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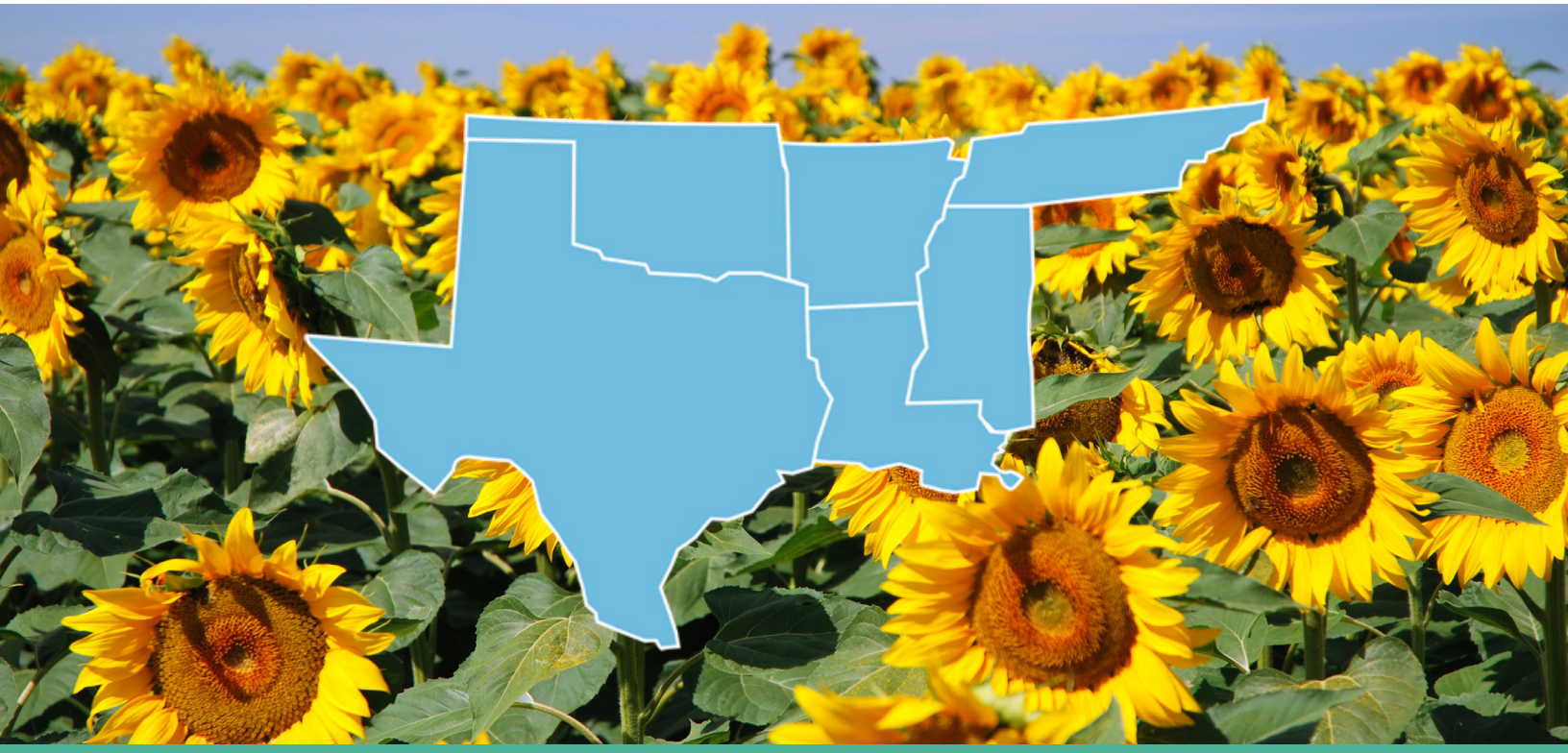
Southern Climate Monitor

June 2015 | Volume 5, Issue 6



In This Issue:

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New Article Finds Gulf Coast Storm Surges Rank Second Globally in Terms of Severity

Hal Needham, Program Manager, SCIPP (Louisiana State University)

SCIPP researchers Hal Needham, Barry Keim and David Sathiaraj published a recent article in *Reviews of Geophysics* that finds Gulf Coast storm surges rank second globally in terms of severity (Needham et al. 2015). The article, titled, *"A Review of Tropical Cyclone-Generated Storm Surges: Global Data Sources, Observations and Impacts*," provides the first summary of global surge data. The authors developed a comprehensive database for six ocean basins that commonly experience tropical cyclones, storms that are known in the Atlantic as hurricanes. These basins, depicted in Figure 1, were:

1) Western North Pacific (East Asia)
2) Northern Indian Ocean
3) Western North Atlantic
4) Eastern North Pacific
5) Australia and Oceania
6) Southwest Indian Ocean

The authors found that more storm surge data are available for the Western North Atlantic Ocean than any other basin. This is largely due to the prolific amount of data provided by the U.S. Government, including the U.S. Army Corps of Engineers, U.S. Geological Survey, the Federal Emergency Management Agency, and the National Hurricane Center. The study identified the peak height and location of 702 storm surges around the world since 1880, of which 390 (56%) were located in the Western North Atlantic basin (Fig. 2).

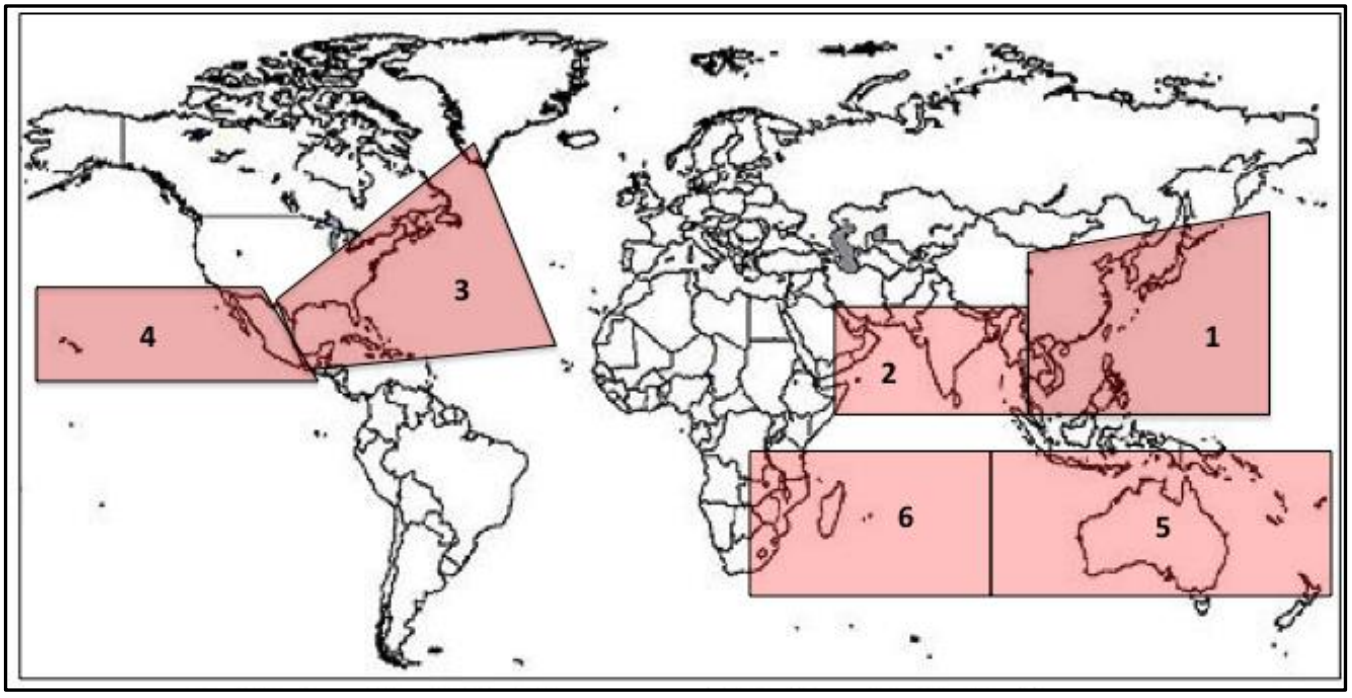

Figure 1. Map of the study areas analyzed by Needham et al. (2015).

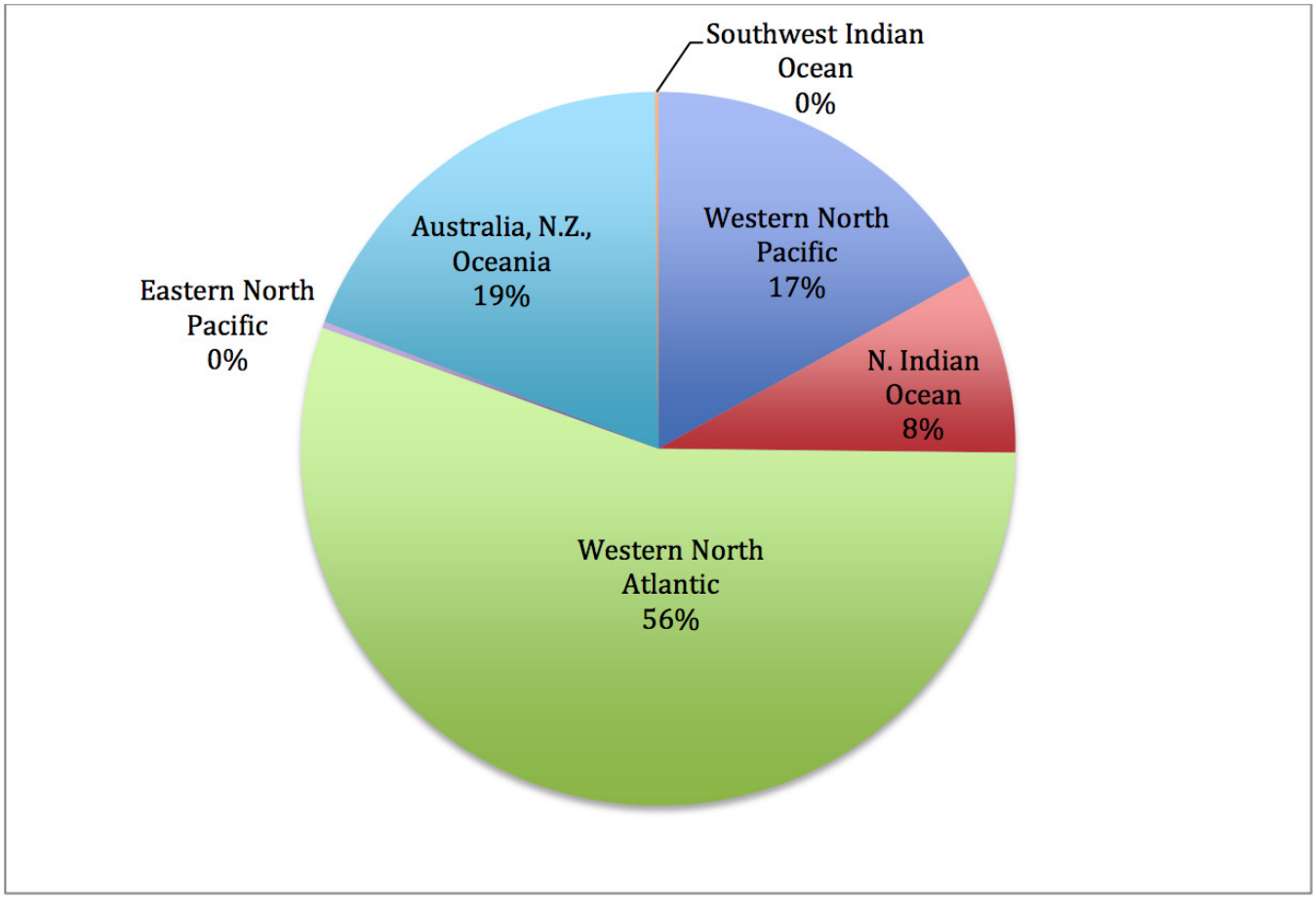

Figure 2. The proportion of global storm surges identified in each basin

This study also found that the U.S. Gulf Coast observes the second highest rate of the most catastrophic storm surges, those ≥ 16.5 ft (5 m). The region observes an average of one of these events per decade, second only to the Bay of Bengal in the Northern Indian Ocean, which observes an average of five events per decade. The U.S. Gulf Coast also observes 18 surges ≥ 3.3 ft (1 m), which is second only to East Asia. China observes an average of 54 of these surges per decade, and rates are probably even higher in the Philippines. Such results indicate that the U.S. Gulf Coast is the second most vulnerable basin to both high- and low- level storm surges.

Storm surge impacts along the Gulf Coast include the flooding threat to the rapidly growing population, as well as threats to the agriculture and energy industries. Agricultural impacts from past surges include dramatic losses in sugar cane and rice yields in South Louisiana following hurricanes Rita and Ike (Kurth and Burckel 2006). Storm surges have also inflicted substantial cattle losses in the region, especially in Louisiana from hurricanes Rita in 2005 (Kurth and Burckel 2006) and Juan in 1985 (National Weather Service Lake Charles 2003), and Texas during an unnamed storm in 1943 (Sumner 1944). Hurricanes Katrina and Rita inflicted severe impacts on the energy industry, as these storms destroyed extensive amounts of infrastructure. Katrina triggered the Murphy Oil Spill, which released approximately 820,000 gallons of oil into a densely populated area of St. Bernard Parish (Pine 2006).

The authors of this paper

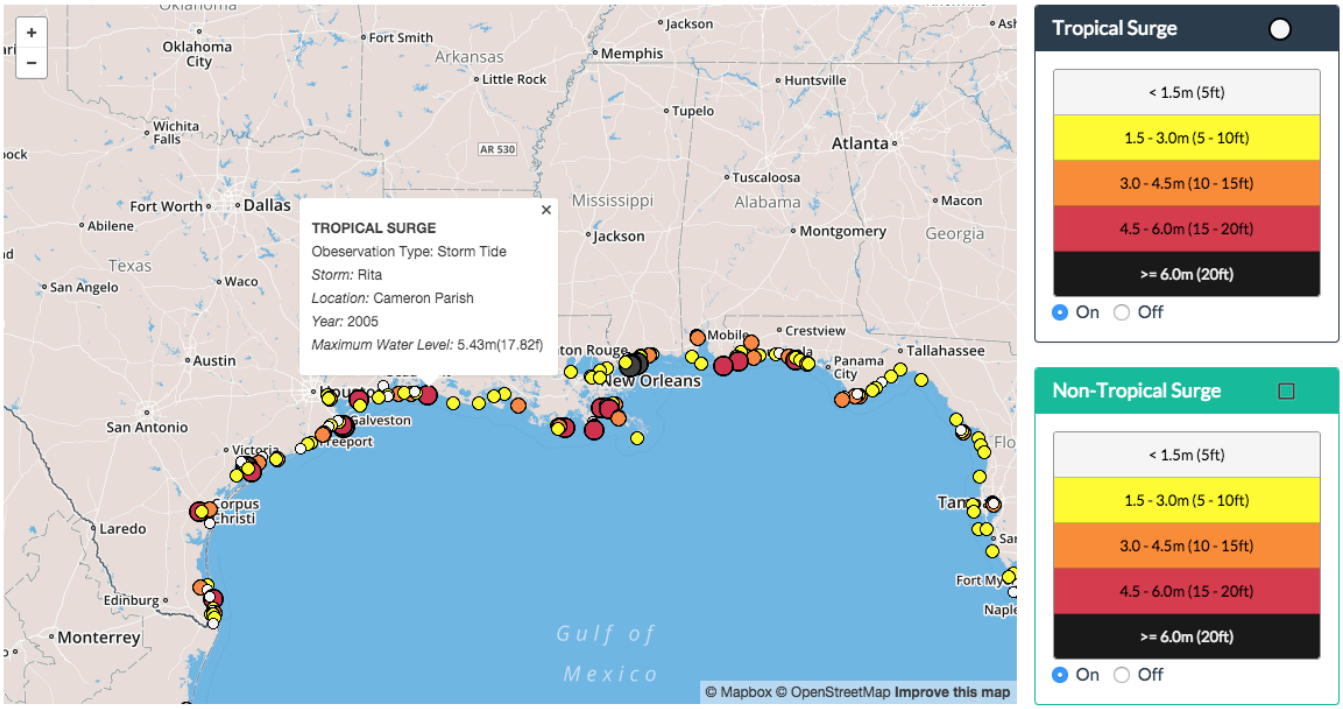

Figure 3. The SURGEDAT website provides an interactive storm surge map that provides information such as the location and height of peak storm surge, as well as the name and year of a hurricane.

constructed an interactive storm surge Web tool that enables users to click on a map of past surge events (Fig. 3). This map provides information for each surge event, including the location and height of peak storm surge, the year of the event and the name of the hurricane that produced the high water mark. A comprehensive database of peak storm surge levels is also available for download as a spreadsheet.

References

Kurth, M.M., and D.V. Burckel, 2006 : The Rita Report: A summary of the social and economic impact and recovery of Southwest Louisiana one year after Hurricane Rita, 58 pp. Report developed for the Louisiana Recovery Authority, link : http://instructor.mstc.edu/instructor/randers/Reports/RitaReportFinal091806.pdf.

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Pine, J.C., 2006: Hurricane Katrina and Oil Spills: Impact on Coastal and Ocean Environments, Oceanography, 19, 37-39.

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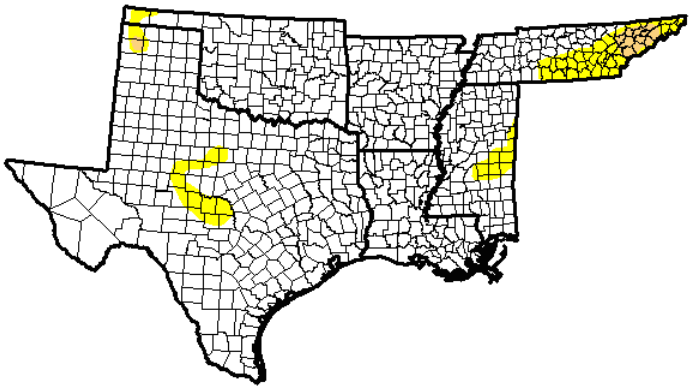
Drought Update

Luigi Romolo,
Southern Regional Climate Center

Heavy May rainfall values have all but eliminated all drought in the Southern Region. Near normal June precipitation has allowed for a continuation of May drought conditions. As of the June 30, 2015 map from the National Drought Mitigation Center, only approximately 0.92 percent of the region is in moderate drought. Most of this drought is concentrated in the easternmost counties of Tennessee.

In Texas, farmers are having a tough time with the recent rainfall as it is delaying their harvesting of hay. Farmers need about 4 weeks of dry weather in order for them to harvest, which seems a bit too much to ask for with the current wet pattern. The wet weather is also bringing an abundance of stripe rust, which is causing issues for wheat crops in the Southern Plains. Ecologically, conditions for cattle and other livestock have never been better since the abundance of rainfall provided plenty of water and tall, healthy grass. The highlight of the month was Tropical Storm Bill, which brought over 13 inches (333.20 mm) of rain near Ganado and El Campo. Bill brought rain to a large portion of the state including from Houston all the way up the Dallas-Fort Worth area. Even though the state has seen a lot of rain, wildfires are still possible problems. A lightning strike early in the month caused a grassfire in Jeff Davis County; 15 acres (.06 sq km) of land were burned before the fire was put out. (Information provided by the Texas Office of State Climatology).



Released Thursday, July 2, 2015

Brian Fuchs, National Drought Mitigation Center

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	92.89	7.11	0.92	0.00	0.00	0.00
Last Week 6/23/2015	92.68	7.32	1.09	0.00	0.00	0.00
3 Months Ago 3/31/2015	57.31	42.69	29.63	19.60	12.60	2.79
Start of Calendar Year 12/30/2014	41.57	58.43	33.88	18.43	8.80	2.36
Start of Water Year 9/30/2014	41.74	58.26	35.49	22.66	8.47	1.98
One Year Ago 7/1/2014	36.88	63.12	41.83	27.42	13.35	3.29

Intensity:

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

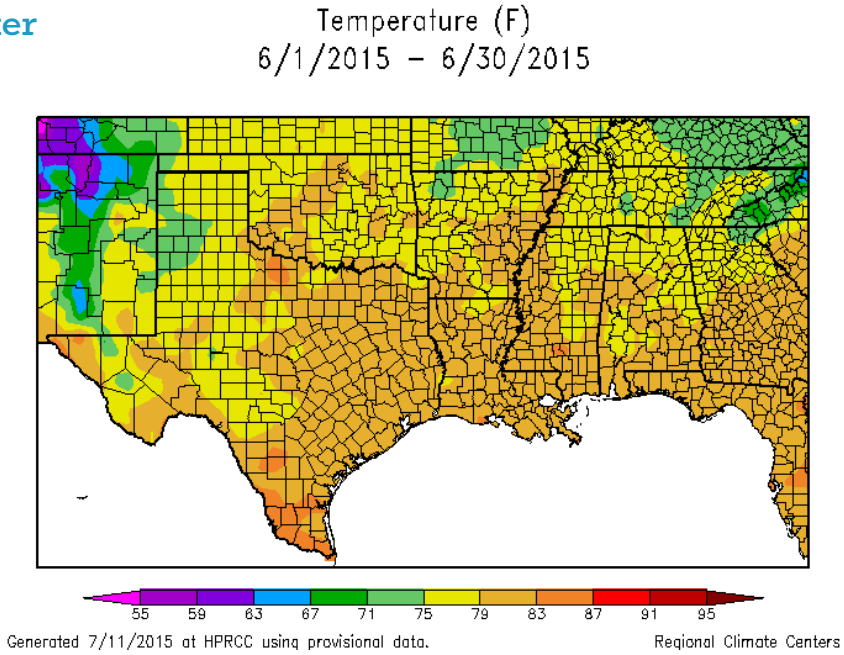
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Above: Drought conditions in the Southern Region. Map is valid for June 30, 2015. Image is courtesy of National Drought Mitigation Center.

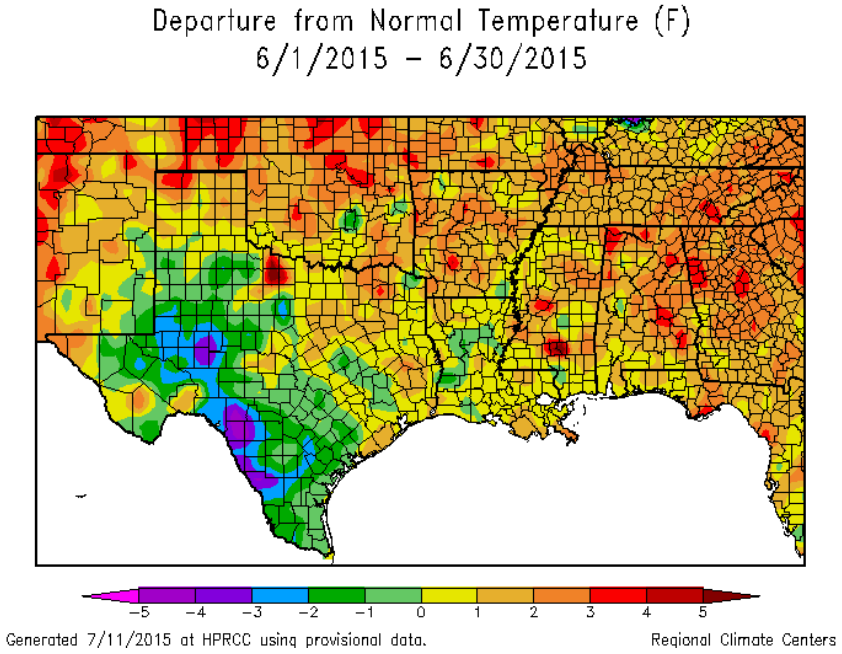
Temperature Summary

Luigi Romolo,
Southern Regional Climate Center

With the exception of south western Texas, the Southern Region experienced a warmer than normal month, with most stations averaging between 2-4 degrees F (1.11-2.22 degrees C) above normal. In southern Texas, temperature anomalies were near normal to slightly below normal, with some stations ranging between 2-4 degrees F (1.11-2.22 degrees C) below expected values. The state-wide average temperatures for the month are as follows: Arkansas averaged 78.10 degrees F (25.61 degrees C), Louisiana averaged 80.60 degrees F (27.00 degrees C), Mississippi averaged 79.10 degrees F (26.17 degrees C), Oklahoma averaged 78.60 degrees F (25.89 degrees C), Tennessee averaged 76.00 degrees F (24.44 degrees C), and Texas averaged 79.30 degrees F (26.28 degrees C). For Tennessee it was the sixteenth warmest June on record, while Arkansas experienced its twenty-third warmest June on record. Oklahoma reported its twenty-eighth warmest June on record. All other state rankings fell within the two middle quartiles. All records are based on data for the period 1895-2015.



Average June 2015 Temperature across the South

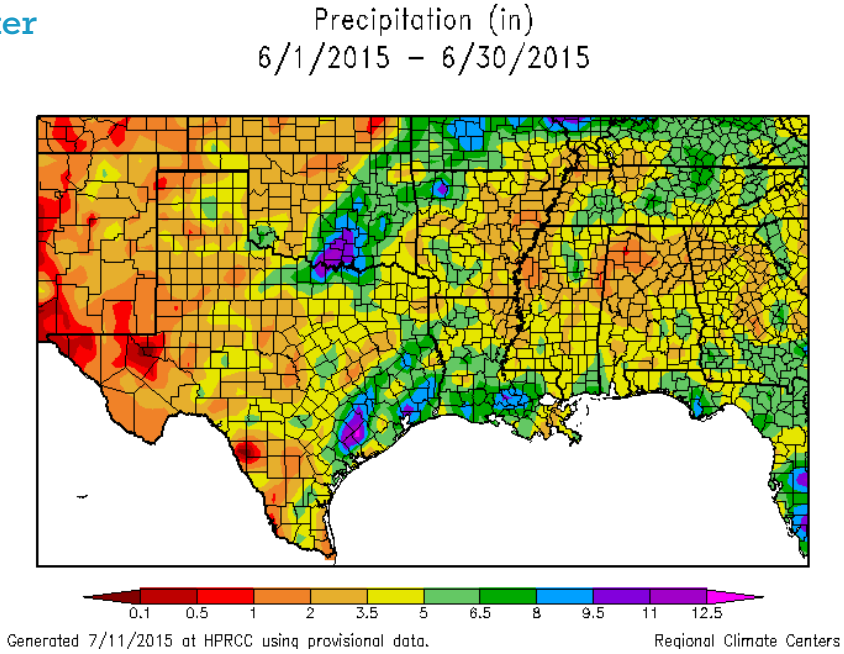


Average Temperature Departures from 1971-2000 for June 2015 across the South

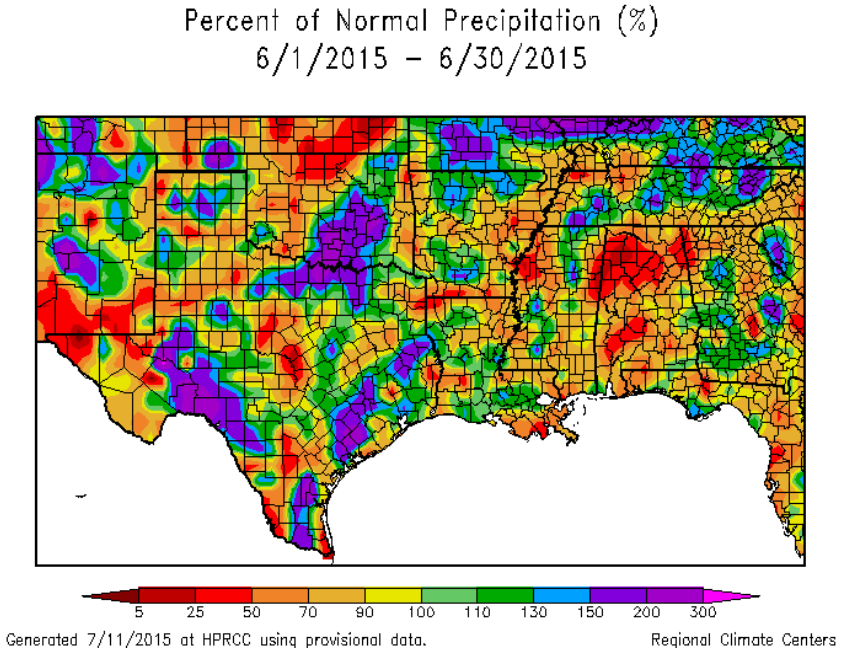
Precipitation Summary

Luigi Romolo,
Southern Regional Climate Center

June precipitation in the Southern Region was quite variable, with several pockets of above normal precipitation and several pockets of below normal precipitation. Areas of above normal precipitation included: south central Oklahoma, Northern Arkansas, southern Texas, and the Texas Gulf Coast region. The remainder of the Southern Region mostly averaged between 70 and 90 percent of normal. The state-wide average precipitation totals for the month are as follows with: Arkansas reporting 3.90 inches (99.06 mm), Louisiana reporting 5.21 inches (132.33 mm), Mississippi reporting 4.13 inches (104.90 mm), Oklahoma reporting 4.79 inches (121.67 mm), Tennessee reporting 4.66 inches (118.36 mm), and Texas reporting 3.78 inches (96.01 mm). Although it was a wetter than normal month for all states except for Arkansas, all state rankings fell within the two middle quartiles.

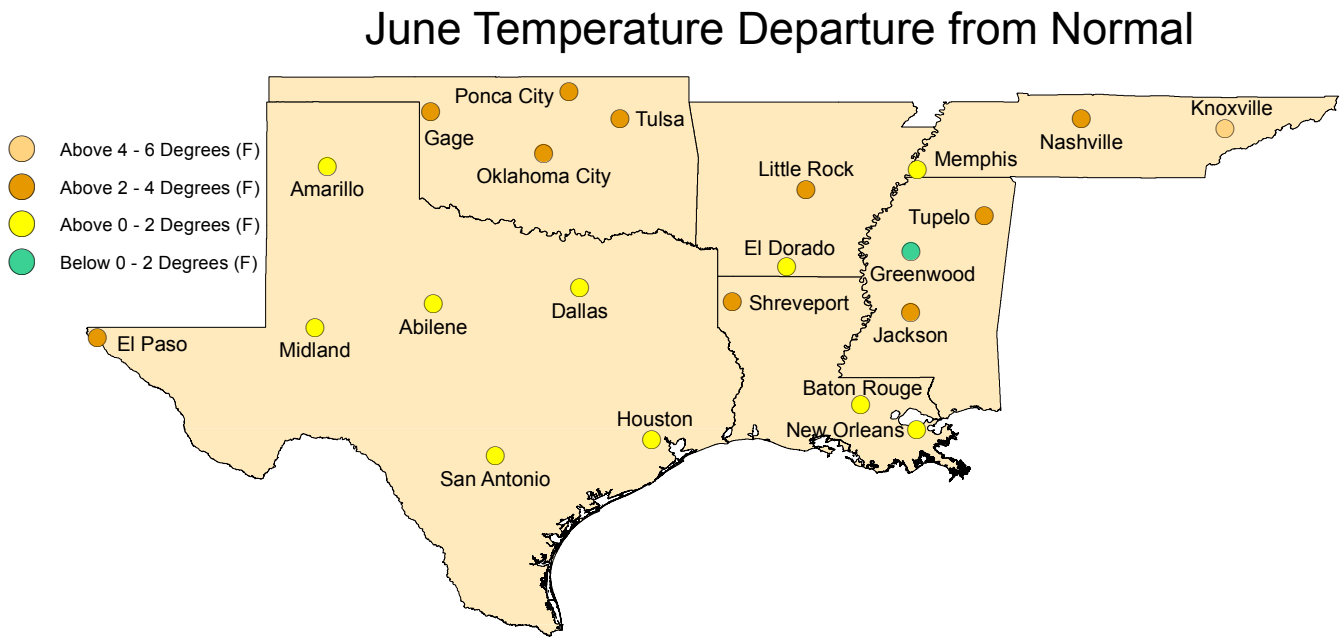


June 2015 Total Precipitation across the South

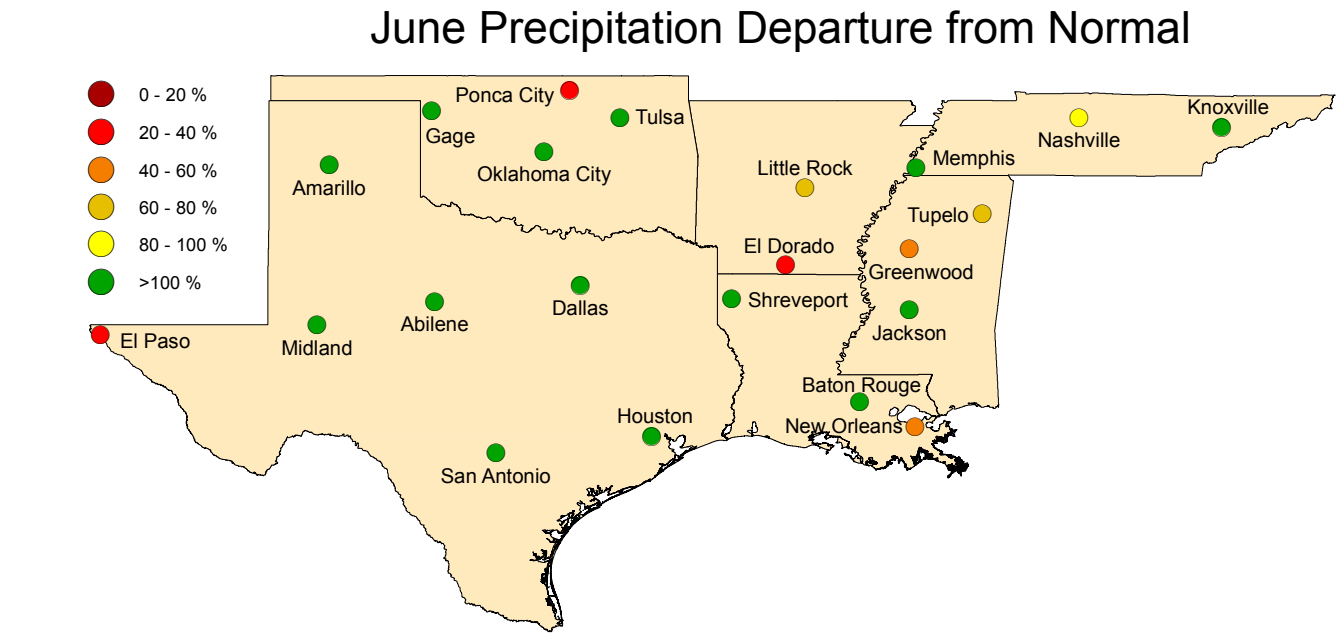


Percent of 1971-2000 normal precipitation totals for June 2015 across the South

Regional Climate Perspective in Pictures



June 2015 Temperature Departure from Normal from 1971-2000 for SCIPP Regional Cities



June 2015 Percent of 1971-2000 Normal Precipitation Totals for SCIPP Regional Cities

Climate Perspective

State	Temperature	Rank (1895-2011)	Precipitation	Rank (1895-2011)
Arkansas	78.10	23rd Warmest	3.90	59th Driest
Louisiana	80.60	33rd Warmest	5.21	42nd Wettest
Mississippi	79.10	33rd Warmest	4.13	57th Wettest
Oklahoma	78.60	28th Warmest	4.79	35th Wettest
Tennessee	76.00	16th Warmest	4.66	40th Wettest
Texas	79.30	50th Coldest	3.78	31st Wettest

State temperature and precipitation values and rankings for June 2015. Ranks are based on the National Climatic Data Center's Statewide, Regional, and National Dataset over the period 1 895-201 1.

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	89.8	69.4	79.6	1.2	95	6/24	62	6/2	2.08	-3.10	40
Little Rock, AR	90.5	71.6	81.1	2.7	99	6/24	64	6/2	2.76	-1.19	70
Baton Rouge, LA	90.8	71.8	81.3	1.6	96	6/23	65	6/1	5.98	0.65	112
New Orleans, LA	89.8	75.0	82.4	1.7	93	6/30+	69	6/10	3.75	-3.08	55
Shreveport, LA	91.4	72.6	82.0	2.1	96	6/10	63	6/1	5.98	0.93	118
Greenwood, MS	89.3	69.4	79.4	-0.1	97	6/24	59	6/4+	2.29	-2.21	51
Jackson, MS	90.6	70.9	80.8	2.3	97	6/23	61	6/3	6.44	2.62	169
Tupelo, MS	88.9	69.5	79.2	2.3	95	6/23	58	6/3	3.38	-1.44	70
Gage, OK	90.0	65.9	78.0	2.7	96	6/30	59	6/27+	2.95	0.06	102
Oklahoma City, OK	89.6	68.4	79.0	2.2	96	6/29+	55	6/1	5.77	1.14	125
Ponca City, OK	90.6	70.2	80.4	2.9	99	6/30	54	6/1	1.62	-2.88	36
Tulsa, OK	90.2	71.4	80.8	2.8	98	6/30+	55	6/1	4.77	0.05	101
Knoxville, TN	89.1	67.4	78.2	4.4	97	6/15	59	6/29+	5.29	1.25	131
Memphis, TN	89.9	71.5	80.7	2.0	98	6/24	60	6/4+	4.46	0.16	104
Nashville, TN	88.1	67.7	77.9	2.8	95	6/17	58	6/4+	3.38	-0.70	83
Abilene, TX	91.2	69.4	80.3	0.5	96	6/29+	63	6/1	3.62	0.56	118
Amarillo, TX	86.6	63.4	75.0	0.7	94	6/28	58	6/2	3.89	0.61	119
El Paso, TX	97.0	71.9	84.5	2.4	104	6/22+	65	6/4	0.18	-0.69	21
Dallas, TX	91.5	72.7	82.1	1.2	97	6/10	59	6/1	3.95	0.72	122
Houston, TX	90.8	73.6	82.2	0.9	94	6/26+	66	6/1	11.40	6.05	213
Midland, TX	91.7	67.8	79.8	0.2	100	6/11	62	6/1	3.29	1.58	192
San Antonio, TX	89.4	73.9	81.6	0.1	93	6/29+	65	6/1	6.42	2.12	149

Summary of temperature and precipitation information from around the region for June 2015. 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 wdays. 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.

London Avenue Canal Breach Due to Remnant Beach Ridge

Barry Keim, Louisiana State Climatologist, Louisiana State University

As we approach the 10th anniversary of Hurricane Katrina, I'm sure we'll all be hearing a lot about the storm and our recovery in coming weeks. Well.... here is one of several contributions to this cause that I'm sure I'll be making myself. Even though we're 10 year out from the this storm, I'm still coming to terms with just what exactly happened - as in my head is still spinning from this event. One lesson (among many) I learned from Hurricane Katrina is that of New Orleans geology. Has anyone ever heard of Pine Island? I'm most confident that it was an incredible place to grab some rays with family and friends - 4000 years ago! Figure 1 shows the evolution of the New Orleans and southeastern Louisiana landscape for a 1000-year period beginning about 5000 years ago. At the time, most of Orleans and St. Bernard Parishes were part of the Gulf of Mexico, with the one exception of Pine Island, with the Mississippi River deltaic deposits coming in a bit later to make Da Parish. Geographically, Pine Island started

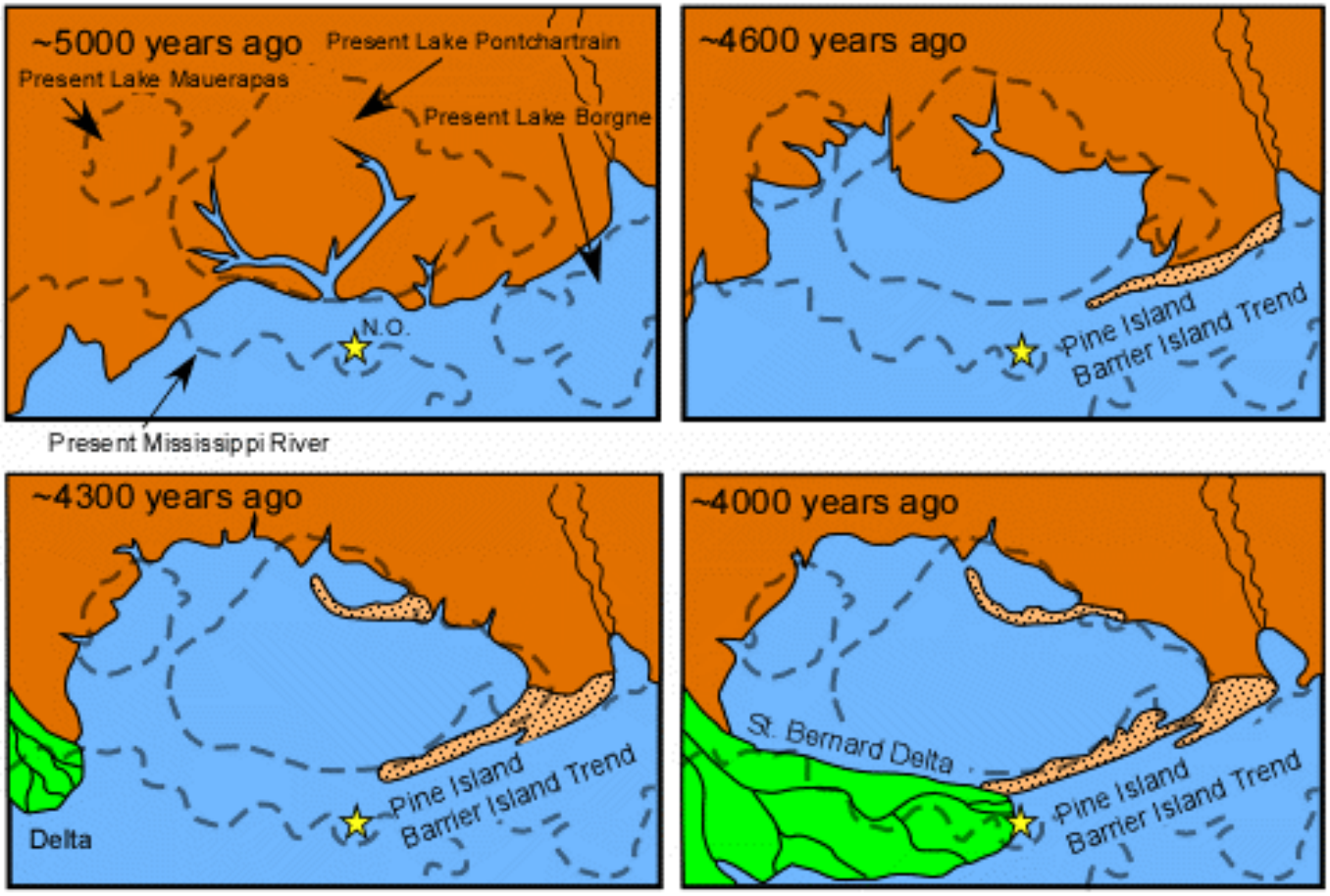


Figure 1. Evolution of the Pine Island Barrier Island from 5000 years ago to 4000 years ago, with outline of current Lake Pontchartrain and Lake Borgne as a dashed line. Colorized image is used with permission from Dr. Stepen A. Nelson at Tulane University. Graphic is modified from Snowden et al. (1980) entitled *Geology of Greater New Orleans-Its Relationship to Land Subsidence and Flooding*. Image can be found at http://www.tulane.edu/~sanelson/New_Orleans_and_Hurricanes/New_Orleans_Vulnerability.htm.

near the Pearl River - which is the boundary between Mississippi and Louisiana - and was a protrusion of sand deposits that originated from the Pearl, and it extended west-southwestward across parts of modern day New Orleans - East and Gentilly. I can only imagine how popular this beach was with the locals of the time. Just for some grounding, around this time, the Egyptians had already developed agriculture, had a form of government, and were writing and doing mathematics. So counting brewkis on the beach in 2000 B.C. - in what was eventually to become Gentilly - is not that wild of a thought, and perhaps a sign of the things to come in the Big Easy in the 20th and 21st Centuries.

I digress..... in more modern times, the importance of this sandy beach ridge as it relates to Hurricane Katrina is that the London Avenue Canal and its levee system was built on top of this remnant beach ridge. When water levels in the Canal rose along with the surge in Lake Pontchartrain, the water (under added pressure) eventually found a conduit underneath the levee structure through a sand lens. This in turn undermined the integrity of the levee structure leading to its failure and the movement of water and much of this sand into the neighborhoods of the 7th Ward. I'm most confident that local residents that resided on the old beach ridge could also have benefited from a brewski or two following the events August 29, 2005 (Figure 2)..... or perhaps not? In New Orleans, it's always something! If you have any questions, feel free to contact me at keim@lsu.edu.

Figure 2. Sandy deposits near one of the breaches on the London Avenue Canal on Pratt Street. Image credit goes to Infrogmation and it can be found at https://commons.wikimedia.org/wiki/File:HousesPrattBehindLondonAvBreech.jpg.

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