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An Assessment of the Climate Information Needs of Oklahoma Decision Makers

Rachel Riley, University of Oklahoma

Climate impacts are frequently experienced on a local scale. Decision makers must be knowledgeable and have access to the appropriate information in order to make sound choices, and climate information providers should try to understand the needs of their users. Interaction between climate scientists and decision makers is crucial (U. S. Global Change Research Program 2009a) so that research is fruitful and decision makers' needs are being met.

SCIPP conducted a climate information needs assessment for decision makers in Oklahoma in 2010 and 2011. Twenty-three semi-structured interviews were conducted with representatives from a variety of agencies in the sectors of water resources, energy, transportation, agricultural production, ecosystems, human health, and society/public safety. Some participants fell into more than one sector.

This study aimed to answer four research questions: 1) What do decision makers in Oklahoma think are the most significant climate-related issues facing them today?; 2) What do they think are the most significant climate-related issues they will face in the future?; 3) What are the spatial and temporal scales in which they make decisions?; and 4) What do they perceive as their most substantial climate-related research needs? The full report is located at http://www.southernclimate.org/publications/OK_Climate_Needs_Assessment_ Report_Final.pdfand a summary of the findings is presented below.

Figure 1: Field conditions in the Oklahoma Panhandle in April 2011 during a drought. Photo: Ladene Beer

Current Climate-Related Issues

It was important to get a baseline understanding for how climate currently impacted decision makers before asking the participants about their future concerns. The participants cited being impacted by numerous climate-related events such as extreme cold, extreme heat, and severe winds. However, the events cited most frequently were flash floods and droughts, followed by water resource issues, ice storms, and tornadoes. Some of the particular issues included power outages caused by strong winds or ice storms, limited water supply or stunted crop growth due to drought (e.g., Figure 1), buckling roads due to extreme heat, and invasive crop species due to untimely freezes and warmth. Whatever the issue, it was clear that climate has a tremendous impact on the operation of Oklahoma agencies.

Future Climate-Related Concerns

Climate projections for Oklahoma include more intense but less frequent rain events, an increase in the frequency of hot extremes and heat waves, the warm season becoming longer and arriving sooner, and a decreasing number of cold extremes. More intense but less frequent rain events, which would lead to an increase in flooding rain and drought, was the most commonly cited change that would have the greatest impact.

In a period of drought, competing interests for water (e.g., energy production, drinking, and recreation) mean that problems can arise when water is in short supply. Alternatively, heavy rain and floods deposit sediment into places it should not be, such as reservoirs. This decreases the water storage capacity of the reservoir. Heavy rain and flooding is also abusive to road and bridge infrastructure. A transportation engineer said design equations take shear velocity into account, which is very different for flash flood type events. So, the design equations would need to change if rainfall patterns were to change.

A lengthening growing season would produce tradeoffs for the agriculture sector. On one hand, a warmer climate would mean that crops would have more time to grow. Alternatively, a warmer climate would also be conducive to invasive pests, which can be problematic for agriculture producers. Lengthening warm seasons also impact wildlife. One biologist noted that temperature changes can alter the timing of incubation. If the air temperature is warm enough to incubate a hen's egg before she is ready to sit on it, unsynchronized hatching might occur and the hen would not be able to take care of all her chicks.

Scales of Decision-Making

If climate projections are to be useful to decision makers, they should be presented in a way that is consistent with the temporal and spatial scales that are useful for planning activities. To this end, the participants were asked about their maximum planning timescales. The participants in all but two of the seven sectors cited a maximum horizon of 15 years or less (Figure 2). The transportation and water resource sectors have a longer planning horizon—50 and 100 years respectively. These two sectors build and maintain large, expensive infrastructure such as dams, reservoirs, bridges, and highways, so they have to make sure that the infrastructure lasts a long time.

Spatially, the most commonly cited scale needed for climate projections was a resolution that broke the state into four to five regions. However, the agricultural participants said climate projections would not be useful to them unless they are provided at the city/farm scale, one reason being the extremely variable precipitation in Oklahoma. The precipitation is often very localized, and crop producers need model projections to have a very high spatial resolution for them to be usable. Moreover, the participants in the agriculture and water resources sectors were primarily interested

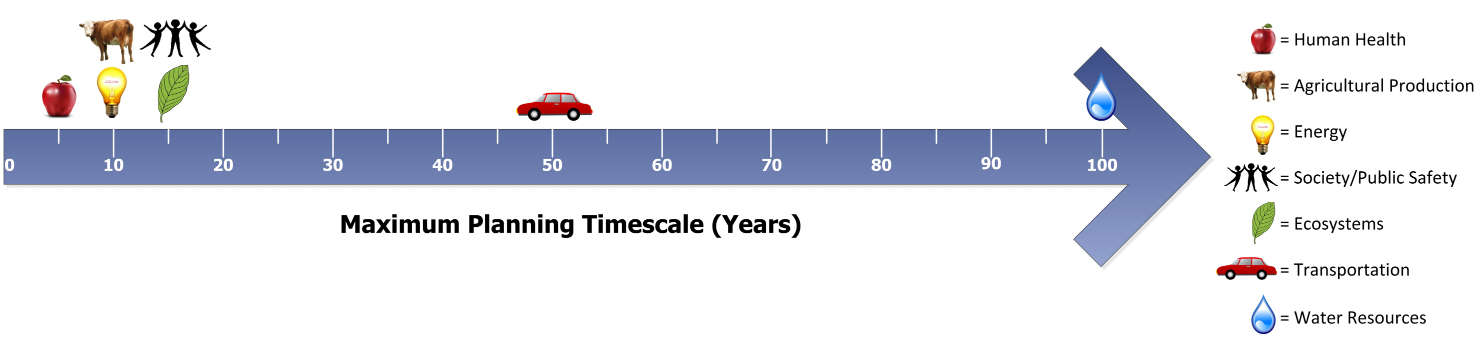

Figure 2: Maximum planning timescale for each sector, as stated by the participants in the Oklahoma climate needs assessment. Icons correspond to the following sectors (from left to right): human health, agriculture, energy, society/public safety, ecosystems, transportation, and water resources.

in river basin and sub-basin scales as opposed to scales based on political boundaries. Information also needs to extend beyond the Oklahoma state boundaries, since decision makers often work across those boundaries or need to prepare for changes occurring in other parts of the country that might impact them in the future.

Research Needs

One of the most substantial research needs, aside from providing decision makers with model projections on the scales that are useful to them, was to determine the critical thresholds that are used for decision making or taking action. Morss et al. (2011) also came to this conclusion. For example, a critical threshold might include the temperature at which a crop no longer grows or the rain rate at which substantial flooding occurs in a city. Meteorologists and climatologists have ideas about what thresholds are important (e.g. 100 degrees F, 57 mph winds) but information is valuable to decision makers only when it is presented in a way that is consistent with the point(s) at which they take action.

Another need that surfaced across numerous sectors was the need to understand changes in second order variables such as evaporation rates, soil temperature and moisture, days near or below freezing, or air pollutant levels, as opposed to just first order variables like precipitation and temperature. Temperature and precipitation trends are too abstract for many decision makers to be able to understand how climate change might impact them.

Conclusions

The points discussed here only provide a summary of the wealth of knowledge gained through this study on the climate-related needs of decision makers in Oklahoma. While the attempt was made to gather as in-depth information as possible across a variety of sectors in Oklahoma, the assessment was not comprehensive nor is it generalizable to all Oklahoma decision makers. Yet, it provides a stepping stone to begin to understand the climate-related issues that Oklahoma decision makers are dealing with and/or might deal with in the future, and insight into how the climate community might better serve them.

References

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Gulf Coast Climate Needs Assessment Survey

Hal Needham, Louisiana State University

The Gulf Coast Climate Needs Assessment Survey was conducted to better understand the climate information needs of decision makers along the Gulf Coast. We conducted 62 one-hour interviews with coastal stakeholders in Louisiana, Mississippi and Texas. Respondents represented 13 professional sectors, including emergency management- homeland security, planning-permitting- building, local government, economic development- trade association, agriculture-farming, fishing- marine harvesting, research-education- outreach, harbors- ports- yacht clubs, healthcare and energy.

The first component of the survey involved defining the word "climate," as well as discussing the roles of temperature, precipitation and sea-level rise in a larger climate context. As we developed these handouts specifically for this survey, we were able to adapt them for the coastal zone. These handouts provided an overview of observed changes and future projections of temperature, precipitation and sea-level rise for the nation and the Gulf Coast region.

Two research questions addressed in this survey related to the most significant present and future climate-related issues facing stakeholders in the region. Hurricanes were listed as the most severe issue, followed by storm surge and rainfall flood for both the present and future. Wind storm was presently listed as the fourth biggest issue, followed by sea-level rise, but in the future, respondents believed sea-level rise will be a bigger issue than wind storms.

Some respondents have already taken steps to adapt to coastal hazards, such as hurricanes and storm surge flooding. For example, a yacht club on the Texas coast upgraded its infrastructure to reduce losses to storm surge. This facility installed

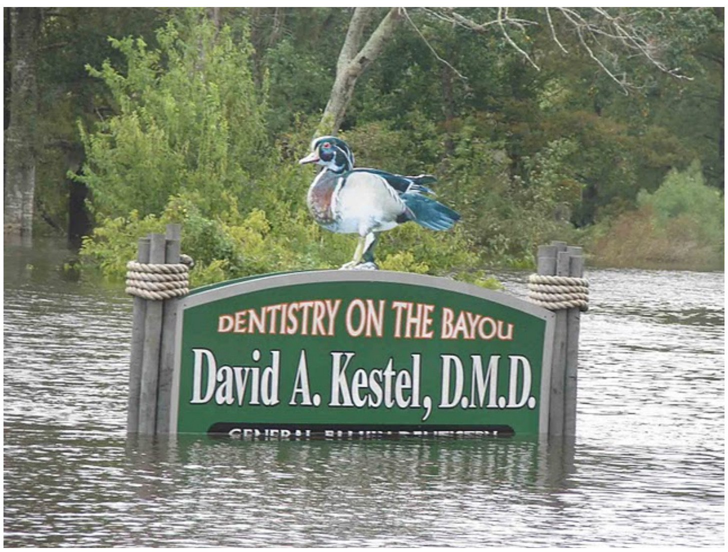
Above: Floating docks break away from the pier during storm surge events, preventing the docks from pulling boats away. Photo: Hal Needham

Below: Tide risers enable moorings to rise when sea levels are elevated. Photo: Hal Needham

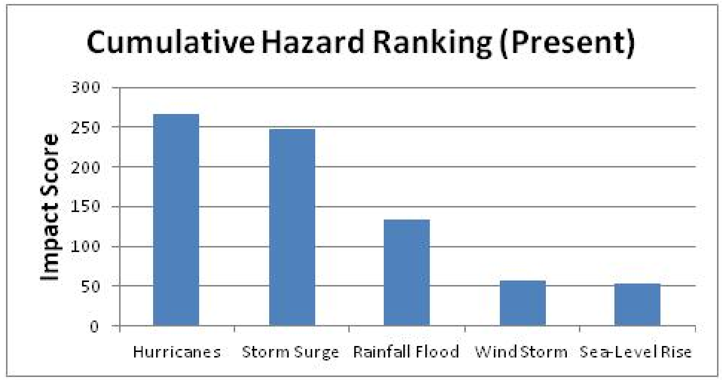
floating docks, which rise and break away during coastal flood events, so that the docks do not rise and pull out the boats. This facility also installed tide risers, buoyant devices attached to dock pilings, which enable moorings to rise with the boat as water levels rise. Although Hurricane Ike caused $5 million in damage to this facility, these improvements will likely reduce losses in a similar storm to around $1 million.

The survey also provided valuable information on the spatial scales for which stakeholders need weather and climate information. Local data was selected as the most beneficial type of information, as approximately 60% of respondents indicated that such data would be beneficial. Approximately 42% of respondents indicated that state and multi-state data would be beneficial. More than 20% of respondents indicated that marine or offshore data would be beneficial, including information on wave direction and heights, offshore currents and water temperature.

In regards to temporal scales of data, approximately 60% of respondents indicated that weather and climate impact their profession daily. Such respondents included farmers and fishermen, who respond to the environment daily in their professional operations. Many local government personnel often use weather and climate information daily as well. For example, permitting specialists must confirm that building permits are not issued within a flood plain, while emergency management personnel may need wind data to help fight a chemical fire.



Hurricane Ike's storm surge inundated much of South Louisiana in 2008. Survey respondents indicated that hurricanes and storm surge are the two biggest present and future weather/ climate hazards in this region. Photo: Hal Needham



Stakeholders indicated that hurricanes and storm surge are the two biggest weather and climate hazards impacting the coastal region. Rainfall floods ranked third, followed by wind storm and sea-level rise.

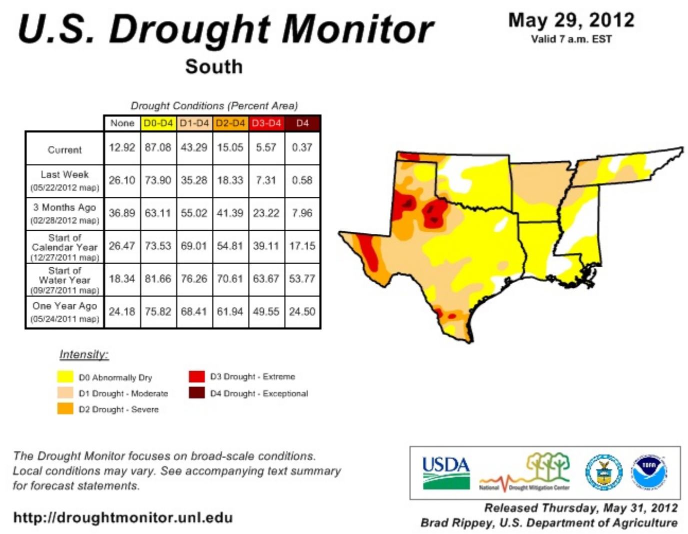
Most respondents felt that SCIPP could help them in the future, especially by providing climate information that is applicable to the sector in which they worked. Approximately 85% of respondents identified some tool or visualization that could be helpful in the future. Many stakeholders indicated that web-based tools, graphics and visualizations are most helpful for decision making, as they enable users to quickly understand weather and climate information.

DROUGHT CONDITIONS and Severe Weather

Luigi Romolo, Southern Regional Climate Center

Consistent dryness over much of the Southern Region has led to an expansion of drought in some areas, while above average precipitation has led to improvements in other areas. In the case of the latter, high precipitation in southwestern Texas, has led to the removal of all exception drought in that portion of the state. Though moderate drought remains, this is a significant improvement over last month, where most of the area was riddled with severe to extreme drought. In northern Arkansas, where precipitation was below normal for much of the month, there has been an introduction of moderate drought. This also includes portions of northeastern Mississippi and western Tennessee, where conditions were also drier than normal over the past several weeks.

On May 10, 2012, over a dozen tornadoes touched down in southern Texas. In La Salle County, two people were reported injured.

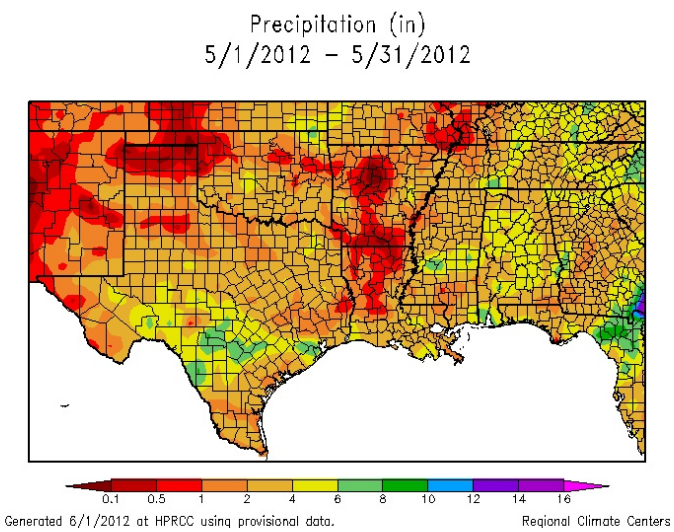


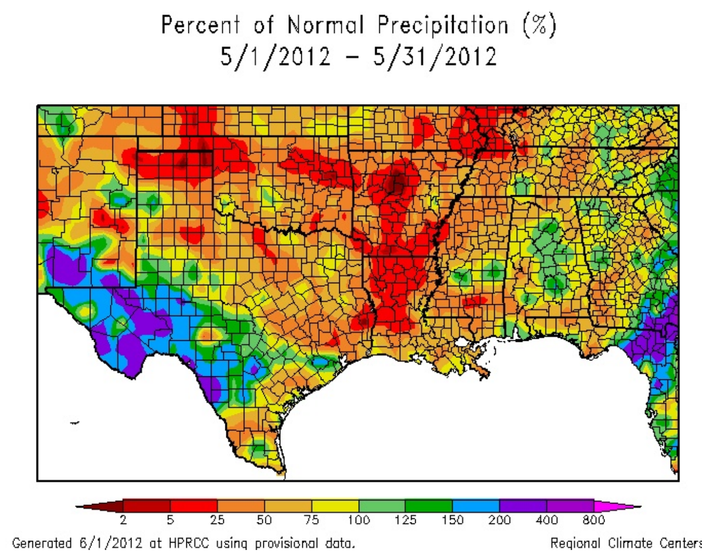
Drought Conditions in the Southern Region. Map is valid for May 29, 2012. Image is courtesy of the National Drought Mitigation Center.

PRECIPITATION SUMMARY

Luigi Romolo, Southern Regional Climate Center

With the exception of southwestern Texas, May was a rather dry month for the bulk of the Southern Region. Precipitation was scarce in the central portions of the region where most stations recorded less than one fourth of the normal monthly totals. This was also the case for most of the Texas and Oklahoma panhandle region. Elsewhere, values ranged mostly between twenty-five and fifty percent of normal. Southwestern Texas was the only portion of the region that observed above normal rainfall, with precipitation totals ranging from one and one half to four times of normal. Despite that, Texas' state wide precipitation average was slightly on the dry side with a total of 2.81 inches (71.37 mm). Arkansas, Oklahoma and Louisiana had the highest state-wide precipitation rankings. For Oklahoma, which received a total of 2.33 inches (59.18 mm), it was the eleventh driest May on record (1895-2011). It was the second driest May on record in Arkansas, which saw only 1.63 inches (41.40 mm) of precipitation. Louisiana averaged 2.26 inches (57.40 mm) of precipitation, which makes it their fifteenth driest May on record (1895-2012). For Mississippi, it was the thirty-third driest May on record, which is based on a state-wide precipitation total of 3.05 inches (77.47 mm). Lastly, Tennessee experienced its twenty-eighth driest May on record, with a state wide precipitation total of 3.26 inches (82.80 mm).



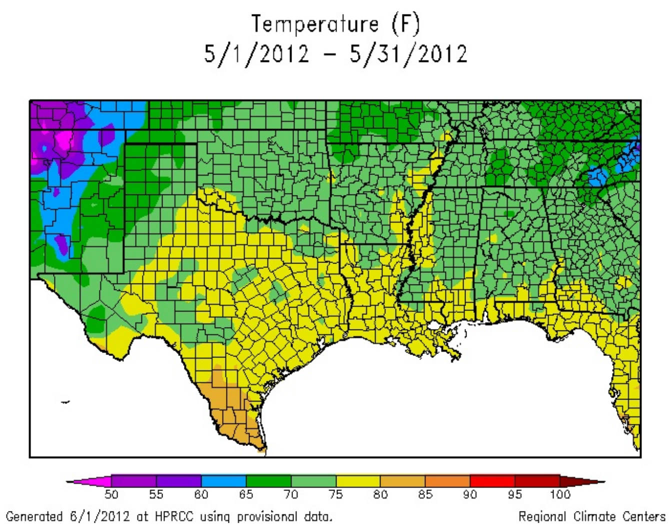


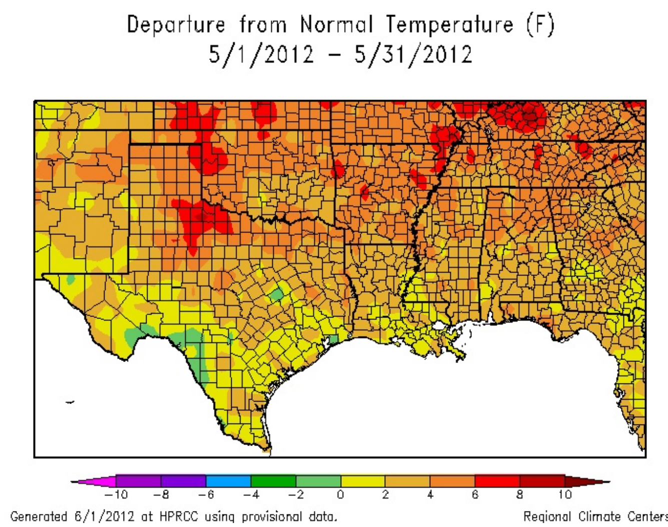
Total precipitation values (left) and The percent of 1971-2000 normal precipitation totals (right) for May 2012.

TEMPERATURE SUMMARY

Luigi Romolo, Southern Regional Climate Center

As was the case in the past few months, the Southern Region experienced yet another warmer than normal month in May. Temperature values were slightly higher in the northern half of the region, ranging from 4 to 8 degrees F (2.22 to 4.44 degrees C) above normal, while in the southern half of the region, values ranged from approximately 2 to 4 degrees F (1.11 to 2.22 degrees C) above normal. Arkansas, Oklahoma and Tennessee had the highest state temperature rankings in the region. Arkansas experienced its fourth warmest May on record, with a state average temperature of 73.10 degrees F (22.83 degrees C). For Oklahoma, it was the fifth warmest May on record (1895-2012), while for Tennessee, it was their sixth warmest May on record (1985-2012). Oklahoma had a state wide temperature average of 72.20 degrees F (22.30 degrees C), while Tennessee had a state wide temperature average of 70.40 degrees F (21.33 degrees C). Temperature rankings were also high in the three remaining states. Texas experienced its eleventh warmest May on record (1895-2012) with a state average temperature of 75.40 degrees F (24.11 degrees C). In Louisiana, the state average temperature was 76.00 degrees F (24.44 degrees C) or the twelfth warmest May on record (1895-2012). Mississippi had its fourteenth warmest May on record (1895-2012) with a state average temperature o f 74.00 degrees F (23.33 degrees C).



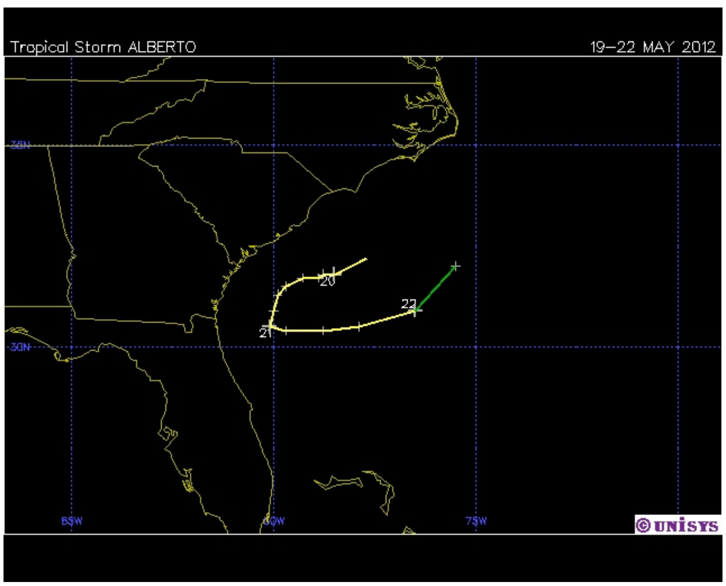


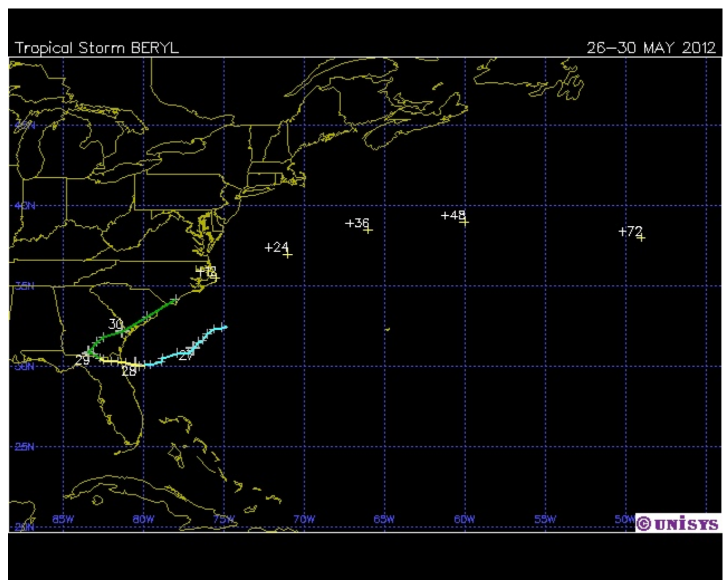
Average temperatures (left) and departures from 1971-2000 normal average temperatures (right) for May 2012, across the South.

2012 Hurricane Season Gets Off to Early Start

Barry D. Keim, Louisiana State Climatologist

Despite the forecasts for a near average hurricane season in 2012, the season is already off to a rapid start. Two named storms occurred in the month of May 2012 – Tropical Storms Alberto and Beryl (See Figure below for the hurricane dates and tracks). Both of these storms formed along the East Coast of the United States, near the Carolinas. While having 2 storms at this point of the season is not unprecedented, this is very uncommon. In fact, over the past 161 years, not including the 2012 season, we have had 2 named storms occur before the official start of hurricane season on 1 June only twice; in 1908 and in 1887….and now three times! So to have two storms before 1 June, we need to reach back over 100 years – 104 to be specific - to find the last time this occurred. This clearly raises the question as to whether the forecasts for this upcoming season are accurate, and are perhaps underscoring how active this upcoming season might be. Using the years 1887 and 1908 as a guide for the rest of this year, these years with early starts ended up with 19 and 10 named storms, respectively. The disparity between these seasons suggest that early season storms do not lend much insight into how a full season will turn out. Only time will tell. However, my best guess is that when we add up all the storms at the end of the season, we won't be far removed from the 10-12 named storms originally forecast.





Tracks of 2012 early season tropical storms Alberto (left) and Beryl (right). Images from http://weather.unisys.com/hurricane/atlantic/2012/index.php

CLIMATE PERSPECTIVE

State	Temperature	Rank (1895-2011)	Precipitation	Rank (1895-2011)
Arkansas	73.10	4th Warmest	1.63	2nd Driest
Louisiana	76.00	12th Warmest	2.26	15th Driest
Mississippi	74.00	14th Warmest	3.05	33rd Driest
Oklahoma	72.20	5th Warmest	2.33	11th Driest
Tennessee	70.40	6th Warmest	3.26	28th Driest
Texas	75.40	11th Warmest	2.81	45th Driest

State temperature and precipitation values and rankings for May 2012. 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	85.7	61.2	73.4	1.9	93	5/30+	49	05/10	0.21	-5.28	4
Little Rock, AR	86.6	64.5	75.6	5.5	97	05/29	55	05/10	1.23	-3.82	24
Baton Rouge, LA	88.3	66.5	77.4	3.4	94	5/30+	58	05/10	2.77	-2.57	52
New Orleans, LA	87.9	70.7	79.3	3.7	94	5/28+	65	05/13	1.77	-2.85	38
Shreveport, LA	87.5	65.8	76.6	3.6	94	5/29+	55	05/10	1.10	-4.15	21
Greenwood, MS	86.6	62.3	74.5	2.1	94	5/30+	50	05/10	2.07	-3.28	39
Jackson, MS	87.1	63.5	75.3	3.8	95	5/30+	53	05/10	6.69	1.83	138
Tupelo, MS	83.3	61.8	72.6	2.9	94	05/30	52	05/23	3.43	-1.91	64
Oklahoma City, OK	82.8	62.0	72.4	4.0	92	05/28	48	05/09	3.59	-1.85	66
Ponca City, OK	85.0	62.8	73.9	5.7	96	05/28	48	05/09	0.66	-4.26	13
Tulsa, OK	85.1	63.5	74.3	5.0	94	5/29+	50	5/22+	1.18	-4.93	19
Knoxville, TN	82.4	61.4	71.9	5.9	92	5/28+	47	05/11	3.61	-1.07	77
Memphis, TN	86.4	66.1	76.3	5.6	95	5/29+	55	05/10	3.17	-1.98	62
Nashville, TN	84.7	60.9	72.8	5.7	95	5/27+	47	05/11	4.01	-1.06	79
Amarillo, TX	83.9	55.2	69.5	4.4	100	05/25	45	05/12	1.53	-0.97	61
El Paso, TX	88.7	61.8	75.3	1.5	100	05/22	52	5/11+	0.53	0.15	139
Dallas, TX	88.0	67.8	77.9	4.8	96	05/29	60	5/16+	1.66	-3.49	32
Houston, TX	88.6	69.1	78.8	3.0	95	05/29	62	05/19	0.77	-4.38	15
San Antonio, TX	87.9	68.3	78.1	2.3	96	05/04	58	05/16	9.84	5.12	208

Summary of temperature and precipitation information from around the region for May 2012. 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. Blue-shaded boxes represent cooler than normal temperatures; red-shaded boxes denote warmer than normal temperatures; tan shades represent drier than normal conditions; and green shades denote wetter than normal conditions.

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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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