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Southern Climate Monitor

October 2018 | Volume 8, Issue 10

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An 18 Year Summary of Drought Characteristics in the Southern United States

Daniela Spade, Ph.D. Candidate, University of Oklahoma Department of Geography and Environmental Sustainability

When considering weather and climate-related hazards throughout the southern region of the U.S., droughts can easily be overlooked relative to the frequency of other regional climatic extremes such as hurricanes and tornadoes. The potential omission of drought from the public's awareness is reinforced by three major factors that differentiate droughts from other natural hazards. First, droughts lack the rapid manifestation associated with other weather phenomena such as tornadoes or hurricanes; rather, droughts are often referred to as a creeping phenomenon, meaning it is a slow-onset natural hazard. Second, drought impacts are not manifested through concentrated infrastructural damage as is common with other natural hazards typical of the area such as hurricanes. Instead, drought impacts are spread over vast geographical areas that are experiencing a net imbalance between precipitation and evapotranspiration. The third and perhaps most technical contributing factor is that the precise definition of drought is ambiguous. Indeed, Wilhite and Glantz (1985) identified over 150 definitions of the phenomenon. One reason for this ambiguity is that droughts are a regional phenomenon, and each region has site-specific climatic characteristics. For example, in regions where rainfall is frequent and consistent year-round such as the northeast U.S., water deficits could appear after only a few weeks without rain. In contrast, regions with a pronounced dry season such as the desert southwest may require a up to season or longer with no rain before a water deficit develops (Lindesay, 2003). Thus, while all types of drought stem from a deficiency in precipitation, no single quantitative definition of drought works in all regions or circumstances. The combination of these three factors results in an insidious natural hazard that is a normal part of the global climate regime, and the southern region of the U.S. is no exception. The maps below illustrate spatial patterns of drought characteristics in the southern U.S. and are intended to address questions that arise when a region is experiencing a drought or is attempting to plan for future water resources, such as the frequency of drought events and the average drought duration in the area.

All figures shown below were created from datasets downloaded from the U.S. Drought Monitor (USDM), which became operational in 1999 as an analysis of current drought conditions in the U.S. The severity of the drought conditions is classified on a scale ranging between D1 (moderate drought) to D4 (exceptional drought). A fifth category, D0, indicates abnormally dry conditions, which commonly either precedes a drought or depicts lingering impacts after a drought event (Table 1; Svoboda et al., 2002). Weekly USDM data are available for download in several data formats from 2000 to present at http://droughtmonitor.unl.edu/Data/GISData.aspx .

The categories and associated percentile ranking of drought magnitude used in the Drought Monitor:

Category	Description	Percentile chance
D0	Abnormally dry	20 to ≤ 30
D1	Moderate drought	10 to ≤ 20
D2	Severe drought	5 to ≤ 10
D3	Extreme drought	2 to ≤ 5
D4	Exceptional drought	≤ 2

Figure 1 depicts the number of drought events over the 2000 - 2017 time period on a 25 km2 grid system, which is used as an approximation for county-scale. While there is no universal definition of drought, in the terminology of the Drought Monitor, a working definition of a drought event is defined here as any location experiencing a level D2 drought for a period of time lasting at least eight weeks. A region experiencing 8 consecutive weeks of D2 (or 1 week of D3) drought conditions is automatically eligible for aid as per the U.S. Department of Agriculture (USDA) guidelines. The drought event is considered over if the drought category dips below a D2 for a minimum of 8 weeks. Although there are no quantitative measures that signal the end of a drought event as per the USDA guidelines, this 8-week standard was used to eliminate scenarios of brief respites from dryness that are immediately followed by severe drought conditions (i.e. a few weeks of D1 and then back to D2). Figure 1 illustrates that repeated drought events have been prevalent throughout the majority of Texas and Oklahoma as well as parts of the southeast including eastern Alabama, Florida, Georgia and western South Carolina over the past 18 years. The high frequency of drought in these areas is mirrored by the persistence of the events, as shown by Figure 2, which illustrates the median duration of these events (in weeks). Whereas drought events tend to be relatively short lived in Arkansas, parts of Louisiana and Mississippi, they can persist anywhere from 9 months to 2 years throughout the bulk of Texas and Oklahoma as well as many of the southeastern states. West central Texas and parts of the panhandle appear hardest hit by persistent drought. The Amarillo area in the Texas panhandle experienced drought conditions that persisted up to 5 years on average, according the Drought Monitor indicators.

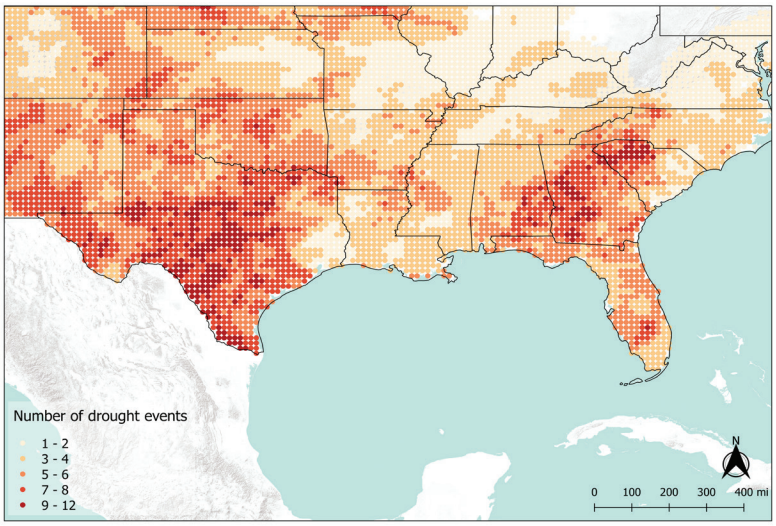

Figure 1: Number of drought events over the 2000 - 2017 time period in the southern U.S. Image resolution is at 25 km2 which is roughly the county scale.

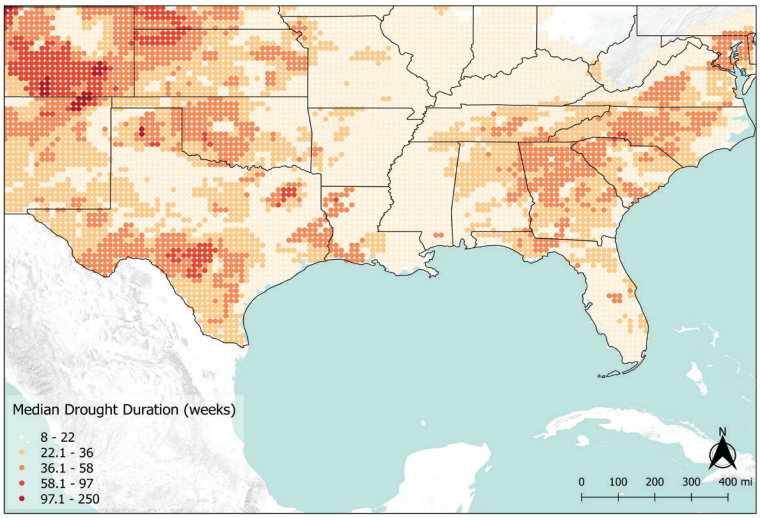

Figure 2: Median duration (in weeks) of drought events over the 2000 - 2017 time period in the southern U.S. Image resolution is at 25 km2.

Of particular relevance to agricultural industries is the development of flash drought conditions, or rapidly intensifying dryness associated with either heat waves or precipitation deficits (Mo and Lettenmair, 2015). Rapid drought onset significantly impacts agriculture as well as fire weather hazards. To analyze spatial patterns in the occurrence of flash droughts throughout the southern U.S., Figure 3 illustrates the median week count between Drought Monitor categories D0 and D3. Drought appears to intensify

rapidly throughout much of the southern U.S., with conditions deteriorating from abnormally dry to extreme drought in as little as 3 months on the conservative end. Note the spatial overlap between drought persistence (Figure 2) and rapid drought intensification (Figure 3) throughout Oklahoma, south central Texas and the southeastern states, suggesting that while drought intensifies rapidly in these regions, its recession is not necessarily characterized by the same abruptness. Overall figures 1 - 3 show that the previous 18 years have been a period of recurring and persistent moisture deficits throughout much of the southern U.S. The western and eastern extents of the region in particular appear to serve as moisture deficit bookends in terms of the sheer amount of drought events and the associated duration.

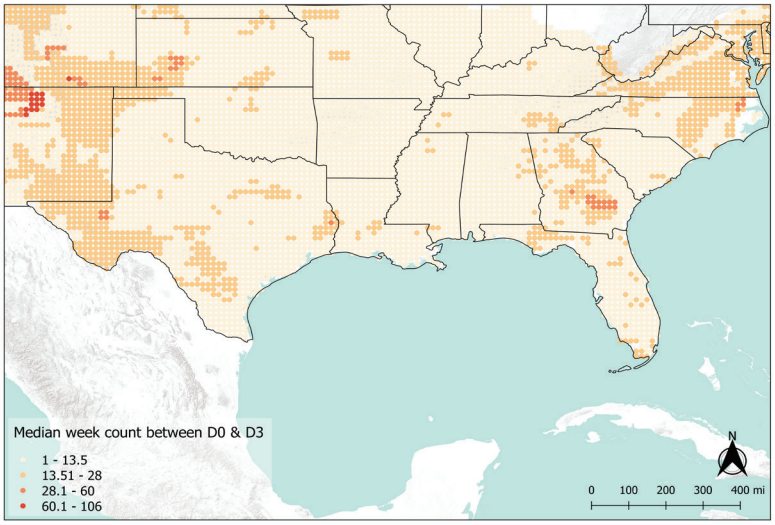

Figure 3: Median amount of time (in weeks) between drought categories D0 (abnormally dry) and D3 (extreme drought). Image resolution is at 25 km2.

References:

Lindesay, J.A. "Climate and drought in Australia." Beyond Drought. People, Policy and Perspective. Ed. Linda Courtenay Botterill and Melanie Fisher. Collingwood, Victoria: CSIRO Publishing, 2003. 21-47. Print.

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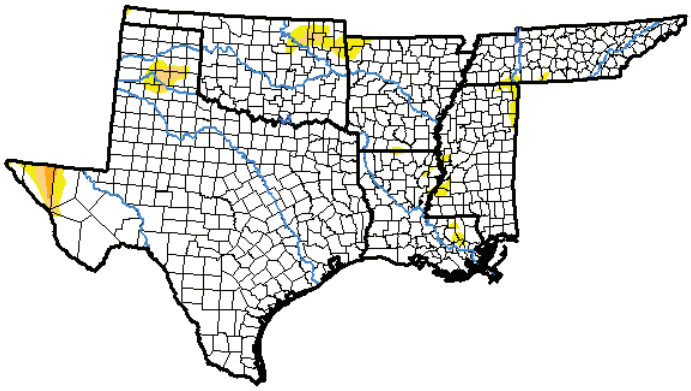
Drought Update

Kyle Brehe and Derek Thompson,
Southern Regional Climate Center

At the end of October, drought conditions continued to improve across the Southern Region. Extreme drought classifications were no longer present in the region, a change from the beginning of the month. Severe drought classifications were present across extreme western Texas, while moderate drought classifications were present in parts of extreme western and northern Texas as well as northeastern Oklahoma. There were no drought conditions in Tennessee, Louisiana, Mississippi, and Arkansas; however, there were some small patches of abnormally dry conditions.

In October, there were a total of 231 storm reports across Texas, Oklahoma, Arkansas, Louisiana, and Mississippi. There were 62 tornado reports, 20 hail reports, and 149 wind reports. Mississippi tallied the most wind reports (52) while Texas tallied the most tornado (21) and hail (17) reports. Texas tallied the most reports total (78) while Tennessee tallied the least (0).

On October 31, 2018, there were 7 tornado reports and 75 wind reports across Texas, Arkansas, Louisiana, and Mississippi. One person was killed and two were injured after a tree fell on a car near Port Gibson, Mississippi. A tree fell on a mobile home near Bogalusa, Louisiana, trapping residents inside, while trees were reported to have fallen on a mobile home near Baton Rouge, Louisiana and on a house near New Orleans, Louisiana. A wind gust of 65 mph (104.61 kph) was reported in Biloxi, Mississippi, while a wind gust of 62 mph (99.78 kph) was reported at Eugene Island, Louisiana. A wind report near Garden Ridge, Texas indicated winds were strong enough to snap a large, live oak tree at the trunk.



Released Thursday, November 1, 2018
Deborah Bathke, National Drought Mitigation Center

Above: Drought Conditions in the Southern Region. Map is valid for October 30, 2018. Image is courtesy of the National Drought Mitigation Center.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	95.61	4.39	1.14	0.22	0.00	0.00
Last Week *10-23-2018*	93.66	6.34	2.33	0.87	0.21	0.00
3 Months Ago *07-31-2018*	29.22	70.78	46.11	23.79	5.58	0.00
Start of Calendar Year *01-02-2018*	31.09	68.91	42.64	15.33	0.30	0.00
Start of Water Year *09-25-2018*	70.82	29.18	12.09	4.10	0.48	0.00
One Year Ago *10-31-2017*	65.38	34.62	10.50	0.06	0.00	0.00

Intensity:

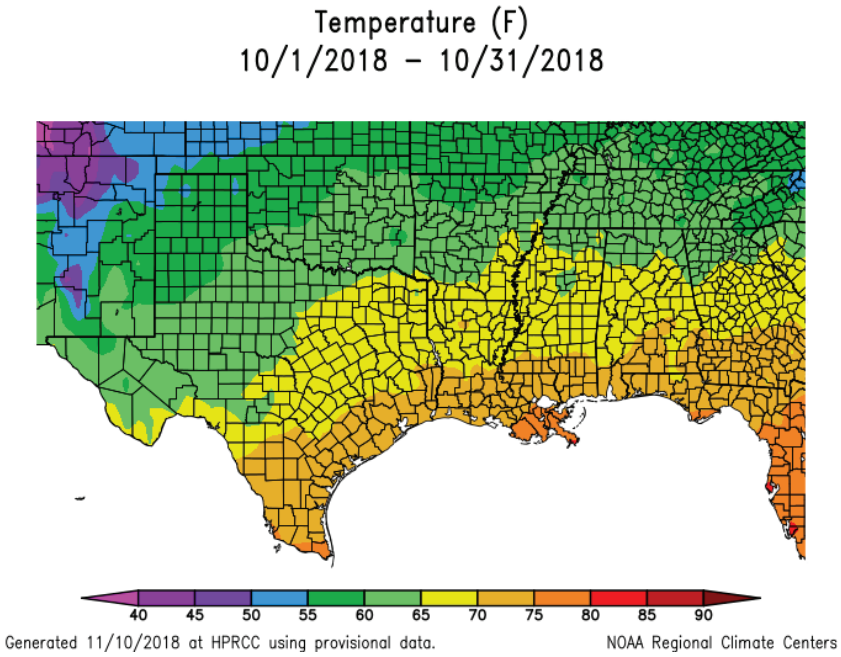
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

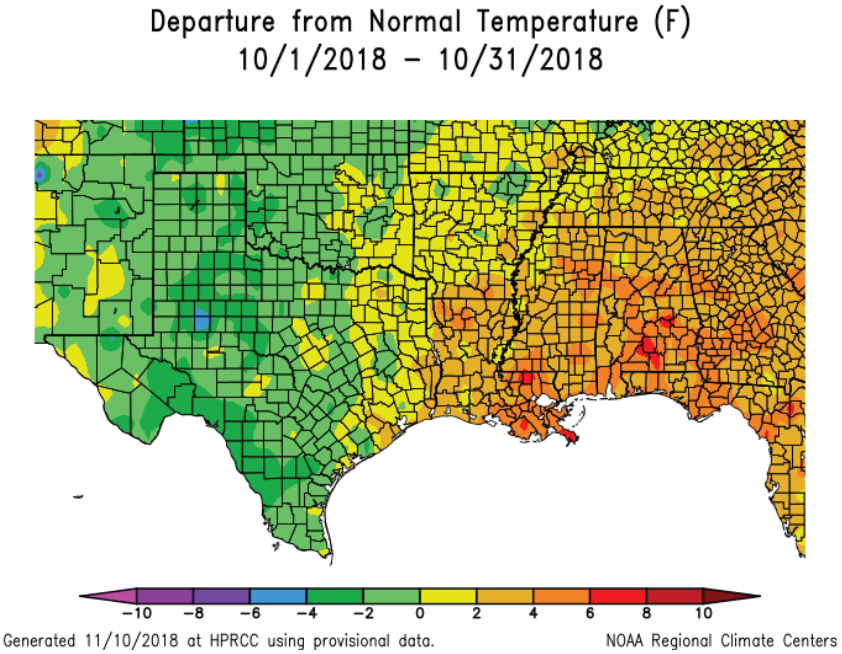
Temperature Summary

Kyle Brehe and Derek Thompson,
Southern Regional Climate Center

Temperatures for the month of October varied spatially throughout the Southern Region, but generally exhibited a pattern with warmer temperatures in the eastern half of the region and cooler temperatures in the western half of the region. Parts of west-central and extreme western Texas experienced temperatures 4 to 6 degrees F (2.22 to 3.33 degrees C) below normal. Parts of southern, southwestern, western, central, and northern Texas as well as extreme western, western, and southwestern Oklahoma experienced temperatures 2 to 4 degrees F (1.11 to 2.22 degrees C) below normal. Most of Louisiana and Mississippi, parts of eastern and southeastern Texas, southern, western, central, and eastern Tennessee, and parts of southern, eastern, central, and northwestern Arkansas experienced temperatures 2 to 4 degrees F (1.11 to 2.22 degrees C) above normal. Parts of southern Arkansas, northwestern and southeastern Louisiana, and southern and eastern Mississippi experienced temperatures 4 to 6 degrees F (2.22 to 3.33 degrees C) above normal. Parts of southeastern Louisiana experienced temperatures 6 to 8 degrees F (3.33 to 4.44 degrees C) above normal. The statewide monthly average temperatures were as follows: Arkansas – 62.50 degrees F (16.94 degrees C), Louisiana – 70.70 degrees F (21.50 degrees C), Mississippi – 67.30 degrees F (19.61 degrees C), Oklahoma – 60.30 degrees F (15.72 degrees C), Tennessee – 60.80 degrees F (16.00 degrees C), and Texas – 65.40 degrees F (18.56 degrees C). The statewide temperature rankings for October were as follows: Arkansas (forty-eighth warmest), Louisiana (fourteenth warmest), Mississippi (twenty-first warmest), Oklahoma (thirty-fourth coldest), Tennessee (thirtieth warmest), and Texas (forty-first coldest). All state rankings are based on the period spanning 1895-2018.



Average October 2018 Temperature across the South

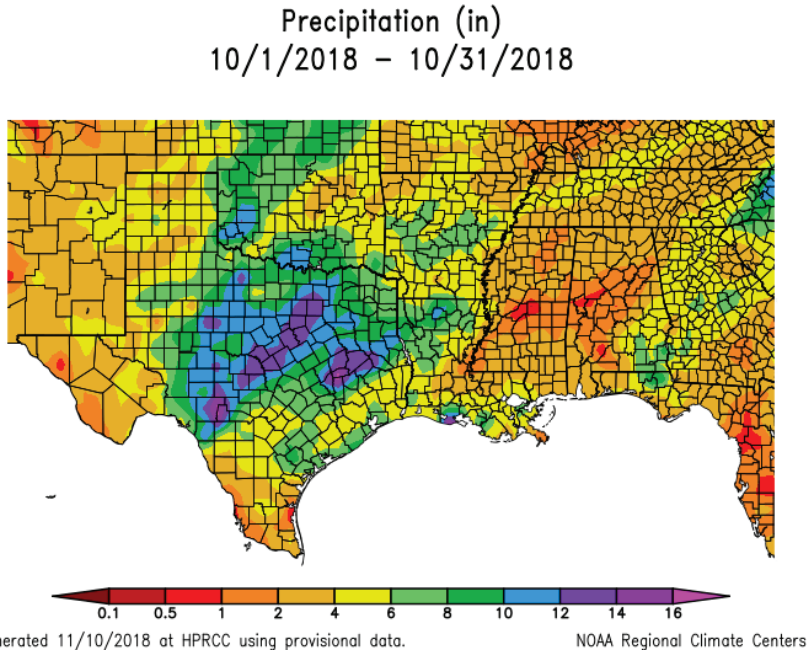


Average Temperature Departures from 1981-2010 for October 2018 across the South

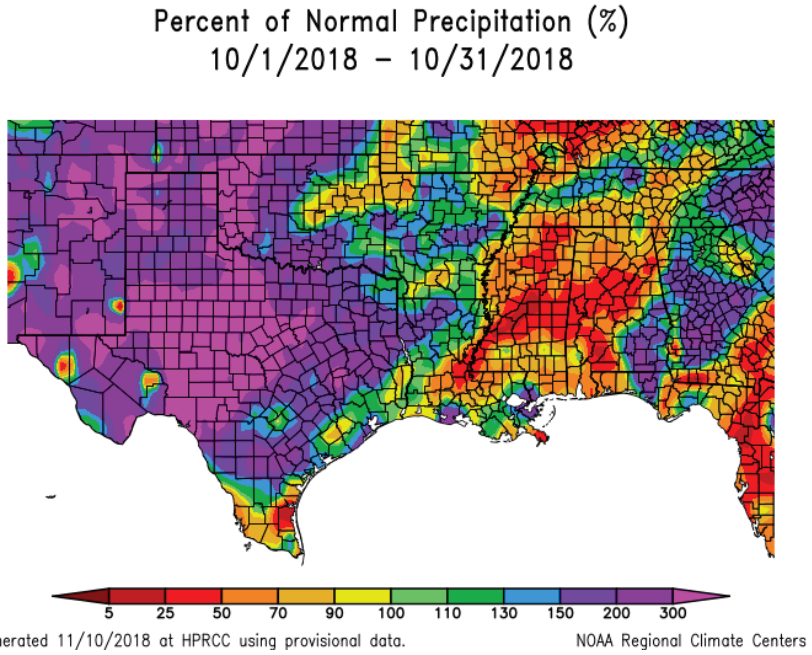
Precipitation Summary

Kyle Brehe and Derek Thompson, Southern Regional Climate Center

Precipitation values for the month of October varied spatially across the Southern Region. Parts of southern Texas and west-central Mississippi received 25 percent or less of normal precipitation. In contrast, parts of eastern and northern Tennessee, southern Mississippi, central, eastern, and northwestern Arkansas, southern, southeastern, and northwestern Louisiana, southeastern, southern, northern, and central Oklahoma, and eastern, southern, northern, and western Texas received 150 percent or more of normal precipitation. Parts of southern and southeastern Louisiana, southern Mississippi, northwestern Arkansas, southern, northern, western, and extreme western Oklahoma, and eastern, southern, western, central, and northern Texas received 200 percent or more of normal precipitation. Parts of western and extreme western Oklahoma as well as central, northern, western, and part of eastern Texas received 300 percent or more of normal precipitation. The state-wide precipitation totals for the month were as follows: Arkansas – 5.03 inches (127.76 mm), Louisiana – 5.07 inches (128.78 mm), Mississippi – 2.46 inches (62.48 mm), Oklahoma – 6.64 inches (168.66 mm), Tennessee – 3.42 inches (86.87 mm), and Texas – 6.86 inches (174.24 mm). The state precipitation rankings for October were as follows: Arkansas (twenty-fifth wettest), Louisiana (twenty-second wettest), Mississippi (fifty-ninth driest), Oklahoma (seventh wettest), Tennessee (forty-seventh wettest), and Texas (first wettest). This was the second consecutive month where Texas recorded its wettest month on record and the third consecutive month where a state in the Southern Region reported a top-10 wettest month. All state rankings are based on the period spanning 1895-2018.

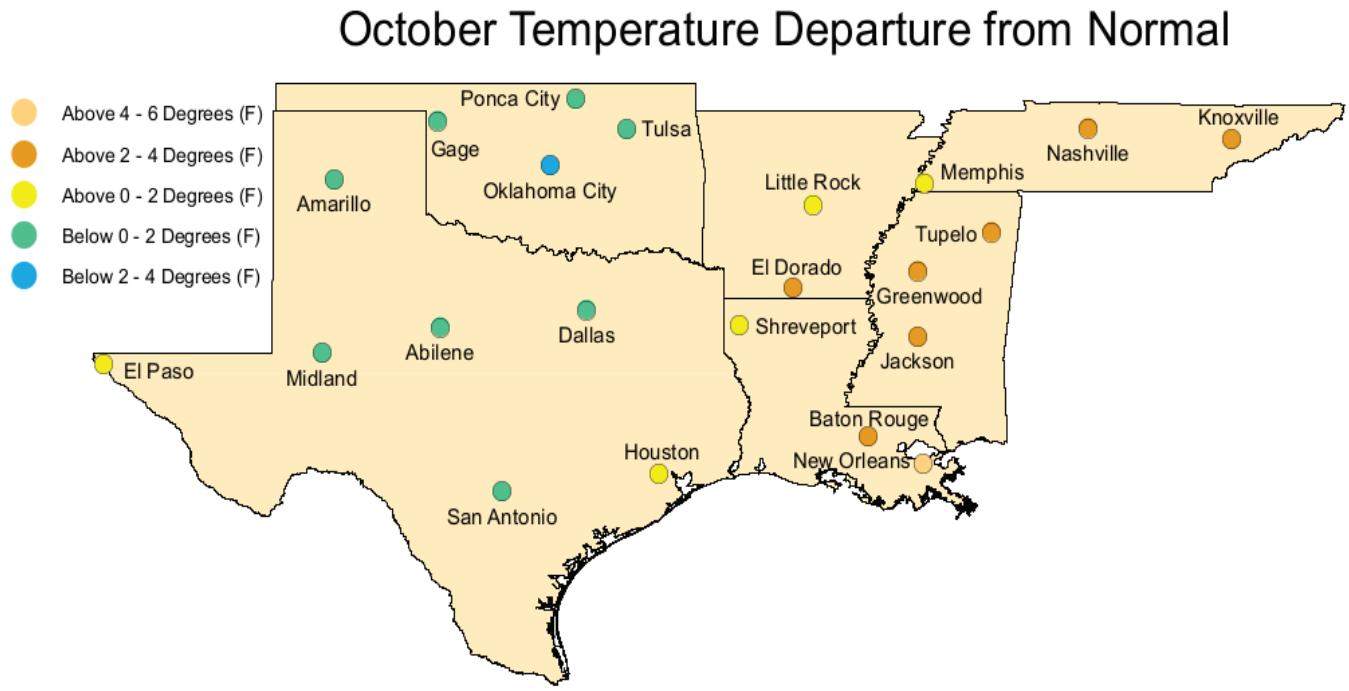


October 2018 Total Precipitation across the South

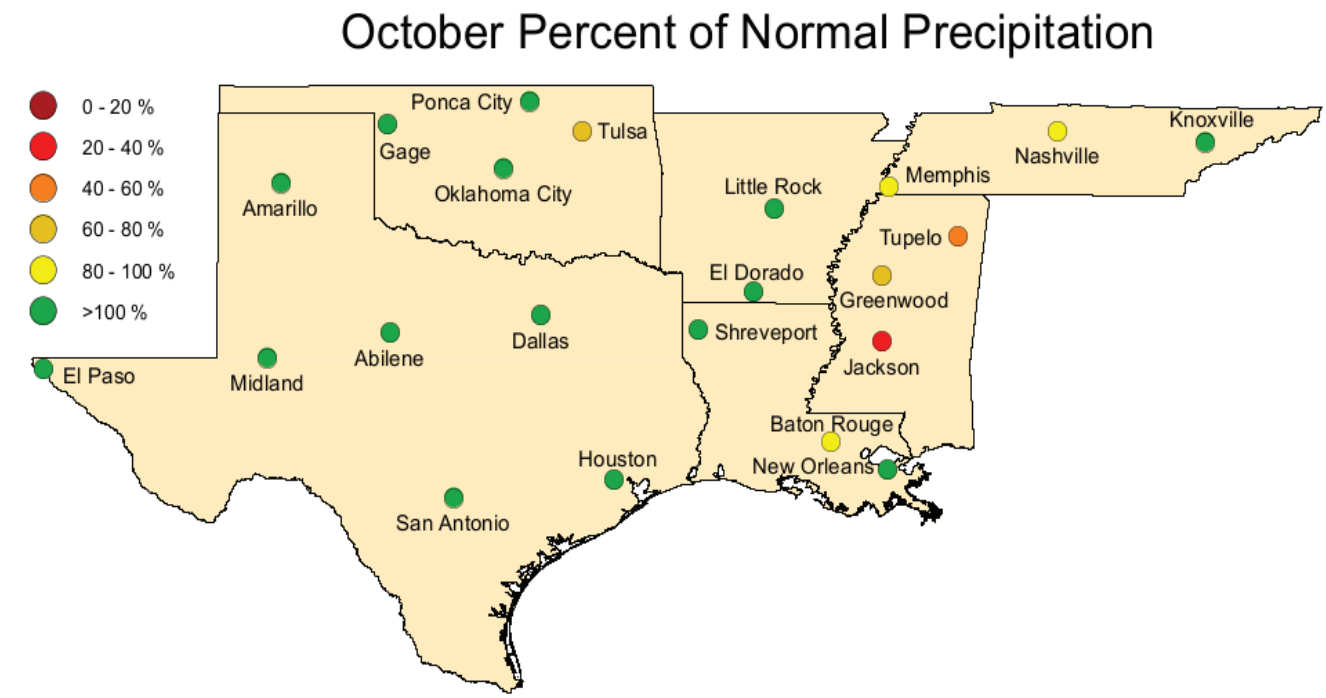


Percent of 1981-2010 normal precipitation totals for October 2018 across the South

Regional Climate Perspective in Pictures



October 2018 Temperature Departure from Normal from 1981-2010 for SCIPP Regional Cities



October 2018 Percent of 1981-2010 Normal Precipitation Totals for SCIPP Regional Cities

Climate Perspective

State	Temperature	Rank (1895-2018)	Precipitation	Rank (1895-2018)
Arkansas	62.50	48th Warmest	5.03	25th Wettest
Louisiana	70.70	14th Warmest	5.07	22nd Wettest
Mississippi	67.30	21st Warmest	2.46	59th Driest
Oklahoma	60.30	34th Coldest	6.64	7th Wettest
Tennessee	60.80	30th Warmest	3.42	47th Wettest
Texas	65.40	41st Coldest	6.86	1st Wettest
Regional	**64.50**	**42nd Warmest**	**4.91**	**17th Wettest**

State temperature and precipitation values and rankings for October 2018. Ranks are based on the National Climatic Data Center's Statewide, Regional, and National Dataset over the period 1895-2018.

Station Summaries Across the South

Station Summaries Across the South

Station Name	Temperatures								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	%Norm
Little Rock, AR	73.3	54.3	63.8	0.1	89	10/05+	36	10/22	8.21	3.30	167
Baton Rouge, LA	82.6	63.2	72.9	3.6	92	10/04+	47	10/22	3.93	-0.77	83
New Orleans, LA	83.8	69.5	76.7	5.4	91	10/07+	55	10/27	5.13	1.59	144
Shreveport, LA	77.6	59.2	68.4	2.0	91	10/06+	42	10/22	8.70	3.74	175
Greenwood, MS	77.4	57.1	67.2	2.9	91	10/05+	37	10/22	2.64	-1.23	68
Jackson, MS	78.9	58.2	68.6	3.5	90	10/05+	39	10/22	1.04	-2.88	26
Tupelo, MS	76.6	55.6	66.1	3.1	92	10/06+	36	10/22	1.93	-2.19	46
Gage, OK	70.8	45.6	58.2	-0.2	95	10/03	29	10/15	7.94	5.95	398
Oklahoma City, OK	68.8	50.7	59.8	-2.7	87	10/05	35	10/15+	5.37	1.66	144
Ponca City, OK	70.3	48.8	59.5	-0.6	92	10/03	32	10/16	8.23	4.85	243
Tulsa, OK	71.0	51.9	61.5	-0.3	91	10/05+	37	10/21	3.09	-0.84	78
Knoxville, TN	71.9	52.3	62.1	2.2	89	10/06+	33	10/22	3.00	0.49	119
Memphis, TN	74.2	56.5	65.3	1.2	92	10/04	39	10/22	3.59	-0.39	90
Nashville, TN	73.5	52.5	63.0	2.7	92	10/05	34	10/22	2.89	-0.15	95
Abilene, TX	72.8	55.0	63.9	-1.9	88	10/05+	36	10/15	12.09	9.11	405
Amarillo, TX	68.1	45.9	57.0	-1.3	94	10/03	28	10/15	3.90	2.24	234
El Paso, TX	74.4	56.1	65.3	0.2	92	10/05	43	10/16+	2.44	1.83	400
Dallas, TX	74.1	58.3	66.2	-1.3	91	10/03	41	10/15	15.66	11.45	371
Houston, TX	80.5	64.0	72.3	0.8	91	10/14+	51	10/22	7.02	1.32	123
Midland, TX	72.6	54.6	63.6	-1.2	93	10/03	37	10/15	5.44	3.71	314
San Antonio, TX	77.4	62.2	69.8	-1.4	89	10/06	45	10/15	6.47	2.36	157

Summary of temperature and precipitation information from around the region for October 2018. Data provided by the Applied Climate Information System. On this chart, "depart" is the average's departure from the normal average, and "% norm" is the percentage of rainfall received compared with normal amounts of rainfall. Plus signs in the dates column denote that the extremes were reached on multiple days. Blueshaded boxes represent cooler than normal temperatures; redshaded boxes denote warmer than normal temperatures; tan shades represent drier than normal conditions; and green shades denote wetter than normal conditions.

NOAA's Winter Outlooks

Margret Boone, SCIPP Program Manager

On November 15, 2018, the NOAA Climate Prediction Center (CPC) released its updated Winter Outlook for the United States. There are three outlooks included: US Temperature Outlook, US Precipitation Outlook, and the Seasonal Drought Outlook.

The U.S. Temperature Outlook (Figure 1) for this Winter illustrates the probability of regions seeing either cooler than normal (blue colors), or warmer than normal temperatures (red colors). Areas shaded in white have equal chances of cooler than normal or warmer than normal temperatures. There is a greater than 33% chance of warmer than normal temperatures across much of the northern and western U.S., with areas of the Pacific Northwest and Alaska having greater than 50-60% chance of warmer than normal temperatures. No part of the U.S. is expected to be cooler than normal.

The U.S. Precipitation Outlook (Figure 2) for this Winter visualizes the probability of drier than normal or wetter than normal conditions across the United States. Like the Temperature Outlook, areas in white have equal chances of drier than normal or wetter than normal conditions. Wetter than normal conditions are possible across the southern portion of the U.S. and portions of Alaska, with northern Florida and southern Georgia having the greatest probability of above average precipitation. The Great Lakes region may see drier than normal conditions this Winter. The rest of United States has equal chances of either drier than normal or wetter than normal conditions.

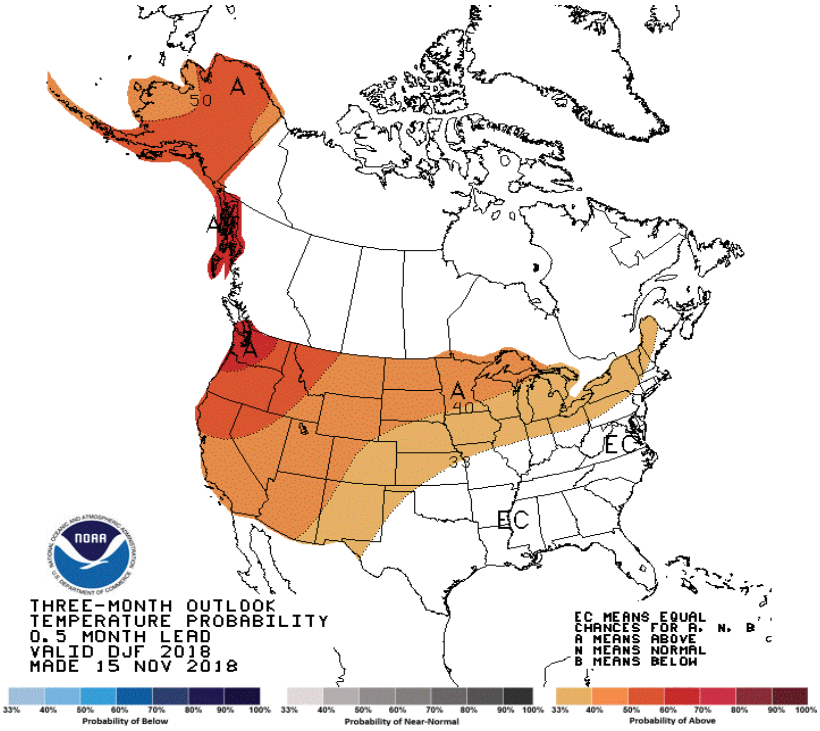


Figure 1: U.S. Winter Temperature Outlook for December, January and February. (http://www.cpc.ncep.noaa.gov/products/predictions/long_range/lead01/off01_temp.gif)

The Seasonal Drought Outlook (Figure 3) was updated on November 15, 2018, and depicts trends in drought conditions across the United States. Drought conditions are likely to persist across portions of Oregon, Colorado, Utah and Nevada. Some improvement is possible across Southern California, Arizona, New Mexico, and coastal Oregon. As a reminder, these are trends based on short and long-range forecasts, and could change.

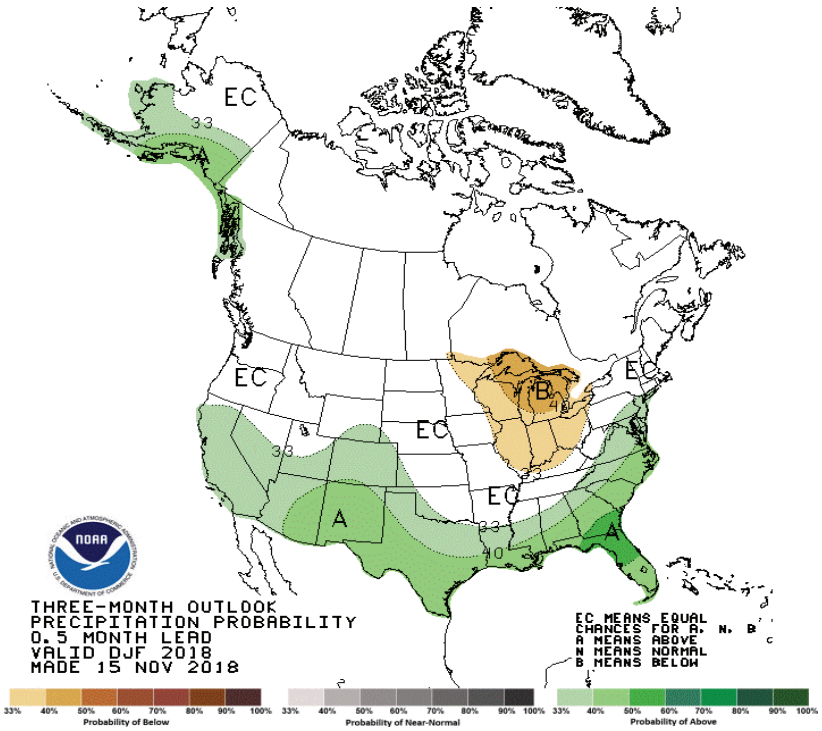


Figure 2: U.S. Winter Precipitation Outlook for December, January and February. (https://www.noaa.gov/media-release/winter-outlook-favors-warmer-temperatures-for-much-of-us)

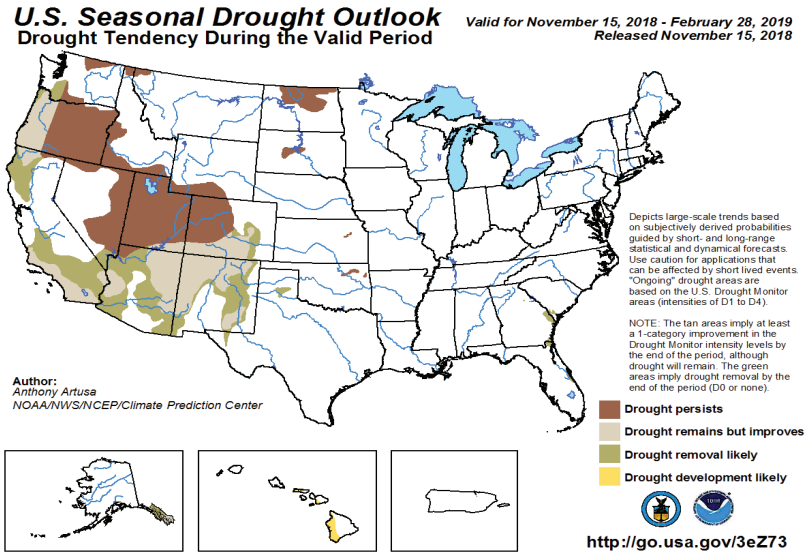


Figure 3: Seasonal Drought Outlook for November, December, January and February. (http://www.cpc.noaa.gov/products/expert_assessment/season_drought.png)

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Assessing Regional Agricultural Vulnerability

Understanding the risks producers face from weather and climate extremes and changes is essential to sustaining resilient agricultural systems. The wide range of cropland, grazing, and forested land management activities across the Southern Plains makes understanding these risks challenging. Check out the Hub's recent reports and assessments for more information about the risks in your state.

Resilient Southern Plains Agriculture and Forestry in a Changing Climate

Southern Plains Vulnerability Assessment

For questions, contact Dr. David Drown, Director of the USDA Southern Plains Climate Hub at David.Brown@ARS.USDA.GOV

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For any questions pertaining to historical climate data across the states of Oklahoma, Texas, Arkansas, Louisiana, Mississippi, or Tennessee, please contact the Southern Regional Climate Center at (225)578-5021.

For questions or inquiries regarding research, experimental tool development, and engagement activities at the Southern Climate Impacts Planning Program, please contact us at (405)325-7809 or (225)578-8374.

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