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Flood Information Needs: A Pilot Study of Emergency Managers

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Even though many areas of SCIPP are currently experiencing drought, flood events have occurred in the past year. Most notably, significant portions of Arkansas, Louisiana, Mississippi, and Tennessee were flooded when the Mississippi River reached record heights in May and June of 2011. In addition to instances of localized flooding, Tropical Storm Lee came ashore on September 1, 2011, affecting parts of Louisiana, Mississippi, and Tennessee. Flash floods have also historically caused significant property damage and death in Texas and Oklahoma.

More people in the United States die from flooding than any other form of severe weather, according to the National Weather Service. About half of all fatalities associated with tropical cyclones are from inland flooding, and almost half of flash flood fatalities occur in vehicles. The incidence and serious consequences associated with floods led NOAA to promote March 12-16, 2012, as Flood Safety Awareness Week.

In light of the significance of flooding, a team of SCIPP researchers is working with three River Forecast Centers (RFC) to learn more about how emergency managers and other decision makers use flood-related information. River Forecast Centers are regional centers within the NWS that issue river stage forecasts and support Weather Forecast Offices in the issuance of flood warnings. The participating RFCs are the Lower Mississippi, the Arkansas-Red Basin, and the West Gulf centers, which provide forecasts and services in the six states that comprise SCIPP. "Our goal," said Greg Shelton of the West Gulf RFC, "is to better understand how NWS hydrologic information is being used, thereby enabling NWS to provide hydrologic information and forecasts in the best way possible to save lives and protect property."

In order to determine what information the managers use and how they access it, the researchers developed an online survey which was pilot tested in October 2011. A link to the survey was sent to 37 emergency managers in Southeastern Louisiana and Mississippi.

Sample and Event Characteristics

This study is based on responses from 13 participants who provided information about their oversight of recent flood events. The response rate was 35%. All participants were employed at the county or parish level and reported to local government. Most participants (n = 11) worked in Emergency/Risk Management and described flooding associated with the Mississippi River, Lake Pontchartrain, the Gulf of Mexico, and a variety of other lakes and rivers. The areas affected by these floods were in Louisiana (n = 8) and Mississippi (n = 4). One participant described flooding that was currently a problem, one described flooding that occurred within the past month, and most (n = 8) described incidents that occurred more than a month previously.

The flooding had multiple causes such as a tropical storm or hurricane (n = 8; 67%), rainfall upstream (n = 6; 50%), intense local rainfall (n = 3; 25%), and/or snowmelt (n = 2; 17%). The events ranged from minor to major, some were long-lived and others were not, and the consequences were generally not serious. Regarding expectations, 91% agreed or strongly agreed the event was predicted. When asked whether the event was "forecast with certainty," 75% (n = 9) agreed or strongly agreed; 25% (n =3) were neutral.

Information Sources

The National Weather Service was used by all of the respondents for information about the flooding (n = 13; 100%). Other sources of information included State or Local Emergency Management (n = 12; 92%), the Governor's Office (n = 8; 62%), RFC/River Forecast Centers (n = 7, 54%), and NOAA (n = 6, 46%). A few participants turned to the State Agricultural Department (n = 3, 23%), the State Department of Environmental Quality/Protection (n = 2; 15%), a State or Local Conservation District Office (n = 2, 15%), the State Climate Office/State Climatologist (n = 2; 15%), and the Regional Climate Center (n = 1; 8%). Most participants identified their primary provider of information as the National Weather Service (n = 9, 69%), although four participants listed other sources: Army Corp of Engineers, State Emergency Management, River Forecast Center, and Southeast RFC Journal.

All forms of communication were used, especially the internet (n = 13, 100%), phone (n = 12, 92%), and email (n = 10, 77%). Face-to-face communication was used by 3 participants (23%). The various forms of communication were judged as very helpful or somewhat helpful by those who used them. Face-to-face contact, email, phone calls, and federal or state supported websites were judged positively.

Judgments of mass media were mixed. Newspapers were used by few (n = 5) and rated as not helpful or only somewhat helpful. Radio was used by more participants (n = 9) and rated as somewhat helpful. Television was used by 12 participants and perceived as either somewhat helpful or very helpful. The most common criticism of the sources was that they were contradictory, not timely, or too general. None were described as too technical, irrelevant, or confusing, and only the mass media were criticized for presenting information poorly.

Products and Tools

The products and tools accessed by participants included forecast maps, coordinates, rainfall amounts and predictions, inundation maps, updates, SLOSH models, river and rainfall gauges, river forecasts, and storm evaluations via webinars, conference calls, and email updates.

Mississippi River flooding in Memphis, Tennessee May 2011; This image is in the public domain. http://en.wikipedia.org/wiki/File:2011_Memphis_flooding.jpg

When queried about the most valuable information or product they used during the flood, respondents listed agencies, communications, and products. The agencies included NWS, NOAA, and the U.S. Army Corps of Engineers. The communications included a NWS Webinar and a phone call to a meteorologist at NWS. Two other sources of valuable information were local "boots on the ground" reports and the knowledge of agencies in the parish. The specific products listed by the respondents included national weather reports, inundation maps, NWS updates with expected rainfall totals and wind potential, river stage forecasts, HURREVAC, SLOSH model, NWS Website, and non-government websites.

Information Gaps

Most of the participants (n =10; 77%) had sufficient information to make good decisions but three identified a need for water level gauges, one noted a need for rainfall gauges, and one was interested in historical flood information for the affected area. One respondent needed accurate inundation maps and noted that the USACE maps were flawed.

Conclusions

This pilot study reveals that the National Weather Service, in conjunction with NOAA and the River Forecast Centers, is providing valuable information to emergency managers when flood events occur. All respondents used NWS information, and a majority identified it as their primary source. Of those who did not list it as a primary source, one listed RFC and one listed a product of the Southeast RFC, both of which are part of NWS.

Emergency managers turn to multiple sources of information when a flood event occurs, ranging from the mass media (television, in particular) to state agencies (the State or Local Emergency Management, the Governor's Office) to federal organizations (primarily NWS). Information is available on the internet and through email, webinars, and conference calls, as well as by phone and face-to-face. Of particular interest is that several respondents listed the NWS webinars as particularly valuable.

This ubiquity of information sources and channels may permit emergency managers to compare and contrast different reports and look for commonalities in forecasts. Thus, most are relatively satisfied that they have sufficient information on which to act.

For some emergency managers, additional information would be valuable. Several who said current information was insufficient independently recommended more gauges, especially for water levels. One respondent offered a specific recommendation and rationale for gauges when asked for final comments at the end of the survey: "A comprehensive system of gauges, remotely accessible (web-based) at the local level, that allows for the monitoring of rising tide/river/tributary/basin levels from the coast to populated areas would allow for advanced warning of inundation threats as they materialize South of us. We could also use the real-time information from those gauges to confirm predicted/forecasted levels against the expected timeline for inundation effects."

This survey will be expanded in the future by distributing it to more emergency managers to collect a larger set of data; assessing communication closer in time to actual flood events; including respondents who have managed flash floods; revising items in the questionnaire to address communications such as webinars; and asking participants to evaluate specific products such as inundation maps and forecasts. These changes will provide even more valuable information to NWS and the River Forecast Centers.

Based on the pilot results, NWS and the RFCs, however, may want to consider the following:

1. Determine whether emergency managers are familiar with all their products and know how to use them;
2. Use more webinars to update emergency managers about flood forecasts and to educate them about the products available;
3. Assess the coordination of information with other providers (e.g., Governor's offices and USACE);
4. Consider creating blogs similar to the one offered by the Southeast RFC;
5. Evaluate the system of gauges to determine where additional resources are needed; and

6. Examine inundation maps for their accuracy and usefulness.

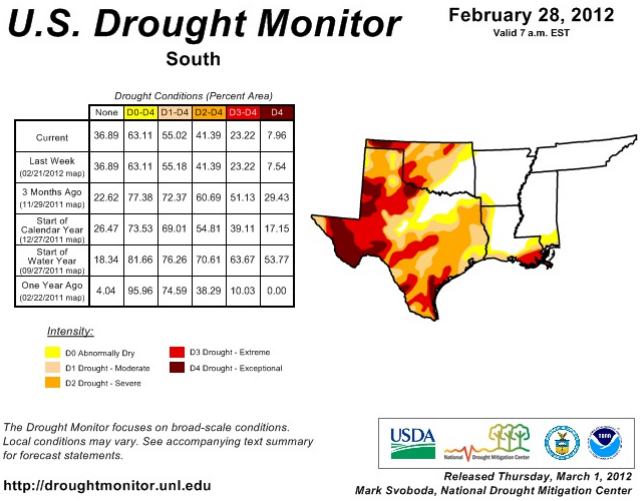
Jeffrey Graschel of Lower Mississippi RFC commented, “These findings will help us improve our services and communication with emergency managers.” Jason Johnson of NWS Weather Forecast Office in San Angelo added, “We hope local emergency managers will continue responding to surveys from our research partners at SCIPP and contact us directly when they have suggestions for how to improve our services.”

DROUGHT CONDITIONS

Luigi Romolo, Southern Regional Climate Center

Drought conditions in the Southern Region improved from the previous month. Heavy precipitation totals in southern Texas and Louisiana have resulted in a significant reduction in extreme drought conditions. Last month, approximately 35 percent of the region was in extreme drought or worse. By February 28, 2012, this value has shrunk to just 23.33 percent. Much of eastern Texas in now in moderate to severe drought, while much of Louisiana, with the exception of the south east, is now drought free. Conditions in Oklahoma remained fairly static, and Arkansas, Mississippi and Tennessee are relatively drought free.

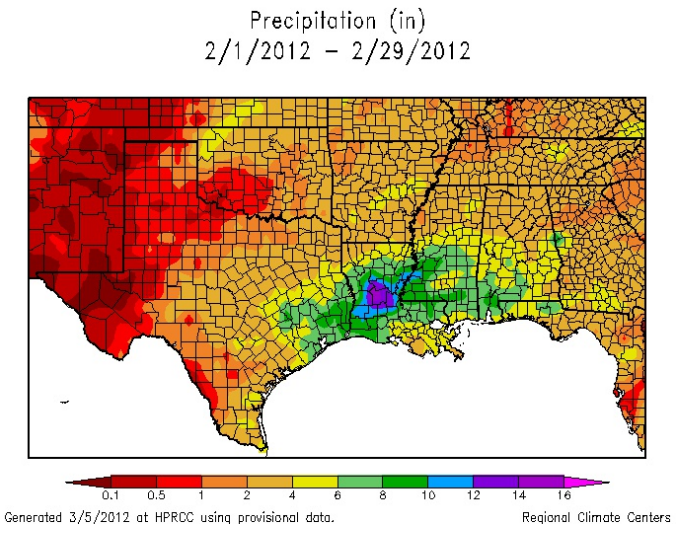
To the Right: Drought conditions in the Southern Region. Map is valid for February 2012. Image courtesy of the National Drought Mitigation Center.

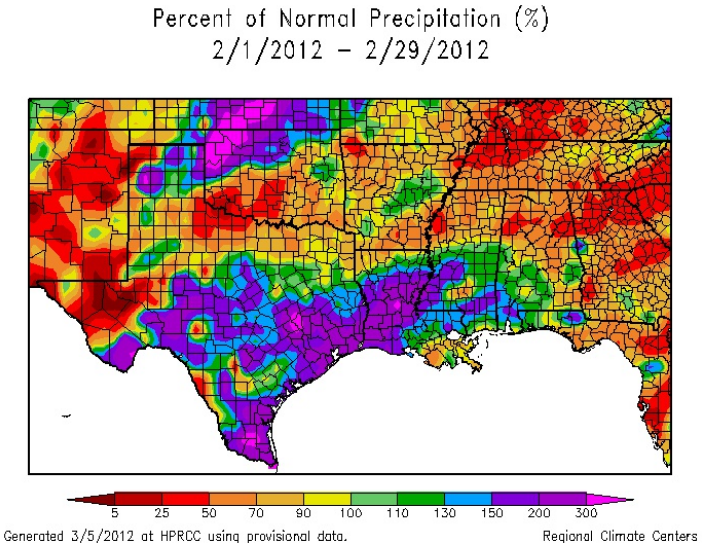


PRECIPITATION SUMMARY

Luigi Romolo, Southern Regional Climate Center

Precipitation varied spatially during the month of February. It was a wetter than normal month for much of the coastal part of the Southern Region, but also in northern Oklahoma. Elsewhere it was generally a drier than normal month. In northern Oklahoma, stations averaged up to three times the normal precipitation for the month. This equated to approximately 2 to 5 inches (50.8 to 127 mm) of precipitation. Similar values were also observed in southern Texas. Louisiana had their ninth wettest February on record (1895-2012) with a state average precipitation of 7.68 inches (195.07 mm). The wettest portions of the bayou state included the central parishes where stations reported in excess of ten inches (254.00 mm) of total precipitation. The driest areas of the region include much of Tennessee, the western panhandle of Texas, and southern Oklahoma. In these areas, precipitation averaged less than half of normal. The remaining state average precipitation totals are as follows: Texas averaged 2.27 inches (57.66 mm), Tennessee averaged 2.97 inches (75.44 mm), Oklahoma averaged 1.86 inches (47.24 mm), Mississippi average 5.05 inches (128.27 mm) and Arkansas averaged 3.09 inches (78.49 mm). The state rankings for these values all fell in the middle two quartiles.





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

HAVE WE SEEN OUR LAST FREEZE FOR THE SEASON?

Barry D. Keim, Louisiana State Climatologist

Given the mild weather experienced over the past few of weeks, I have spent some time trying to rejuvenate my garden. One decision that goes into new planting is "what are the odds of having another freeze event?" The average date for the last spring freeze varies some across the SCIPP region, as shown in Table 1. The average date ranges from February 11 at New Orleans to April 3 at Nashville, with the other sites in the array below all experiencing their last spring freeze in March, on the average. However, the last spring freeze has occurred as late May 3rd at Oklahoma City over the historic record, with all the other sites having the latest freeze on record sometime in April. So far this winter, temperatures are running mild, and most locations have not experienced as many freeze days as is typical. In New Orleans, for example, the last freeze this season was on January 14th. Oh, and it was the only freeze of the entire season at the Airport, and the temperature dropped to only 32 degrees. An average winter season in New Orleans has 10 days when the temperature drops to 32 degrees or below, and this season, so far, only has one!

This image is from the Centers for Disease Control and Prevention and is in the public domain.
http://upload.wikimedia.org/wikipedia/commons/e/ea/Aedes_Albopictus.jpg

This does not bode well for the mosquitoes and other pests. As a result, those along the Gulf Coast, and throughout the region, better get prepared.

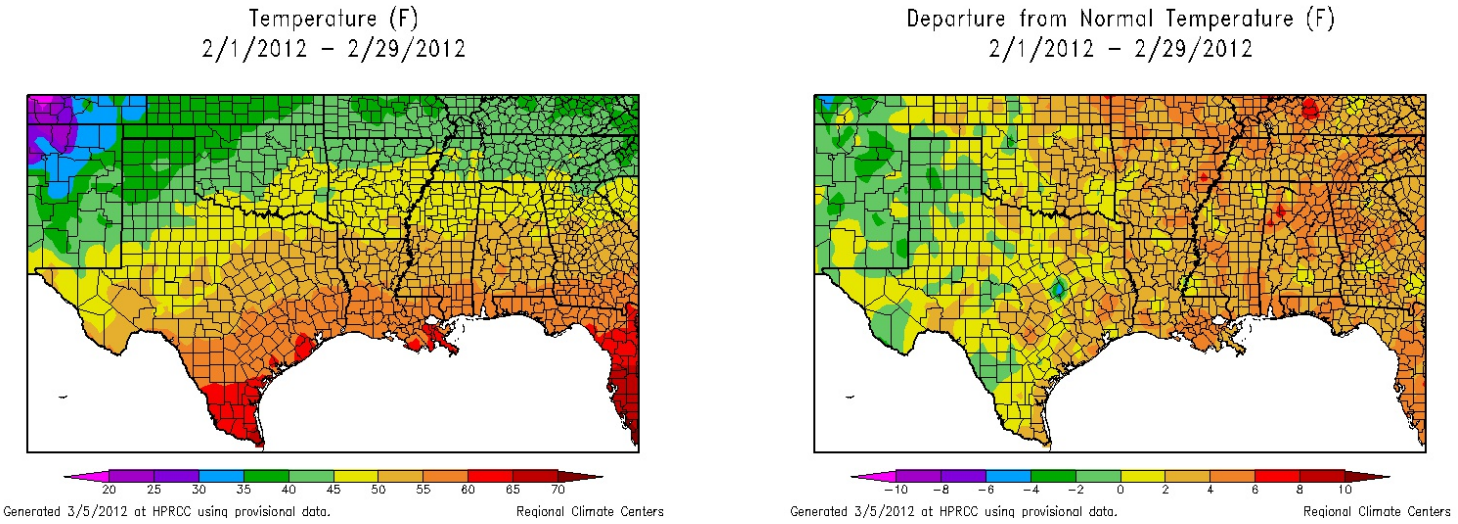
	Earliest Last Freeze	Average	Latest Last Freeze	So Far This Year (as of March 10)
New Orleans, LA	No	11-Feb	8-Apr	14-Jan
San Antonio, TX	18-Jan	1-Mar	3-Apr	12-Feb
Little Rock, AR	19-Feb	20-Mar	19-Apr	20-Feb
Jackson, MS	13-Feb	21-Mar	15-Apr	25-Feb
Oklahoma City, OK	5-Mar	31-Mar	3-May	4-Mar
Nashville, TN	7-Mar	3-Apr	23-Apr	6-Mar

Table 1. Dates of the Last Spring Freeze at Selected SCIPP Locations. Data from the Southern Regional Climate Center, Louisiana State University.

TEMPERATURE SUMMARY

Luigi Romolo, Southern Regional Climate Center

Temperatures in the Southern Region did not vary much spatially in the month of February, and with the exception of north western Texas and western Oklahoma, the region experienced a generally warmer than normal month. For Arkansas, Louisiana, Mississippi, and Tennessee, mean daily temperatures averaged approximately 2 to 4 degrees F (1.11 to 2.22 degrees C) above normal, with some areas as high as 4 to 6 degrees F (2.22 to 3.33 degrees C) above normal. Arkansas averaged 46.80 degrees F (9.22 degrees C), while Louisiana, Mississippi, and Oklahoma recorded state average temperatures of 56.00 degrees F (13.33 degrees C) , 51.60 degrees F (10.89 degrees C) and 43.30 degrees F (6.28 degrees C), respectively. In Texas and Oklahoma, most stations averaged between 2 degrees F (1.11 degrees C) below normal and 2 degrees F (1.11 degrees C) above normal. The state average temperature for Texas was 51.50 degrees F (10.83 degrees C), while Tennessee averaged 44.30 degrees F (6.83 degrees C). For both Louisiana and Arkansas, it was the twenty-fourth warmest February on record (1895-2012). All other state rankings fell in the middle two quartiles.



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

CLIMATE PERSPECTIVE

State	Temperature	Rank	Precipitation	Rank
Arkansas	46.8	24th Warmest	3.09	52nd Driest
Louisiana	56.0	24th Warmest	7.68	9th Wettest
Mississippi	51.6	28th Warmest	5.05	55th Wettest
Oklahoma	43.3	34th Warmest	1.86	41st Wettest
Tennessee	44.3	25th Warmest	2.97	26th Driest
Texas	51.5	41st Warmest	2.27	26th Wettest

State temperature and precipitation values and rankings for February 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	60.5	38.3	49.4	1.0	83.0	2/23	21.0	2/21	2.32	-2.08	53
Little Rock, AR	59.1	39.5	49.3	4.0	82.0	2/29+	20.0	2/12	4.53	1.07	131
Baton Rouge, LA	67.4	50.3	58.9	5.3	81.0	2/29	28.0	2/12	7.56	2.29	143
New Orleans, LA	68.2	53.9	61.0	5.2	83.0	2/29	33.0	2/12	4.72	-0.93	84
Shreveport, LA	64.3	46.8	55.5	4.2	87.0	2/23	28.0	2/12	3.56	-0.79	82
Greenwood, MS	60.9	38.5	49.7	1.2	84.0	2/23	16.0	2/12	3.60	-0.76	83
Jackson, MS	63.6	44.9	54.2	4.9	84.0	2/23	24.0	2/12	8.28	3.62	178
Tupelo, MS	59.3	38.7	49.0	4.1	83.0	2/23	19.0	2/12	4.63	-0.24	95
Oklahoma City, OK	55.1	34.3	44.7	2.3	74.0	2/22	18.0	2/12	0.86	-0.78	52
Ponca City, OK	52.9	30.8	41.8	2.0	71.0	2/22	14.0	2/12	2.48	1.00	168
Tulsa, OK	55.3	35.2	45.2	3.1	75.0	2/22	16.0	2/12	1.61	-0.43	79
Knoxville, TN	55.8	36.5	46.2	4.3	76.0	2/23	16.0	2/12	4.06	-0.11	97
Memphis, TN	57.3	40.6	49.0	3.9	79.0	2/23	22.0	2/12	3.03	-1.45	68
Nashville, TN	56.0	35.4	45.7	4.3	77.0	2/23	18.0	2/13+	2.81	-1.03	73
Amarillo, TX	52.6	27.9	40.2	-0.5	76.0	2/22	13.0	2/8	0.63	0.05	109
El Paso, TX	63.6	37.4	50.5	-0.1	76.0	2/23	29.0	2/21	0.02	-0.38	5
Dallas, TX	62	42.9	52.4	2.9	82.0	2/23	25.0	2/12	1.88	-0.59	76
Houston, TX	67.7	52.4	60.1	4.6	84.0	2/29	34.0	2/12	5.98	2.89	194
San Antonio, TX	66.2	48.7	57.4	2.6	85.0	2/23	32.0	2/12	5.63	3.82	311

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