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The TexMesonet

John Nielsen-Gammon, Texas A&M University, Texas State Climatologist

One night in late May 2015, it started raining hard in the upper reaches of the Blanco River watershed in central Texas. This area of Texas, from Waco to San Antonio to Del Rio, is known as Flash Flood Alley. The combination of shallow soils, hilly terrain, and rain-producing weather systems make this part of Texas especially prone to flash flooding.

But it's not enough to know that an area is prone to flash floods. You also need to know when and where the next flood will take place. On this particular night, everyone knew that floods were possible, but nobody knew that the Blanco River would soon rise forty feet above its normal level, higher than anybody living had ever seen it and higher than any gauge had ever recorded.

As it happened, there weren't any rain gauges transmitting data on the amount of rain falling on the upper Blanco. Radar indicated heavy rain in the area, but just how much rain wouldn't become clear until the floodwaters arrived. Data is key to weather forecasting and climate services. The first weather networks in the United

States were established for climate purposes, in order to determine the climate characteristics of the new and expanding nation. With the advent of aviation came the need for high-frequency weather observations to support safe takeoffs and landings, and the hourly weather network was born.

Originally, all weather and climate observations were recorded manually. Eventually, as electronic and communications technology improved, it became possible for weather stations to record and transmit their own observations. With the human observer not needed, it became possible to record observations at high frequency at many more locations than before, permitting ever more detailed information about the weather. Thus was born the automated mesonet.

The most important mesonet in the southern United States is the Oklahoma Mesonet. Established in the early 1990s by the University of Oklahoma and Oklahoma State University, it has been a national model for reliability, quality control, and product generation. Later, the West Texas Mesonet was created by Texas Tech University. Modeled after the Oklahoma Mesonet, it too recorded weather and soil data with a goal of at least one station in every county. There had been talk of a statewide Texas Mesonet, but nothing had ever come of it...until now.

Later analysis showed that over ten inches of rain had fallen in less than six hours on that night in May 2015. The rapidly rising Blanco River bore down on the town of Wimberly, sweeping

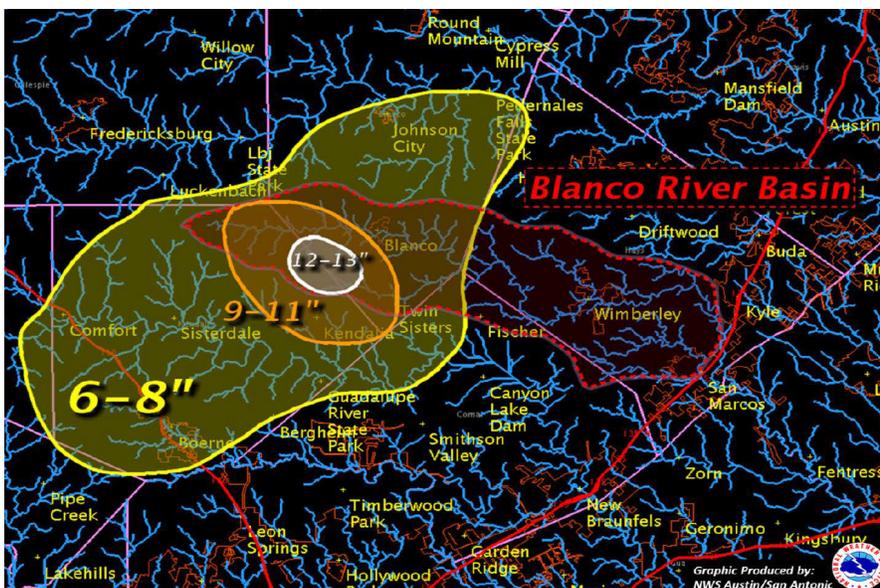


Figure 1. Retrospective analysis of rainfall that produced the Blanco River flood, May 24, 2015.

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away rocks, trees, and even houses in its path. Twelve people lost their lives. The flood illustrates the value of high-quality, high-density weather data, and the cost when that data simply doesn't exist or isn't available in time.

The Texas Water Development Board (TWDB) provides water planning, data collection and dissemination, financial assistance, and technical assistance services to the citizens of Texas. While water planning is often focused on dealing with drought and ensuring that enough water is available, data collected by the TWDB and other entities is also valuable for monitoring flooding and dealing with too much water. After the events of May 2015, the TWDB created TexasFlood.org to provide real-time information on flooding throughout the state in service of public safety. Because most floods start with excess precipitation, the precipitation monitoring provided by a dense network of automated stations can be critical for effective and timely flood warnings by the National Weather Service and other public safety officials.

The TWDB is following three paths toward the goal of a statewide mesonet, which they are calling the TexMesonet. First, TWDB has established a web site, texmesonet.org, to collect and display weather data from as many quality networks as possible from within Texas. Besides the West Texas Mesonet and conventional airport observations, many other local mesonets exist within Texas, but the data had never been integrated into a comprehensive database of Texas weather. The site is live and provides a valuable service to anyone who cares about weather in Texas.

Second, TWDB is establishing its own mesonet stations to fill gaps in the existing mesonets. Initially, the highest priority has been the Texas Hill Country, where flash flooding is especially dangerous and weather stations are sparse. A handful of stations are already deployed,

collecting and transmitting data on atmospheric conditions, soil temperature, soil moisture, and solar radiation.

Third, TWDB tasked Texas A&M University, The University of Texas at Austin, and Texas A&M AgriLife with the job of figuring out what works and doesn't work for other existing mesonets and to determine how to maintain and expand the TexMesonet in a sound and sustainable way. The project team included myself, Todd Caldwell, Guy Fipps, Brent McRoberts, and others. We surveyed mesonets across the country and as far away as Australia, held a workshop in February 2017 for mesonet operators and stakeholders within Texas, and explored various options for the TexMesonet.

We found that public safety was the most common purpose for a mesonet, and agriculture the second most common purpose. Most of the successful mesonets served a variety of purposes. Most mesonets are funded and have expanded through a mix of federal, state, and local sponsorship. Maintenance expenses tend to be harder to come by than the up-front capital costs, and over the long haul they occupy the bulk of the network costs, but proper maintenance is essential for a reliable network. Wise choice of instrumentation can improve reliability and lower maintenance costs.

A standardized network such as Oklahoma, with the same instruments at all stations, simplifies maintenance considerably. However, with many quality mesonets already present within Texas, standardization would be an expensive waste of resources. Instead, the combination of new and existing stations within Texas will produce a TexMesonet with varying levels of accuracy and reliability. It will be critical to document and archive information about each station and its instruments, so that

users of the TexMesonet can obtain weather data with an appropriate balance of data density and reliability.

One possible path forward for the TexMesonet will be a mixed approach, with some stations established and operated by TWDB, others established and operated in partnership with other local and regional entities, and still others owned and operated by regional entities such as the Guadalupe Blanco River Authority, the Lower Colorado River Authority, and the Edwards Aquifer Authority. This mixed approach will

benefit from similar efforts under way at the federal level (the National Mesonet Program) and coordination activities among other states.

Ultimately, for the TWDB, the bottom line is water. In that regard, the TexMesonet should include or support stations at key locations that can be used for reliable estimates of the amount of water leaving the ground, known as evapotranspiration, or ET. In and of itself, ET data is critical for managing irrigated agriculture, and even homeowners are starting to use ET data to manage their gardens through the Water My Yard

program. More generally, the combination of data on rainfall, evapotranspiration, and streamflow will enable water managers to better keep track of water supplies and changes in water inputs and losses.

With stations in the right places, the TexMesonet may provide emergency managers and first responders with crucial information regarding heavy rains upstream, so that when the next flood comes (as it surely will), there will be more time to get people out of the way before it's too late.

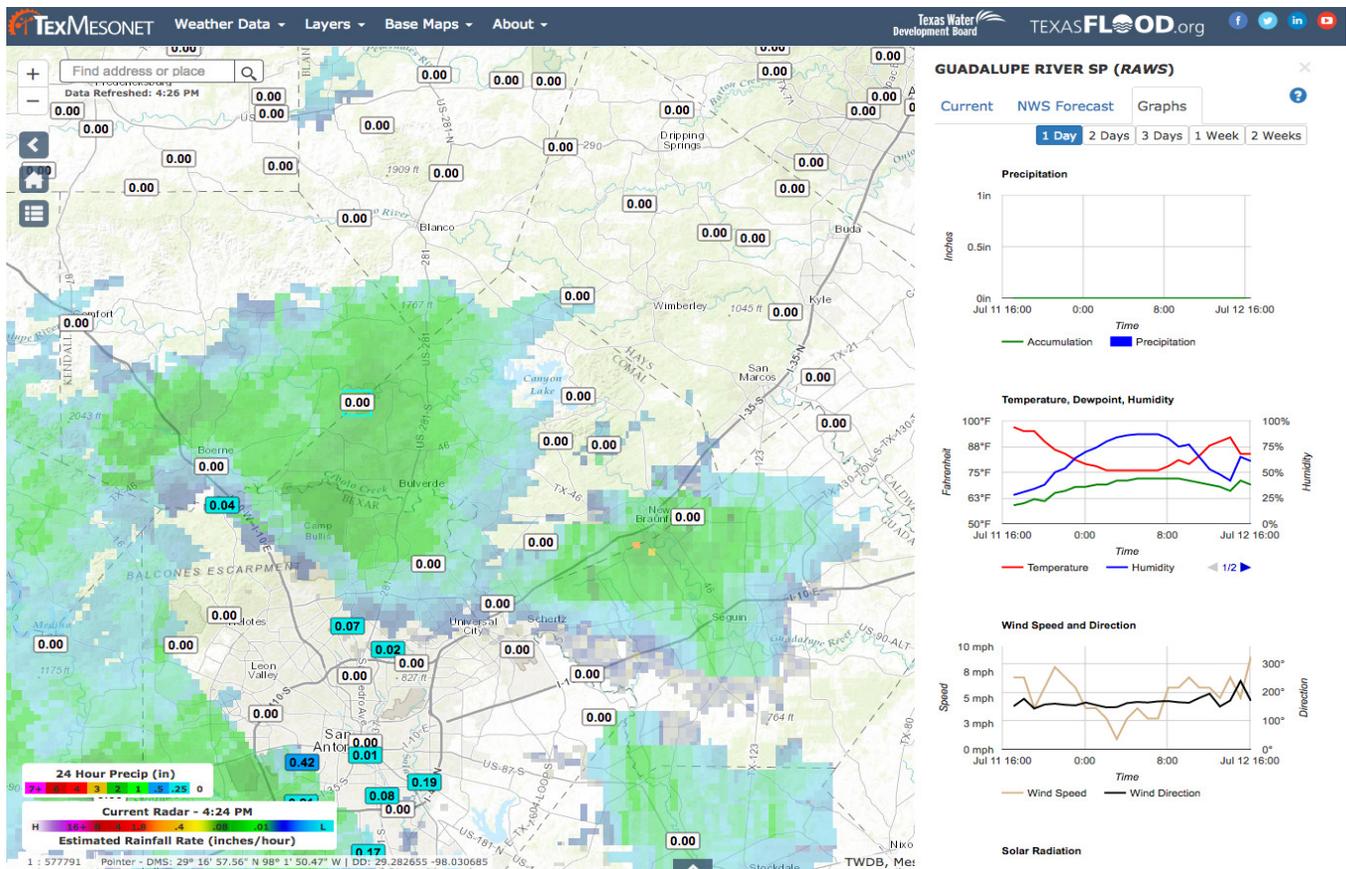


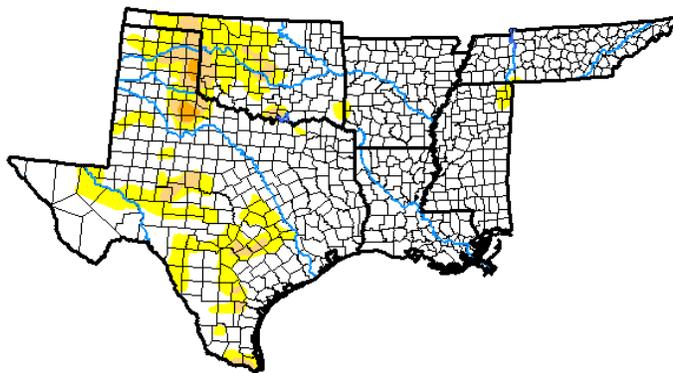
Figure 2. A screenshot from the TexMesonet.org web site, produced by the Texas Water Development Board.

Drought Update

Kyle Brehe and Rudy Bartels,
Southern Regional Climate Center

Over the month of June 2017, moderate drought conditions are present in western and central Oklahoma and parts of northern and central Texas. There is an area of severe drought located near the panhandle of Texas. Most of Oklahoma is experiencing abnormally dry conditions which were not present in May. Northeastern Mississippi and areas in central and southern Texas are reporting abnormally dry conditions. The moderate drought has improved to abnormally dry in northeastern Mississippi. Abnormally dry conditions improved to near normal conditions during June for parts of western Arkansas and northeastern Louisiana.

On June 16, 2017, there were two tornado reports



Released Thursday, July 6, 2017
David Simera, Western Regional Climate Center



Above: Drought conditions in the Southern Region. Map is valid for July 4, 2017. Image is courtesy of National Drought Mitigation Center.

in Mississippi. Mississippi reported over 80 wind events.

On June 22, 2017, there was one tornado report in Marshall, Mississippi which caused tree damage. Wind events caused down trees in Natchitoches, Louisiana.

On June 25, 2017, there were three tornadoes reported in Cimarron county, Oklahoma. Baseball sized hail was also reported in Cimarron county, Oklahoma which caused crop and farm damage. There was an 82 mph (131.97 kph) wind gust reported in Muleshoe, Texas.

On June 30, 2017, there was baseball to softball size hail reports in Littlefield, Texas. There was an 80 mph (128.75 kph) wind gust reported in Levelland, Texas.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	80.40	19.60	4.44	0.47	0.00	0.00
Last Week <i>06-27-2017</i>	78.01	21.99	4.65	0.31	0.00	0.00
3 Months Ago <i>04-04-2017</i>	58.78	41.22	13.44	2.18	0.00	0.00
Start of Calendar Year <i>01-03-2017</i>	53.95	46.05	27.69	11.09	1.11	0.00
Start of Water Year <i>09-27-2016</i>	76.89	23.11	6.74	1.89	0.28	0.11
One Year Ago <i>07-05-2016</i>	80.65	19.35	7.86	1.82	0.05	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 Rudy Bartels,
Southern Regional Climate Center

June was cooler than normal for the majority states in the southern region besides Texas and Oklahoma. Parts of central and northeastern Louisiana, western and southern Mississippi, northeastern Tennessee, and Arkansas had reports of 2 to 4 degrees F (1.111 to 2.222 degrees C) below normal temperatures for June. Eastern and southern Oklahoma along with eastern and southwestern Texas were slightly below normal temperatures in June. The northern and western part of Texas and western Oklahoma were 2 to 6 degrees F (1.111 to 3.333 degrees C) above normal with a cluster of stations in the panhandle of Texas reporting 6 to 8 degrees F (3.333 to 4.444 degrees C) above normal temperatures. The statewide June monthly average temperatures were as follows: Arkansas reporting 75.50 degrees F (24.17 degrees C), Louisiana reporting 78.40 degrees F (25.78 degrees C), Mississippi reporting 76.70 degrees F (24.83 degrees C), Oklahoma reporting 77.40 degrees F (25.22 degrees C), Tennessee reporting 72.90 degrees F (22.72 degrees C), and Texas reporting 80.60 degrees F (27 degrees C). The state-wide temperature rankings for June are as follows: Arkansas (thirty-first coldest), Louisiana (seventeenth coldest), Mississippi (twentieth coldest), Oklahoma (fourth-ninth warmest), Tennessee (thirty-second coldest), and Texas (thirty-third warmest). All state rankings are based on the period spanning 1895-2017.

Temperature (F)
6/1/2017 – 6/30/2017

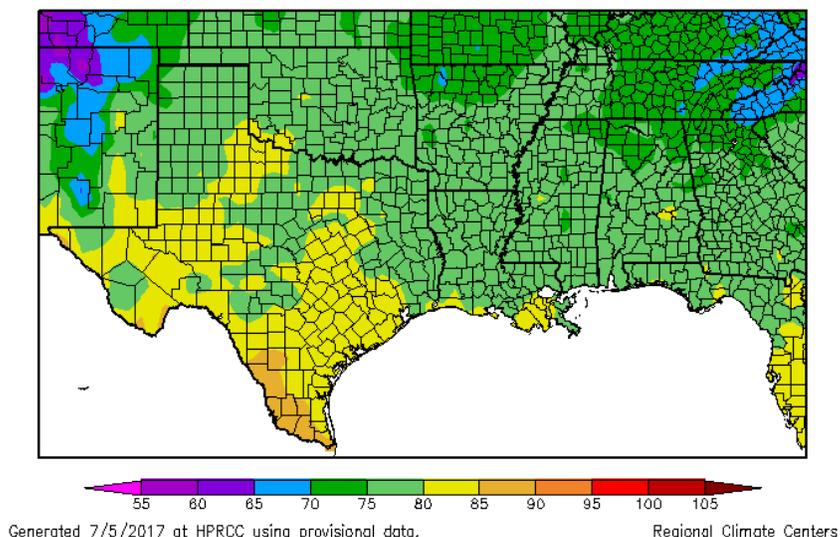


Figure 1: Average June 2017 Temperature across the Southern Region.

Departure from Normal Temperature (F)
6/1/2017 – 6/30/2017

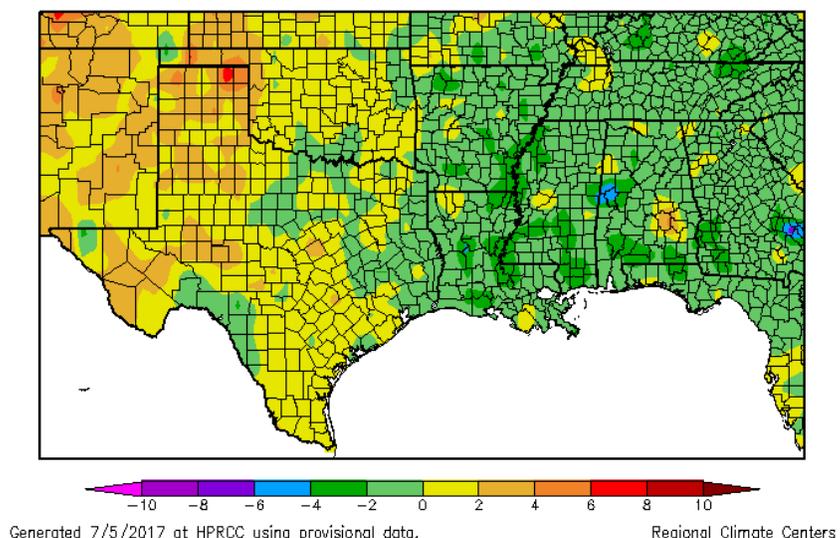


Figure 2: Departure from normal temperatures for the month of June, 2017 in the Southern Region.

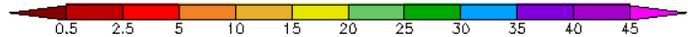
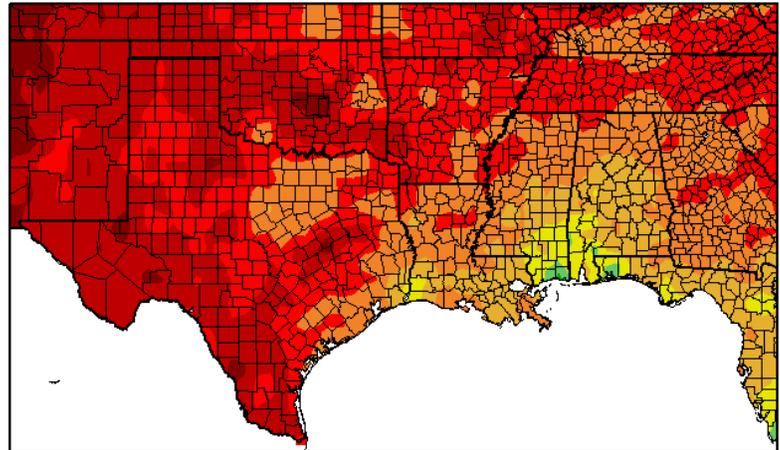
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Precipitation Summary

Kyle Brehe and Rudy Bartels,
Southern Regional Climate Center

Precipitation values for the month of June varied spatially across the Southern Region. Parts of southeastern and central Mississippi reported 300% normal precipitation for June. Central and northeastern Mississippi, southern Louisiana, parts of northern Louisiana, central Texas, and eastern Arkansas received 150 – 200% normal precipitation. In contrast, Areas in central and western Oklahoma, western Arkansas, and parts of central and southern Texas received 5 – 50% normal precipitation for June. The majority of Tennessee received near normal precipitation for June with parts of western and eastern Tennessee receiving 50 – 70% of normal precipitation. The state-wide precipitation totals for the month of June are as follows: Arkansas reporting 3.97 inches (100.84 mm), Louisiana reporting 8.70 inches (220.98 mm), Mississippi reporting 9.09 inches (230.89 mm), Oklahoma reporting 2.07 inches (52.58 mm), Tennessee reporting 4.19 inches (106.43 mm), and Texas reporting 3.02 inches (76.7 mm). The state precipitation rankings for the month are as follows: Arkansas (sixty-second wettest), Louisiana (eighth wettest), Mississippi (fifth wettest), Oklahoma (sixteenth driest), Tennessee (sixtieth wettest), and Texas (forty-fourth wettest). All state rankings are based on the period spanning 1895-2017.

Precipitation (in)
6/1/2017 – 6/30/2017

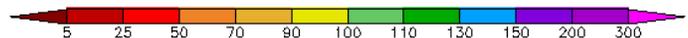
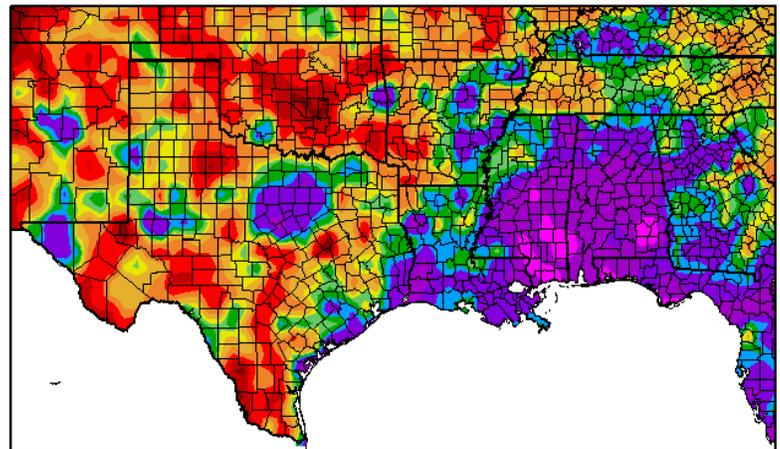


Generated 7/5/2017 at HPRCC using provisional data.

Regional Climate Centers

June 2017 Total Precipitation across the South

Percent of Normal Precipitation (%)
6/1/2017 – 6/30/2017



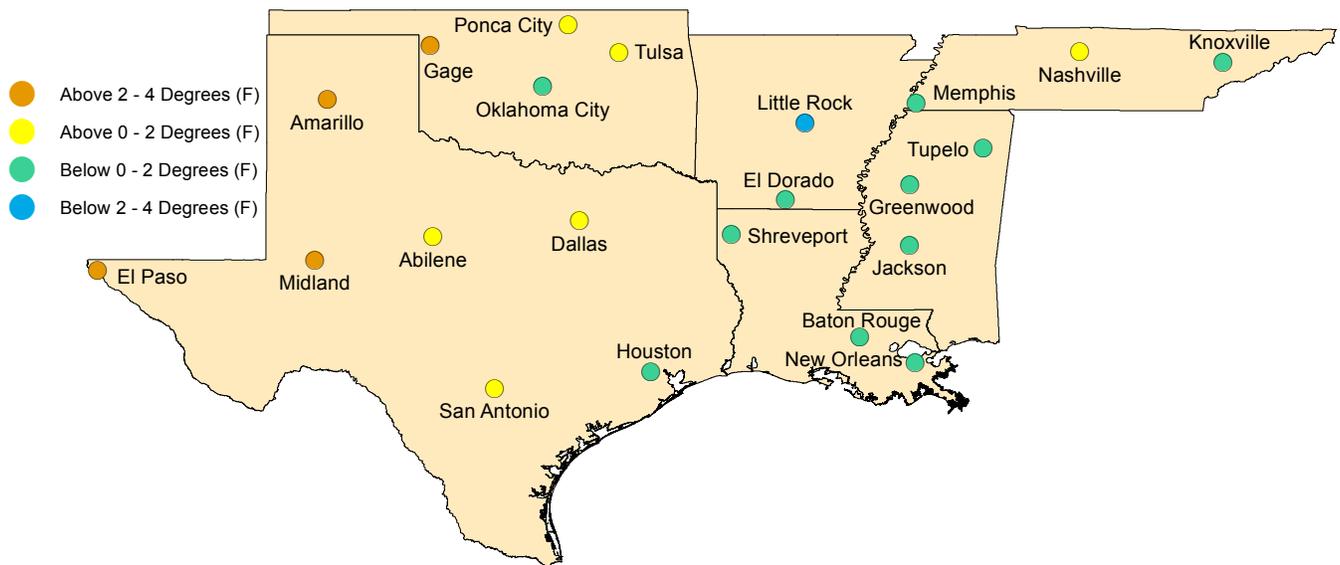
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Regional Climate Centers

Percent of normal precipitation for the month of June, 2017 within the Southern Region.

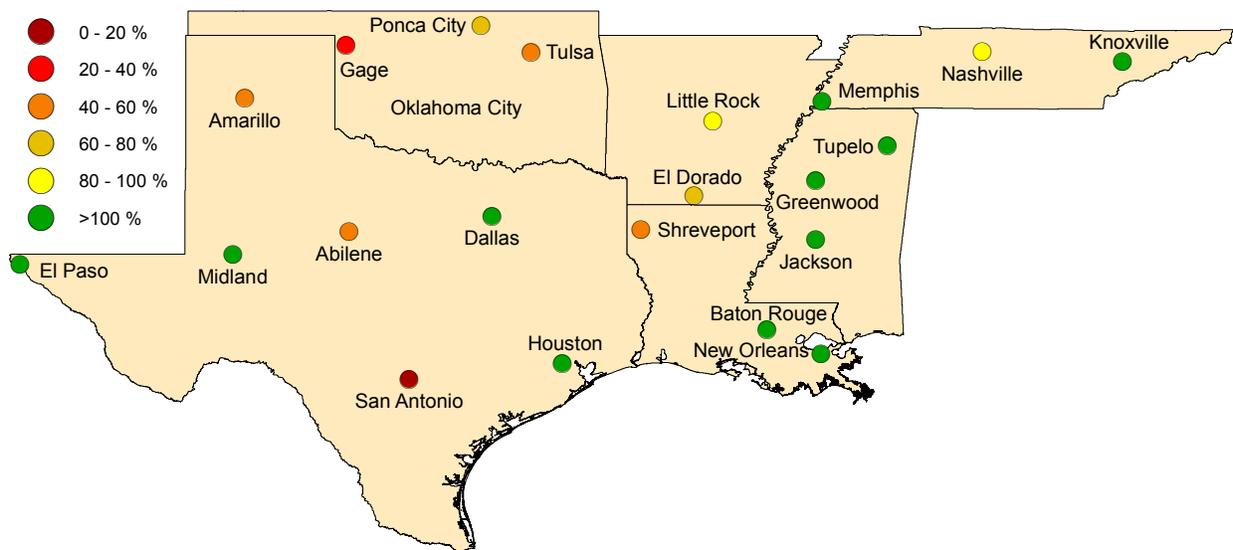
Regional Climate Perspective in Pictures

June Temperature Departure from Normal



June 2017 Temperature Departure from Normal from 1981-2010 for SCIPP Regional Cities

June Percent of Normal Precipitation



June 2017 Percent of 1981-2010 Normal Precipitation Totals for SCIPP Regional Cities

Climate Perspective

State	Temperature	Rank (1895-2017)	Precipitation	Rank (1895-2017)
Arkansas	75.50	31 st Coldest	3.97	62 nd Wettest
Louisiana	78.40	17 th Coldest	8.70	8 th Wettest
Mississippi	76.70	20 th Coldest	9.09	5 th Wettest
Oklahoma	77.40	49 th Warmest	2.07	16 th Driest
Tennessee	72.90	32 nd Coldest	4.19	60 th Wettest
Texas	80.60	33 rd Warmest	3.02	44 th Wettest

State temperature and precipitation values and rankings for June 2017. Ranks are based on the National Climatic Data Center's Statewide, Regional, and National Dataset over the period 1895-2017.

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	86.9	68.2	77.5	-0.7	93	06/16	57	06/09+	3.10	-1.80	63
Little Rock, AR	86.0	67.0	76.5	-2.6	92	06/16	57	06/09	3.24	-0.41	89
Baton Rouge, LA	87.4	71.0	79.2	-1.9	92	06/30+	60	06/09	9.56	3.15	149
New Orleans, LA	86.6	73.6	80.1	-1.4	92	06/19	65	06/09	15.48	7.42	192
Shreveport, LA	88.3	71.0	79.7	-0.1	94	06/30	60	06/09	3.05	-2.35	56
Greenwood, MS	86.7	68.3	77.5	-1.2	91	06/16+	57	06/09+	5.73	1.42	133
Jackson, MS	86.4	68.6	77.5	-1.5	93	06/30	58	06/09+	8.42	4.30	204
Tupelo, MS	85.9	67.3	76.6	-1.5	91	06/18+	57	06/09+	8.63	4.11	191
Gage, OK	90.9	65.3	78.1	3.0	103	06/29	56	06/06	0.84	-2.66	24
Oklahoma City, OK	88.7	67.0	77.8	-0.2	96	06/16+	54	06/08	0.11	-4.82	2
Ponca City, OK	89.3	67.0	78.2	1.6	97	06/16+	57	06/08	3.41	-1.65	67
Tulsa, OK	88.4	67.8	78.1	0.5	95	06/16	56	06/08	2.77	-1.95	59
Knoxville, TN	83.3	63.7	73.5	-1.5	91	06/13	54	06/28	4.42	0.61	116
Memphis, TN	87.4	69.5	78.4	-1.2	92	06/20+	59	06/09	4.61	0.98	127
Nashville, TN	86.7	65.7	76.2	0.5	94	06/14	53	06/09	4.03	-0.11	97
Abilene, TX	91.0	68.5	79.7	0.2	103	06/23	62	06/07+	1.67	-1.89	47
Amarillo, TX	91.8	62.1	76.9	2.5	106	06/17	53	06/14	1.50	-1.66	47
El Paso, TX	99.2	72.0	85.6	3.9	111	06/23	64	06/01	1.16	0.22	123
Dallas, TX	91.2	73.8	82.5	1.2	100	06/23	66	06/09	8.44	4.59	219
Houston, TX	90.4	73.9	82.1	-0.3	96	06/23+	67	06/10+	7.19	1.26	121
Midland, TX	97.1	70.8	84.0	3.7	111	06/17	62	06/03	3.05	1.25	169
San Antonio, TX	93.7	72.9	83.3	0.9	101	06/23	68	06/07+	0.40	-3.74	10

Summary of temperature and precipitation information from around the region for June 2017. 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. Blushaded 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.

Lake Pontchartrain is no Lake

Barry Keim, Louisiana State Climatologist, Louisiana State University

What would you say if I told you that Lake Pontchartrain is not a lake at all? Well, it isn't (see Figure 1). The definition of a lake according to the Free Dictionary (www.thefreedictionary.com/lake) is "an expanse of water entirely surrounded by land and unconnected to the sea except by rivers or streams." While Lake Pontchartrain is mostly surrounded by land, it isn't entirely as there are openings to Lake Borgne via the Rigolets and Chef Pass, and Lake Borgne is very open to the Gulf of Mexico. As such, neither Lake Pontchartrain nor Lake Borgne are technically lakes. The same holds true for Lakes Salvatore, Maurepas, and Lery... and even Lac Des Allemands.

Each of these "so-called" lakes is actually an estuary, much like Chesapeake Bay, Narragansett Bay in Rhode Island, and Puget Sound in Washington. An estuary is defined in Wikipedia as "a partially enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea." Lake Pontchartrain fits this definition like a glove, for example, is partially enclosed, has several rivers flowing into it, i.e., the Tangipahoa, Tchefuncte, Tickfaw, Amite, and Bogue Falaya rivers, and Bayou Lacombe and Bayou Chinchuba. As a result, the water is brackish, which is a mixture of fresh and salt water, and the "lake" is open to the sea. In fact, tides move salt water into the estuary, and move brackish water out, though the tidal range is generally small at about 1 foot. The estuary also has both fresh water fish species (e.g., bass), as well as salt water species (e.g., speckled trout and sharks), depending on where you're fishing in the Lake, and the day you're fishing it. The estuary is very dynamic and weather conditions and tides can change water conditions and the

fish species at any given location in a matter of minutes to hours.

While I fully realize that we are stuck with the names Lake Pontchartrain, and Lake Borgne - Pontchartrain Bay and Borgne Bay may have been more accurate - I do feel it is important to fully understand that it is not a true lake. Rather, it is a dynamic estuary that fully contributes to the diverse ecosystem that makes our commercial and recreational fishing among the best in the world...and for that, we should all be grateful! Please contact me with any questions at keim@lsu.edu.



Figure 1. LANDSAT image of Lake Pontchartrain from November 2016.

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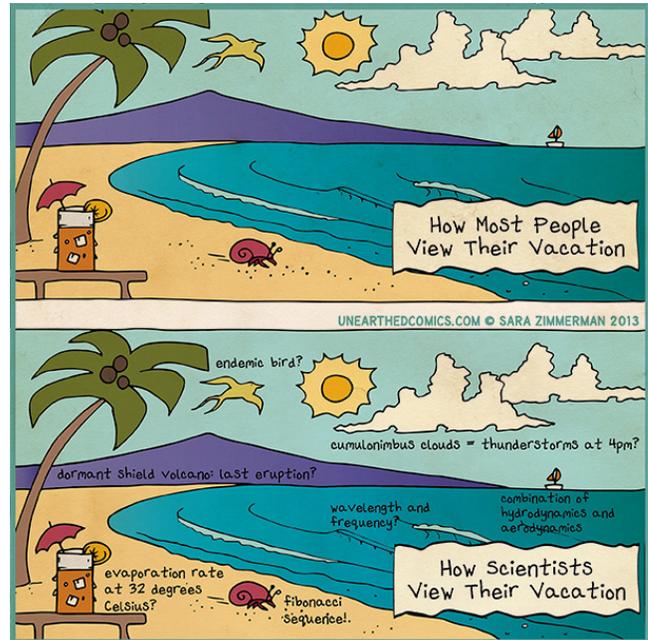
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For any questions pertaining to historical climate data across the states of Oklahoma, Texas, Arkansas, Louisiana, Mississippi, or Tennessee, please contact the Southern Regional Climate Center at [225-578-5021](tel:225-578-5021).

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](tel:405-325-7809) or [225-578-8374](tel:225-578-8374).

Monthly Comic Relief



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