Southern Climate Monitor

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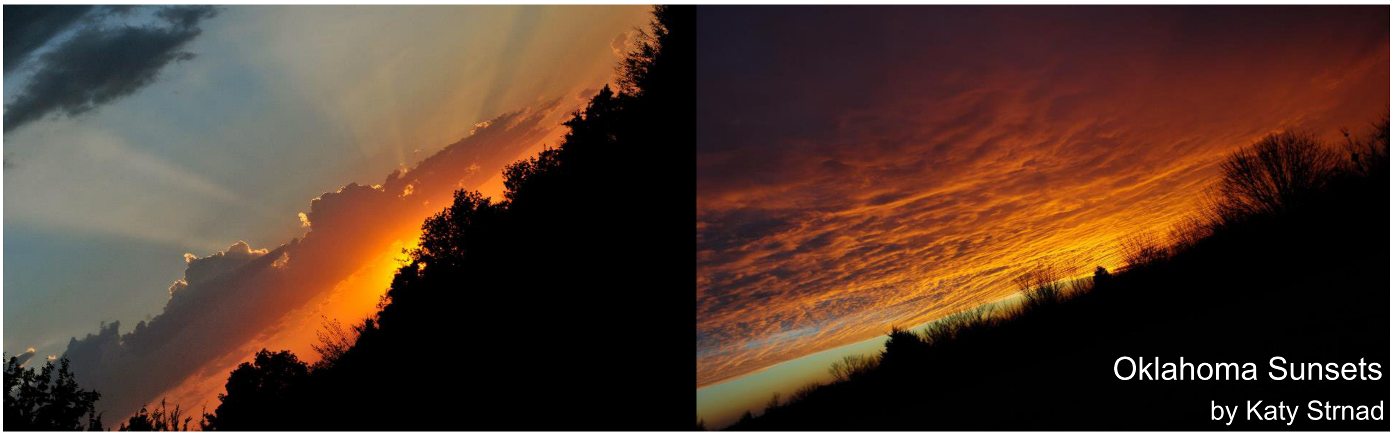

Oklahoma Sunsets
by Katy Strnad

Southern Climate Impacts Planning Program

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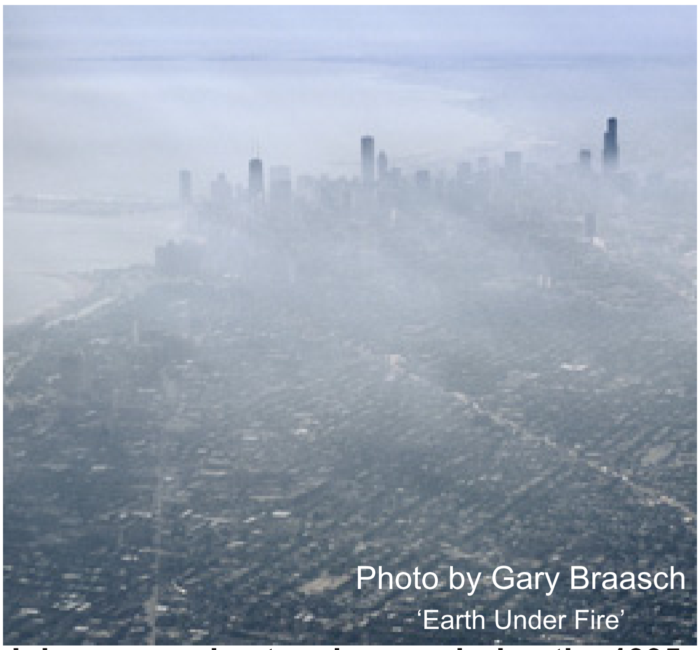
Past, Present, and Future Implications of Extreme Heat Events on Human Health

Scott Greene, Environmental Verification and Analysis Center

The impact of climate on human health continues to draw increased attention as it has become apparent that human sensitivity to weather is considerable and varies through time and space. The health implications of a possible human-induced climate change has only served to heighten this awareness. More specifically, heat, in the form of Excessive heat events (EHEs), has been identified as the leading cause of weather-related deaths in the United States [(National Weather Service) NWS 2009]. Although heat is a consistent killer with more than 1500 deaths per year in the US associated with EHEs (Kalkstein and Greene, 1997; Greene et al., 2011), it has been a few select events that have attracted the most attention. For example, the over 700 deaths in Chicago during a 1995 EHE have been well documented (Klinenberg 2002; Semenza et al. 1996. Whitman et al. 1997). In the US, this event, and associated deaths in other cities during the same EHE, has been viewed as a watershed moment with respect to increasing awareness of the health impacts of EHEs. A more extreme example is the European EHE in August 2003 that was responsible for approximately 40,000 deaths across Europe (Valleron and Boumendil 2004). However, due to the general lack of awareness of heat as such a deadly killer, EHEs are associated with a largely avoidable loss of life.

EHEs are more than extreme temperature, however. People respond to the total effect of all weather variables interacting simultaneously on the body, rather than one or two particular variables. Thus, human health is affected by the simultaneous interactions from a much larger suite of meteorological conditions (e.g., temperature, humidity, pressure, cloud cover, wind speed, etc.). Therefore, an appropriate means to evaluate weather/health relationships is through the identification of high risk weather situations which could negatively affect human health. One such commonly used approach is to use a synoptic classification (Greene and Kalkstein, 1996, Sheridan, 2002; Kysely and Huth 2004). This approach examines a range of meteorological variables, and classifies each day at a particular location into one of several recognizable, homogeneous, weather types. One such synoptic method, the spatial synoptic classification (SSC) identifies the spatial occurrences of air masses, and thus, in each city, each day is classified into one of six main airmass categories, or is considered a transition between the categories. The general conditions associated with each airmass category can be found and has been identified in a number of publications (Sheridan, 2002, Greene and Kalkstein, 1996; Greene, et al., 2011, and many others).



July summer heat and smog during the 1995 Chicago heat wave.

Figures 1 and 2 show the average number of EHE days experienced each summer in the period 1975–2004, and the corresponding average number of EHE-attributable deaths per summer during this period. Cumulatively, the results indicate over 1500 lives being lost due to EHEs during an average summer; however, these results vary dramatically by location (Greene et al., 2011). There is a pronounced regional pattern with cities in the midwest and northeast cities having most of the highest excess mortality. This shows that EHE-related mortality increases with increasing inter- and intra-seasonal climate variability (e.g., Kalkstein et al., 2010; Chestnut et al., 1998; Sheridan et al., 2009). Conversely, cities with low excess mortality are often associated with stable climates. This is particularly true for many cities in the Southern Climate Impacts Planning Program (SCIPP) region. Houston, for example, has on average, only 1-2 EHE days per year, and very little associated excess mortality. For New Orleans, these values increase to approximately 5 EHE days per year and 20-25 excess deaths. Overall, for the five large cities in the SCIPP area that have been analyzed, the totals are approximately 150 excess deaths per year on average. Dallas is the most vulnerable city, with 11 EHE days and approximately 50 EHE-attributable deaths in an average summer.

Climate models generally project increasing average temperatures in the coming decades, and many regions of the United States can anticipate more frequent and severe EHEs in the future (e.g., Meehl and Tebaldi 2004; O'Neill and Ebi 2009). Figures 3 and 4 show the estimated number of EHE days and deaths under a ''business as usual'' greenhouse gas emissions scenario to illustrate the potential impacts of climate change for select decades throughout the 21st century (see Kalkstein and Greene 1997; Greene, et al., 2011 for details).

Figure 1 - Average EHE Days 1975-2004

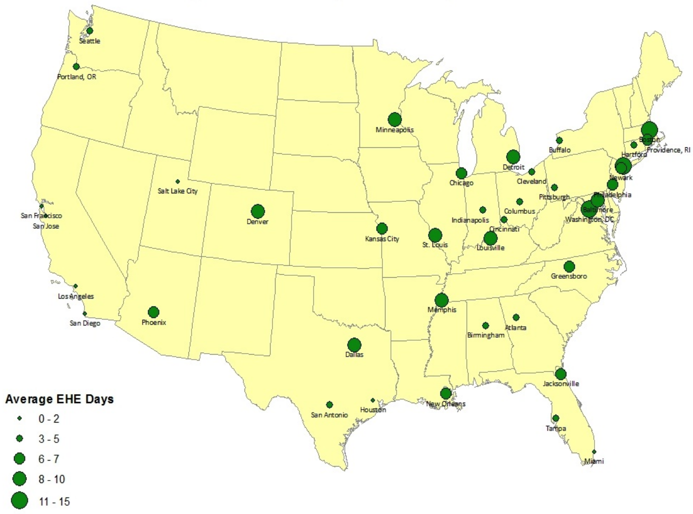
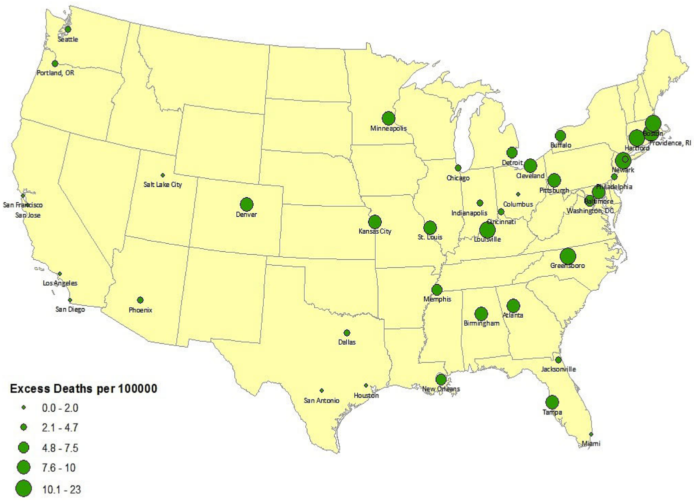


Figure 2 - Excess Mortality 1975-2004 per 100,000



Results illustrate the potential dramatic impact of climate change. For example, New Orleans is projected to have a tremendous increase in EHE days toward the latter half of the 21st century, and Dallas is projected to increase to 37 EHE days and over almost 200 EHE-attributable deaths by the end of the century. The cities with the smallest projected increase in the SCIPP region are San Antonio and Houston, which are projected to "only" double the EHE-attributable deaths.

These numbers do not include an estimate of the impact of intervention and adaptation strategies on EHE-attributable excess mortality.

It is known, however, that these efforts do decrease the excess mortality. For example, Philadelphia's excess mortality from the July 1995 EHE was significantly lower per 100,000 population when compared to Chicago. During this time period, Philadelphia had just implemented an innovative synoptic-based heat warning system, while Chicago had no such system in place. The difference between the cities suggests that an EHE notification and response program could have a positive public health benefit. For example, over a three-summer period in the mid-1990's, Philadelphia's program was estimated to have saved over 115 lives (Ebi et al., 2004).

If the patterns associated with EHE-attributable excess mortality in cities which have an effective adaptation strategy are incorporated into the estimates, the dramatic increase projected in the future can be reduced. For example, for Dallas the total values drops from 194 to 99 deaths per year. This almost 50% in excess mortality reduction provides a concrete example of how intervention and adaptation to climate can have a noticeable real impact. These intervention and adaptation efforts include programs such as as SSC-based heat health warning systems (already implemented in many cities worldwide), improvements in EHE forecasting and recognition as well as increased commitment of resources to EHE education, notification, and response measures. Thus, in addition to improved awareness, a key component is to transmit an effective message to the public and necessary stakeholders. Thus, through the efforts of local officials and stakeholders, there is proof that the impact of the most silent of weather-related disasters can be reduced through increased awareness, education, and research.

Figure 3 - Future EHE days

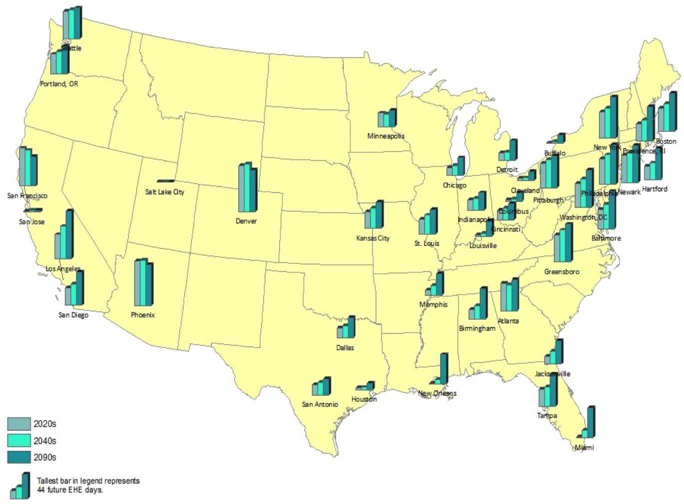
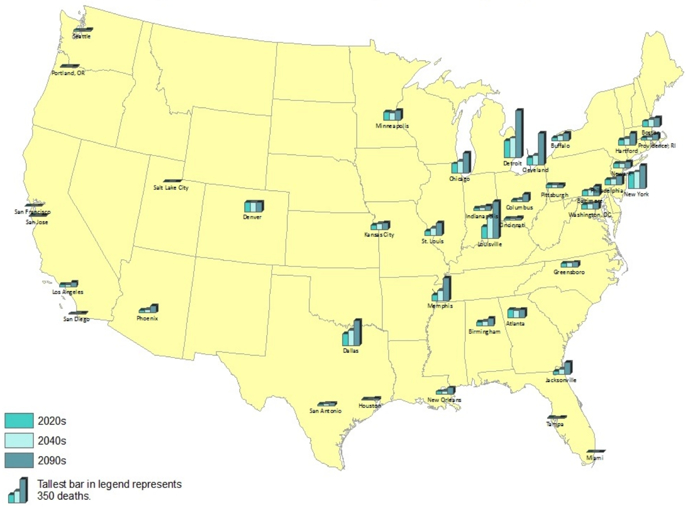


Figure 4 - Future Average Deaths per year



More to Learn

http://www.epa.gov/heatisland/about/heatguidebook.html

http://www.udel.edu/SynClim/ssc.html

http://www.arb.ca.gov/newsrel/2011/HeatImpa.pdf

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Drought Update

Luigi Romolo
Southern Regional Climate Center

Prolonged dryness in the north western area of Texas and in western Oklahoma over the past month has led to a significant increase in the amount of extreme and exception drought conditions. Elsewhere, drought conditions have improved as a result of some much needed rainfall. Areas of improvement include central and southern Texas, southeastern Arkansas, and central Oklahoma. In Texas, damages from weather this month have been higher than the most recent few months. The Granbury tornado caused an estimated $34 million in damages. Instances of vehicular damage from hail and reduced visibility following the various storm systems were common. Even after the frontal passages, dry regions were subjected to low humidity and high winds, causing fires near Possum Kingdom Lake and presenting fire danger to several other regions around the state.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	41.93	58.07	51.68	35.56	20.24	9.83
Last Week (05/28/2013 map)	40.25	59.75	52.84	36.91	19.92	9.60
3 Months Ago (03/05/2013 map)	36.58	63.42	55.03	43.05	20.26	5.01
Start of Calendar Year (01/01/2013 map)	21.18	78.82	63.69	50.50	32.80	10.98
Start of Water Year (09/25/2012 map)	24.13	75.87	66.61	51.50	29.86	9.11
One Year Ago (05/29/2012 map)	12.92	87.08	43.29	15.05	5.57	0.37

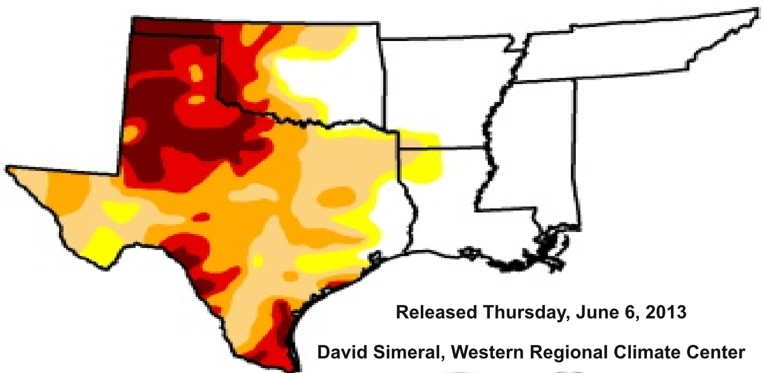
Intensity:

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

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

Several frontal passages have helped improve short-term conditions in the eastern and southern portions of the state, but not without their own problems. A storm system early in the month helped contribute to the low monthly average temperature, causing record lows in Houston and other parts of eastern Texas. Later storms brought heavy rain and flooding.

The most significant occurrence of severe weather in May, 2013 is without question, the tornado that struck the town of Moore, Oklahoma on May 20, 2013. The twister is estimated to have been an EF5, which is the highest ranking on the Enhanced Fujita Tornado Scale. The tornado had peak winds in and around 210 miles per hour (340 km/h). Damages from the storm are not fully calculated, however, preliminary estimates suggest that the storm caused somewhere between one and a half to two billion dollars in damage, which in not surprising considering that approximately twelve to thirteen thousand homes were destroyed or in some way damaged. According to CNN.com, a total of three hundred and seventy-seven people were reported injured and twenty-four people lost their lives.



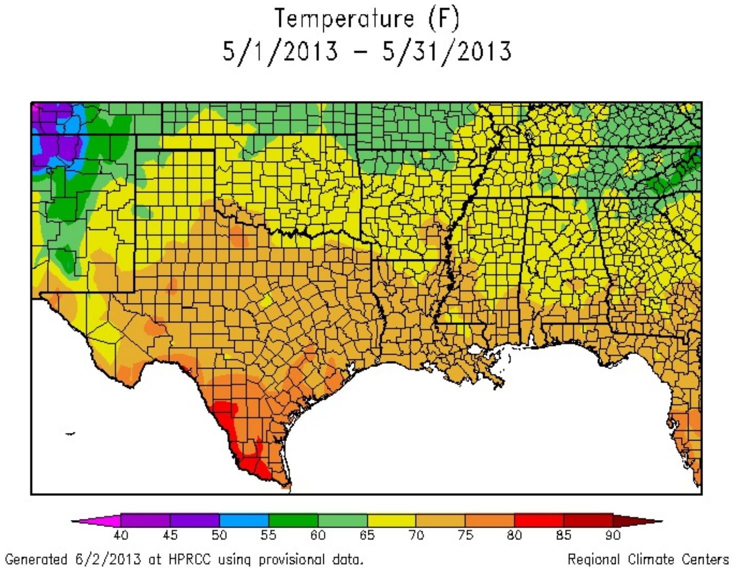
USDA National Drought Mitigation Center

Above: Drought conditions for the Southern Region. Map is valid for June 4, 2013. Image courtesy of the National Drought Mitigation Center.

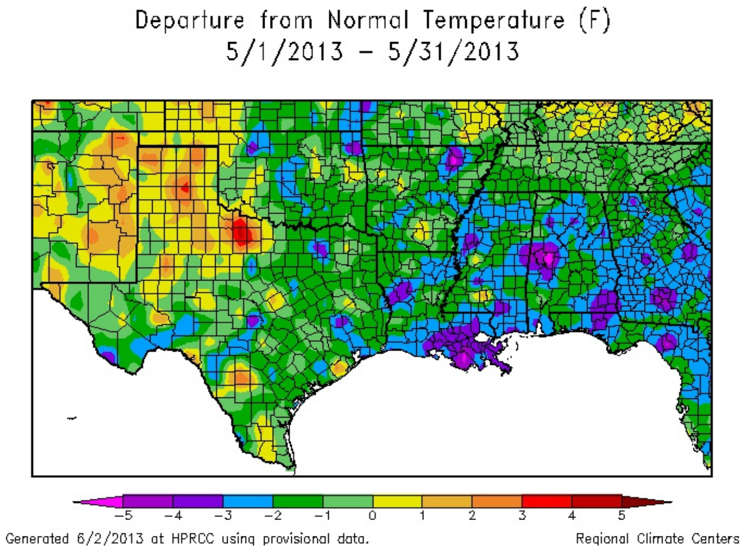
Temperature Summary

Luigi Romolo
Southern Regional Climate Center

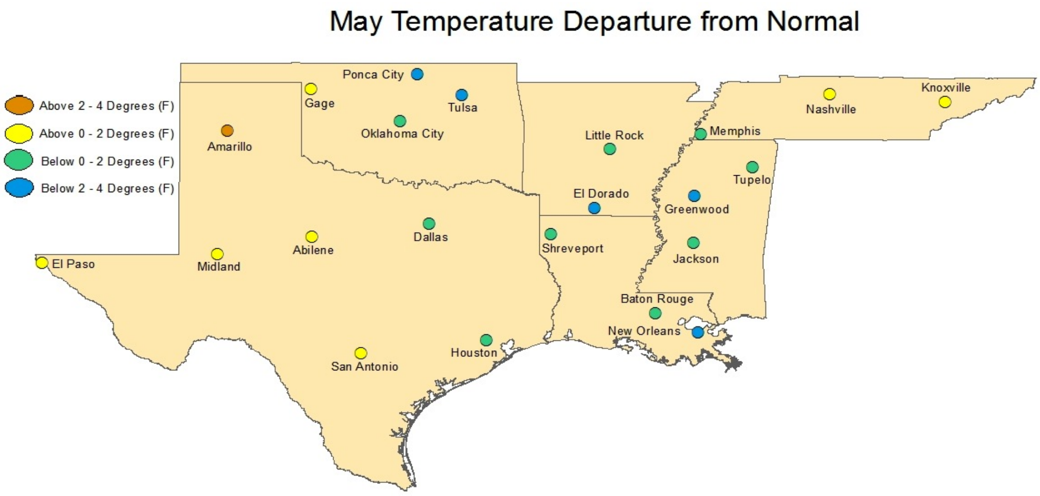
Unlike April, the month of May was generally a cooler than normal month for most of the Southern Region. With the exception of the north western corner of the region, temperature averages for the month ranges from 0 to 4 degrees F (0 to 2.22 Degrees C) below normal. In the Texas and Oklahoma panhandles, temperature averages were only slightly higher than normal. The state average temperature values for the month of May are: 67.40 degrees F (19.67 degrees C) for Arkansas, 71.40 degrees F (21.89 degrees C) for Louisiana, 69.20 degrees F (20.67 degrees C) for Mississippi, 66.90 degrees F (19.39 degrees C) for Oklahoma, 65.20 degrees F (18.44 degrees C) for Tennessee, and 72.50 degrees F (22.50 degrees C) for Texas. All state rankings fell within the two middle quartiles, with the exception of Louisiana which experienced its thirteenth coldest May on record (1895-2013), and Mississippi, which experienced its twentieth coldest May on record (1895-2013).



Average temperature for May 2013 across the South.



Average temperature departures from 1971-2000 for May 2013 across the South.

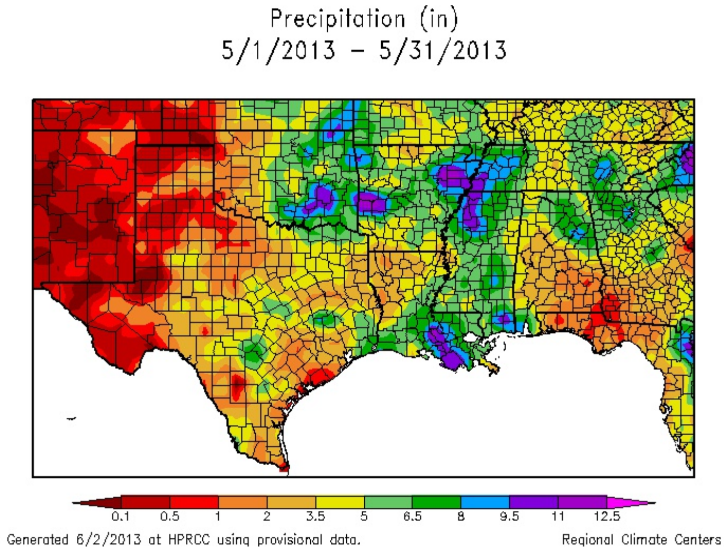


May Temperature Departure from Normal from 1971-2000 for SCIPP Regional Cities.

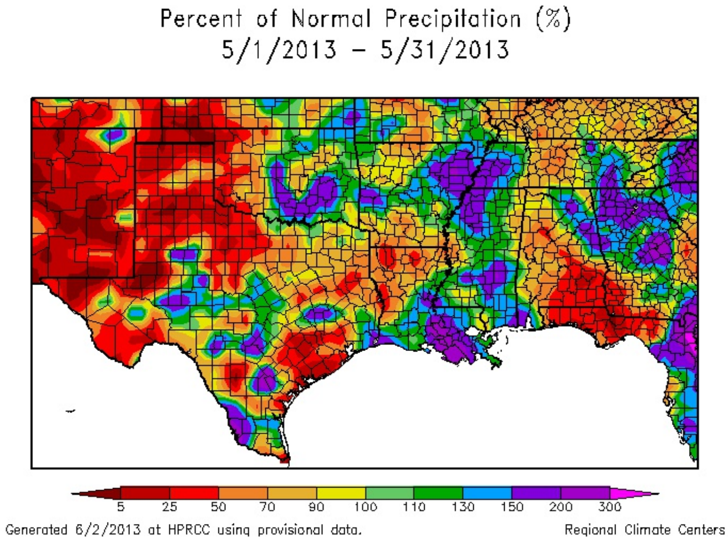
Precipitation Summary

Luigi Romolo
Southern Regional Climate Center

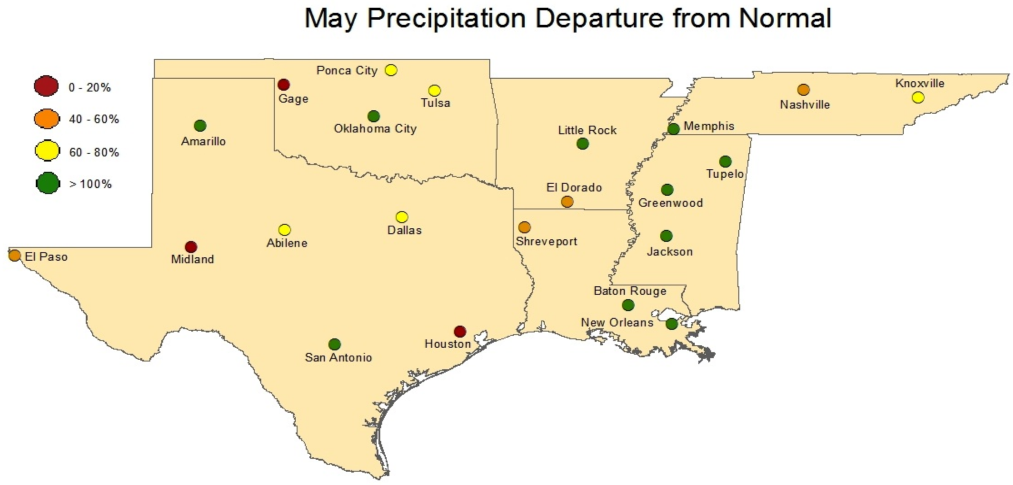
May precipitation in the Southern Region varied significantly, with a patchy spatial pattern including areas of extreme dryness and areas of intense saturation. Within the Southern region, anomalously high precipitation totals were observed in: south east Louisiana, north eastern Arkansas, north western Mississippi, south western Tennessee, and small pockets in central Texas. Conversely, areas of dryness included: north western Texas, western Oklahoma, northern Louisiana, and along much of the northern Gulf coast of Texas. With the exception of Texas, all states reported a wetter than normal May. The state precipitation totals are as follows: Arkansas with 6.14 inches (155.96 mm), Louisiana with 5.54 inches (140.72 mm), Mississippi with 6.96 inches (176.78 mm), Oklahoma with 5.12 inches (130.05 mm), Tennessee with 5.81 inches (147.57 mm), and Texas with 2.61 inches (66.29 mm). For Mississippi, it was the nineteenth wettest May on record (1895-2013), while Tennessee experienced its twenty-fifth wettest May on record (1895-2013). All other state rankings fell within the middle two quartiles. It is noteworthy that these rankings are not indicative of the high spatial variance in precipitation since values are averaged over the entire state.



Total precipitation values for May 13 across the South.



Percent of 1971-2000 normal precipitation totals for May 2013 across the South.



May Percent of 1971-2000 Normal Precipitation Totals for SCIPP Regional Cities.

Climate Perspective

State	Temperature	Rank (1895-2011)	Precipitation	Rank (1895-2011)
Arkansas	67.40	38th Coldest	6.14	41st Wettest
Louisiana	71.40	13th Coldest	5.54	43rd Wettest
Mississippi	69.20	20th Coldest	6.96	19th Wettest
Oklahoma	66.90	38th Coldest	5.12	51st Wettest
Tennessee	65.20	44th Coldest	5.81	25th Wettest
Texas	72.50	57th Warmest	2.61	40th Wettest

State temperature and precipitation values and rankings for May 2013. 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 Name	Temperatures (degrees F)								Precipitation (inches)		
	Averages				Extremes				Totals		
	Max	Min	Mean	Depart	High	Date	Low	Date	Obs	Depart	%Norm
El Dorado, AR	80.0	58.5	69.2	-2.3	89.0	5/31+	36.0	5/4	3.06	-2.43	56
Little Rock, AR	79.2	59.5	69.4	-0.7	90.0	5/20	38.0	5/4+	7.16	2.11	142
Baton Rouge, LA	82.8	61.9	72.4	-1.6	91.0	5/20	40.0	5/4	7.03	1.69	132
New Orleans, LA	81.4	65.7	73.5	-2.1	89.0	5/24+	46.0	5/4	8.23	3.61	178
Shreveport, LA	82.9	61.5	72.2	-0.8	92.0	5/31	39.0	5/4	2.65	-2.60	50
Greenwood, MS	79.4	58.6	69.0	-3.4	89.0	5/31+	35.0	5/4	6.28	0.93	117
Jackson, MS	80.7	59.0	69.9	-1.6	90.0	5/31+	36.0	5/4	5.29	0.43	109
Tupelo, MS	79.4	58.3	68.8	-0.5	89.0	5/21+	37.0	5/4	6.49	0.69	112
Gage, OK	81.5	52.2	66.8	1.2	98.0	5/27+	28.0	5/3	0.43	-3.29	12
Oklahoma City, OK	77.0	56.4	66.7	-1.7	89.0	5/18	34.0	5/3	14.52	9.08	267
Ponca City, OK	76.0	55.0	65.5	-2.7	90.0	5/14	32.0	5/3	3.94	-0.98	80
Tulsa, OK	76.7	56.8	66.8	-2.5	91.0	5/14	36.0	5/3+	4.71	-1.40	77
Knoxville, TN	77.3	55.6	66.4	0.4	89.0	5/30	39.0	5/13	3.52	-1.16	75
Memphis, TN	78.7	60.6	69.7	-0.9	89.0	5/29	36.0	5/4	10.75	5.60	209
Nashville, TN	78.3	56.5	67.4	0.3	89.0	5/29+	39.0	5/13	2.77	-2.30	55
Abilene, TX	85.9	60.1	73.0	0.2	104.0	5/17	33.0	5/3	2.00	-0.83	71
Amarillo, TX	84.3	52.3	68.3	3.1	100.0	5/17	27.0	5/3	2.80	0.30	112
El Paso, TX	87.5	62.6	75.0	1.3	98.0	5/23	40.0	5/3	0.18	-0.20	47
Dallas, TX	82.5	62.1	72.3	-0.8	92.0	5/18	39.0	5/4+	3.17	-1.98	62
Houston, TX	85.0	66.0	75.5	-0.3	93.0	5/31	42.0	5/4	1.02	-4.13	20
Midland, TX	88.5	60.0	74.3	1.5	104.0	5/31	32.0	5/3	0.03	-1.76	2
San Antonio, TX	86.5	65.0	75.8	0.0	97.0	5/17+	42.0	5/4	13.19	8.47	279

Summary of temperature and precipitation information from around the region for May 2013. 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.

Almost had a "Cross-Over" Hurricane

Barry Keim, Louisiana State Climatologist, Louisiana State University

Hurricane season 2013 is now officially underway. It just so happens that 2 storms have already occurred in the eastern Pacific Ocean – Alvin and Barbara (see Figure 1). At one point, it appeared that Hurricane Barbara might cross over from the Pacific Ocean, take the high road over Mexico, and then enter the Gulf of Mexico. If that had happened, the storm would have then become an Atlantic tropical storm or hurricane, and it would have been given an new Atlantic name, in this case it would have been – Andrea. YUP, Hurricane Barbara would have become Hurricane Andrea by virtue of changing from the Pacific Basin to the Atlantic Basin (which includes the Caribbean and Gulf of Mexico). Although this did not happen this time, this type of occurrence is not unprecendented. Over the past century, we've had 8 cross-over storms, most of which have traveled from the Atlantic over to the Pacific, with only 2 of these going from the Pacific to the Atlantic (see Figure 2).

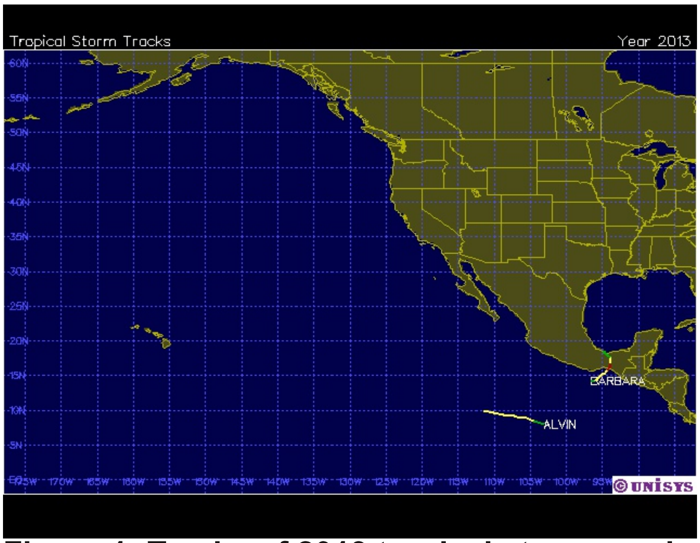


Figure 1: Tracks of 2013 tropical storms and hurricanes in the eastern Pacfic Ocean. <http://weather.unisys.com/hurricane/e_pacific/2013/index.php>.

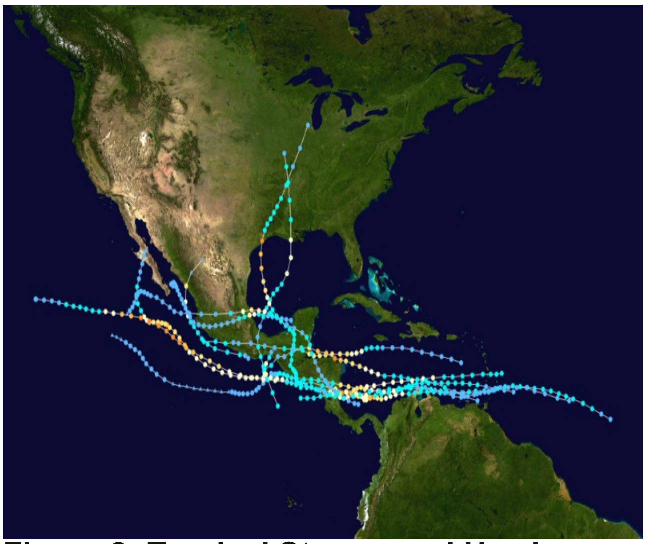


Figure 2: Tropical Storms and Hurricane tracks that crossed-over from the Atlantic to the Pacific or vice-versa. http://en.wikipedia.org/wiki/File:Tracks_of_Atlantic-Pacific_crossover_storms.png.

For Louisiana, the most noteworthy of these cross-over storms occurred in 1923, when a storm formed in the Pacific Ocean off of the Mexico Coast. The storm then crossed over Mexico and entered the Gulf of Mexico, and then took a northerly path to make a landfall near Cocodrie, Louisiana. With this storm, our SURGEDAT storm surge database at LSU shows surge values of 8 feet at Biloxi, 7.5 feet at Mandeville, and 3.6 feet Morgan City. There was a similar type storm in 1949 that also crossed Mexico and made a landfall on the Texas Coast producing a surge of near 11 feet. We've had close calls on cross over storms in the past, and last week was another one. Mother Nature continues to work in mysterious ways. If you have any questions, feel free to contact me at keim@lsu.edu.

Monthly Comic Relief

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