

Southern Climate Monitor

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SCIPP

Southern Climate Impacts Planning Program
A NOAA RISA Team

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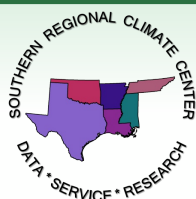
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A Central Texas Predecessor Rain Event Associated with Hurricane Odile

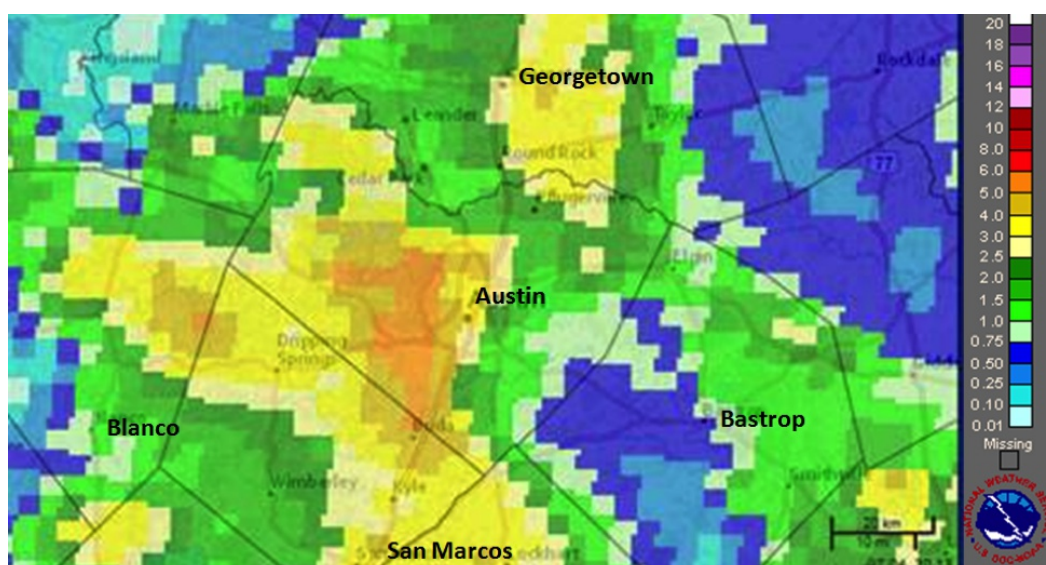
Bob Rose, Lower Colorado Rivery Authority

Land falling tropical cyclones oftentimes bring torrential rains and cause disastrous flooding as they slowly make their way inland out of the warm oceans. Forecasters have a fair amount of skill in forecasting these types of rain events as they follow the core of the dissipating tropical cyclone inland. But over the past couple of decades, scientists have taken note of several high-impact heavy rain and flood events across the US that have occurred well in advance of and apart from land falling tropical cyclones. While these rain events have not been directly related to the tropical cyclone itself, it is believed the indirect transport of tropical and high-level moisture ahead of the tropical cyclone intersecting with a unique Jet Stream configuration can sometimes lead to the development of small scale but significant heavy rain events. Meteorologists have designated these unique rain events as Predecessor Rain Events or PREs.

PREs are often characterized by rainfall totals greater than or equal to 100 mm (~4 inches) in 24 hours, occurring approximately 1000 km (~600 miles) poleward of dissipating tropical cyclones. Across the US, these events have most often occurred during the months of August and September, approximately 36 hours prior to the arrival of the rain shield associated with the tropical cyclone. Scientists have found that PREs are not limited to tropical

cyclones originating in tropical Atlantic and can sometimes occur with systems originating out of the Pacific as well. PREs pose a difficult forecast challenge because operational forecast models often have difficulty depicting such small scale regions of heavy rainfall in both space and time. These types of rain events are often under-analyzed or missed altogether by the forecast models.

In the late evening hours of September 17th, 2014, an area of thunderstorms with very heavy rain developed to the north of Austin, Texas. These storms tracked to the south-southwest and persisted across the city of Austin and parts of nearby Travis County for almost 6 hours. Widespread totals of 5 to 7 inches of rain were recorded across the western half of Austin and Travis County during this 6 hour period. These torrential rains falling in such a short period of time caused the widespread flooding of numerous creeks, low water crossings and streets around Austin. There were numerous power outages along with one high-water rescue. The rain event produced one fatality when a

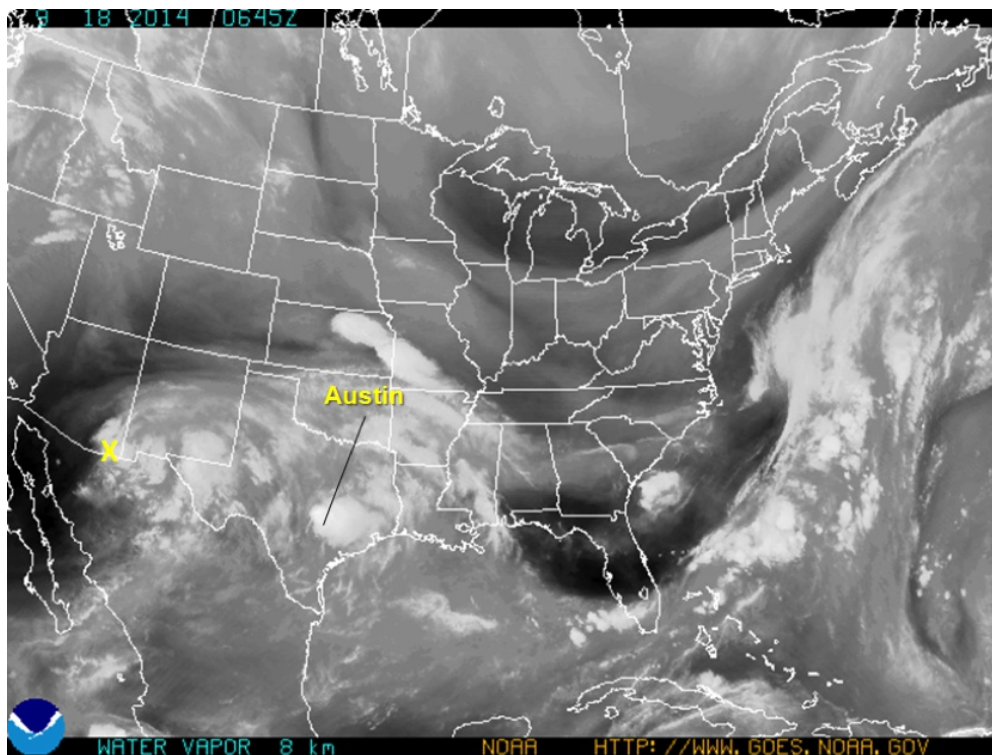


National Weather Service estimated 24-Hour rainfall for the period between 7 am 9/17 and 7 am 9/18.

Travis County Sheriff's deputy monitoring flood waters along a creek in western Travis County was swept away as rising waters inundated her patrol car. The rain area moved south of Austin and diminished around daybreak on September 18th.

While heavy rain and flood events are not unusual in Austin and Central Texas, this particular event happened to occur at the same time the remnants of eastern Pacific hurricane Odile were spreading into southeastern Arizona. Rich, tropical moisture from the eastern Pacific, directly associated with the remnant core of hurricane Odile, produced widespread 2-4 inch rains across southern Arizona and southern New Mexico between September 17th and 18th. These core rains had no connection to what took place 1200 miles away in Austin, Texas on that same night. But indirectly, Austin's heavy rains were indeed connected to this land falling tropical cyclone, in the form of a Predecessor Rain Event.

At approximately about the same time hurricane Odile made landfall along the northwestern coast of Mexico, a weak tropical wave was pushing inland along the middle and upper Texas coast out of the Gulf of Mexico. This tropical wave, in combination with a very moist low-level wind flow out of the deep tropics, caused the low and middle layers of the atmosphere across West and South Texas to become unusually moist. At the same time, a broad cyclonic wind flow in the upper atmosphere around hurricane Odile was pulling considerable high-level moisture from the tropical cyclone northeast across Mexico and much of Texas. The addition of this high-level moisture was crucial in causing the atmospheric column, from the lower atmosphere to the upper atmosphere, to become saturated and conditionally unstable. With a saturated atmosphere in place, scattered rain showers and thunderstorms developed from western to southeastern Texas in the afternoon and evening hours ahead of the intense rain event.



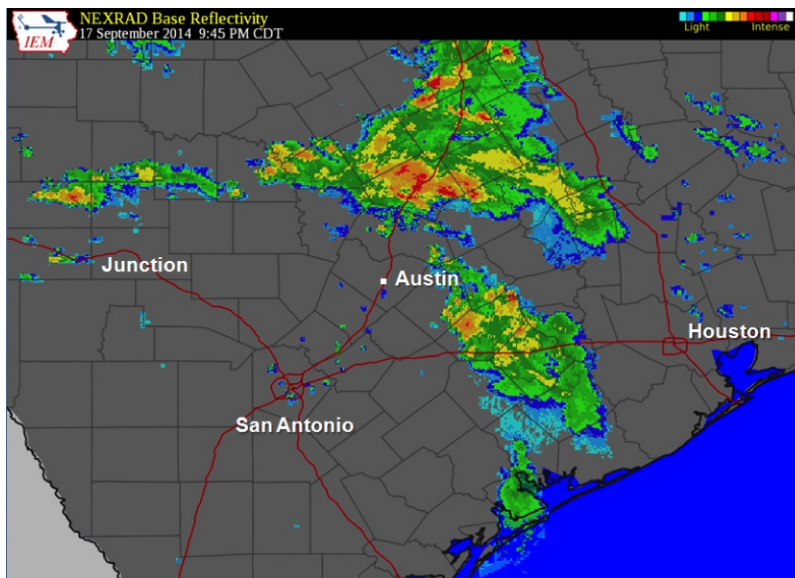
Water vapor imagery from 1:45 am CDT on September 18th. The remnant center of Odile was located over southeastern Arizona while intense rains were occurring across Austin, Texas.

The Predecessor Rain Event itself began to take shape in the late evening hours of September 17th when a cluster of thunderstorms developed north of Austin, in the vicinity of the Balcones Escarpment. This escarpment is an abrupt rise in the landscape of approximately 300 to 500 feet in elevation that divides the coastal plains region from the Texas Hill Country. It is believed weak atmospheric lift

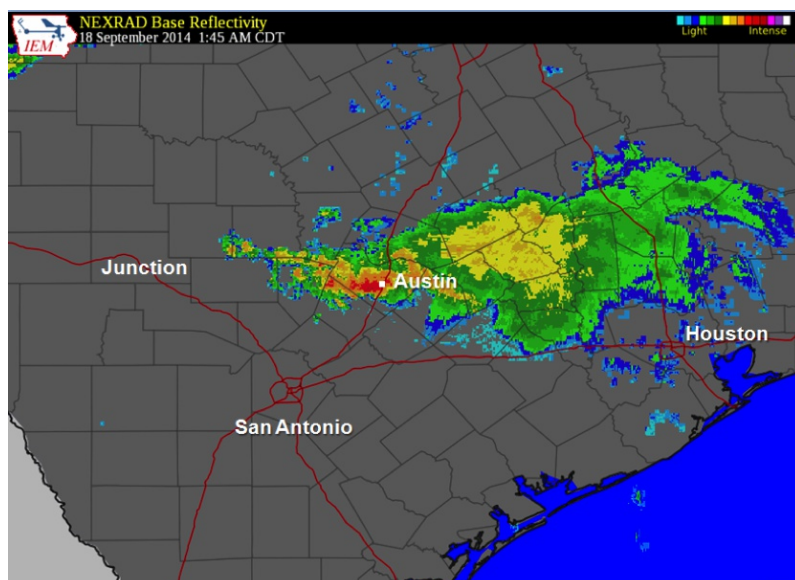
generated from southerly winds intersecting the escarpment in the saturated atmosphere initially caused the thunderstorm cluster to develop.

But the thunderstorms increased rapidly in intensity and areal extent when the entrance region to a feature called a Jet Streak or an area of unusually strong winds at the Jet Stream level, passed over Central Texas that evening. These winds caused strong atmospheric lift at the surface while providing efficient ventilation of the rising air columns, creating a very efficient rain process. Over the next 6 hours, the thunderstorms and torrential rain drifted south over the Austin area, often producing rainfall rates in excess of 4 inches per hour. The thunderstorm complex finally decreased in intensity around daybreak when the Jet Streak pushed east and atmospheric conditions became less favorable for rain.

Austin's intense rain event was not directly associated with the remnants of Hurricane Odile. But at the same time, the event would not have occurred had the high-level moisture from the hurricane not coincided with the area of tropical moisture out of the Gulf of Mexico, and the favorable position of the Jet Stream. Interestingly, more rain fell in the Austin area than was observed over Arizona with the remnants of the dissipating hurricane itself. It was a unique set of parameters all coming together, set in motion by the addition of high-level moisture from the dying tropical cyclone located 1200 miles to the west. Much more research is needed to better identify and forecast these unusual and unique tropical rainfall events.



Radar image from 9:45 pm CDT as the rain event was developing and organizing to the north of Austin.



Radar image from 1:45 am CDT showing intense rain falling across the Austin/Travis County area.

Drought Update

Luigi Romolo
Southern Regional Climate Center

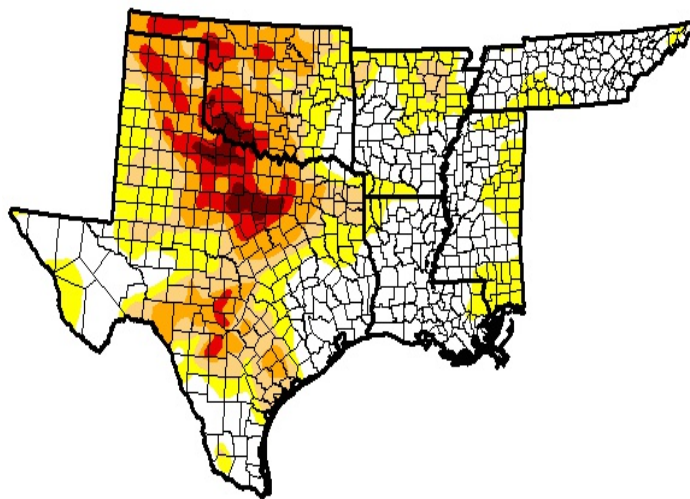
Drought conditions in the Southern Region improved slightly across the Southern Region. Texas and Oklahoma are still the only two states exhibiting severe to exceptional drought, however, the areal coverage over the month of September has reduced from roughly 25 percent (of the region) on September 2, 2014, to roughly 22 percent (of the region) on September 30, 2014.

September was a relatively quiet month in terms of severe weather. On September 2, 2014, an EF-1 tornado touched down in De Soto Parish, Louisiana, and blew the metal roof off a barn. A number of downed limbs were also reported.

In Texas, September saw improvements to crop moisture and increased crop harvests. Almost all of Texas's crops are at their 5-year average for harvesting by the end of the month, with the exception of peanuts, soybeans, and oats. Corn, cotton, and soybeans are behind their maturation for this time of year as well. Winter wheat is on par in terms of planting and emergence with 2013 September and is ahead of their 5-year average. Rangelands improved somewhat due to the rain, but mostly stayed in the same conditions as August. Beef prices reached another record high this month, which is being credited to the drought both here in Texas and in California (Information provided by the Texas Office of State Climatology).

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	41.74	58.26	35.49	22.66	8.47	1.98
Last Week 9/23/2014	47.74	52.26	35.79	20.98	7.56	1.21
3 Months Ago 7/1/2014	36.88	63.12	41.83	27.42	13.35	3.29
Start of Calendar Year 12/1/2013	55.85	44.15	27.23	13.21	3.58	0.72
Start of Water Year 10/1/2013	26.20	73.80	50.11	17.90	3.16	0.25
One Year Ago 10/1/2013	26.20	73.80	50.11	17.90	3.16	0.25



Intensity:

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

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompany text summary for forecast statements. <http://droughtmonitor.unl.edu>

Released Thursday, October 2, 2014

Richard Heim, NCDC/NOAA



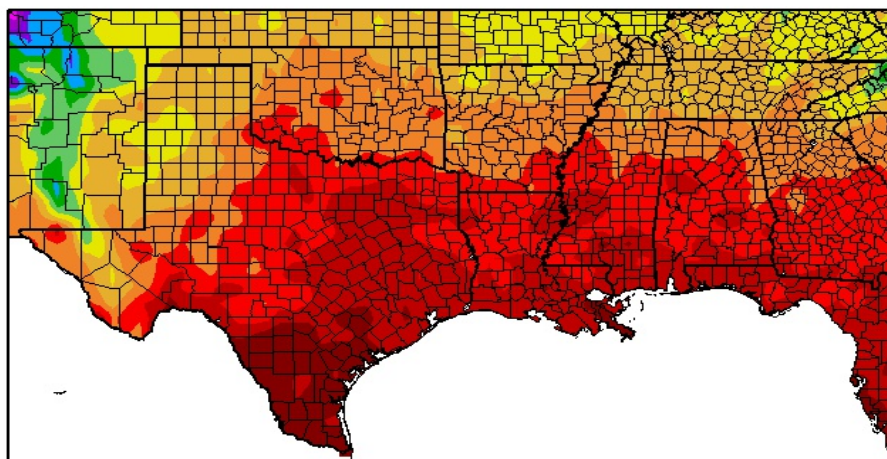
Above: Drought Conditions in the Southern Region. Map is valid for September 30, 2014. Image is courtesy of National Drought Mitigation Center.

Temperature Summary

Luigi Romolo
Southern Regional Climate Center

The September average temperatures did not vary much from normal over the Southern Region. Although some areas of central Mississippi did average between 3 and 5 degrees F (1.67 and 2.78 degrees C) above normal, most of the stations in the region averaged between 2 degrees F (1.11 degrees C) of the monthly average. All six state average temperature rankings fell within the middle two quartiles. The state wide average temperatures for the month are as follows: Arkansas reported 72.60 degrees F (22.56 degrees C), Louisiana reported 78.20 degrees F (25.67 degrees C), Mississippi reported 76.40 degrees F (24.67 degrees C), Oklahoma reported 73.30 degrees F (22.95 degrees C), Tennessee reported 70.60 degrees F (21.44 degrees C), and Texas reported 76.40 F (24.67 degrees C).

Temperature (F)
9/1/2014 – 9/30/2014

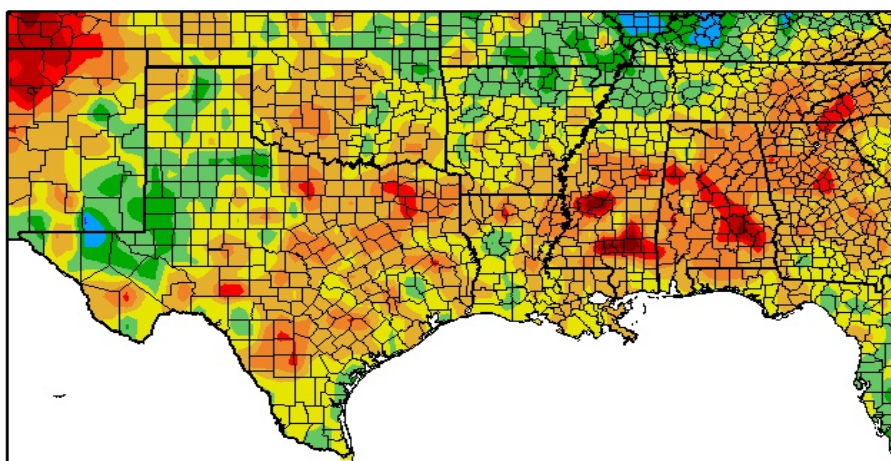


Generated 10/5/2014 at HPRCC using provisional data.

Regional Climate Centers

Average September 2014 Temperature across the South

Departure from Normal Temperature (F)
9/1/2014 – 9/30/2014



Generated 10/5/2014 at HPRCC using provisional data.

Regional Climate Centers

Average Temperature Departures from 1971-2000 for September 2014 across the South

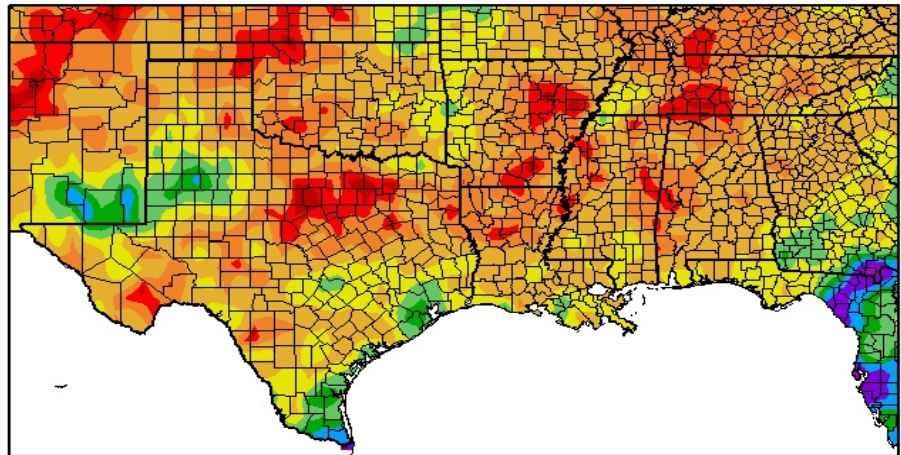
Precipitation Summary

Luigi Romolo
Southern Regional Climate Center

The month of September was a drier than normal month for most of the Southern Region, with the exception of western and southern Texas, which saw precipitation totals of over three times the monthly average. Texas was the only state in the region to report a wetter than normal month. The state wide precipitation totals for September are as follows:

Arkansas received 2.38 inches (60.45 mm), Louisiana received 2.94 inches (74.68 mm), Mississippi received 2.59 inches (65.79 mm), Oklahoma received 2.45 inches (62.23 mm), Tennessee received 2.17 inches (55.18 mm) and Texas received 3.52 inches (89.41 mm). For Tennessee, it was the twenty-sixth driest September on record (1895-2014), while Arkansas experienced its thirtieth driest September on record (1895-2014). All other state rankings fell within the middle two quartiles.

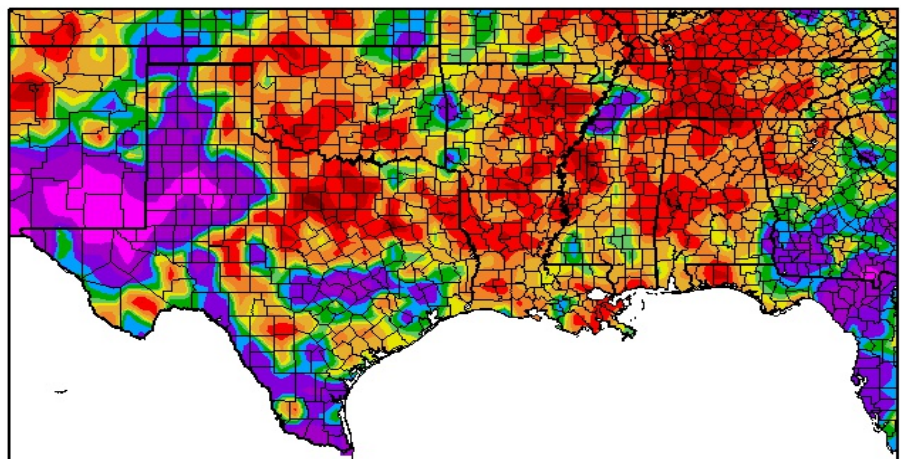
Precipitation (in)
9/1/2014 – 9/30/2014



Generated 10/5/2014 at HPRCC using provisional data. Regional Climate Centers

September 2014 Total Precipitation across the South

Percent of Normal Precipitation (%)
9/1/2014 – 9/30/2014

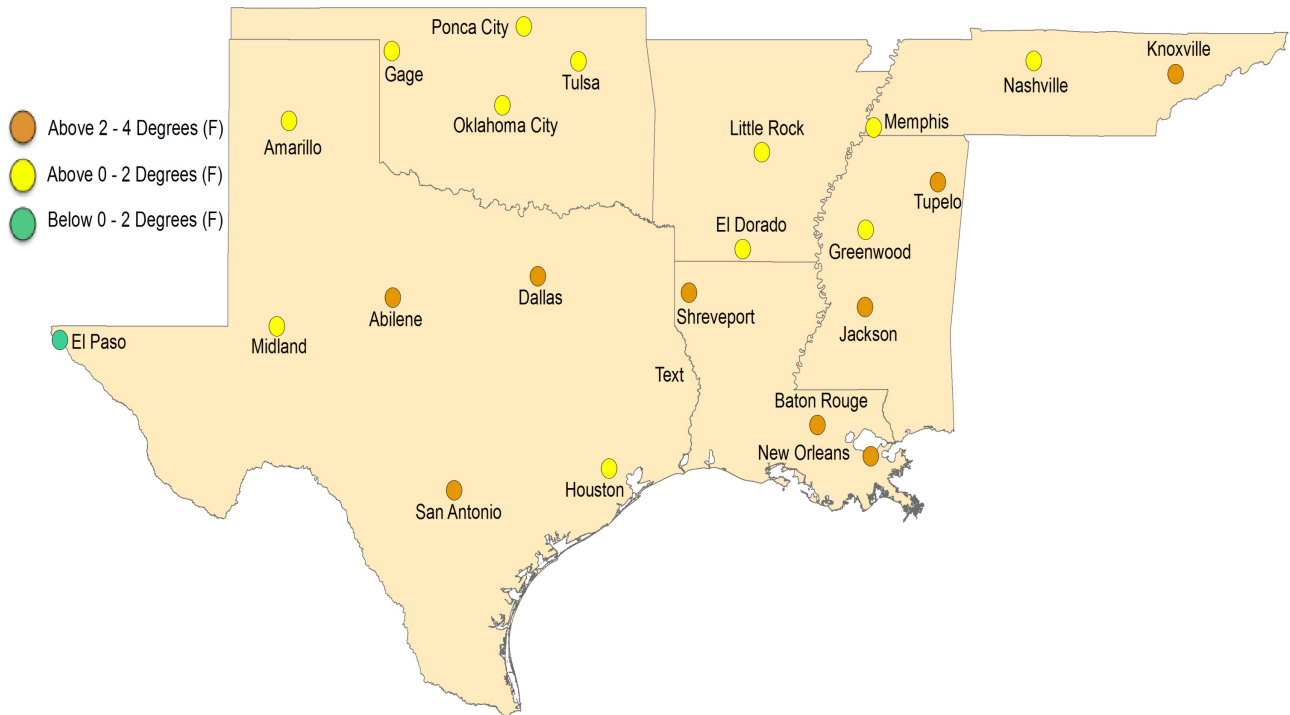


Generated 10/5/2014 at HPRCC using provisional data. Regional Climate Centers

Percent of 1971-2000 normal precipitation totals for September 2014 across the South

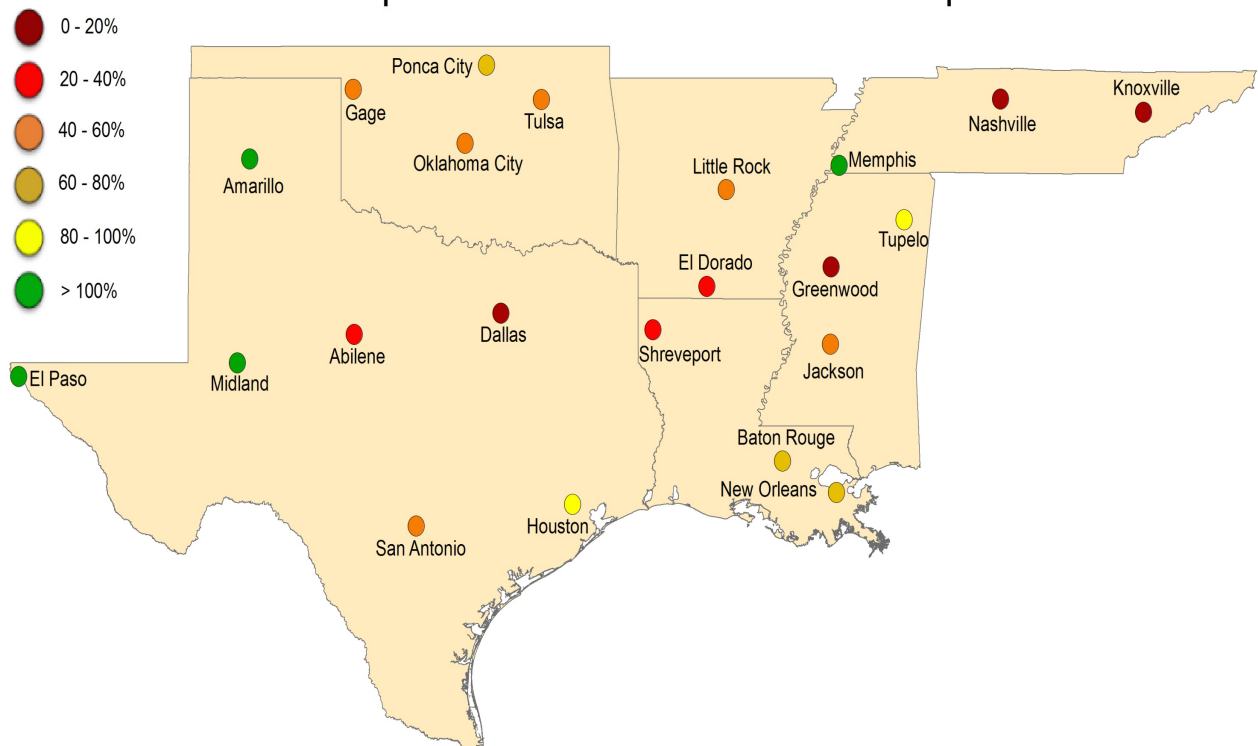
Regional Climate Perspective in Pictures

September Temperature Departure from Normal



September 2014 Temperature Departure from Normal from 1971-2000 for SCIPP Regional Cities

September Percent of Normal Precipitation



September 2014 Percent of 1971-2000 Normal Precipitation Totals for SCIPP Regional Cities

Climate Perspective

State	Temperature	Rank (1895-2011)	Precipitation	Rank (1895-2011)
Arkansas	72.60	56th Coldest	2.38	30th Driest
Louisiana	78.20	37th Warmest	2.94	39th Driest
Mississippi	76.40	39th Warmest	2.59	41st Driest
Oklahoma	73.30	58th Warmest	2.45	46th Driest
Tennessee	70.60	49th Warmest	2.17	26th Driest
Texas	76.40	44th Warmest	3.52	40th Wettest

State temperature and precipitation values and rankings for September 2014. Ranks are based on the National Climatic Data Center's Statewide, Regional, and National Dataset over the period 1895-2011.

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	86.8	64.5	75.6	0.5	94	9/5	51	9/24+	0.77	-2.52	23
Little Rock, AR	85.8	65.5	75.6	1.2	95	9/5	53	9/23	2.01	-1.70	54
Baton Rouge, LA	89.3	69.8	79.6	2.1	94	9/11	59	9/23	3.06	-1.78	63
New Orleans, LA	88.9	74.3	81.6	2.7	95	9/11	67	9/27	3.85	-1.70	69
Shreveport, LA	90.3	68.6	79.5	2.5	97	9/6+	53	9/24	1.21	-2.00	38
Greenwood, MS	87.9	65.5	76.7	1.0	95	9/4	48	9/23	0.39	-2.86	12
Jackson, MS	88.7	67.5	78.1	2.6	94	9/11+	57	9/25+	1.72	-1.51	53
Tupelo, MS	86.1	65.0	75.5	2.2	94	9/9+	50	9/23	3.23	-0.12	96
Gage, OK	85.0	59.1	72.0	1.5	97	9/3	47	9/13+	1.11	-0.86	56
Oklahoma City, OK	86.3	63.7	75.0	1.8	98	9/4+	50	9/13	2.13	-1.85	54
Ponca City, OK	84.7	61.5	73.1	0.1	96	9/4	42	9/13	2.43	-1.24	66
Tulsa, OK	84.7	62.8	73.8	0.3	97	9/4+	51	9/22+	2.19	-2.57	46
Knoxville, TN	82.9	63.2	73.0	2.2	89	9/11+	50	9/23	0.20	-2.84	7
Memphis, TN	85.6	66.7	76.2	1.4	95	9/5+	54	9/23	4.75	1.44	144
Nashville, TN	83.6	62.4	73.0	1.7	93	9/5	49	9/23	0.21	-3.38	6
Abilene, TX	88.2	67.4	77.8	2.3	103	9/10	52	9/13	0.78	-2.13	27
Amarillo, TX	80.2	58.6	69.4	0.3	96	9/2	45	9/13+	4.16	2.28	221
El Paso, TX	84.7	66.0	75.3	-0.1	100	9/2	56	9/13	4.23	2.62	263
Dallas, TX	90.1	70.4	80.3	2.8	101	9/10	56	9/13	0.06	-2.36	2
Houston, TX	89.2	72.0	80.6	1.7	97	9/11	64	9/24+	3.89	-0.44	90
Midland, TX	85.6	64.2	74.9	0.4	101	9/1	53	9/14	6.60	3.77	233
San Antonio, TX	91.8	72.1	82.0	2.5	99	9/11+	63	9/13	1.77	-1.23	59

Summary of temperature and precipitation information from around the region for September 2014. 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.

Alligator Gender Determined by Climate

Barry Keim, Louisiana State Climatologist, Louisiana State University

In Louisiana, alligators have been an important part of the landscape going back to pre-historic times. They've been harvested in Louisiana for over 200 years for their hides which are used to make boots, belts, and were even used to make saddles for Confederate soldiers during the Civil War. However, it wasn't until commercial tanning processes were used that the hides were in high demand because this processing made the hides softer and more durable and pliable. Because of this increased demand around the turn of the 20th century, hunting of alligators increased and by the late 1950s, the population dropped to dangerously low numbers. As a result, in 1962, alligator hunting in Louisiana was closed in an effort to help increase the population, while State Officials tried to find some sound management practices for the species. While under protection, alligator populations thrived and between 1972 and 1981, the Louisiana Department of Wildlife and

Fisheries gradually introduced a regulated wild alligator harvest. Today, there are 2000 licensed alligator hunters who take between 30,000-35,000 alligators annually. In the wild, there are estimates that Louisiana has about 1.5 - 2 million gators in the wild, while another 300,000 - 500,000 are being raised on alligator farms around the State. Some sources say that Louisiana has more alligators than any other state, including Florida. Oh, and in 1983, the alligator was adopted as Louisiana's State Reptile (Figure 1).

So, what do alligators have to do with weather? Well, the gender of alligators happens to be determined by temperature during the incubation of the gator eggs (Figure 2). The particular period of incubation that is sensitive is between 7-21 days, whereas when the temperature is ≤ 86 degrees, the gender is female, while an incubation temperature ≥ 93 degrees

produces male gators. At temperatures in between....well, I guess you get a mix. Nests for the eggs are built out of vegetation, sticks, leaves, and mud, while the decomposition of the vegetation generates heat for the eggs. Levee nests are generally warmer and produce males,



Figure 1. Louisiana alligator resting comfortably and sunbathing on log. Image is in the public domain and is available at <http://pixabay.com/en/alligator-swamp-bayou-animal-169121/>.

while nests in the wet marsh are generally cooler and tend to produce females. And by the way, turtle eggs tend to work in the opposite direction, whereas warmer incubation periods produce females and cooler eggs lead to males.

In the bigger picture, there is some speculation that some animals may have gone extinct because climate change led

to one gender of species being selected out of existence due to the climate, in much the manner discussed above. It is amazing how important weather and climate can be, even when it comes to frisky alligators. Please contact me with any questions at keim@lsu.edu.

The following websites were useful in compiling this story:

http://en.wikipedia.org/wiki/American_alligator

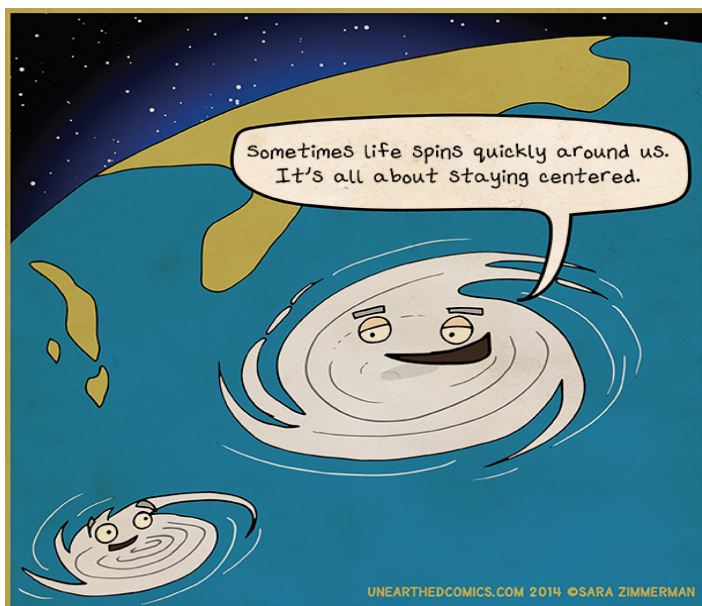
<http://www.wlf.louisiana.gov/alligator-hunting-regulations-overview>

<http://www.nature.com/nature/journal/v296/n5860/abs/296850a0.html>



Figure 2. Baby alligators hatching. Image is in the public domain and available at http://upload.wikimedia.org/wikipedia/commons/f/fe/Alligator_eggs_and_young_alligators.jpg.

Monthly Comic Relief



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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 225-578-502. 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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