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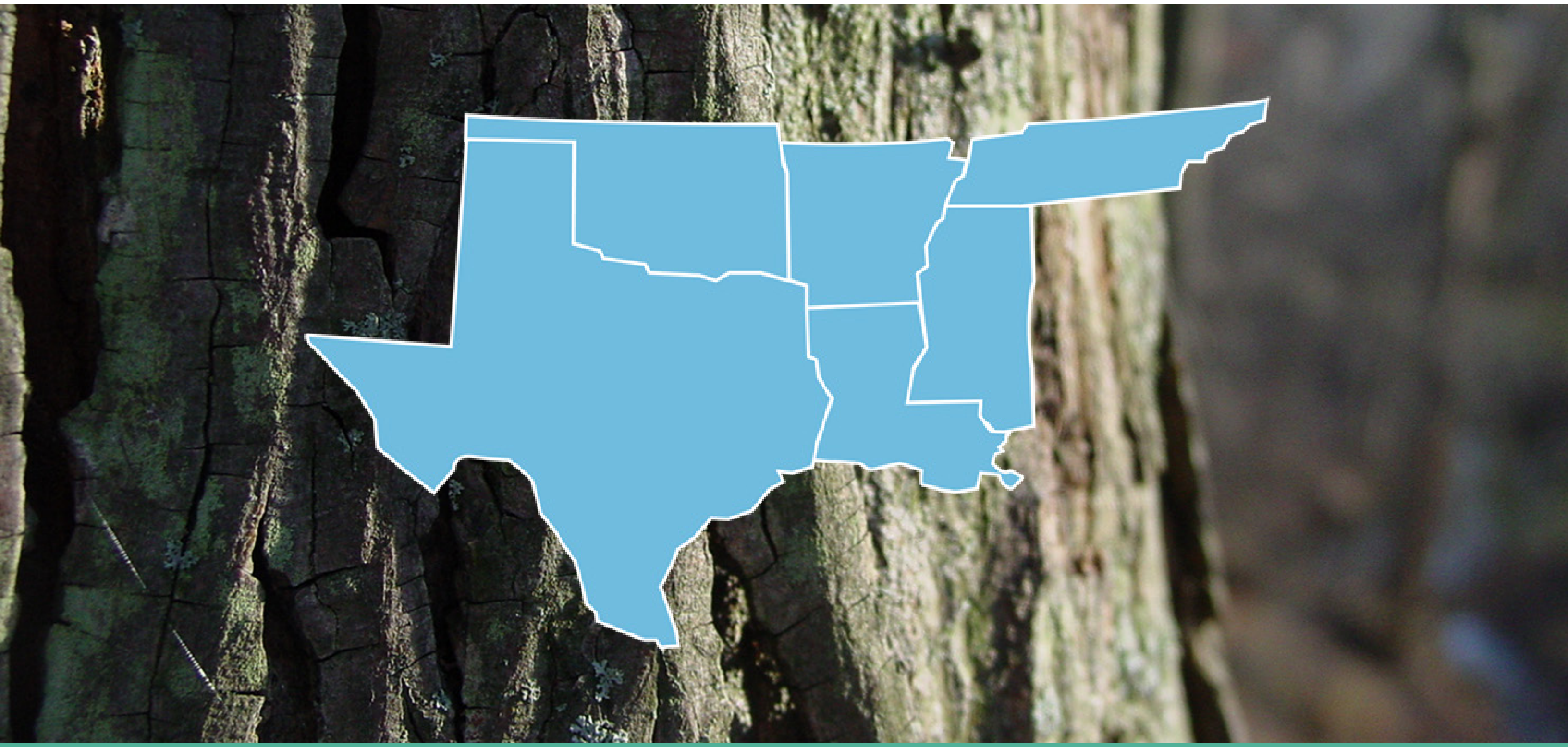

In This Issue:

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A climatology of high-wind days for the southern United States from 1973–2014

Joshua M. Gilliland, Ph.D. Candidate, Louisiana State University

Introduction

During the past decade, regional climatologies have examined geographic and atmospheric parameters to explain high-wind events that occur in midlatitude regions of the United States (Niziol and Paone 2000; Lacke et al., 2007; Kurtz 2010). These studies have examined topography (Niziol and Paone 2000) and mid-latitude dynamics (Lacke et al., 2007; Kurtz 2010) as plausible influences on the predominant orientation of wind direction for high-wind observations across the Great Lakes and Great Plains regions. A comprehensive review concluded that wind dynamics are the result of many atmospheric processes, rather than one dominant contributor (Knox et al., 2011). Despite this research, high-wind events have not been extensively research for the southern United States. As a result, this paper examines and provides an overview on the climatological characteristics of high-wind days for the southern United States from 1973-2014.

Data and Methods

All high-wind observations classified in the study are derived from hourly surface wind data provided by National Centers for Environmental Information Integrated Surface Database (NCEI-ISD) [data available at: https://www.ncdc.noaa.gov/isd]. The National Weather Service (NWS) defines high-wind warnings and watches based on two criteria: (1) wind speed and (2) duration. A sustained (gust) high-wind day is achieved when wind speeds meet or exceed 18 m s-1 for at least 1 hour (26 m s-1 for any duration). The high-wind dataset consists of 77 quality-controlled weather observations for the southern United States (Figure 1). DeGaetano (1997) analyzed the quality of hourly wind and directional data for 41 northeastern U.S. first-order stations and found that < 0.1% of the records failed the quality control test (i.e., removal of excessive wind variability and inaccurate wind observations). As a result, each report is inspected using official government online resources [e.g., NCEI Climate Database Modernization Program (CDMP), Quality Controlled Local Climatological Data (QCLCD), and Unedited Local Climatological Data (ULCD)] to check for erroneous or questionable observations at each weather site (e.g., a station

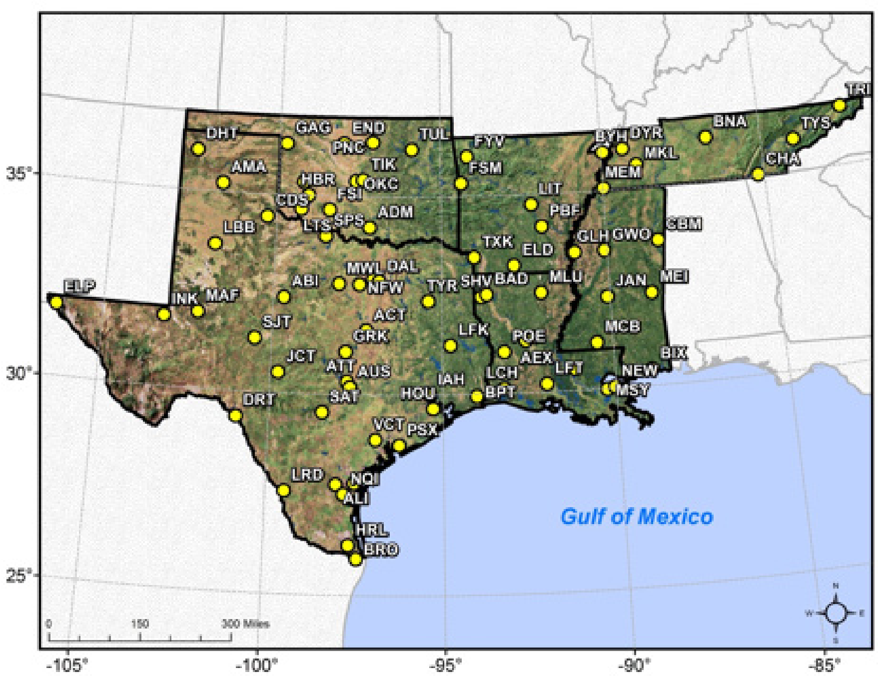

Figure 1. The spatial distribution of the 77 observation stations used in the study during 1973–2014.

observed a wind speed = 0 but records a wind direction ≠ 0). Any high-wind observation that could not be verified or authenticated was otherwise removed from the study.

Another factor that was considered is the anemometer history of each observation site used in the study. Studies have documented that most station instruments were moved during the 1960s from building rooftops and relocated to ground surface locations (Klink 1999; Lacke et al., 2007; Pryor et al., 2007). Additionally, weather stations also had their anemometers repositioned from the height of 6.1 m to 10 m to meet the wind height standard set by the World Meteorological Organization (WMO). Consequently, all wind speed observations were adjusted to the height of 10 meters using the wind profile power law (Klink 1999; Pryor et al., 2007). Finally, the high-wind dataset is comprised of hourly weather observations from 1973–2014. This 42-year period of record was selected based on the quality and availability of data made available by the NCEI-ISD. A previous study by Lacke et al., (2007) found one problem with using the NCEI-ISD archive was non-accumulated and/or missing data prior to 1972. It was then decided to choose stations that were not missing a significant number of observations (i.e., continuous and stationary data) and were beyond the problematic time period.

Results

During the 42-year period, 725 (1466) sustained (gust) high-wind days were recorded over southern United States. Approximately 70% (506) of sustained high-wind days occur during winter (DJF) and spring (MAM), with the highest frequencies occurring in March (19%) and April (17%). However, the highest incidence of gust-high wind days were observed during spring (MAM) and summer (JJA), with the maximum occurring in May (15%) and June (15%). Figure 2 shows a seasonal lagged or delay in the number of high-wind days for sustained and gust. This finding suggests that sustained and gust high-winds are possibly being influence by different atmospheric conditions and warrants further investigation.

A spatial mean wind direction analysis provides site specific sustained and gust high-wind patterns for the study area (Figure 3). The majority of westerly and southwesterly sustained and gust high-wind records are observed within the interior of the southern United States. In contrast, a highly variable southerly coastal effect is evident along the Gulf Coast that extends from Texas to Mississippi. Lastly, a northwesterly sustained wind preference exists over Arkansas and Louisiana. This northwesterly wind pattern could be a result of a limited

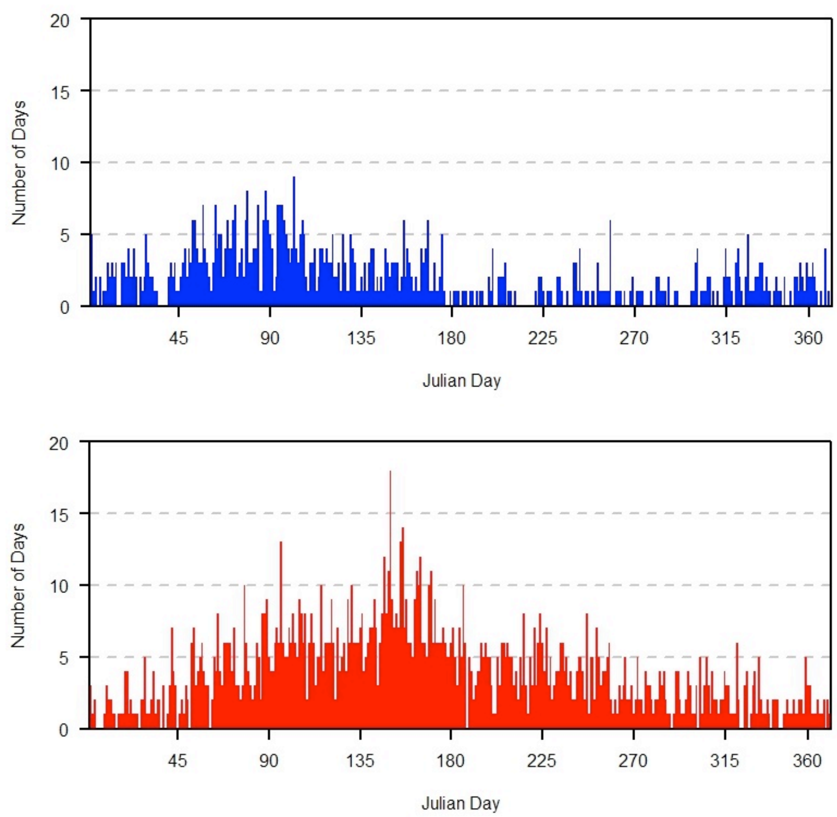

Figure 2. Total number of (top) sustained and (bottom) gust high-wind days by Julian day from 1973–2014 for the southern United States.

number of high-wind events that have resulted at these site locations.

A time series analysis was conducted to understand if the average high-wind direction has changed during 1973–2014. Figure 4 shows that the mean sustained and gust high-wind direction has shifted and become more southerly over the study period. This result may suggest that large-scale and synoptic circulations are changing as a result of possible various scenarios. However to further speculate about this potential finding is beyond the purpose of the paper and requires additional research before any conclusive statement can be made.

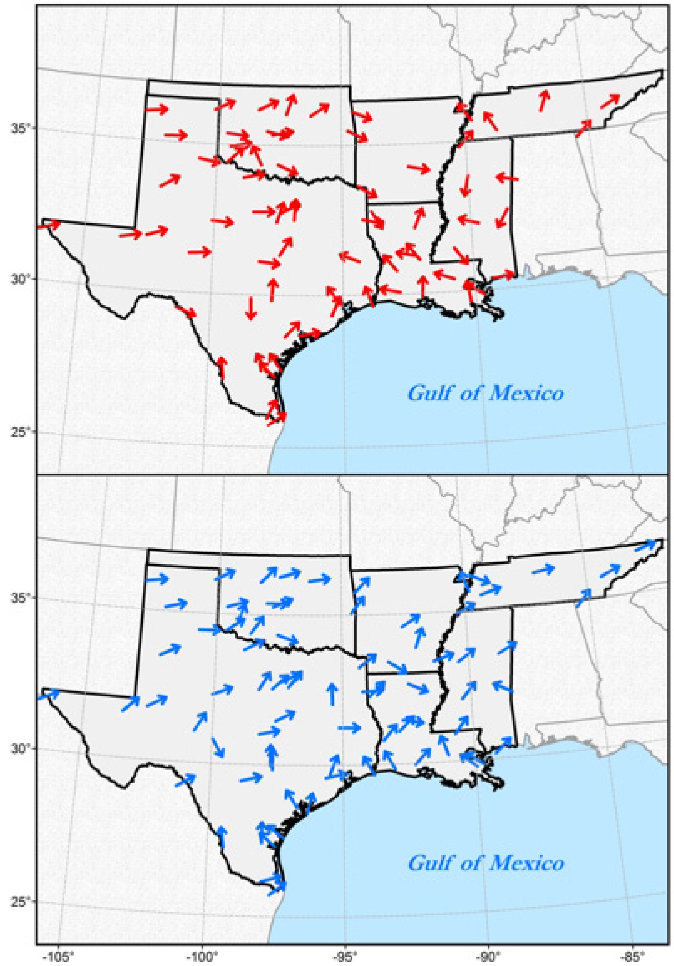

Figure 3. Average high-wind direction based on (top) sustained and (bottom) gust observations for the southern United States during 1973–2014.

Conclusions

This paper examined the high-wind characteristics of 77 stations located in southern United States from 1973–2014. This study classified high-wind days and observations using NWS high-wind warning and watch criteria and found distinct temporal and spatial patterns with respect to wind direction and frequency of days and observations. High-wind days tend to most frequently occur during the winter and spring with the exception of gust high-wind days which are typically observed during late spring and early summer. These findings suggest that gust observations are more influenced by thunderstorm activity whereas nonconvective frontal boundaries are more prevalent during late winter and early spring and are associated with sustained events. A spatial analysis shows that three wind direction groups were determined for the study area. Finally, annual mean sustained and gust high-wind direction has started to more of a southerly direction over the lifespan of the study period.

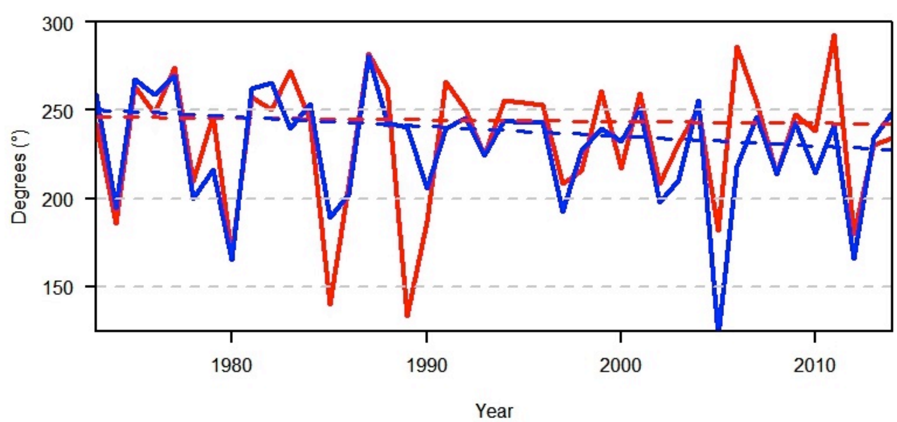

Figure 4. Annual mean direction (°) of sustained (red) and gust (blue) observations with dash lines representing linear trends.

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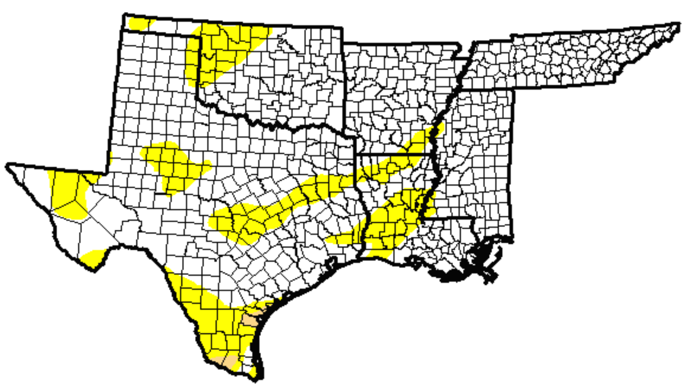
Drought Update

Luigi Romolo,
Southern Regional Climate Center

February was a drier than normal month for Texas, Oklahoma, Arkansas and Louisiana. Though this is the second consecutive dry month, the Southern Region remains drought-free. Some small pockets of abnormally dry (D0) have been identified and will be closely monitored by the National Drought Mitigation's Drought Monitor Team.

On February 2, 2016, several tornadoes were reported in east central Mississippi. These were the result of thunderstorm activity from a cold front that passed through the region. Damage was reported in the following counties: Newton, Lauderdale, Kemper, and in Crockett County, Tennessee, where one injury was reported.

A cold front produced several severe thunderstorms on February 23, 2016. These storms wreaked havoc in southern Louisiana and central Mississippi. Two fatalities were reported in St. James Parish, Louisiana from an EF-3 rated twister. Gold's Gym in Prairieville, Louisiana suffered major damage while the gym was in use, and fortunately no one was seriously injured. Another fatality was reported in Lamar County, Mississippi. Significant damage was reported in several counties throughout the area of these storms.



Released Thursday, March 3, 2016
David Miskus, NOAA/NWS/NCEP/CPC

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	80.47	19.53	0.55	0.00	0.00	0.00
Last Week *2/23/2016*	88.01	11.99	0.40	0.00	0.00	0.00
3 Months Ago *12/1/2015*	96.28	3.72	0.00	0.00	0.00	0.00
Start of Calendar Year *12/29/2015*	97.72	2.28	0.00	0.00	0.00	0.00
Start of Water Year *9/29/2015*	36.88	63.12	37.43	18.31	5.72	0.00
One Year Ago *3/3/2015*	36.76	63.24	35.83	20.17	10.48	2.47

Intensity:

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

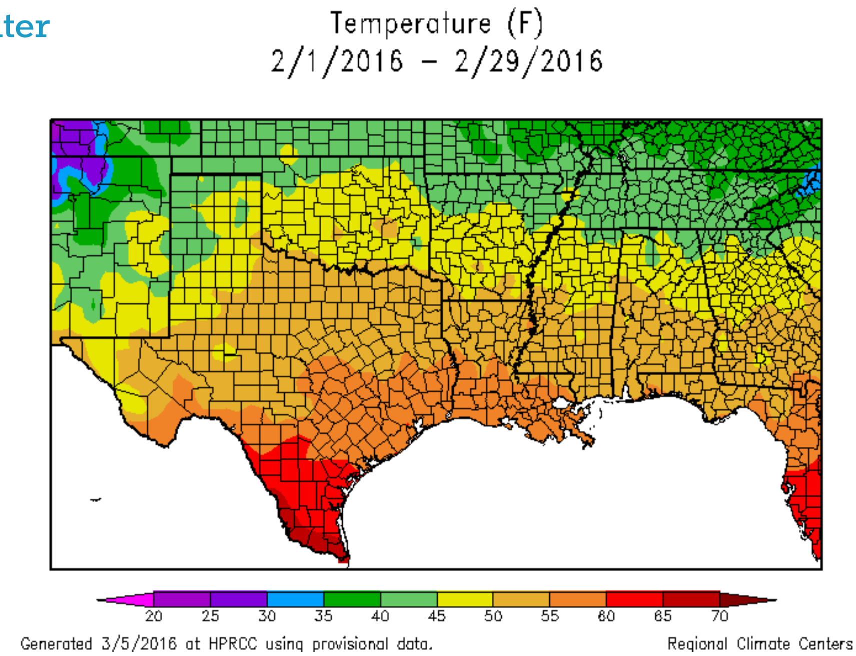
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Above: Drought conditions in the Southern Region. Map is valid for March 1, 2016. Image is courtesy of National Drought Mitigation Center.

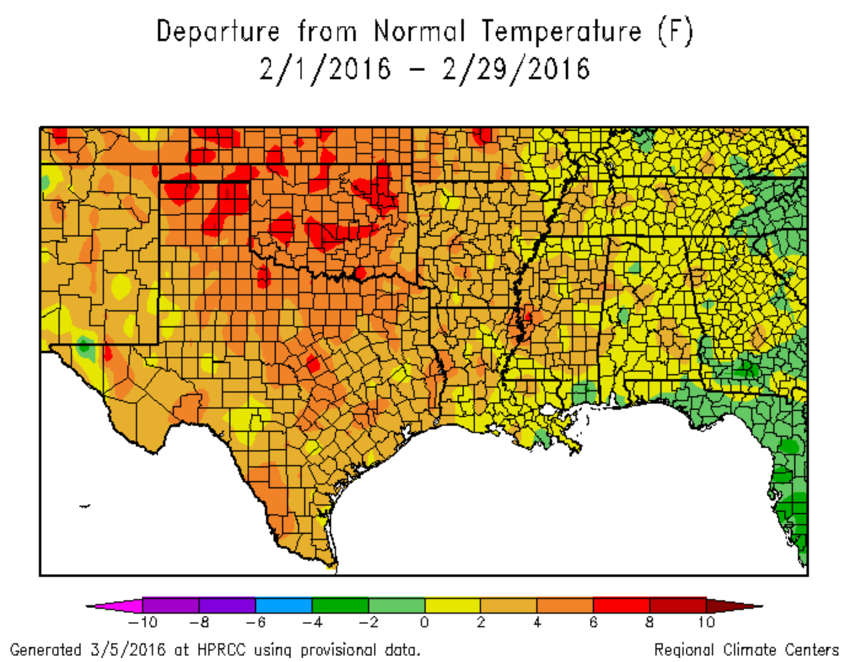
Temperature Summary

Luigi Romolo,
Southern Regional Climate Center

February was a cold month for all six states in the Southern Region. In Texas and Oklahoma, temperatures averaged between 2 to 5 degrees F (1.11 to 2.78 degrees C) below normal. Elsewhere, temperatures were even colder, ranging between 5 to 10 degrees F (2.78 to 5.56 degrees C) below normal. Further to this, stations in northern Tennessee reported average temperatures between 10 and 15 degrees F (5.56 to 8.33 degrees C) below the monthly normal. The state-wide average temperatures are as follows: Arkansas averaged 36.20 degrees F (2.33 degrees C), Louisiana averaged 47.50 degrees F (8.61 degrees C), Mississippi averaged 41.80 degrees F (5.44 degrees C), Oklahoma averaged 38.10 degrees F (3.39 degrees C), Tennessee averaged 31.40 degrees F (-0.33 degrees C), and Texas averaged 48.40 degrees F (9.11 degrees C). Both Arkansas and Tennessee recorded their eighth coldest February on record (1895-2015). For Mississippi it was the eleventh coldest February, while Louisiana posted its fourteenth coldest February on record (1895-2015). All other state rankings fell within the two middle quartiles.



Average February 2016 Temperature across the South

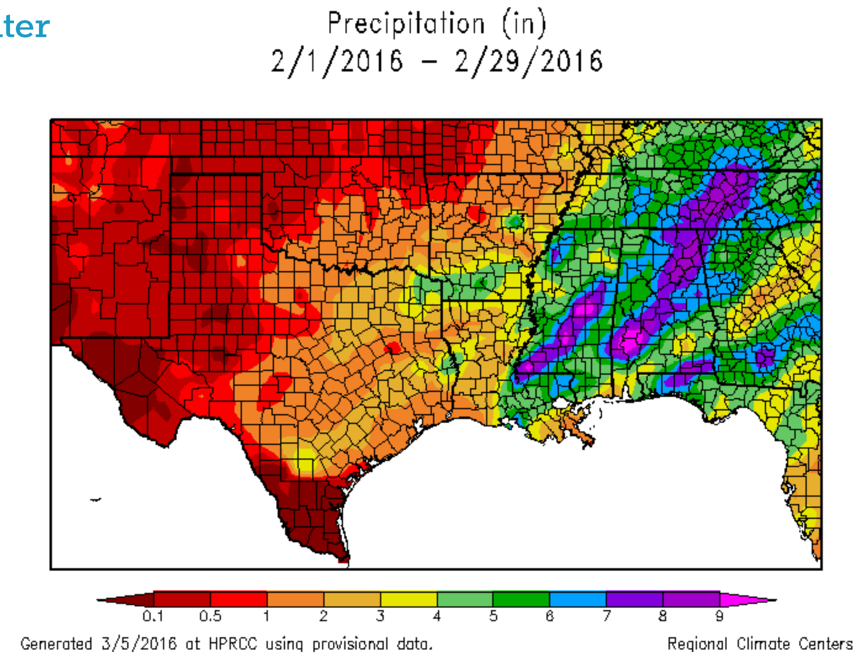


Average Temperature Departures from 1971-2000 for February 2016 across the South

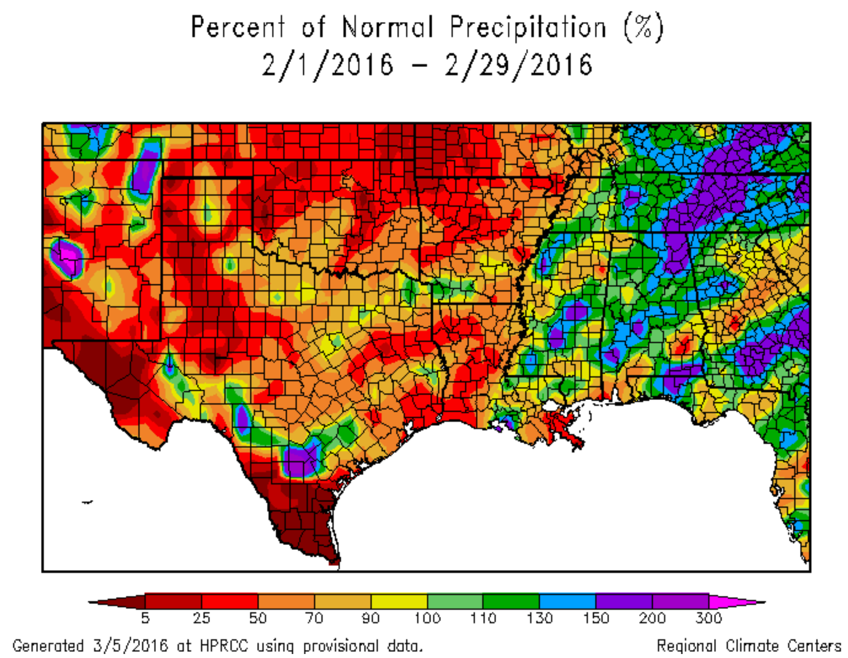
Precipitation Summary

Luigi Romolo,
Southern Regional Climate Center

Precipitation totals across the Southern Region varied spatially in the month of February, with Mississippi and Tennessee experiencing a wetter than normal month. The remaining four states to the west experienced a drier than normal month. The driest portions of the region included much of Oklahoma and western Texas, the extreme south of Texas, and northwestern Arkansas. Stations in these areas typically averaged less than half the normal precipitation, with many stations recording less than twenty-five percent of normal. Eastern Tennessee represents the wettest portion of the region, with stations averaging over one and a half times the normal precipitation. The state-wide precipitation totals for the month are as follows: Arkansas reporting 2.49 inches (63.25 mm), Louisiana reporting 3.27 inches (83.06 mm), Mississippi reporting 5.38 inches (136.65 mm), Oklahoma reporting 0.88 inches (22.35 mm), Tennessee reporting 5.70 inches (144.78 mm), and Texas reporting 1.05 inches (26.67 mm). The state precipitation rankings for the month are as follows: Arkansas (thirty-first driest), Louisiana (thirty-sixth driest), Mississippi (forty-ninth wettest), Oklahoma (thirtieth driest), Tennessee (twenty-sixth wettest), and Texas (thirty-sixth driest). All state rankings are based on the period spanning 1895-2016.

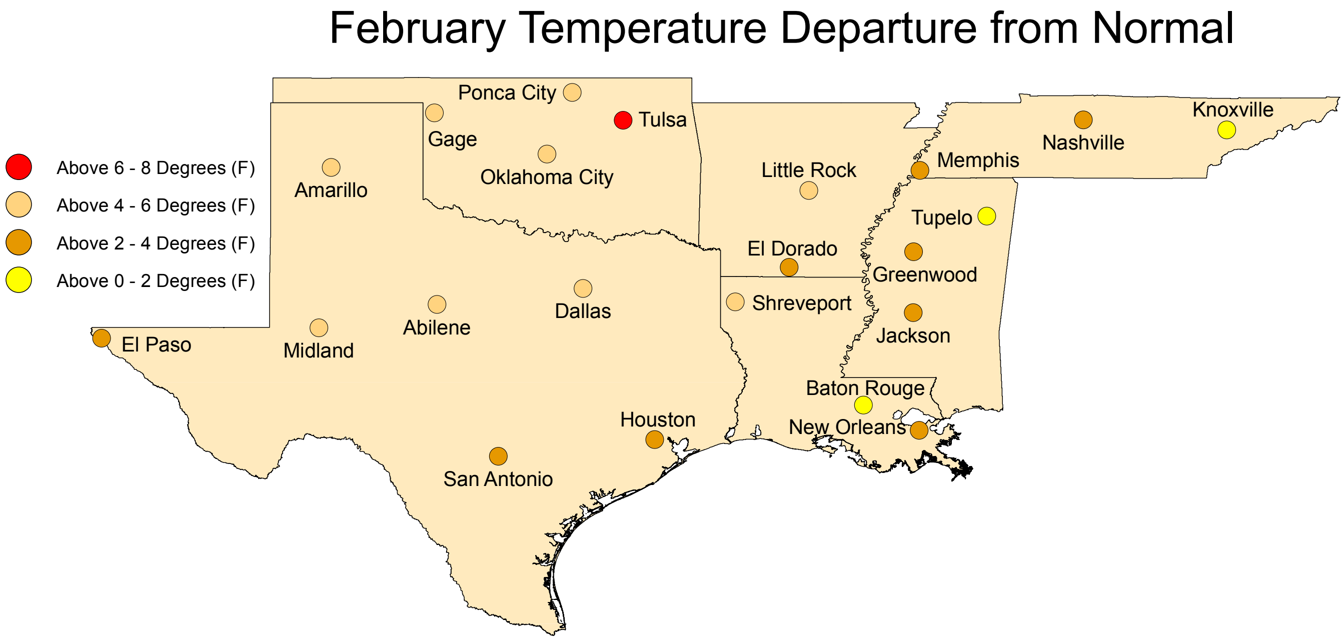


February 2016 Total Precipitation across the South

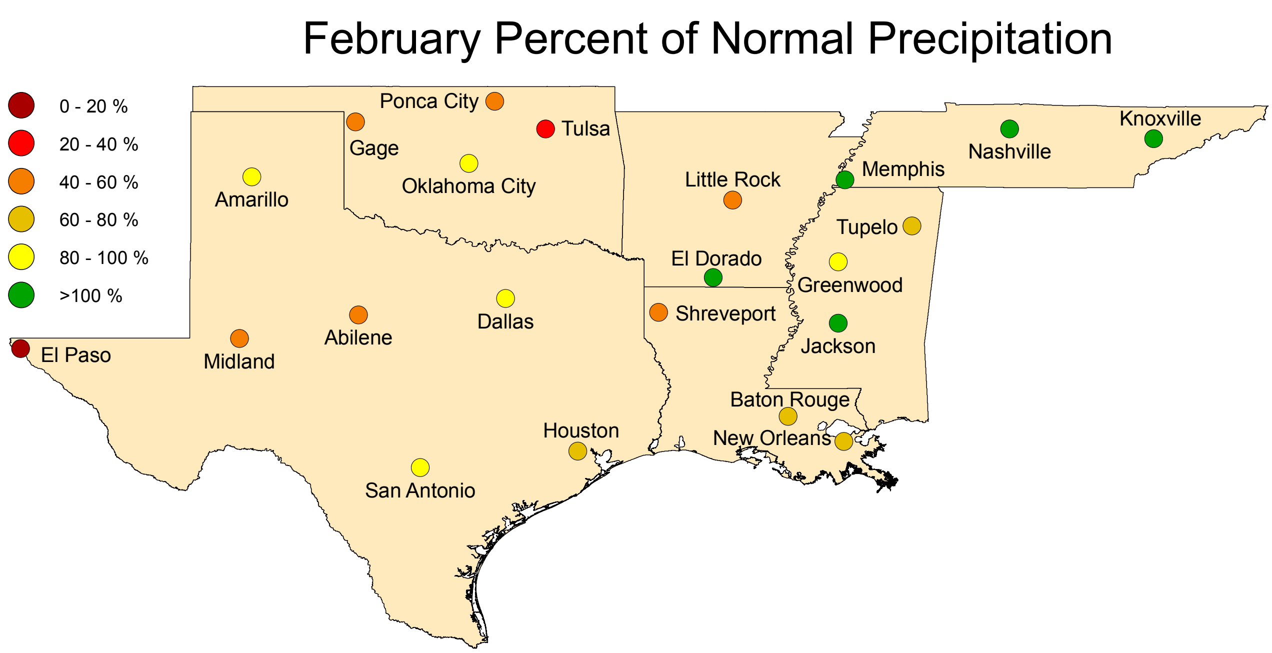


Percent of 1971-2000 normal precipitation totals for February 2016 across the South

Regional Climate Perspective in Pictures



February 2016 Temperature Departure from Normal from 1971-2000 for SCIPP Regional Cities



February 2016 Percent of 1971-2000 Normal Precipitation Totals for SCIPP Regional Cities

Climate Perspective

State	Temperature	Rank (1895-2011)	Precipitation	Rank (1895-2011)
Arkansas	46.90	24th Warmest	2.49	31st Driest
Louisiana	55.00	32nd Warmest	3.27	36th Driest
Mississippi	50.80	33rd Warmest	5.38	48th Wettest
Oklahoma	47.30	8th Warmest	0.88	30th Driest
Tennessee	42.40	40th Warmest	5.70	26th Wettest
Texas	54.30	11th Warmest	1.05	36th Driest

State temperature and precipitation values and rankings for February 2016. 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	63.5	38.2	50.8	3.0	78	02/19	23	02/05	4.85	0.06	101
Little Rock, AR	60.0	38.6	49.3	4.5	75	02/21+	27	02/10+	2.14	-1.52	58
Baton Rouge, LA	68.3	43.7	56.0	0.9	79	02/20+	30	02/06+	3.58	-1.46	71
New Orleans, LA	68.7	49.1	58.9	2.2	79	02/02	36	02/06	3.72	-1.58	70
Shreveport, LA	66.8	43.0	54.9	4.3	79	02/19+	26	02/05	2.15	-2.60	45
Greenwood, MS	61.6	38.3	49.9	2.4	79	02/02	19	02/10	4.27	-0.15	97
Jackson, MS	64.5	40.8	52.6	3.1	77	02/02	23	02/10	8.23	3.47	173
Tupelo, MS	58.6	37.0	47.8	1.9	73	02/29+	20	02/10	3.33	-1.63	67
Gage, OK	62.6	26.7	44.6	5.9	90	02/18	16	02/04	0.33	-0.46	42
Oklahoma City, OK	61.8	35.6	48.7	5.0	83	02/20	20	02/04	1.35	-0.23	85
Ponca City, OK	60.1	30.3	45.2	5.5	79	02/18	16	02/26	0.80	-0.54	60
Tulsa, OK	61.6	35.7	48.7	6.4	82	02/20	22	02/04	0.59	-1.26	32
Knoxville, TN	50.5	34.5	42.5	0.1	75	02/02	19	02/14+	7.12	2.86	167
Memphis, TN	57.3	38.9	48.1	2.6	75	02/02	24	02/10	5.58	1.19	127
Nashville, TN	53.2	34.9	44.0	2.4	75	02/02	19	02/10	4.46	0.52	113
Abilene, TX	67.2	39.3	53.3	4.7	83	02/19+	23	02/04	0.68	-0.68	50
Amarillo, TX	62.1	30.1	46.1	5.8	86	02/18	14	02/03	0.50	-0.06	89
El Paso, TX	69.0	36.9	53.0	2.9	85	02/18	21	02/06	0.07	-0.39	15
Dallas, TX	66.9	43.4	55.2	5.3	79	02/19	31	02/04	2.20	-0.47	82
Houston, TX	70.9	47.3	59.1	2.7	81	02/19	33	02/05	1.95	-1.25	61
Midland, TX	68.2	37.0	52.6	4.1	87	02/19	22	02/04	0.30	-0.41	42
San Antonio, TX	72.1	46.3	59.2	3.6	82	02/12	30	02/07	1.55	-0.24	87

Summary of temperature and precipitation information from around the region for February 2016. 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.

2015 Was Warmest Year on Record

Barry Keim, Louisiana State Climatologist, Louisiana State University

The year 2015 is now in the record books. All of the weather and climate data have been processed, quality assurred and controlled, whisked, kneaded, and sliced and diced for the globe, and are plotted in Figure 1. What the graphic shows is the annual average tempearture for each year since 1880, ending with 2015. And wouldn't you know it, but 2015 was the warmest year on record, edging out the previous warmest year on record - 2014. What is interesting about 2015 is that it's not even close, as it crushed the previous record. In fact, every single month of 2015 was warmer than any month for the top 7 warmest years on record, and 11 of the 12 months for 2015 set a new global temperature record for the month (Figure 2). The only exception was in January, when one other year - not in the top 7 warmest years - had the warmest on record. It is likely that El Nino contributed to the exceptionally warm 2015, but it certainly is not the only contributing factor, as we've had many other El Nino years buried within this 136 year record. So if you feel as if you've had a little more sweat under the collar last year, you'd be correct and are very observant. These mild temperatures are wonderful in winter in Da Parish, but look out come summer if this pattern continues. Stay cool St. Bernard. If you have any questions, feel free to contact me at keim@lsu.edu.

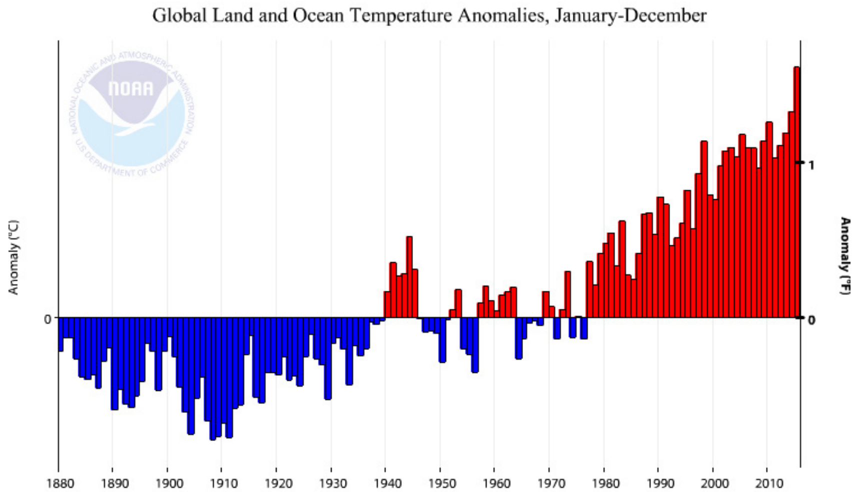


Figure 1. Global temperature curve from 1880-2015. Graphic is from the National Center for Environmental Information and is found at https://www.ncdc.noaa.gov/cag/time-series/global/globe/land_ocean/ytd/12/1880-2015.

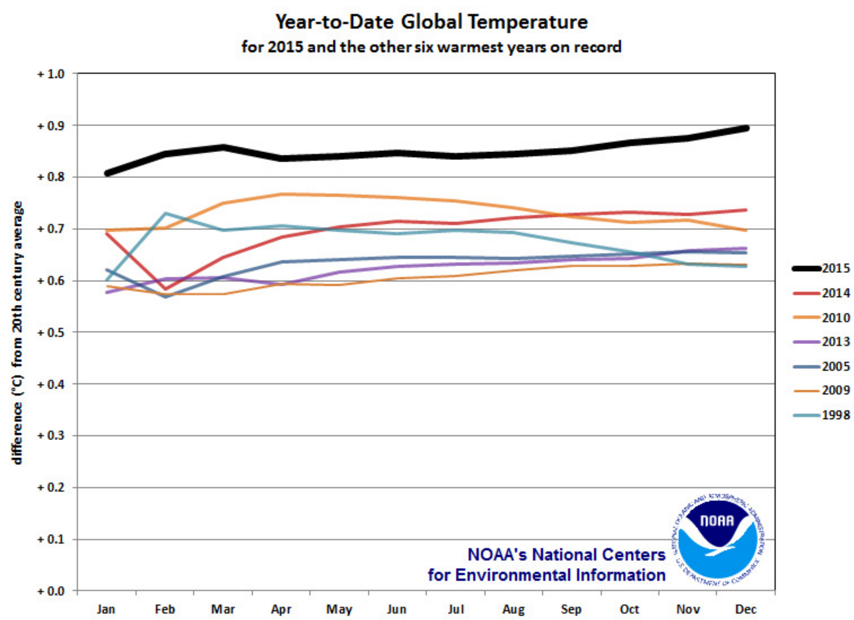


Figure 2. Global monthly average temperatures for 2015 compared to global monthly temperatures for the other 6 warmest years on record. Image is from the the National Center for Environmental Information and is found at https://www.ncdc.noaa.gov/sotc/global/201513/supplemental/page-3.

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