SCIPP
A NOAA RISA TEAM

Southern Climate Monitor

May 2018 | Volume 8, Issue 5

In This Issue:

The Southern Climate Monitor is available at
www.srcc.lsu.edu & www.southernclimate.org

Understanding and Using Climate Tools

Renee Edwards, Louisiana State University

Weather and climate information is frequently communicated using climate tools. Simply put, a climate tool is a source of information used for planning and decision-making. One type of climate tool is historical in that it describes the climatology of the past. An example is SURGEDAT, a tool created by the SCIPP team that archives historical storm surge data. Other tools are short-term forecasts that provide weather information for the near future. These include severe weather forecasts such as the hurricane tracking chart from the National Hurricane Center (NHC) and the severe weather outlooks from the Storm Prediction Center. Finally, some tools are future-oriented and provide information concerning projected climate and sea level. One example is NOAA's Sea Level Rise Viewer from the Office of Coastal Management, which displays the projected impacts of rising seas. This report will highlight research on the understanding and use of climate tools, specifically the hurricane tracking chart, and then describe an ongoing project to create a tool for extreme precipitation projections.

Climate tools often take the form of maps, charts, and graphs. In fact, the past five issues of the SCIPP's Southern Climate Monitor used 43 graphical displays, for an average of 8.6 per issue. These tools are convenient for condensing large amounts of precise information into a relatively small format. It would take many paragraphs (or even pages or chapters) to explain in words all the information present in a single display. Packing much information into one representation is both a strength and a weakness of graphs and charts. While they display a significant amount of data efficiently, their interpretation is highly dependent on the knowledge and motivation of the reader. Someone who is not familiar with the topic may not be able to make sense of the graph or may misinterpret some of the elements. A different person with a lot of experience may "read in" information that is not there. Other, less motivated readers may not spend the time or expend the effort necessary to understand the content or its importance. These challenges limit the successful interpretation and use of climate tools.

One important tool is the NHC Track Forecast Cone, also known as the "cone of uncertainty" (NOAA, National Hurricane Center, 2017), which is used to depict possible deviations in 3-day and 5-day forecasts (Figure 1). The cone captures two-thirds of the forecast errors from over the past 5 years. Thus, the best interpretation is that there is roughly a 33 percent chance that the center of a storm will shift outside the cone and a 67 percent chance the center will stay within the cone. According to SCIPP PI and Louisiana State Climatologist Barry Keim, most users of the tool probably do

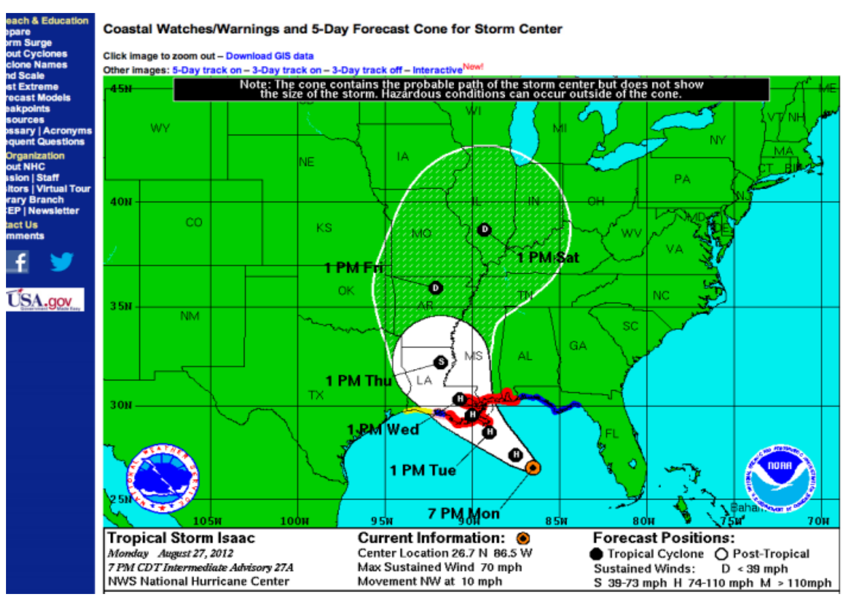


Figure 1: Cone of error for Tropical Storm Isaac in 2012. Image is from the National Hurricane Center

not know this. Meteorologists and forecasters also have very low expectations of the TV viewing audience's scientific literacy and its ability to understand the cone of uncertainty and other technical information (Eosco, 2009).

Consistent with this assessment, several studies have documented misinterpretation and biased use of the Forecast Cone. Research conducted with the general public after Hurricane Charlie struck Florida showed that the forecast cone led to a perception of less risk and an expectation for less damage (Broad, Leiserowitz, Weinkle, & Steketee, 2007). The visual imagery of the cone may be a challenge for non-experts to interpret. Viewers who do not have experience with hurricanes interpret the larger size of the forecast cone (as it nears the coast) to mean that greater damage is expected when, in fact, the larger size is meant to reflect greater uncertainty about the track (Ruginski et al., 2016). Some researchers (e.g., Ruginski et al., 2016) have tested alternative images for communicating hurricane tracks in search of a format that communicates risk and severity more accurately to the public.

However, it is not only the general public that misinterprets the hurricane forecast track; broadcast meteorologists sometimes provide information that deviates from the official forecasts provided by the National Hurricane Center. Broadcast meteorologists are professional communicators who provide information about the weather to the general public via television, radio, newspapers, and the internet. Some have training in meteorology but others do not. The American Meteorological Society (AMS) has a certification program whereby meteorologists take exams testing both their knowledge and their ability to communicate complex information about the weather and climate. However, this program is voluntary and many meteorologists do not fully understand basic weather-related concepts such as probability of precipitation.

To better understand of the hurricane forecast track, Broad and his colleagues (2007) interviewed meteorologists in Florida about their broadcasts concerning hurricanes. This study found that the meteorologists often make changes to the cone of uncertainty in their weather reports. They provide additional information about an approaching storm; sometimes this information directly contradicts that provided by the National Hurricane Center. These meteorologists privilege their own knowledge and experience over that of the forecasters at the National Hurricane Center. Broad et al. (2007) concluded that "communication of the official NHC cone of uncertainty to the public is mediated by the differing interpretations and strategies of local weather forecasters....with possibly significant consequences" (p. 656)

Although some research has addressed the hurricane tracking chart, little is known about interpretations and use of other types of climate tools. In an effort to address this gap, researchers from LSU and Texas Tech examined the actual and perceived comprehension of three formats displaying precipitation projections (Edwards, Ryu, Hayhoe, & Keim, 2017). Participants (n = 81) for the survey were water managers in Texas and Louisiana. They included water and sewerage officials in both states and water managers associated with levees in Louisiana and reservoirs in Texas. Respondents completed an online survey that presented precipitation data in three formats – a map, a bar chart, and a line graph (Figures 2-4). For each image, they answered multiple choice questions that tested their actual comprehension of the information. They also described their confidence in their level of understanding (perceived comprehension).[1]

The study found that both actual and perceived comprehension were highest for the map, followed by the bar chart, and then the line graph. In other words, participants scored

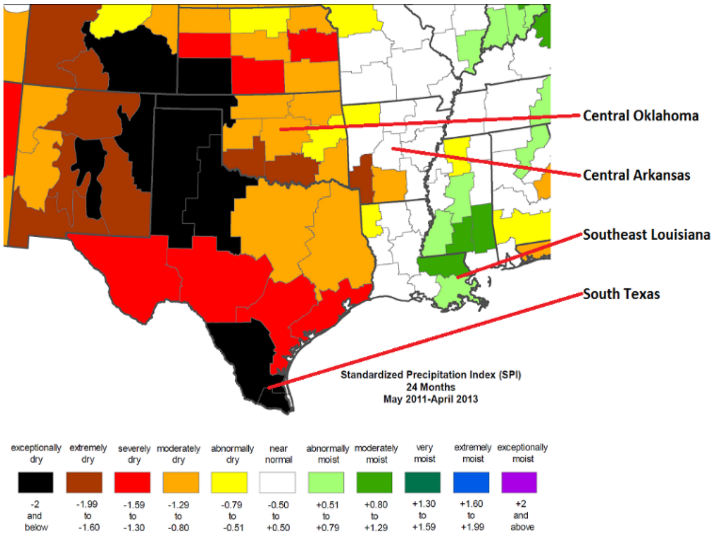


Figure 2: Map format from Edwards et al., 2017.

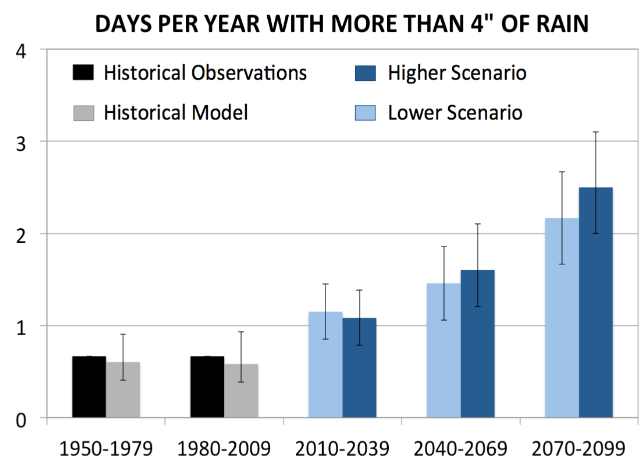


Figure 3: Bar chart format from Edwards et al., 2017.

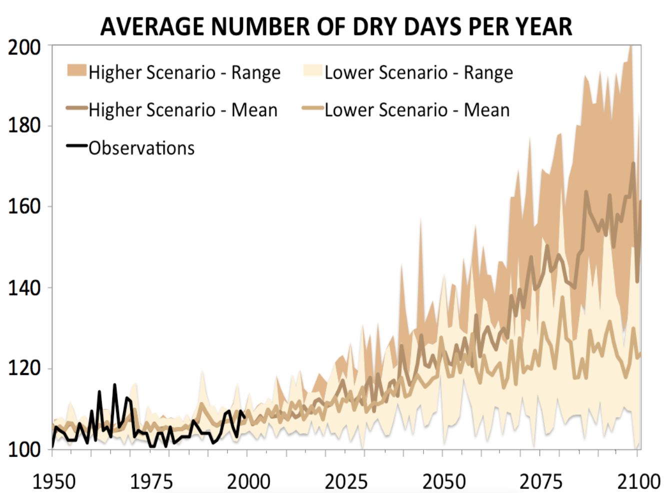


Figure 4: Line graph format from Edwards et al., 2017.

highest on the multiple choice questions about the map (M = 90%), second highest for the bar chart (M = 86%), and lowest for the line graph (M = 70%). Their confidence in understanding each format followed the same pattern. What factors could have influenced actual and assumed comprehension? It is possible that maps are more familiar to water managers than bar charts and line graphs, leading to greater success and satisfaction. Perhaps the multiple choice questions were easier for the map than for the other formats. The map conveyed the least amount of information and the line graph the most. The map was the brightest and it was easy to distinguish individual areas. In contrast, the line graph used a single color scheme with differences in hue and intensity signifying important information. Participants who took the survey using their phones or other small devices (rather than desktop computers) may have been especially challenged by the complexity and subtle shading of the line graph.

Additional investigations are needed to address these and other issues. Based on the existing research, however, it is clear that communication with climate tools is problematic in that creators and users can make divergent interpretations. Choices by creators to pack lots of information into a single image rather than using multiple images may impact understanding. Similarly, subtle choices such as coloring may also influence usability and understanding. Choices by users, such as privileging their own experience over the data in the tool, have consequences. Both creators and users of tools should be mindful of these challenges as well as their own choices in the development and use of climate tools.

Notes:

[1]To see the complete questionnaire used in this study, including the multiple choice questions that tested for actual comprehension, go to http://lsu.qualtrics.com/jfe/form/SV_6tcFYbphpkQYhQ9

References:

Broad, K., Leiserowitz, A., Weinkle, J., & Steketee, M. (2007). Misinterpretations of the “Cone of Uncertainty” in Florida during the 2004 hurricane season. Bulletin of The American Meteorological Society, 88, 651-667. doi:10.1175/BAMS-88-5-651

Edwards, R., Ryu, J. H., Hayhoe, K., & Keim B. (2017, January) Long-range seasonal precipitation projections: Stakeholder needs and comprehension of information in different formats. Poster presented at the annual meeting of the American Meteorological Association, Seattle, WA.

Eosco, G. (2009). Toward a simple science: Comparing popular visual and verbal science messages in meteorology. Paper presented at the annual meeting of the International Communication Association.

Ruginski, I. T., Boone, A. P., Padilla, L. M., Liu, L., Heydari, N., Kramer, H. S., & ... Creem-Regehr, S. H. (2016). Non-expert interpretations of hurricane forecast uncertainty visualizations. Spatial Cognition and Computation, 16, 154-172. doi:10.1080/13875868.2015.1137577

Drought Update

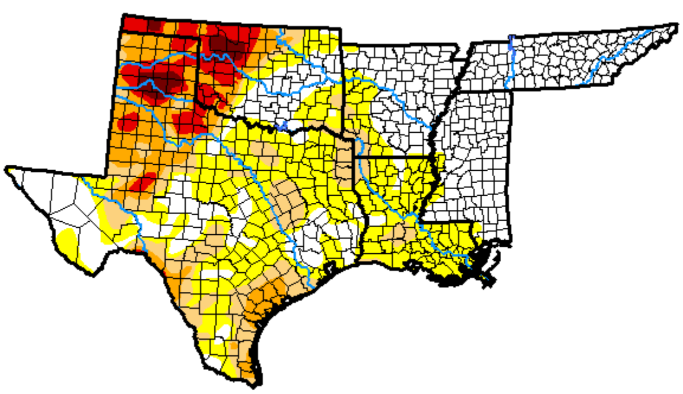
Kyle Brehe and Rudy Bartels,
Southern Regional Climate Center

At the end of May, exceptional and extreme drought classifications are still present throughout parts of western Oklahoma and northern Texas. Severe drought classifications are present throughout parts of southwestern, southeastern, and northern Texas and western and northern Oklahoma. The moderate drought classification remains throughout parts of western, central, northern, and southeast Texas. Moderate drought classification appeared in northeastern and southwestern Texas and in extreme southeastern Louisiana. There are currently no drought conditions in Arkansas, Mississippi, and Tennessee.

On May 2, 2018, there were five tornadoes reported throughout Oklahoma and Texas. There were reports of golf ball sized hail in Sonora, Texas. In Frederick, Oklahoma a wind gust of 106 mph (170.59 kph) was reported.

On May 18, 2018, strong winds caused downed trees in Alcoa, Tennessee. In New Orleans, Louisiana, strong winds caused damages to the performance stage and booths at the Bayou Boogallo on Bayou Street.

On May 27, 2018, baseball sized hail was reported in Pampa, Texas; an 80 mph (128.75 kph) wind gust was reported in Kingsmill, Texas.



Released Thursday, June 7, 2018
Anthony Artusa, NOAA/NWS/NCEP/CPC

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	39.35	60.65	30.12	17.24	7.39	1.68
Last Week *05-29-2018*	51.74	48.26	26.46	16.47	7.90	1.90
3 Months Ago *03-06-2018*	52.15	47.85	33.68	16.43	11.74	0.62
Start of Calendar Year *01-02-2018*	31.09	68.91	42.64	15.33	0.30	0.00
Start of Water Year *09-26-2017*	72.17	27.83	2.38	0.02	0.00	0.00
One Year Ago *06-06-2017*	89.19	10.81	1.02	0.00	0.00	0.00

Intensity:

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

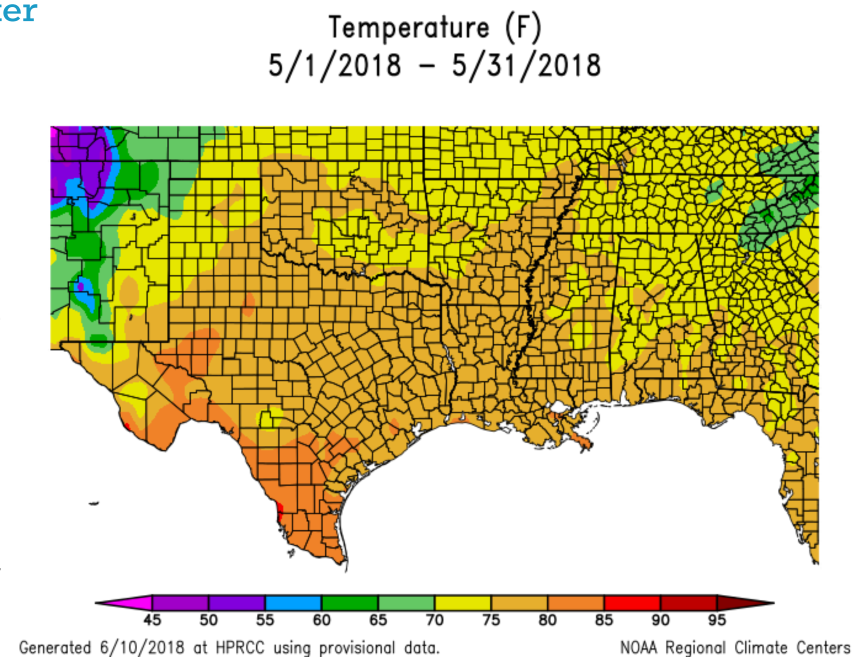
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Above: Drought Conditions in the Southern Region. Map is valid for June 5, 2018. Image is courtesy of the National Drought Mitigation Center.

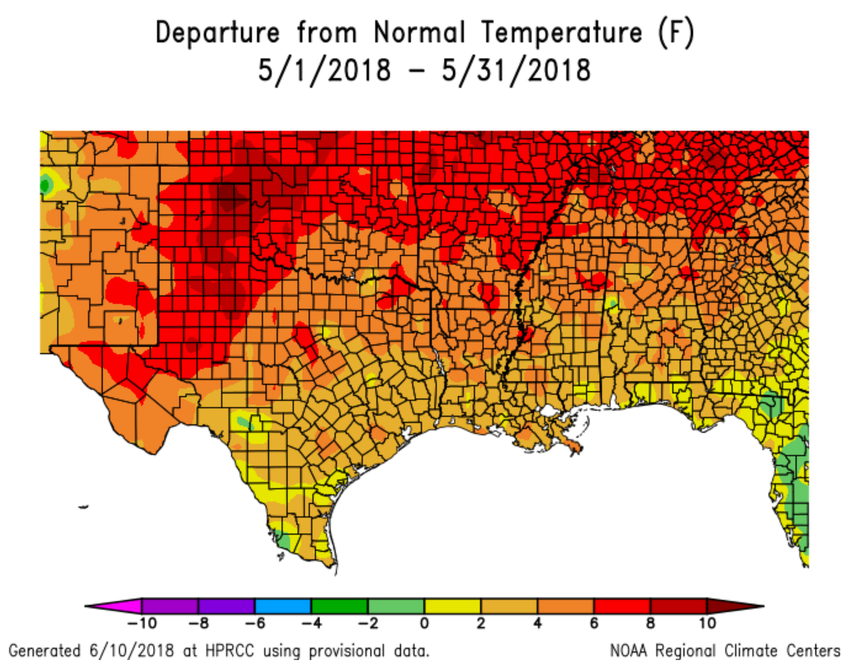
Temperature Summary

Kyle Brehe and Rudy Bartels,
Southern Regional Climate Center

May temperatures were above normal throughout most of the Southern Region. Western Oklahoma and northern Texas experienced temperatures 8 to 10 degrees F (4.44 to 5.55 degrees C) above normal. Most of Arkansas, Tennessee, and Oklahoma, northern, central and western Texas, northern Louisiana, and northern and central Mississippi experienced 4 to 8 degrees F (2.22 to 4.44 degrees C) above normal. There were only a few areas in southwest Texas that experienced slightly below normal temperatures. The statewide monthly average temperatures were as follows: Arkansas – 74.80 degrees F (23.78 degrees C), Louisiana – 77.50 degrees F (25.28 degrees C), Mississippi – 75.80 degrees F (24.33 degrees C), Oklahoma – 74.90 degrees F (23.83 degrees C), Tennessee – 72.20 degrees F (22.33 degrees C), and Texas – 77.90 degrees F (25.50 degrees C). The statewide temperature rankings for May were as follows: Arkansas (first warmest), Louisiana (third warmest), Mississippi (fourth warmest), Oklahoma (first warmest), Tennessee (second warmest), and Texas (second warmest). The region as a whole had its warmest May on record. All state rankings are based on the period spanning 1895-2018.



Average May 2018 Temperature across the South

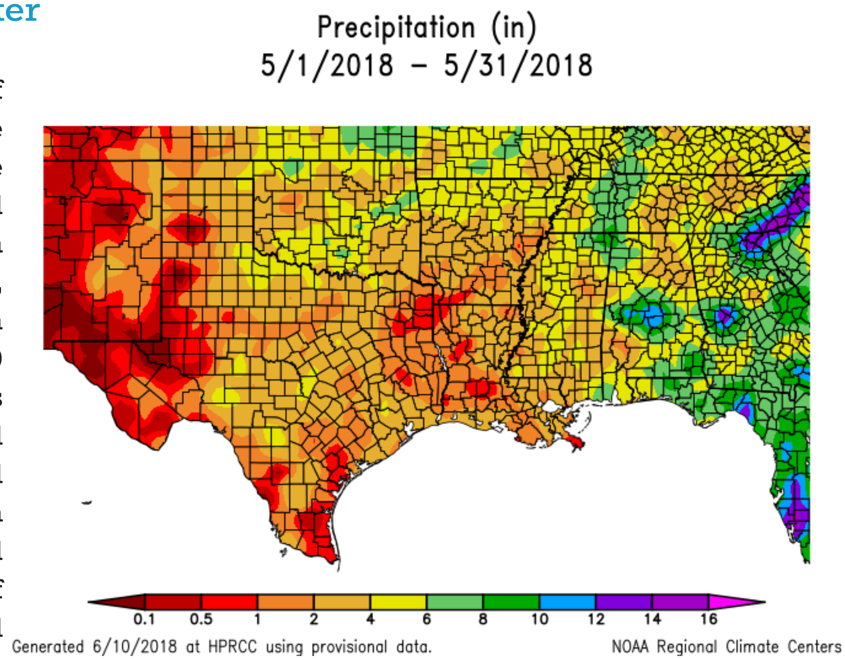


Average Temperature Departures from 1981-2010 for May 2018 across the South

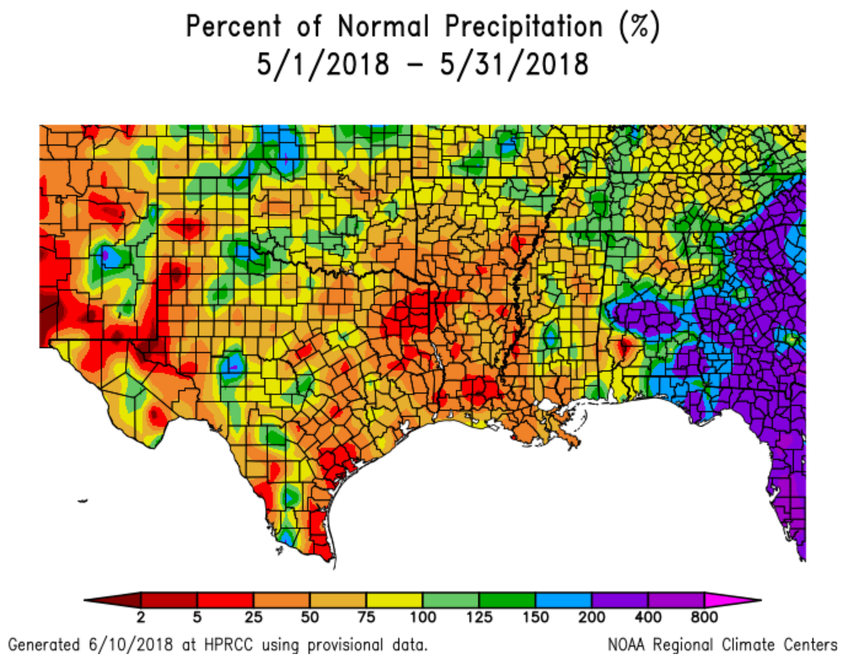
Precipitation Summary

Kyle Brehe and Rudy Bartels,
Southern Regional Climate Center

Precipitation values for the month of May varied spatially throughout the Southern Region. Eastern Tennessee received 200 – 400 percent of normal precipitation. Parts of northwestern Oklahoma, northern and central Texas, southwestern Mississippi and south central Tennessee received 150 – 200 percent of normal precipitation. Areas in Western Tennessee, northeastern and southeastern Mississippi, southern and central Texas, and southern Oklahoma received 125 – 150 percent of normal precipitation. In contrast, parts of northwestern and western Texas received 5 percent or less of normal precipitation. Areas of central, western, eastern, and southern Texas, southwestern Oklahoma, southern and eastern Arkansas, east central Mississippi, and most of Louisiana received 50 percent or less of normal precipitation. The state-wide precipitation totals for the month were as follows: Arkansas – 3.29 inches (83.57mm), Louisiana – 2.02 inches (51.31 mm), Mississippi – 3.58 inches (90.93 mm), Oklahoma – 4.05 inches (102.87 mm), Tennessee – 4.82 inches (122.43 mm), and Texas – 2.04 inches (51.82 mm). The state precipitation rankings for the month were as follows: Arkansas (twenty-third driest), Louisiana (tenth driest), Mississippi (forty-fifth driest), Oklahoma (forty-eighth driest), Tennessee (forty-eighth wettest), and Texas (nineteenth driest). All state rankings are based on the period spanning 1895-2018.

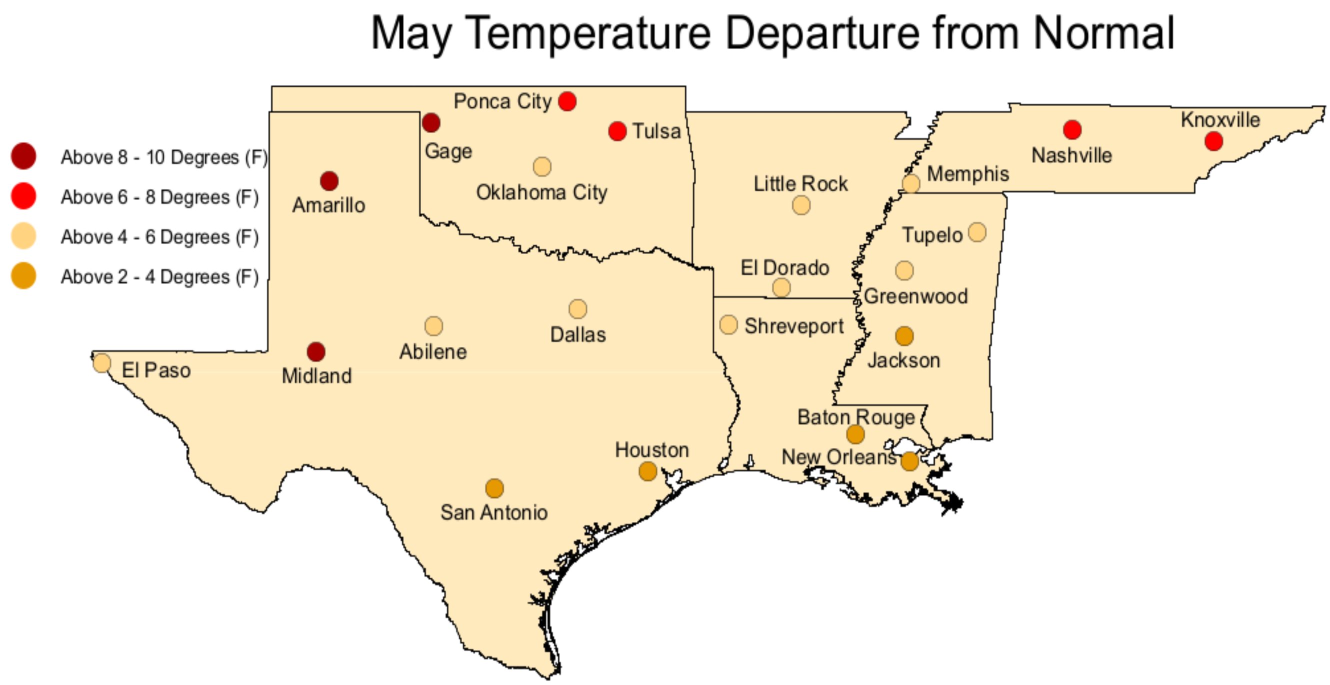


May 2018 Total Precipitation across the South

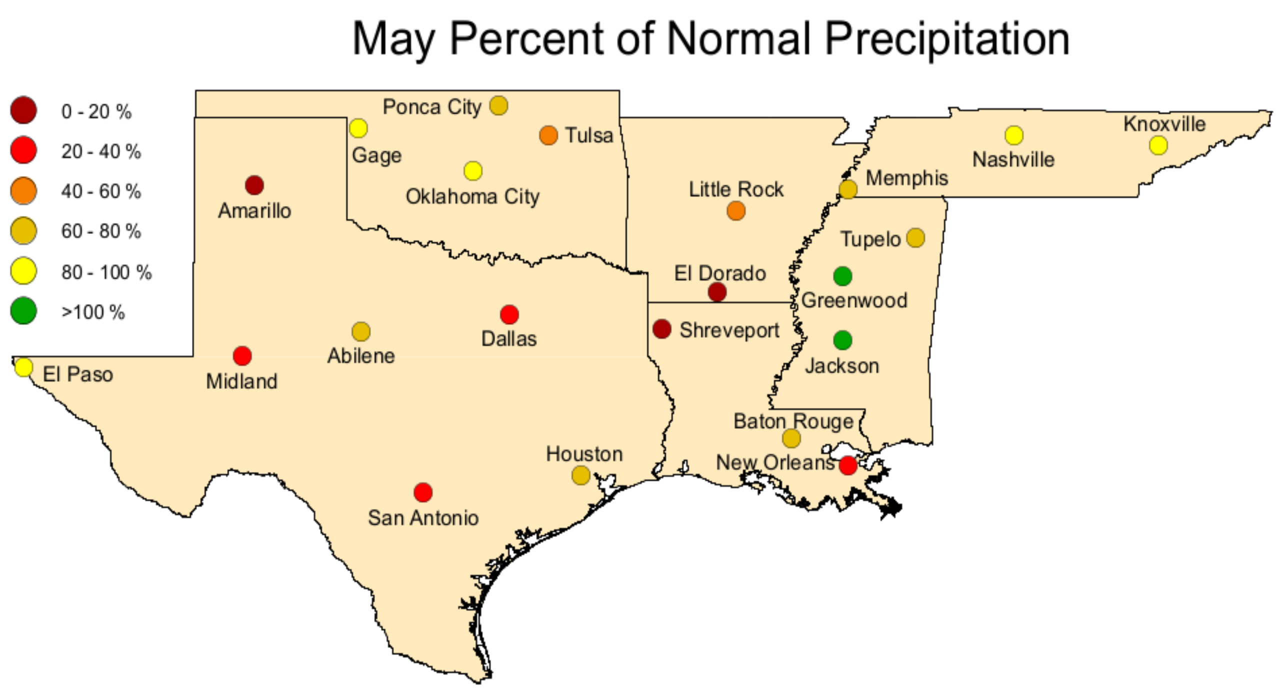


Percent of 1981-2010 normal precipitation totals for May 2018 across the South

Regional Climate Perspective in Pictures



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



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

Climate Perspective

State	Temperature	Rank (1895-2018)	Precipitation	Rank (1895-2018)
Arkansas	74.80	1st Warmest	3.29	23rd Driest
Louisiana	77.50	3rd Warmest	2.02	10th Driest
Mississippi	75.80	4th Warmest	3.58	45th Driest
Oklahoma	74.90	1st Warmest	4.05	48th Driest
Tennessee	72.20	2nd Warmest	4.82	48th Wettest
Texas	77.90	2nd Warmest	2.04	19th Driest
Regional	76.51	1st Warmest	2.79	15th Driest

State temperature and precipitation values and rankings for May 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
El Dorado, AR	89.1	64.7	76.9	5.6	95	05/30	55	05/06	0.89	-4.16	18
Little Rock, AR	87.4	65.4	76.4	5.3	92	05/30+	56	05/01	2.46	-2.41	51
Baton Rouge, LA	90.4	67.6	79.0	3.3	96	05/15	56	05/01	3.50	-1.39	72
New Orleans, LA	89.5	70.4	80.0	3.3	97	05/15	61	05/01	1.72	-2.91	37
Shreveport, LA	89.6	67.2	78.4	5.2	95	05/30+	59	05/07+	0.68	-4.25	14
Greenwood, MS	88.2	65.7	76.9	5.1	94	05/15+	52	05/01	5.57	0.62	113
Jackson, MS	88.1	64.5	76.3	4.0	94	05/15	51	05/01	7.56	3.18	173
Tupelo, MS	87.1	64.6	75.8	5.2	94	05/15	47	05/01	4.44	-1.12	80
Gage, OK	90.9	61.4	76.1	9.8	97	05/26+	45	05/05	2.70	-0.57	83
Oklahoma City, OK	85.0	63.3	74.2	4.3	93	05/30	52	05/05	4.30	-0.35	92
Ponca City, OK	87.6	63.6	75.6	8.0	94	05/26	44	05/05	3.61	-1.20	75
Tulsa, OK	87.3	66.1	76.7	7.4	93	05/30+	51	05/05	2.89	-3.02	49
Knoxville, TN	84.3	63.1	73.7	6.5	91	05/14	42	05/01	4.19	-0.32	93
Memphis, TN	87.0	67.8	77.4	5.7	93	05/15+	56	05/06+	3.32	-1.93	63
Nashville, TN	86.5	64.5	75.5	8.0	93	05/15	48	05/01	5.43	-0.07	99
Abilene, TX	90.7	65.5	78.1	5.1	102	05/31+	54	05/05	1.93	-1.25	61
Amarillo, TX	89.9	57.5	73.7	8.1	99	05/26+	45	05/05+	0.18	-2.11	8
El Paso, TX	94.0	64.9	79.5	5.6	102	05/31	53	05/04	0.41	-0.06	87
Dallas, TX	89.2	68.9	79.0	5.1	97	05/26	58	05/06+	1.87	-3.03	38
Houston, TX	90.1	69.6	79.8	2.9	96	05/17	63	05/10+	3.83	-1.26	75
Midland, TX	96.2	68.0	82.1	8.5	107	05/30	52	05/05	0.68	-1.06	39
San Antonio, TX	91.6	69.3	80.5	3.6	99	05/31	56	05/06	0.97	-3.04	24

Summary of temperature and precipitation information from around the region for May 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 Atlantic Hurricane Season Outlook

Margret Boone, SCIPP Program Manager

On May 24, 2018, the NOAA Climate Prediction Center (CPC) released the Atlantic Hurricane Season Outlook. The Atlantic Hurricane Season runs from June 1 to November 30, though tropical storms and hurricanes have occurred outside of that time frame. The Hurricane Outlook reflects the probability of tropical storm and hurricane development in the North Atlantic Ocean, Caribbean Sea, and the Gulf of Mexico, but it does not reflect the probability of these storms making landfall.

The 2018 Atlantic Hurricane Season Outlook indicates there is a 70% probability of 10-16 Named Storms, 5-9 Hurricanes, and 1-4 Major Hurricanes (Fig. 1). This translates to a 40% chance of a near-normal season, a 35% chance of an above-normal season, and a 25% chance of a below-normal season.

NOAA's Climate Prediction Center considers the El Nino Southern Oscillation (ENSO) and Atlantic Sea Surface Temperatures when preparing the outlook. Currently, ENSO neutral conditions prevail in the Pacific Ocean and cool sea surface temperatures persist in the Atlantic hurricane main development region (i.e. the tropical Atlantic Ocean and Caribbean Sea). El Nino conditions can suppress hurricane development due to the potential increase in vertical wind shear, so ENSO neutral conditions present a more favorable environment for hurricane development. On the other hand, the cooler sea surface temperatures may act as a limiting factor to hurricane development.

This year, NOAA's National Hurricane Center will have new and improved numerical models and satellite data to improve their forecasts and

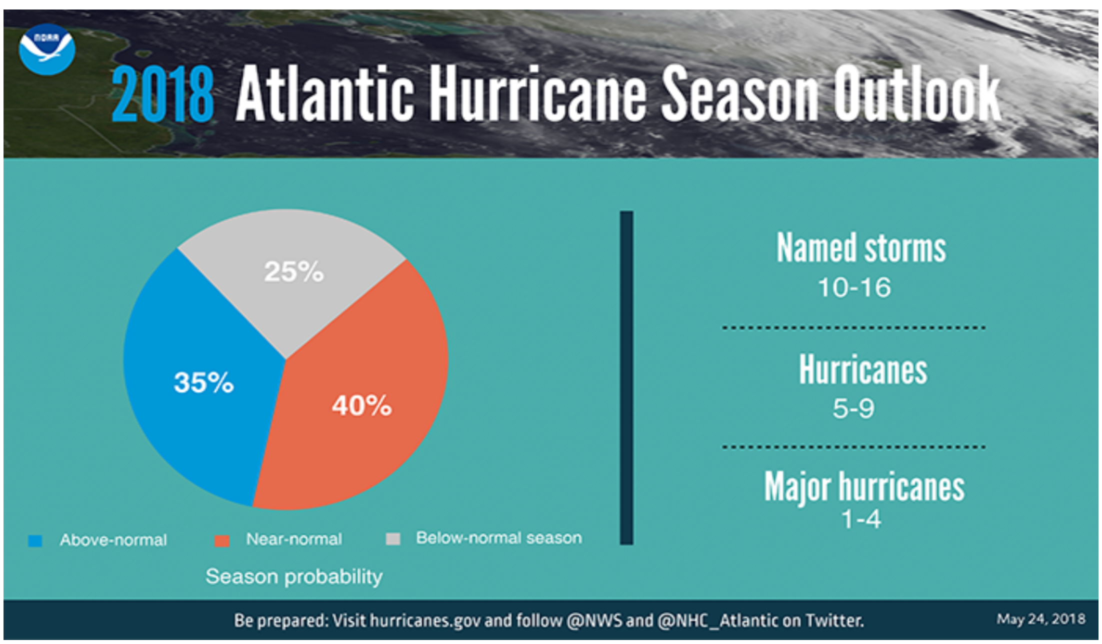


Figure 1: Shows the probability of how active the North Atlantic hurricane season may be.

products. Among these new tools are the GOES-17 satellite which was launched in March, and will complement the new GOES-16 weather satellite. Operationally, the National Hurricane Center will utilize new graphics for the Arrive Time of Topical-Storm-Force Winds. These graphics will display earliest reasonable arrival time of tropical storm force winds, and most-likely arrival time of tropical storm force winds.

NOAA's Hurricane Outlook will be updates in early August, prior to the peak of the hurricane season. Figure 2 shows a list of the Atlantic tropical cyclone names for 2018.

If you are interested in reading this publication, the manuscript can be found online at the following link: https://journals.ametsoc.org/doi/10.1175/JHM-D-17-0148.1

This work was supported, in part, by the Agriculture and Food Research Initiative Competitive Grant (2013-69002) from the USDA National Institute of Food and Agriculture and National Science Foundation Grant ICER1663840. For more information about this research, contact Paul Flanagan, pxf11@ou.edu

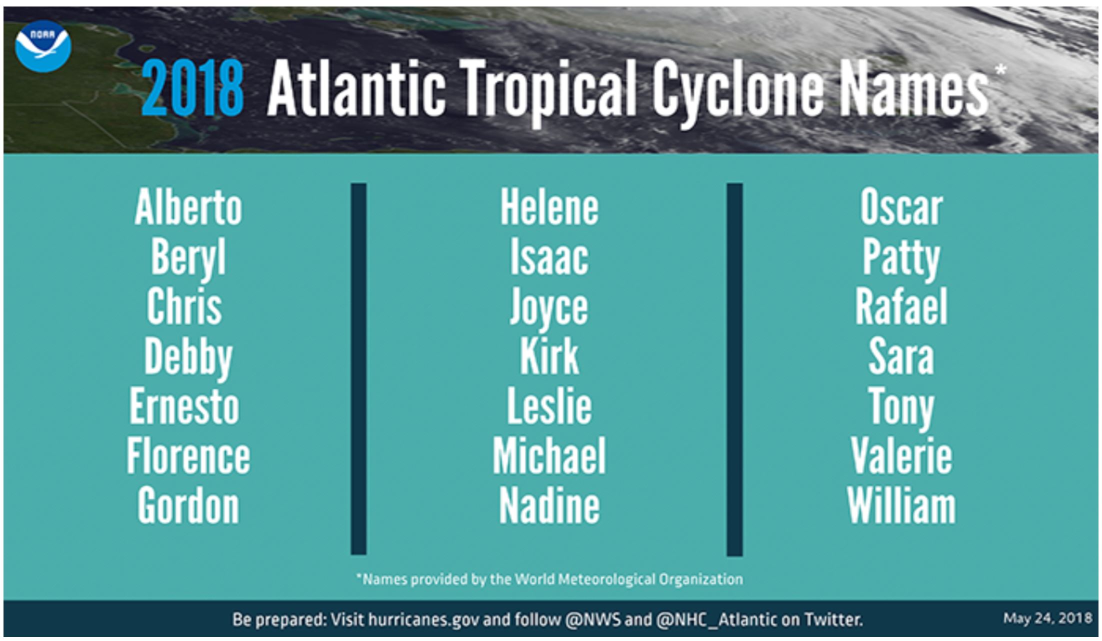


Figure 2: List of the 2018 North Atlantic Tropical Cyclone Names

Southern Climate Monitor Team

Kyle Brehe, Regional Climatologist
Southern Regional Climate Center (LSU)

James Cuellar, Student Assistant SCIPP (OU)

Margret Boone, Program Manager SCIPP (OU)

Alan Black, Program Manager SCIPP (LSU)

From Our Partners

South Central Climate Science Center: Regional Climate Projections for the Transportation Sector

Extreme weather, including severe storms, droughts, floods, and extreme temperatures, poses hazards to transportation safety and state of repair. Future temperature and precipitation trends are likely to be outside of the range of historical environmental conditions on which many transportation design standards are currently based. Understanding regional climate hazards is the first step in adequately adapting to these changes and reducing potential social, economic, and environmental impacts to the transportation system.

A recently completed project funded in part by the Southern Plains Transportation Center (SPTC) and in partnership with the South Central Climate Adaptation Science Center uses multiple climate datasets to identify historical trends and future climate scenarios for the 5-state region of Oklahoma, Texas, Arkansas, Louisiana, and New Mexico. The project explores specific weather and climate hazards identified as important by transportation decision-makers and describes how changes in these hazards may impact the transportation sector in each state.

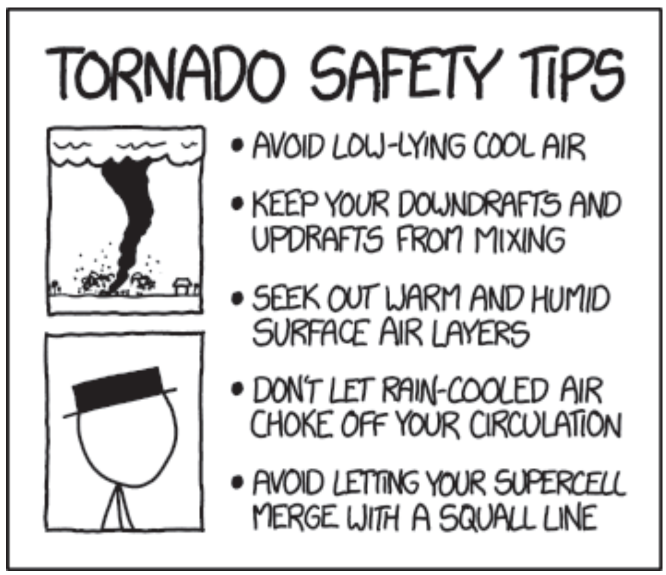
Contact Us

To provide feedback or suggestions to improve the content provided in the Monitor, please contact us at monitor@southernclimate.org. We look forward to hearing from you and tailoring the Monitor to better serve you. You can also find us online at www.srcc.lsu.edu & www.southernclimate.org.

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.

Monthly Comic Relief



SCIPP A NOAA RISA TEAM