snap

Significantly below-normal temperatures occurred throughout a majority of the state in mid-July.

According to NOAA National Centers for Environmental Information, 2019 is tied with 2017 as South Carolina's hottest year on record (1895 - 2019), with an average temperature of 65.1°F.

Hurricane Dorian

As Hurricane Dorian approached South Carolina, the entire coastline prepared for potential impacts.

Drought Persists, Heat Records Occur

September and October were incredibly warm, with several days over 100°F and a new October record of 104°F (Pelion 0.8 NW). Drought worsened.

Midlands Halloween Tornadoes

On the evening of Halloween, three tornadoes occurred in the Midlands region as part of a severe weather event.

November Cold Snap

After record heat in September and October, November brought below average temperatures.

December Coastal Storm

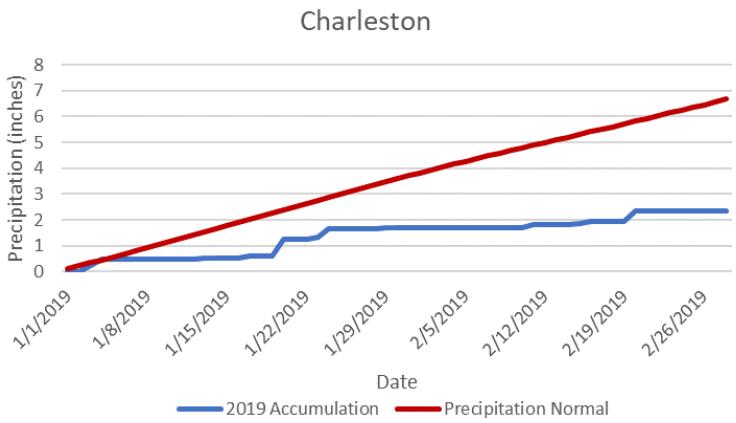
December supplied large amounts of much needed rainfall to the state. The greatest rainfall amounts recorded were along the coast.

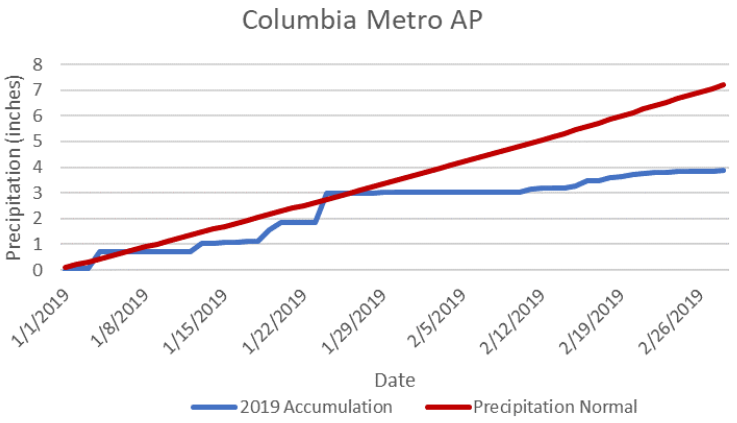
Dry Winter Months

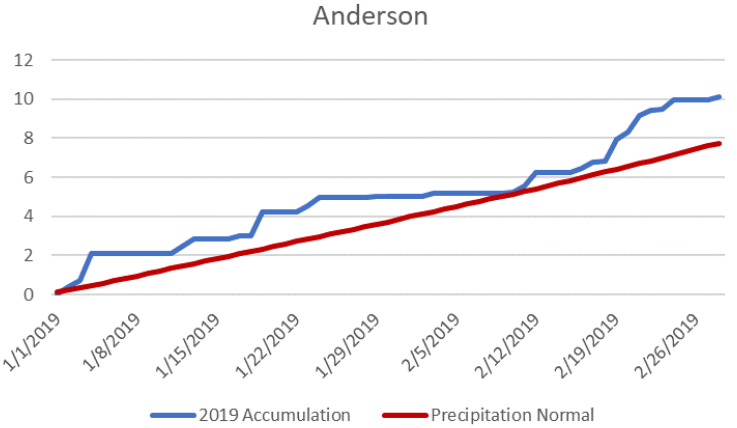
Many portions of the state received below normal precipitation during the winter months of 2019, with the exception of the Upstate region. The graphs on this page illustrate the normal precipitation accumulation for January and February at each location, with a comparison of the data gathered in 2019. As seen below, Anderson was the only graphic to show above average January to February precipitation. Luckily, December of 2018 brought above normal precipitation in most areas, so the state was able to receive some groundwater and surfacewater recharge to lessen hydrological drought impacts.

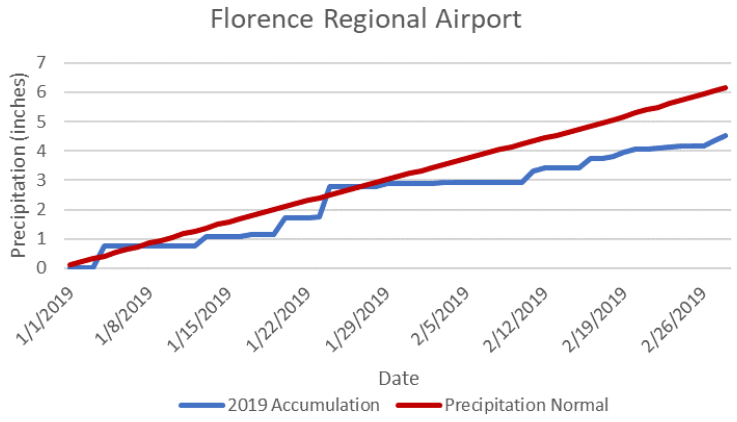
A CoCoRaHS Condition Monitoring reporter in Bluffton (SC-BF-10), SC, in the Lowcountry reported on this dryness that set in:

> "This past week we received 0.25" of rain. It was unusually warm, and very dry. The humidity was 20-25% and it has been windy the past couple of days setting up fire hazard. We're irrigating this morning for the first time this winter."









Spring Tornadoes

In 2019, peak tornado activity occurred in March and April, 17 tornadoes were recorded in South Carolina during these two months. The first significant event was on March 3, 2019, when six tornadoes were confirmed in the following counties: Edgefield, Orangeburg, Lexington, and Richland. These tornadoes were the result of strong thunderstorms associated with a cold front passing through the state. The following were recorded:

Photo courtesy of National Weather Service. March 3, Richland County

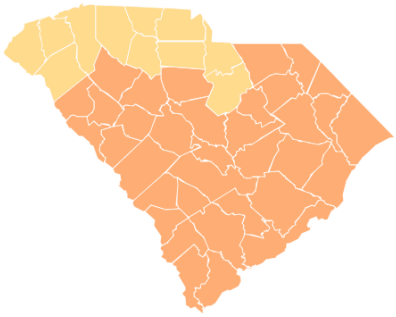
- EF2 - Edgefield County
- 2 EF1 - Lexington County
- 2 EF1 - Richland County
- EF0 - Orangeburg County

The second tornado event occurred on April 14, 2019, when a strong line of thunderstorms moved through the region ahead of a strong frontal system. Two EF1 tornadoes touched down in Greenville County. No fatalities or injuries were reported, but significant damage to homes was recorded.

The last spring tornado event in occurred when a cold front produced a strong squall line, causing 96 tornadoes from April 17 - 19 as the system moved from Texas to the East Coast. Seven tornadoes occurred in South Carolina:

- EF2 - Orangeburg County
- EF2 - Clarendon County
- EF1 - Orangeburg & Calhoun County
- 2 EF1 - Newberry County
- EF0 - Florence County
- EF0 - Williamsburg County

Flash Drought

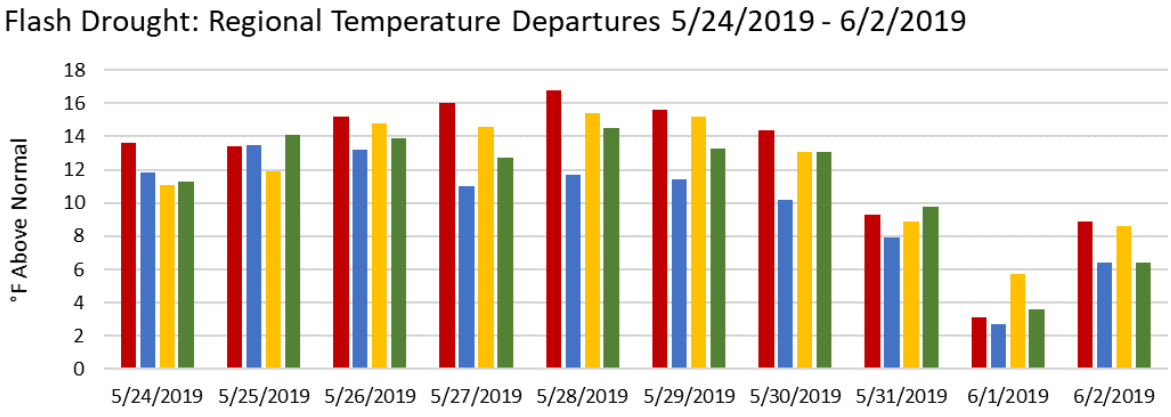


June 6, 2019 drought status, scdrought.com

What is a "flash drought"?

According to the American Meteorological Society, a flash drought is when above normal temperatures combine with rapidly decreasing soil moisture, resulting in unexpected dry conditions that are often difficult to predict.

An early season heat wave began on May 24, when a high pressure ridge centered over the Southeastern US. Temperatures reached the upper 90's at several locations around the state, with daily average temperatures reaching nearly 17°F above normal, as illustrated in the graphic below. In addition to the record-breaking heat, it was significantly drier than normal, with relative humidity anomalies up to 30% below normal. Despite this flash drought period lasting only 10 days, the impacts were significant across the state as agricultural producers spent the summer struggling to recover.



	5/24/2019	5/25/2019	5/26/2019	5/27/2019	5/28/2019	5/29/2019	5/30/2019	5/31/2019	6/1/2019	6/2/2019
Florence Area Departure (°F)	13.6	13.4	15.2	16	16.8	15.6	14.4	9.3	3.1	8.9
GSP Region Departure (°F)	11.8	13.5	13.2	11	11.7	11.4	10.2	7.9	2.7	6.4
Charleston Area Departure (°F)	11.1	11.9	14.8	14.6	15.4	15.2	13.1	8.9	5.7	8.6
Columbia Area Departure (°F)	11.3	14.1	13.9	12.7	14.5	13.3	13.1	9.8	3.6	6.4

July Cold Snap

The beginning of July was dominated by the typical expected South Carolina summer weather: hot and humid, with frequent afternoon convective thunderstorms. However, the end of July was marked by a sharp decrease in temperatures, caused by a cold front approaching the region and stalling offshore on July 24. Temperatures dropped from the high 90's prior to the cold front passing to more "fall-like" temperatures: the Upstate recorded lows in the upper 50's and many locations had highs in the mid 80's. Several reporting stations in South Carolina reported one of their coolest July 25 mornings on record.

Hurricane Dorian

Hurricane Dorian, the second-most-powerful Atlantic storm ever recorded, caused a significant amount of concern as it approached the Southeast Coast of the United States at the end of August and into September. On August 31, when the National Hurricane Center's track forecast showed that the entire state of South Carolina could be impacted by Dorian as a strong hurricane, Governor McMaster declared a state of emergency. After the public saw the devastation that Dorian brought the Abaco Islands and Grand Bahama on September 1, Governor McMaster released mandatory evacuation orders for all coastal counties. In the end, Dorian remained off the coast of South Carolina as a Category 3 storm, and made landfall near Cape Hatteras, NC on September 6 as a Category 1.

Although Dorian remained offshore as it moved past South Carolina, the storm caused tropical storm force winds, heavy precipitation, and coastal flooding that combined with already high King Tides. Rainfall over 10 inches was recorded in isolated positions along the coast, with as little as one inch occurring in other portions of the state. The strong winds ended up being of most concern as the storm swept by the state on its approach to North Carolina. Over 160,000 power outages were seen along the coast, and the winds spawned 3 tornadoes in Horry County on September 5.

Drought and Dorian

Prior to Dorian, drought was present in every region of the state. Without rainfall, it was clear that all of South Carolina was likely to deal with continued drought conditions. After Dorian, some stations still had 9 day precipitation totals as low as 6.43 inches (Anderson). The two maps below show the US Drought Monitor map of South Carolina before and after Dorian's impacts. Regions that didn't experience Dorian's rainfall showed deteriorating drought conditions into September, especially throughout the Aiken area of the Midlands into the Lowcountry.

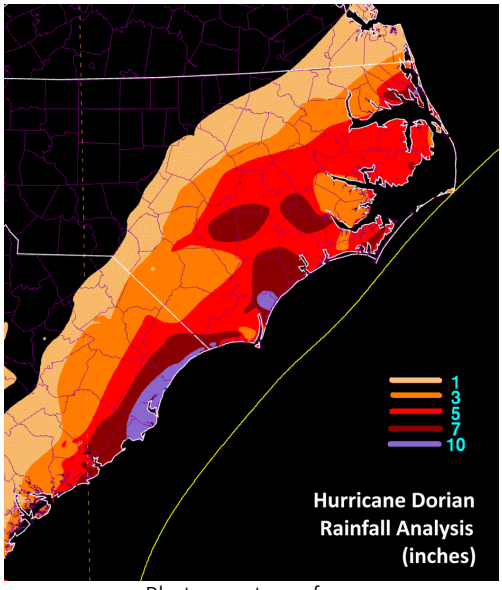
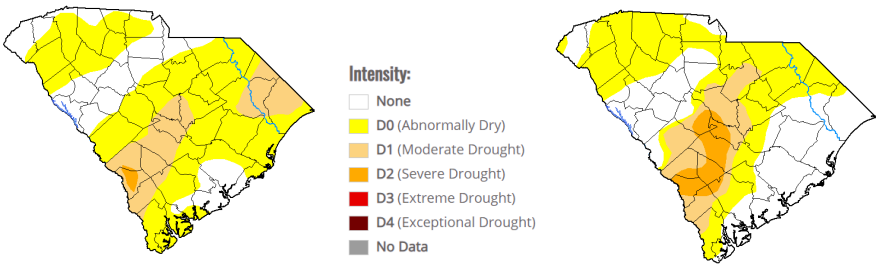
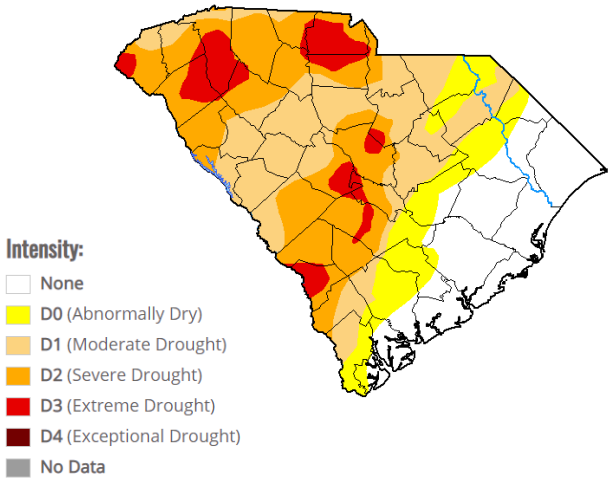


Photo courtesy of
National Weather Service - Wilmington

Before: 8/27/2019 **After: 9/10/2019**



Drought Persists, Heat Records Occur

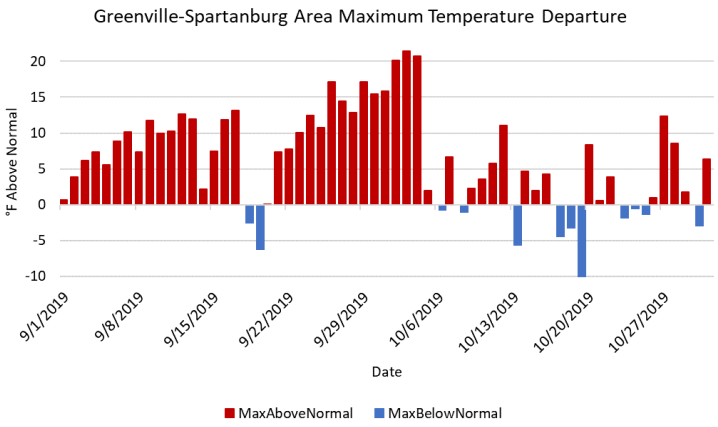


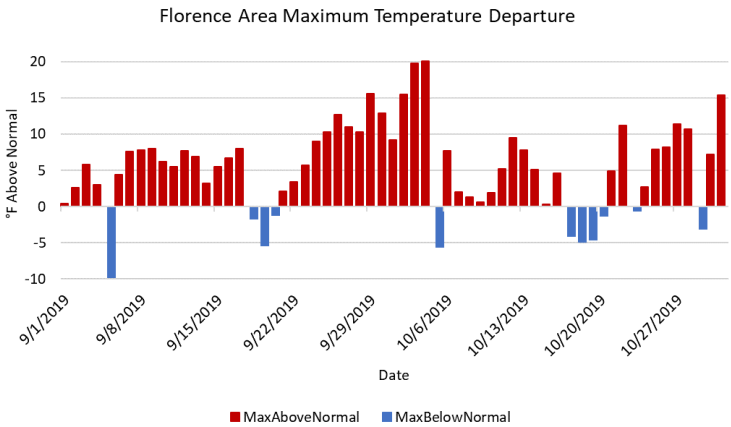
As seen from the map displayed on the right, a majority of South Carolina dealt with drought throughout the summer and fall. The coastal counties experiencing incipient drought (yellow) or normal conditions (white) are the counties that received heavy rainfall from Hurricane Dorian, saving them from experiencing the same prolonged drought conditions that other counties in the state encountered.

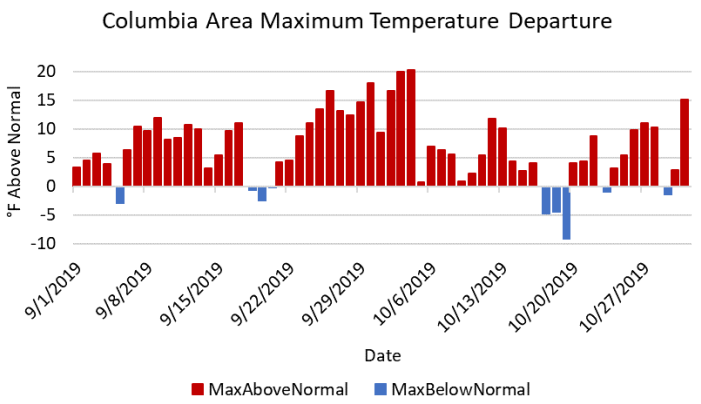
The major impacts seen from the drought were in the agricultural sector. Experts from Clemson University Extension reported that overall crop yields were expected to be lower as a result of the drought, and that corn and peanuts especially suffered from the hot, dry weather. John Irwin, a beef producer in Laurens County and member of South Carolina's Drought Response Committee, emphasized that the severe agricultural drought has damaged crops and endangered livestock. Also, forage yields were greatly reduced, leading to emergency hay feeding to livestock.

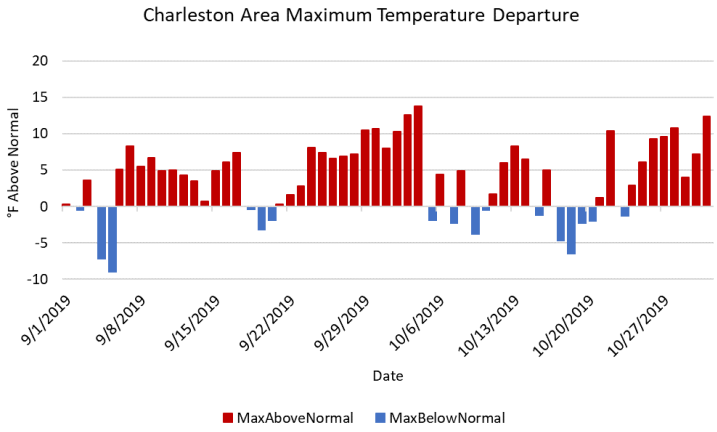
A CoCoRaHS Condition Monitoring reporter provided the following narrative:

> "The heat and lack of rainfall are seriously stressing area soybean crops as soybean plants have rapidly yellowed this past week...I have seen a few pastures being cut for hay this past week, but yields look visually poor, and other hay pastures were cut but not harvested which makes sense because the grass was short and brown before the cutting." - Inman 2.6 W









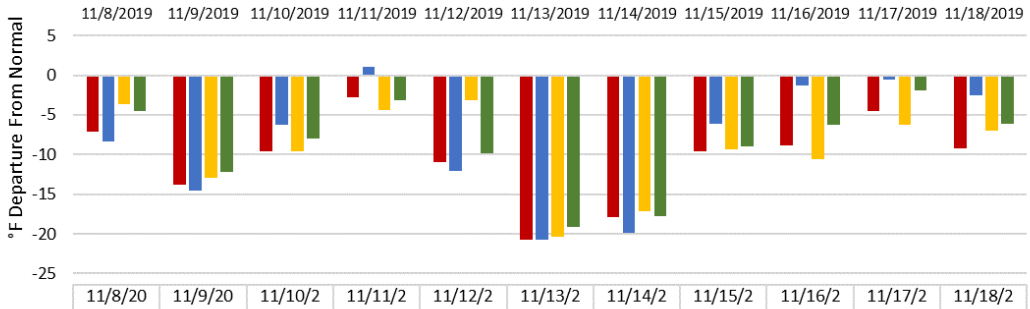
Midlands Halloween Tornadoes

October 31 brought severe weather into South Carolina, with the worst impacts occurring in the Midlands. In one day, both a cold front and a warm front passed through the state. 3 tornadoes were recorded in Lexington County, SC, one EF0 and two EF1's. Most of the reported damage was to trees and lighter weight mobile objects.

November Cold Snap

After the warmest September - October period on record for South Carolina, November impacted every region with a sharp cold snap that occurred in two waves as two separate cold fronts swept across the state on November 8 and November 12. From November 8 - 18, average daily temperatures recorded statewide were up to 20 degrees below normal. This 2019 cold snap felt especially strong because it was in such a stark contrast to the record-breaking heat recorded through September and October. The cold temperatures lasted for approximately one week before another weather system became present over the state and returned temperatures back closer to normal.

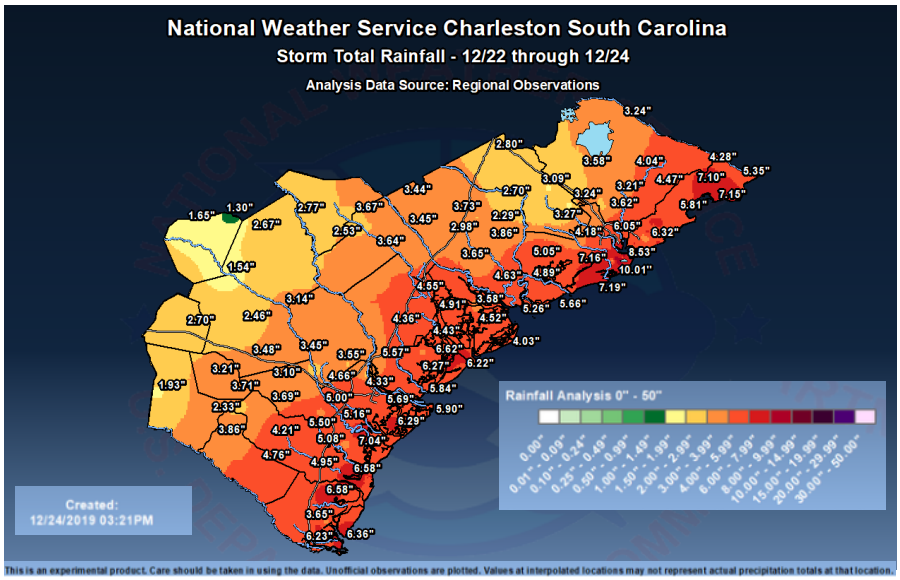
November Cold Snap: Regional Average Daily Temperature Departures 11/8/2019 - 11/18/2019



	11/8/2019	11/9/2019	11/10/2019	11/11/2019	11/12/2019	11/13/2019	11/14/2019	11/15/2019	11/16/2019	11/17/2019	11/18/2019
Florence Area Departure (°F)	-7.1	-13.8	-9.6	-2.8	-11	-20.7	-17.9	-9.6	-8.8	-4.5	-9.2
GSP Regional Departure (°F)	-8.3	-14.5	-6.2	1.1	-12.1	-20.8	-19.9	-6.1	-1.3	-0.5	-2.6
Charleston Area Departure (°F)	-3.6	-12.9	-9.6	-4.4	-3.1	-20.4	-17.1	-9.3	-10.6	-6.3	-7
Columbia Area Departure (°F)	-4.5	-12.2	-8	-3.2	-9.9	-19.1	-17.8	-9	-6.2	-1.9	-6.1

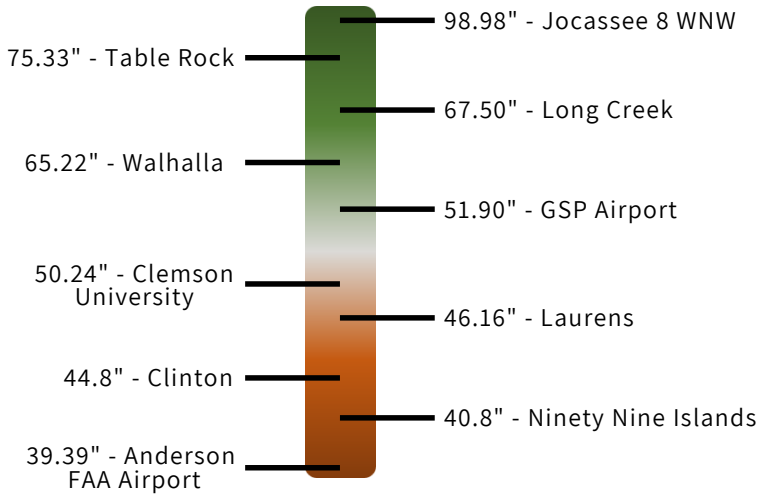
December Coastal Storm

From December 22 - 24, a low pressure system moved east through Florida, bringing heavy rainfall to the coastline of South Carolina that combined with high tide to produce some coastal flooding. A dam breach occurred in Aiken County along Town Creek due to the heavy rain in the Savannah River Area. A CoCoRaHS station on Pawleys Island (SC-GT-24) recorded 8.10 inches on December 24th. Other stations along the coast experienced anywhere from 2 - 6 inches of precipitation.

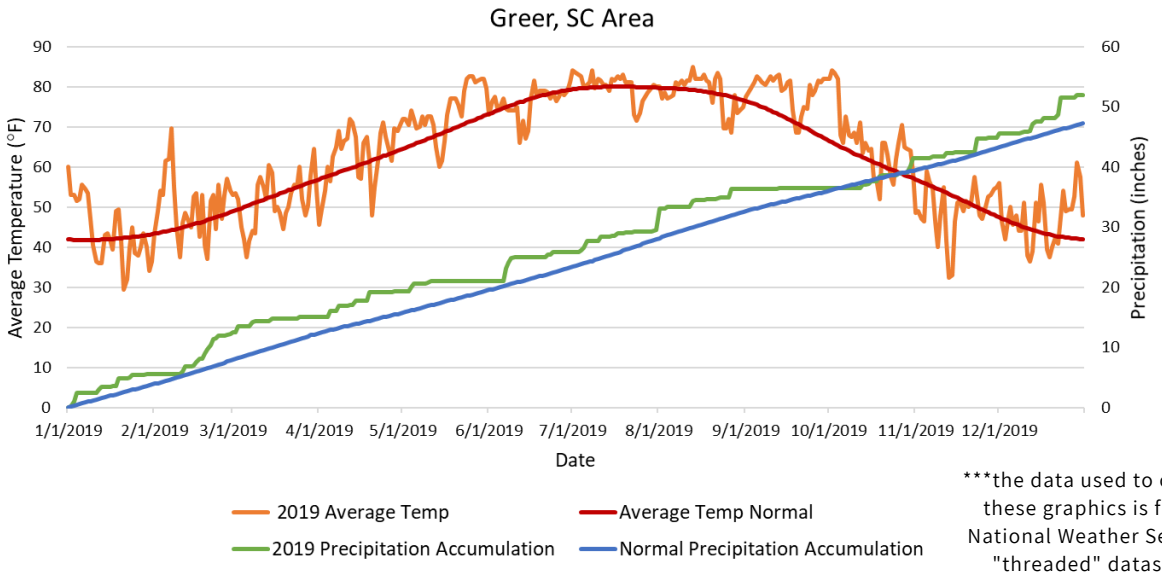


REGIONAL ANALYSIS

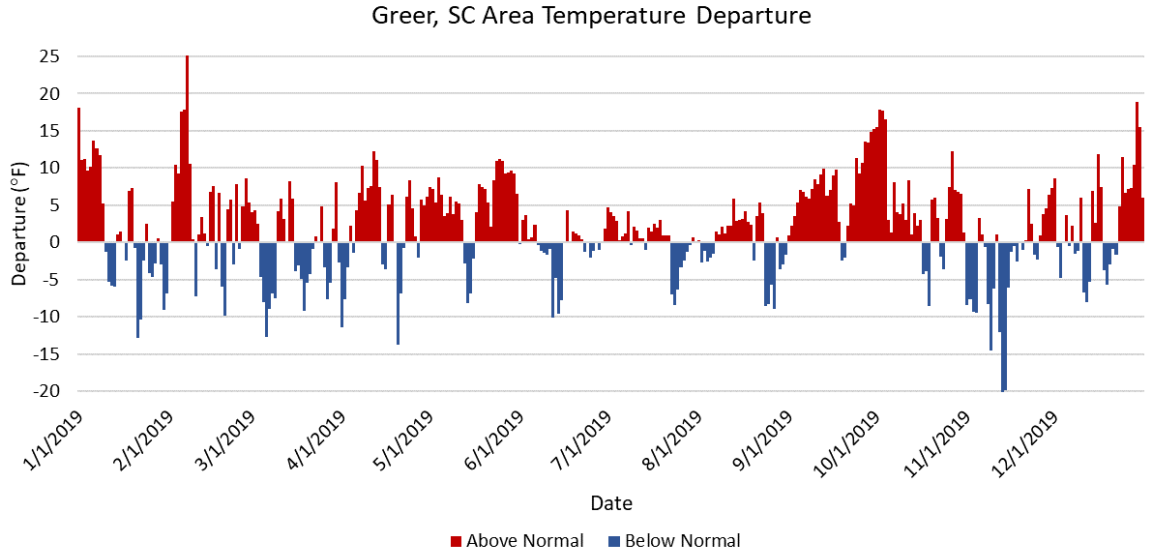
Upstate



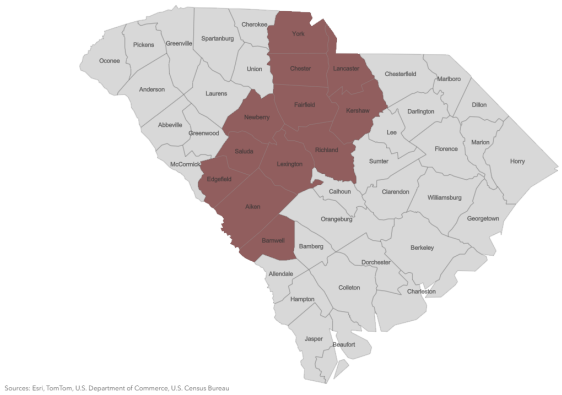
In 2019, the Upstate of South Carolina was plagued by heat, agricultural drought, and various severe weather events. While the Greer, SC area graphic below indicates normal to above normal precipitation, other stations in the region experienced far lower annual precipitation totals. The scale bar graphic shown above shows the differing range in 2019 annual precipitation measurements. Every station provided here reported every day in 2019. The 1895 - 2019 average annual rainfall for the mountain region is 64.70 inches, and is 50.49 inches for the northwest region. The 2019 drought crippled the Upstate more than any other region in South Carolina, with many producers experiencing decreased crop yields and lower hay amounts for their cattle.

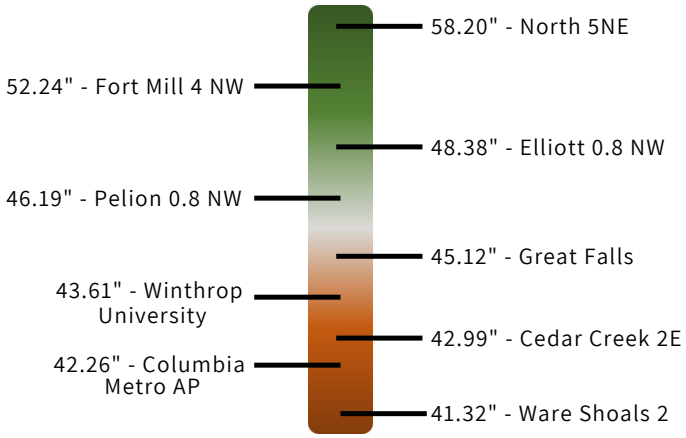


The graph below depicts the Greer area's daily temperature departures from normal in 2019. This shows that the temperatures departed farthest from normal weren't during the summer months. Rather, the significantly above-normal temperatures were seen in the "cooler" seasons — spring and winter. Also illustrated in this graphic is the November cold snap that was experienced statewide.

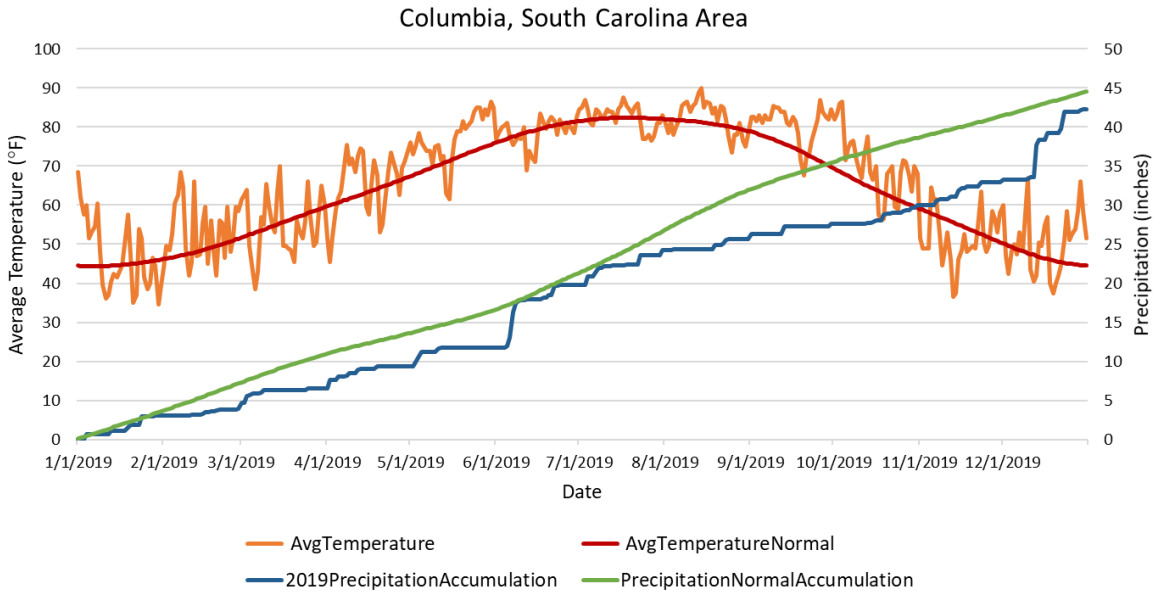


Midlands



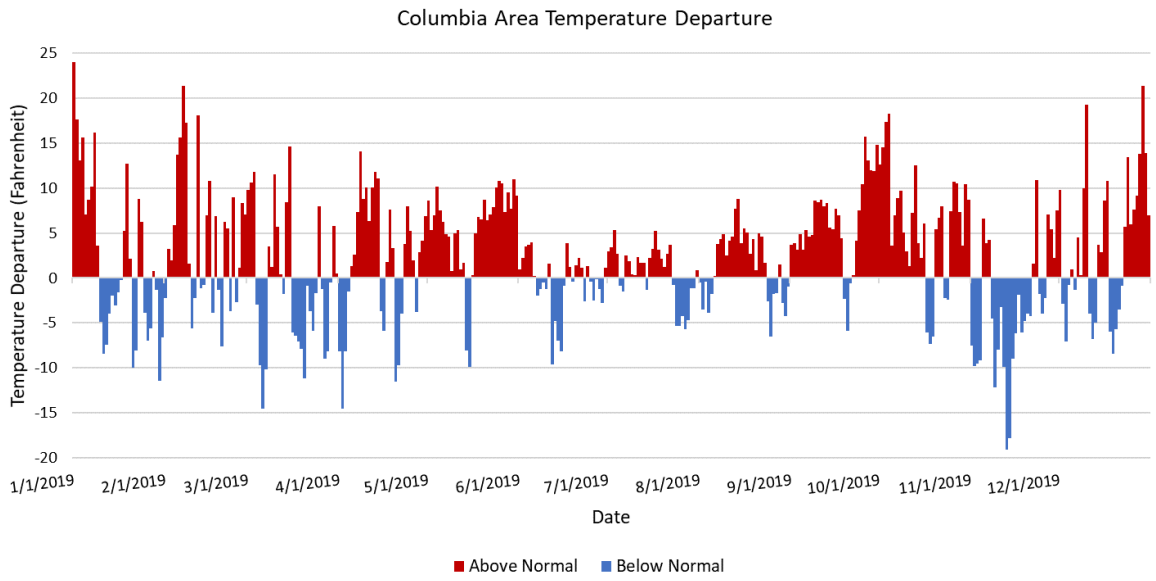


Significant severe weather moved through the Midlands during 2019, from a severe thunderstorm with hail on February 12 to winter weather experienced in the Northern Midlands (York and Chester counties) to flash drought to Halloween tornadoes. 10 tornadoes were recorded during the year in the region, with the strongest category experienced being an EF2. A new statewide record of 105°F on October 4, 2019 was established at Pelion 0.8 NW for the highest October temperature.

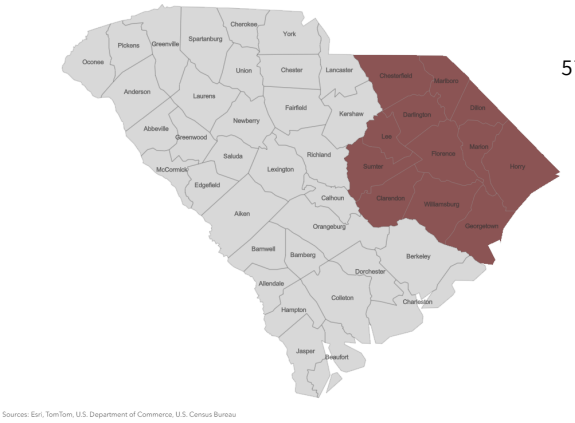


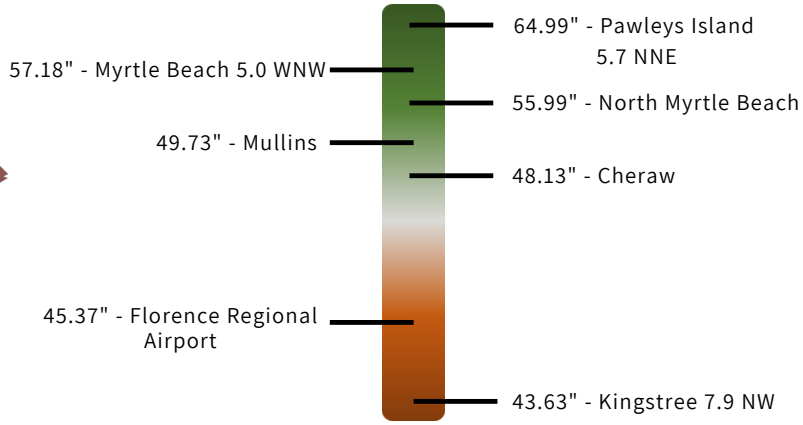
The graph above shows the 2019 precipitation accumulation for the Columbia area (threaded data) in contrast to the climatological normal precipitation totals. It also shows the daily average temperature contrasted with the average daily temperature normal. The precipitation graph shows the drought experienced in the Midlands during the spring and fall. Hurricane Dorian dropped from 0 - 2 inches or rainfall in the Midlands, and therefore didn't provide relief from the drought conditions.

The graph below depicts the Columbia area's average daily temperature departures throughout 2019. This shows that the temperatures dramatically above normal weren't experienced in the summer, although the summer did host some periods several degrees above normal. Rather, most of the above-normal temperatures were seen in the "cooler" seasons— spring and winter. Also illustrated in this graphic are the May flash drought and the November cold snap that was experienced statewide.



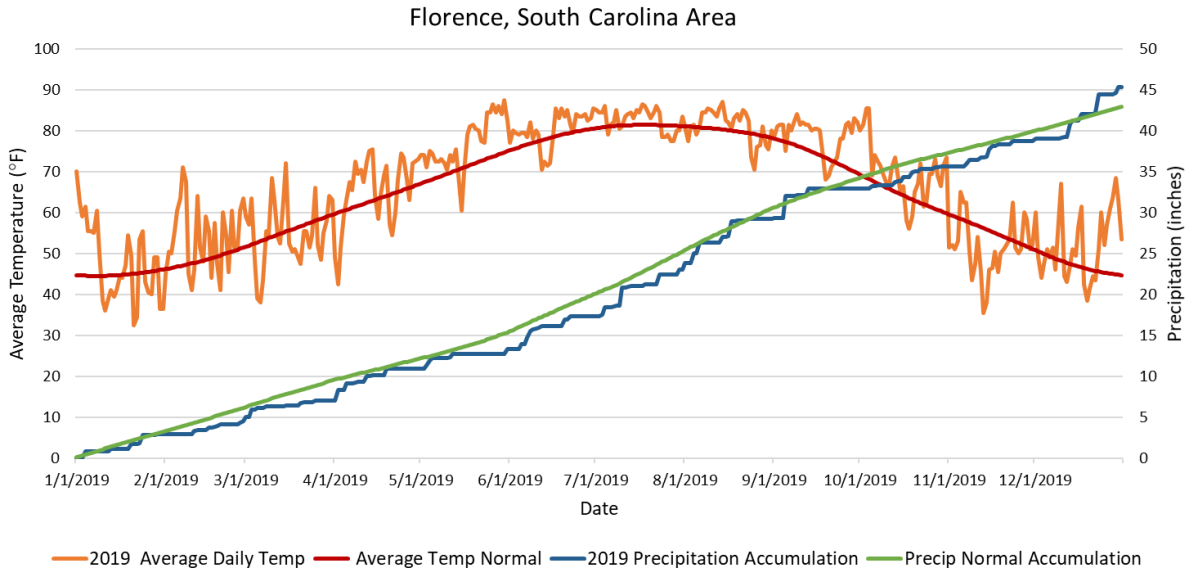
Pee Dee



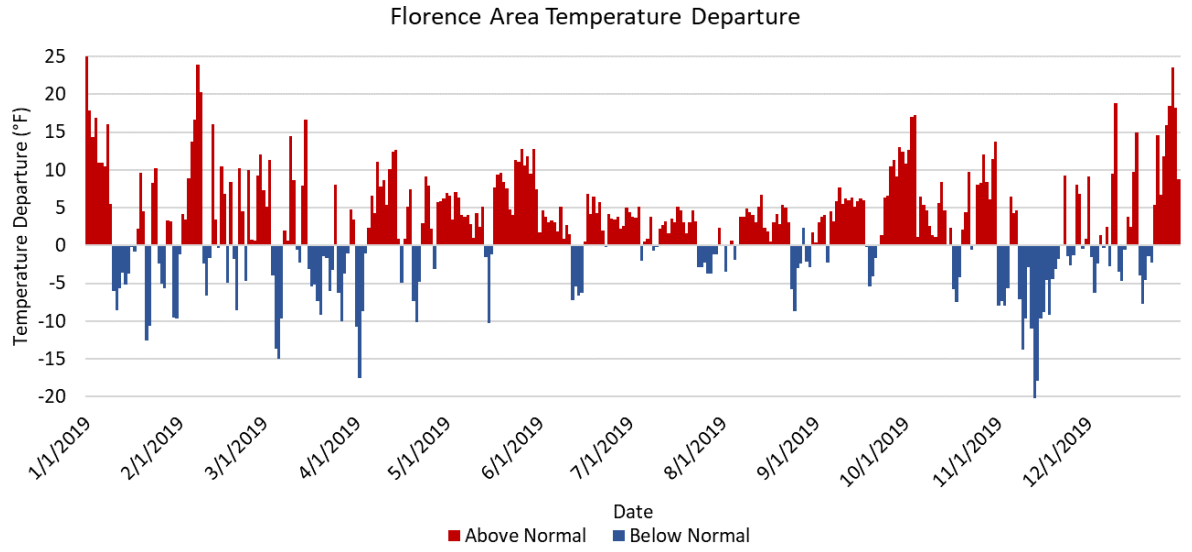


Due to Hurricane Dorian's rainfall at the beginning of September, the coastal part of the Pee Dee region experienced a relief from drought conditions, with rainfall amounts upwards of 10 inches. Several flash floods and coastal flooding events were recorded on September 5, the day that Hurricane Dorian passed offshore. According to the NOAA Storm Events Database, the region recorded a total of 7 tornadoes, the strongest being an EF2 on the 19th of April in Clarendon County. During that same event, two EF0s also occurred, one in Florence County and one in Williamsburg County. 3 tornadoes occurred in Horry County on September 5 as they spawned off of Hurricane Dorian. The final tornado recorded in the Pee Dee region was an EF0 in Horry County, spawned by the remnants of tropical storm Nestor.

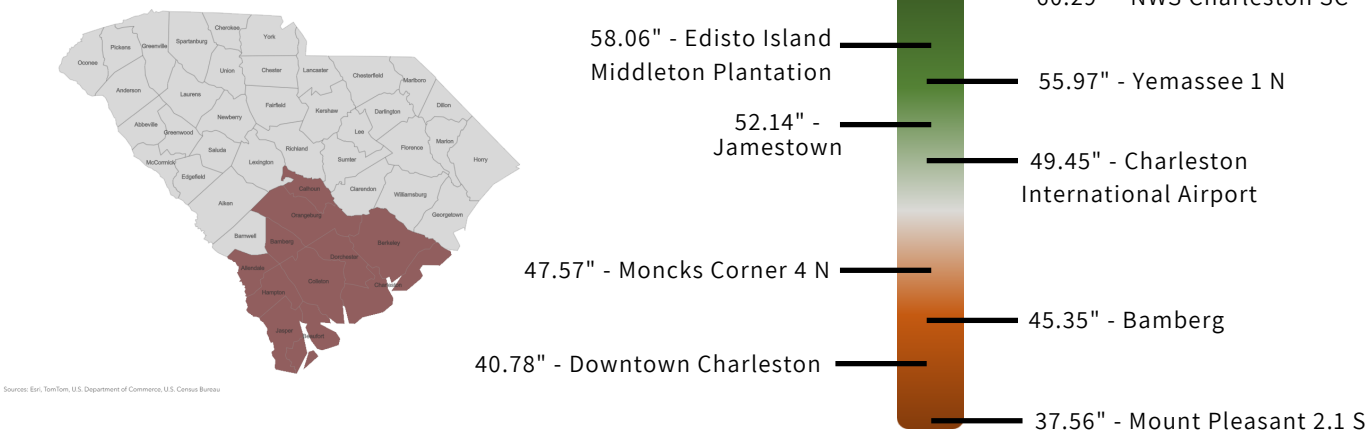
The graph below shows the 2019 temperature and precipitation data compared to the climate normals for the threaded data. Precipitation data is shown as an annual accumulation for the purpose of illustrating deficits. The precipitation portion of the graph shows the Florence area becoming gradually dry throughout the spring of 2019 and remaining below normal until the fall, when Dorian's rainfall in the region closes the gap of dryness that was previously being experienced.



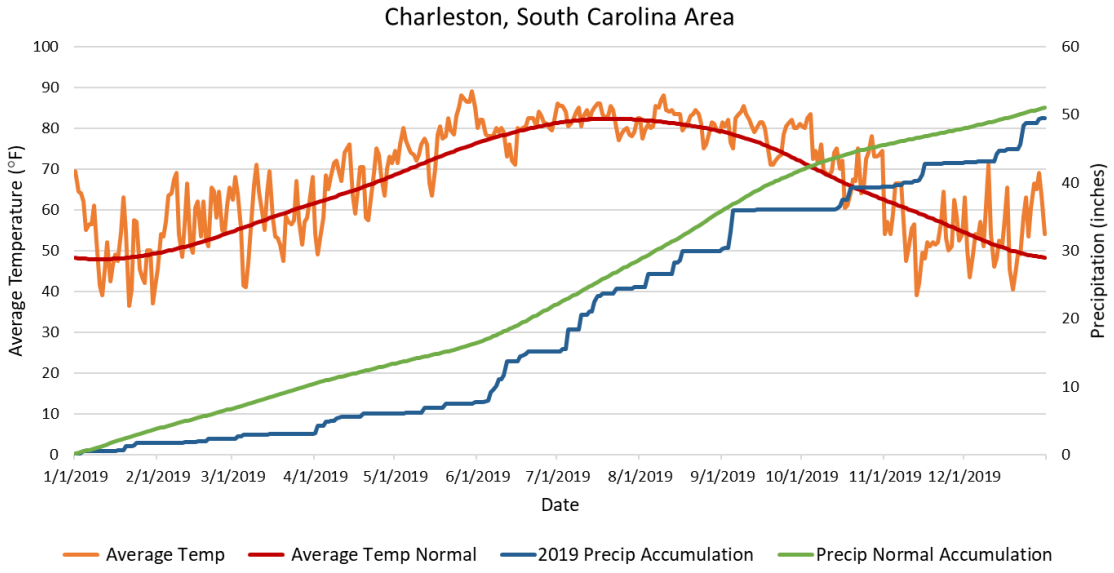
The graph below depicts the Florence area's average daily temperature departures in 2019. This shows that the temperatures significantly departed from normal were seen in the "cooler" seasons— spring and winter— rather than seen during the summer months. The largest above-normal departures are seen in December, January, and February. Also illustrated in this graphic is the November cold snap and the prolonged above normal temperatures experienced in September and October.



Lowcountry



In 2019, the Lowcountry of South Carolina avoided significant rainfall impacts from summer tropical systems. Rather, this region experienced significant December rainfall in the form of a coastal storm. The graph below illustrates the 2019 precipitation accumulation in the Charleston area (threaded data) compared to the climatological normal for the state. It also displays the 2019 average daily temperature coupled with the climatological normal average daily temperature.



Of importance in the Charleston area in 2019 was the frequent coastal flooding. The National Weather Service Charleston office reported that the area experienced 89 days of coastal flooding, far surpassing the previous 2015 record of 58 days. According to the NOAA National Centers for Environmental Information's Storm Events Database, the Lowcountry only experienced one tornado during 2019, an EF1 that occurred during the April 19 outbreak that caused several tornadoes throughout the state. Prior to Hurricane Dorian's passing offshore South Carolina, King Tides were causing significant coastal flooding, with 10 reports recorded in the Storm Events Database.

The graph below depicts the Charleston area's daily temperature departures in 2019 using a threaded dataset. The graph of departures for the entire year depicts the fact that the most significant departures from normal occurred in the winter months, as seen in the warm "peaks" in December, January, and February, and the cold "peak" in November.