

**MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS**

REPORT FOR:  
 MONTH **November** YEAR **2011**

TO: Hydrometeorological Information Center, W/OH2  
 NOAA / National Weather Service  
 1325 East West Highway, Room 7230  
 Silver Spring, MD 20910-3283

SIGNATURE  
**Steven F. Piltz**  
 (Meteorologist-in-Charge)

DATE  
**December 13, 2011**

*When no flooding occurs, include miscellaneous river conditions, such as significant rises, record low stages, ice conditions, snow cover, droughts, and hydrologic products issued (NWS Instruction 10-924)*

An "X" in the box indicates no flood stages were reached in this Hydrologic Service Area (HSA) during the month above.

Two multi-day heavy rain events brought flooding to portions of eastern Oklahoma and northwest AR this month, while also helping to alleviate drought conditions across much of the area. Normal precipitation for November ranges from 2.6 inches in Pawnee County to 4.4 inches in Haskell County. Normal precipitation for the Ozark region of northwest Arkansas averages 4.2 inches.

**Monthly Summary**

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for November 2011 ranged from around 2.5" in portions of Pawnee and Osage Counties in northeast OK to an area of 15"-20" in southern Le Flore County in southeast OK. A large portion of eastern OK and northwest AR received between 4" and 8" of precipitation during the month. While these rainfall totals corresponded to near to above November rainfall normals across much of the HSA, a few areas of far northeast OK and southeast OK received 75%-90% of the normal November rain (Fig. 1b). Some areas of east central and southeast OK, however, received 200% to over 300% of the normal rain for November.

Tulsa, OK (TSA): November, 2011 Monthly Observed Precipitation  
 Valid at 12/1/2011 1200 UTC- Created 12/3/11 21:38 UTC

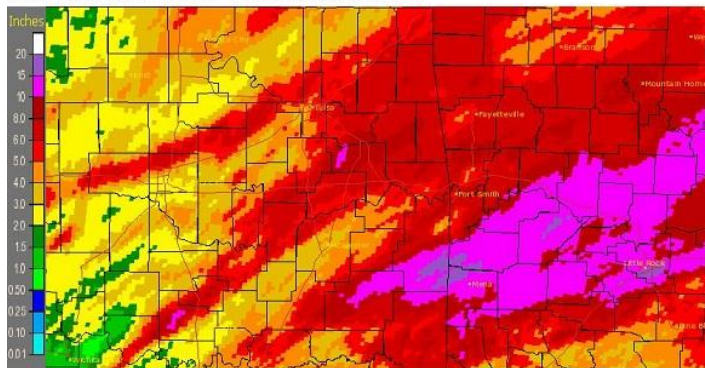


Fig. 1a. Estimated Observed Rainfall for November 2011

Tulsa, OK (TSA): November, 2011 Monthly Percent of Normal Precipitation  
 Valid at 12/1/2011 1200 UTC- Created 12/3/11 21:42 UTC

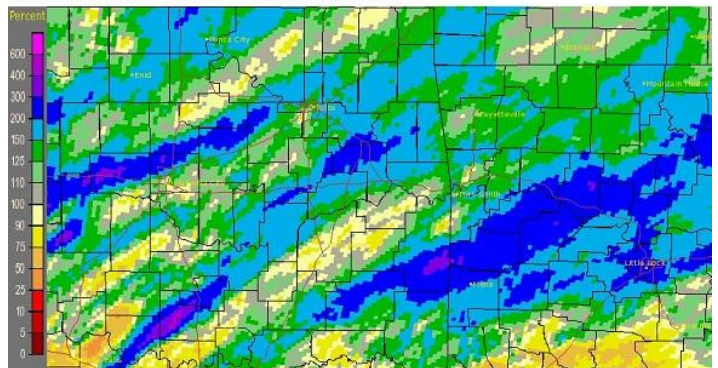


Fig. 1b. Estimated % of Normal Rainfall for November 2011

In Tulsa, OK, November 2011 ranked as the 47<sup>th</sup> warmest November (50.8°F, tied with 2008, 1975; since records began in 1905) and the 16<sup>th</sup> wettest November (5.37"; since records began in 1888). Fort Smith, AR, was the 14<sup>th</sup> warmest November (54.5°F, tied with 2006, 1973, 1899) and the 11<sup>th</sup> wettest November (7.19") since records began in 1882.

Some of the larger precipitation reports (in inches) for November 2011 included:

Tuskahoma, OK (coop)	12.62	Talihina, OK (meso)	11.05	Clayton, OK (meso)	9.33
Mountainburg, AR 2NE (coop)	9.16	Antlers, OK (meso)	9.07	Natural Dam, AR (coop)	9.00
Fanshawe, OK (coop)	8.89	Porter, OK (meso)	8.78	Muskogee, OK (ASOS)	8.46

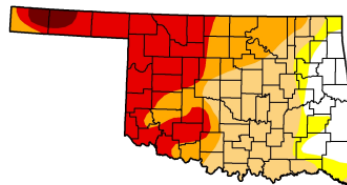
According to the [U.S. Drought Monitor](#) (USDM) from December 6, 2011, significant improvements in drought conditions were made during November 2011. Severe drought (D2) conditions stretched across most of Pawnee, Osage, Washington, and northwest Nowata Counties in eastern OK. Moderate drought (D1) conditions were found across portions of Craig, Nowata, Rogers, Washington, Tulsa, Creek, Okmulgee, Okfuskee, western McIntosh, Pittsburg, and Choctaw Counties in eastern OK (see Figs. 2 & 3). Abnormally Dry (D0) conditions affected portions of Ottawa, Craig, Mayes, Rogers, Wagoner, far western Muskogee, eastern McIntosh, far eastern Pittsburg, Latimer, and far western Pushmataha Counties in eastern OK. No drought conditions were occurring in northwest AR.

## U.S. Drought Monitor

December 6, 2011  
Valid 7 a.m. EST

Oklahoma

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	12.56	87.44	80.27	50.88	32.08	2.11
Last Week (11/29/2011 map)	7.33	92.67	85.70	59.58	39.92	10.27
3 Months Ago (09/06/2011 map)	0.00	100.00	100.00	100.00	85.44	69.15
Start of Calendar Year (12/28/2010 map)	13.82	86.18	47.90	1.50	0.00	0.00
Start of Water Year (09/27/2011 map)	0.00	100.00	100.00	100.00	78.97	66.42
One Year Ago (11/30/2010 map)	46.34	53.66	3.13	0.00	0.00	0.00



### 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 accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu>



Released Thursday, December 8, 2011  
David Miskus, NOAA/NWS/NCEP/Climate Prediction Center

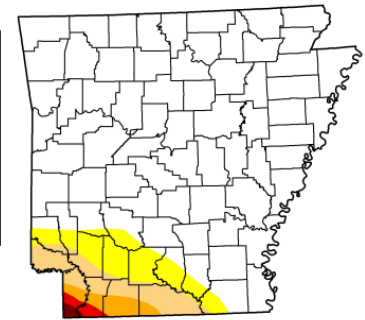
Fig. 2. Drought Monitor for Oklahoma

## U.S. Drought Monitor

December 6, 2011  
Valid 7 a.m. EST

Arkansas

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	85.78	14.22	7.70	2.51	0.79	0.25
Last Week (11/29/2011 map)	70.15	29.85	15.78	5.23	2.68	0.51
3 Months Ago (09/06/2011 map)	2.19	97.81	76.51	38.09	15.82	2.17
Start of Calendar Year (12/28/2010 map)	0.00	100.00	85.33	69.74	13.26	0.00
Start of Water Year (09/27/2011 map)	1.21	98.79	75.99	39.48	18.92	1.53
One Year Ago (11/30/2010 map)	17.42	82.58	67.68	45.48	4.07	0.00



### 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 accompanying text summary for forecast statements.

<http://droughtmonitor.unl.edu>



Released Thursday, December 8, 2011  
David Miskus, NOAA/NWS/NCEP/Climate Prediction Center

Fig. 3. Drought Monitor for Arkansas

According to statistics from the [Oklahoma Climatological Survey](#) (OCS):

Rank since 1921 ("Last XX days" ending November 30, 2011)	November 2011	Cool Growing Season (Sep 1, 2011 – Nov 30, 2011)	Water Year (Oct 1, 2011 – Nov 30, 2011)	Last 180 days (Jun 4, 2011– Nov 30, 2011)	Year-to-Date (Jan 1, 2011 – Nov 30, 2011)	Last 365 days (Dec 1, 2010– Nov 30, 2011)
Northeast OK	12 <sup>th</sup> wettest	43 <sup>rd</sup> driest	27 <sup>th</sup> wettest	18 <sup>th</sup> driest	22 <sup>nd</sup> driest	21 <sup>st</sup> driest
East Central OK	9 <sup>th</sup> wettest	39 <sup>th</sup> wettest	23 <sup>rd</sup> wettest	23 <sup>rd</sup> driest	31 <sup>st</sup> driest	25 <sup>th</sup> driest
Southeast OK	8 <sup>th</sup> wettest	44 <sup>th</sup> driest	20 <sup>th</sup> wettest	10 <sup>th</sup> driest	11 <sup>th</sup> driest	10 <sup>th</sup> driest
Statewide	10 <sup>th</sup> wettest	44 <sup>th</sup> driest	21 <sup>st</sup> wettest	9 <sup>th</sup> driest	6 <sup>th</sup> driest	6 <sup>nd</sup> driest

Most of the major reservoirs in the Tulsa HSA were within  $\pm 5\%$  of the top of their conservation pools as of December 12, 2011. However, the heavier rains during November led to flood control operations at a couple of dams: Wister 33% and Hugo 13% of flood pools in use. The following reservoirs were reporting conservation pool deficits below 95% as of December 12, 2011: Birch Lake 47%, Skiatook Lake 64%, Hulah Lake 77%, Eufaula Lake 86%, Oologah Lake 89%, and Copan Lake 94.

## Outlooks

The [Climate Prediction Center](#) (CPC) outlook for December 2011 (issued November 30, 2011) indicates a slightly enhanced chance for above normal temperatures across southeast OK and west central AR, and equal chances for above, near, and below normal temperatures elsewhere. This outlook also indicates an enhanced chance for above median precipitation for all of eastern OK and northwest AR. This outlook was based primarily on short-term dynamical computer models with La Niña and Madden-Julian Oscillation (MJO) impacts considered. For the 3-month period Dec-Jan-Feb 2011-12, CPC is forecasting an enhanced chance for above average temperatures and below median precipitation across all of eastern OK and northwest AR (outlook issued November 17, 2011). This is consistent with a La Niña pattern, as well as long-range computer model

output and patterns associated with a second winter La Niña during multi-year La Niña events. According to CPC, weak La Niña conditions remained in place at the end of November. La Niña conditions are forecast to strengthen and continue through Winter 2011-12, with impacts waning during Spring 2012.

## Summary of Precipitation Events

### November 1 – 15:

A strong cold front moved through eastern OK and northwest AR on November 2, 2011, bringing much colder temperatures and widespread showers to the area. Rainfall totals ranged from around 0.10" to around 0.75".

Two strong earthquakes affected the region on November 5<sup>th</sup>. The [first earthquake, which was a foreshock, was a magnitude 4.7](#) and occurred at 02:12:45 AM on the 5<sup>th</sup> (Nov. 5 07:12:45 UTC) near Prague, OK (20 miles northeast of Shawnee, OK or 41 miles west of Okmulgee, OK), Fig B. The [second earthquake was a magnitude 5.6](#) and occurred at 10:53:10 PM CDT on the 5<sup>th</sup> (Nov. 6 03:53:10 UTC). The epicenter was located 5 miles northwest of Prague, OK (21 miles north-northeast Shawnee, OK or about 75 miles southwest of Tulsa, OK) and occurred at a depth of 3.1 miles, Fig 4. This second earthquake was the largest recorded in Oklahoma (previous strongest OK earthquake was M5.5 April 9, 1952 near El Reno, OK) and was clearly felt from Dallas, TX to St. Louis, MO, which are about 300 miles from the epicenter (see Fig. 5). USGS reports indicated that this quake was felt as far away as Wisconsin and Indiana. The USACE inspected dams within 70 miles of the epicenter, including Keystone, Skiatook, Eufaula, and Heyburn, but no damage was discovered. A third strong aftershock [earthquake of magnitude 4.7](#) occurred 6.4 miles NNW of Prague at 8:46:57 PM CST on the 7<sup>th</sup> (Nov. 8 2:46:57UTC), Fig. 7.

According to the USGS, "The magnitude 4.7 and 5.6 earthquakes that occurred on November 5, 2011, east of Oklahoma City are typical of the larger areas of North America east of the Rocky Mountains that have infrequent earthquakes large enough to cause minor to major damage. There have been dozens of aftershocks recorded following the November 5, 2011 magnitude 5.6 earthquake and its magnitude 4.7 foreshock that occurred on the same day. These aftershocks will continue for weeks and potentially months but will likely decrease in frequency. This is not an unusual amount of aftershock activity for a magnitude 4.7 to 5.6 earthquake sequence. In general, it is very difficult to correlate earthquakes to specific faults in the region and in eastern North America. The earthquake sequence that started yesterday occurred close to where a magnitude 4.1 earthquake occurred on February 27, 2010. From the location of the earthquake and the focal mechanism it is possible that this earthquake occurred on the Wilzetta fault. The Wilzetta fault is one of a series of small faults formed in the Pennsylvanian Epoch (approx. 300 million year ago) during the intraplate deformation known as the Ancestral Rocky Mountains mountain-building episode (orogeny). The relationship between the recent earthquakes and this older structure is still unknown and requires further investigation."

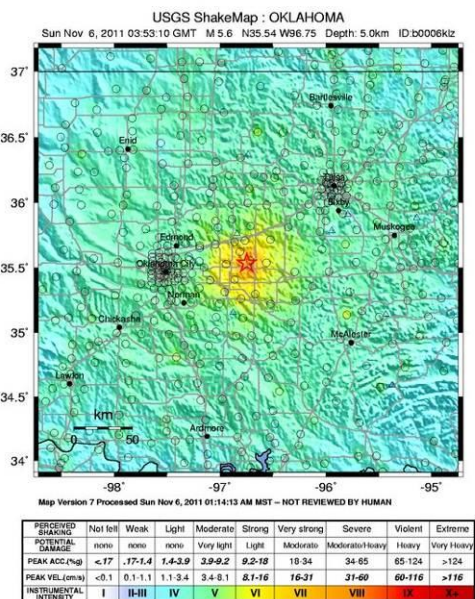


Fig. 4. USGS Shake Map of M5.6 earthquake 11/05/2011

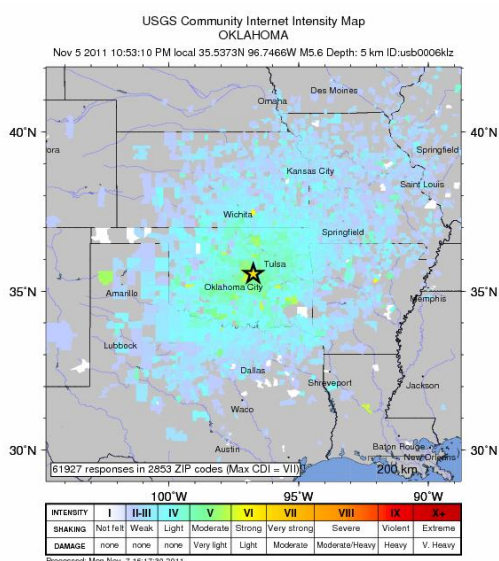


Fig. 5. USGS map of reports of the M5.6 earthquake 11/05/2011

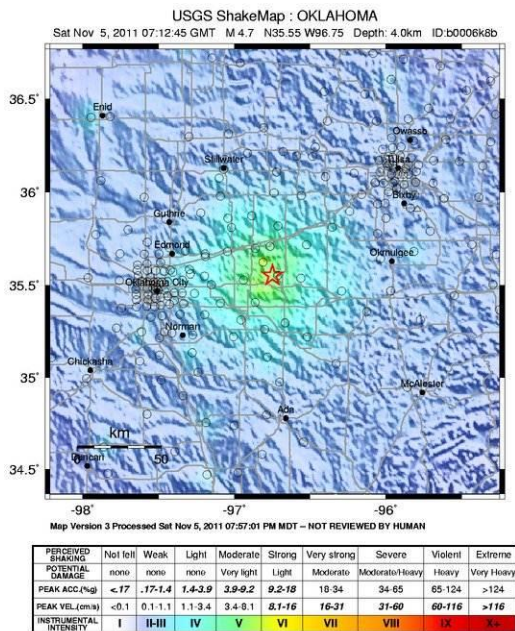


Fig. 6. USGS Shake Map of M4.7 earthquake 11/05/2011.

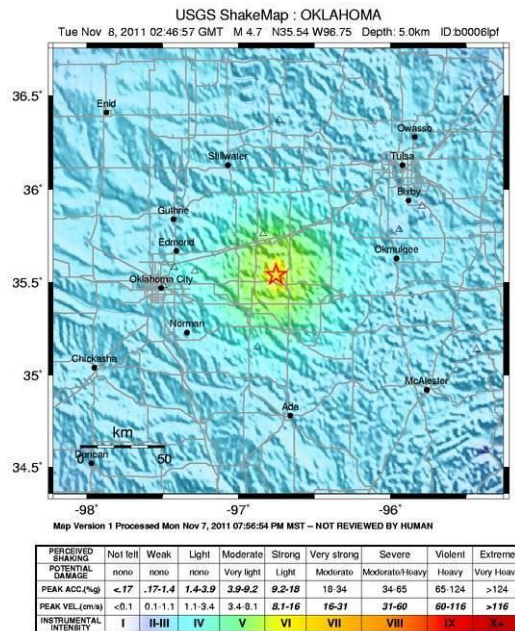


Fig. 7. USGS Shake Map of M4.7 earthquake 11/07/2011

A significant storm system brought periods of heavy rain to eastern OK and northwest AR beginning on the evening of the 6<sup>th</sup> and continuing through the early evening of the 8<sup>th</sup>. Efficient rain producing showers and thunderstorms developed in an area of strong moisture advection during the overnight and early morning hours from the 6<sup>th</sup> - 7<sup>th</sup> and affected locations from south central OK into northeast OK and far northwest AR. Rainfall totals were around 0.5" to 1.5" across the affected area, with isolated amounts of 2"-4" (Fig. 8). The NWS coop observer 1S Scipio measured 2.50", while the Oklahoma Mesonet site in Porter measured 2.62" and in Haskell measured 2.69".

Rain continued on the 7<sup>th</sup> as the upper-level storm system moved out of the southwest U.S. and into the Southern Plains. Training thunderstorms brought high rainfall totals to northeast and east central OK (Fig. 9). The highest totals of 3" to 5" from 6am CST 11/7 through 6am CST 11/8 occurred in three bands: across the northwest half of Osage County; from northern Creek through northern Tulsa into northern Rogers Counties; and across most of Muskogee and into Cherokee, Adair, and northwest Sequoyah Counties. Rainfall rates were in excess of 1"/hour at times. The NWS coop observer 6NW Mannford measured a 24-hr rainfall total of 4.88" through 7am CST. The USGS/COE river gages measured a 24-hr total of 4.85" at Tahlequah and 4.65" at Muskogee ending at 11am CST. The Oklahoma Mesonet sites measured a 24-hr total of 4.32" at Oilton and 4.08" at Foraker ending at 11:15am CST. Along and north of I-40, rainfall totals were over 0.75", while across southeast OK, totals were generally around 0.25" or less.

A cold front then moved through the HSA on the 8<sup>th</sup>, bringing additional showers and thunderstorms, some of which produced strong, damaging wind gusts. Rainfall totals after 6am CST 11/8 ranged from around 0.25" northwest of I-44 to over 3" across portions of southeast OK, Fig. 10. The highest rainfall totals during this time occurred across Pushmataha, Le Flore, and southern Sebastian Counties, where totals were 2.5" to around 5".

The storm total precipitation from the Nov. 6-8 event was significant, with amounts as high as 6"-8". Most of the HSA received at least 1.5" with widespread 3" totals (Figs. 11, 12). A large portion of Muskogee County was inundated with 5"-8" of rain by the time the storm system moved east (Figs. 11, 12). Roads were closed across much of Muskogee County due to high water, with minor flooding also affecting roadways in portions of Okmulgee and Benton Counties. It is likely that the flash flooding from this event would have been much worse if an extreme-exceptional drought had not been ongoing. The 4"-5" rainfall over much of the Illinois River Basin led to minor flooding along the Illinois River near Watts and near Tahlequah. Several other rivers and creeks across northeast and east central OK rose several feet; however, due to the drought and preceding low flows, no other rivers exceeded flood stage. Additionally, area reservoirs saw significant improvements in conservation storage due to this event, with many lakes reporting an increase in storage of 10% - 30% compared to end of October levels.

Tulsa, OK (TSA): 11/7/2011 1-Day Observed Precipitation  
Valid at 11/7/2011 1200 UTC- Created 11/7/11 13:41 UTC

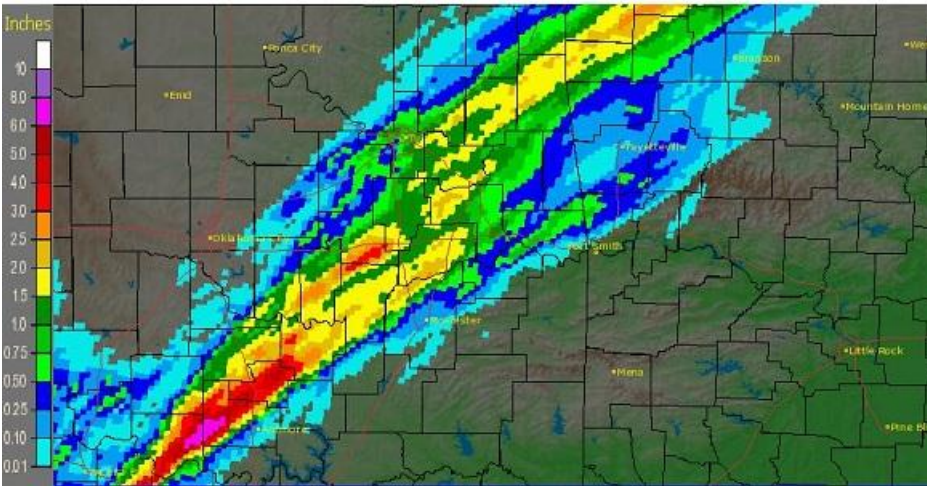


Fig. 8. Estimated 24-hr observed rainfall ending 6am CST 11/07/2011.

Tulsa, OK (TSA): 11/8/2011 1-Day Observed Precipitation  
Valid at 11/8/2011 1200 UTC- Created 11/8/11 15:41 UTC

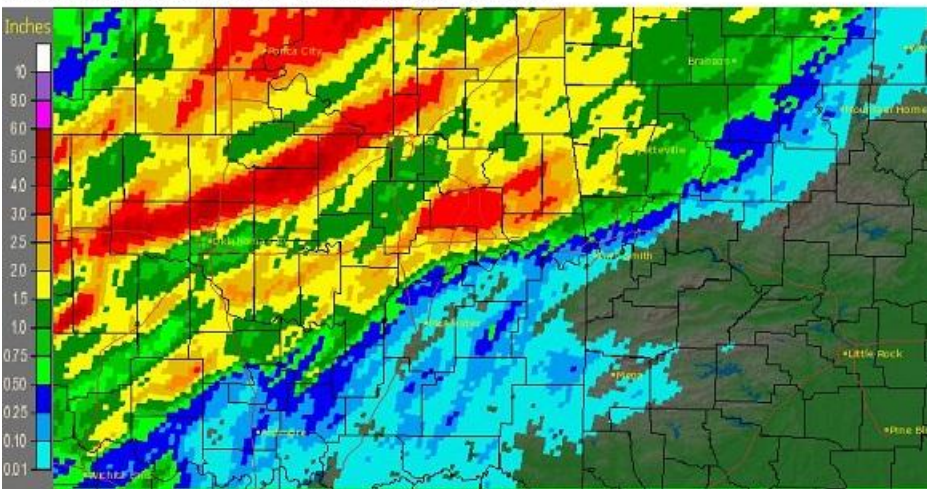


Fig. 9. Estimated 24-hr observed rainfall ending 6am CST 11/08/2011.

Tulsa, OK (TSA): 11/9/2011 1-Day Observed Precipitation  
Valid at 11/9/2011 1200 UTC- Created 11/9/11 13:41 UTC



Fig. 10. Estimated 24-hr observed rainfall ending 6am CST 11/09/2011.

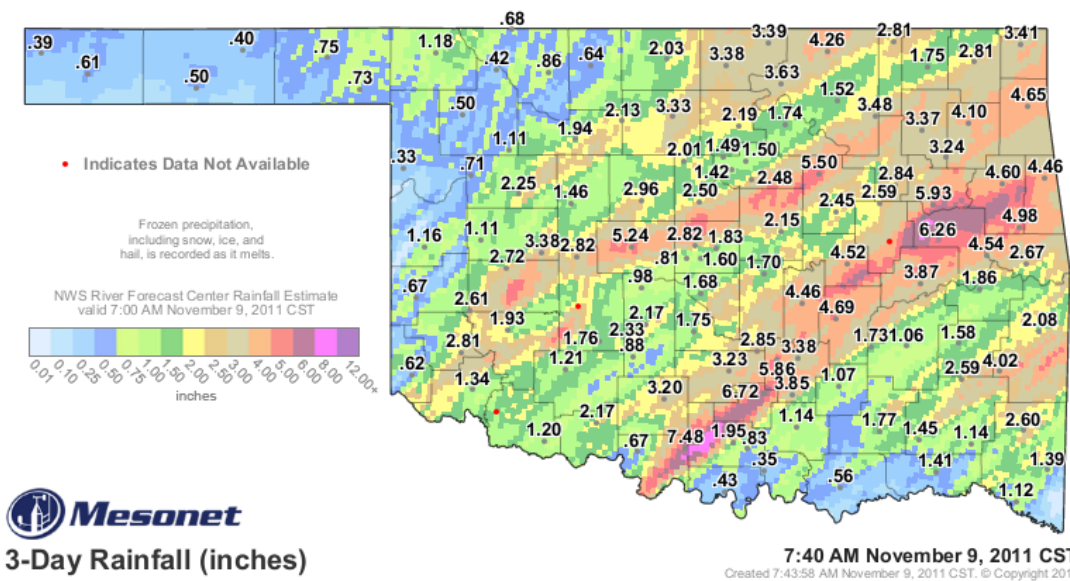


Fig. 11. Oklahoma Mesonet rainfall measurements & RFC estimated (image) storm total rainfall ending 7:40am CST 11/09/2011.



Fig. 12. Estimated storm total observed rainfall ending 6am CST 11/09/2011.

Showers and thunderstorms brought additional rain to locations along and southeast of I-44 on the 14<sup>th</sup> as a cold front moved into the region. Choctaw County once again missed out on the rain, but elsewhere, precipitation totals were generally a few hundredths to half an inch. A few bands of higher totals to around 1.5" did occur across southeast OK and northwest AR. Isolated showers and thunderstorms continued near the quasi-stationary front on the 15<sup>th</sup>, with an additional 0.25" or more southeast of a line from Hugo to Fort Smith to Fayetteville. Isolated locations within this area received 1" to 3" of rain.

### **November 16 – 30:**

Light rain showers affected southeast OK on the 16<sup>th</sup>, bringing a few hundredths to around half an inch of rain to portions of northern Choctaw, Pushmataha, far southern Pittsburg, far southern Latimer, and southern Le Flore Counties.

A strong cold front moved through the area on the 19<sup>th</sup> bringing some scattered light rainfall of a few hundredths to around one quarter of an inch to the area during the late evening/overnight hours. The front then stalled across northern TX/central AR, just southeast of the HSA, by the evening of the 20<sup>th</sup>. Lift over the front led to showers and thunderstorms south of I-44 through the evening and overnight hours. The heaviest rainfall

occurred closer to the front across far southeast OK, bringing 1.5"-4" of rain (Fig. 13). The Oklahoma Mesonet site in Antlers, OK measured 3.53", and the NWS cooperative observer in Tuskahoma, OK measured 3.15". Widespread 0.5" to 1.5" fell southeast of a McAlester, OK to Huntsville, AR line.

After a brief break in the rain, showers and thunderstorms once again brought heavy rain to southeast OK and west central AR from late afternoon of the 21<sup>st</sup> until about midnight that night as the cold front lifted north into far southeast OK. Most of the HSA received 0.5" – 1.5" of additional rainfall (see Fig. 14). The heaviest rain fell over the same area as the previous night, bringing 2"-6" more rain to Pushmataha and Le Flore Counties (see Fig. 15, 16), and a portion of southern Le Flore County received 8"-10" of rain. This heavy rain led to severe flash flooding in southern Le Flore County. Several campers were rescued from a campground at Cedar Lake (~13 miles southwest of Heavener). Many swift water rescues were performed and the county had to close multiple roads. The Le Flore County Emergency Manager had reports that 8'-10' of water was over some of the roads. Thankfully, no injuries were reported from this event.

The NWS cooperative observer in Tuskahoma, OK (near Clayton in northern Pushmataha Co.) measured an additional 4.15" on the 21<sup>st</sup>, bringing his 2-day total to 7.30". The rain gage along the Kiamichi River near Big Cedar (southern Le Flore County) measured a storm total of 7.37" of rain. The river at this point crested at 17.9' at 05:30Z 11/22/11, which is one of the highest annual crests on record. The rain gage along the Kiamichi River near Clayton measured 6.65" of rain for the 2 days, and the river crested at 18.1' at 05Z 11/22/11. Storm total rainfall of 6.61" was measured in Honobia, OK. At the NWS river forecast point along the Kiamichi River near Antlers, 5.89" of rain was measured over the 2-day event. This led to minor flooding (~0.5' short of moderate flooding), with the river cresting at 28.42' at 2am CST on 11/22/11. At Sardis Lake, a storm total of 5.36" was measured. The Poteau River near Panama crested just below flood stage. Wister Lake rose significantly due to this storm system. Prior to the rain, lake levels were near 479.5'. The lake then rose over 12' over a 2-day period and according to the USACE Tulsa District was 42% into its flood pool as of 8am CST 11/23/11.

The last round of rainfall for the month began on the evening of the 25<sup>th</sup> and continued on the 26<sup>th</sup> as a low pressure system and corresponding cold front moved through the Southern Plains. Widespread showers and scattered thunderstorms brought between 0.25" and 1.5" of rain to most of the HSA. The highest totals of around 1.5" occurred along a line from near Wagoner, to Pryor, to Vinita, to northwest Ottawa County, as well as across far southern Le Flore County.

Tulsa, OK (TSA): 11/21/2011 1-Day Observed Precipitation  
Valid at 11/21/2011 1200 UTC- Created 11/21/11 13:41 UTC

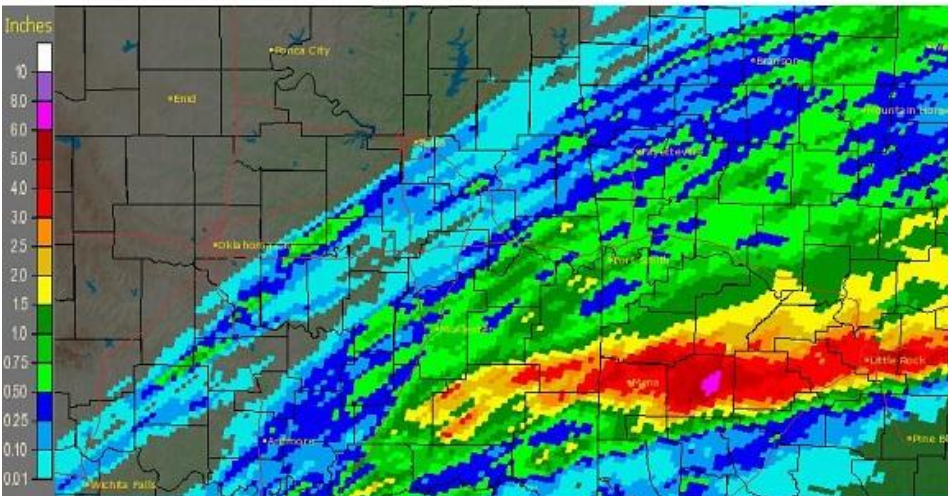


Fig. 13. Estimated 24-hr observed rainfall ending 6am CST 11/21/2011.

Tulsa, OK (TSA): 11/22/2011 1-Day Observed Precipitation  
 Valid at 11/22/2011 1200 UTC- Created 11/22/11 13:41 UTC

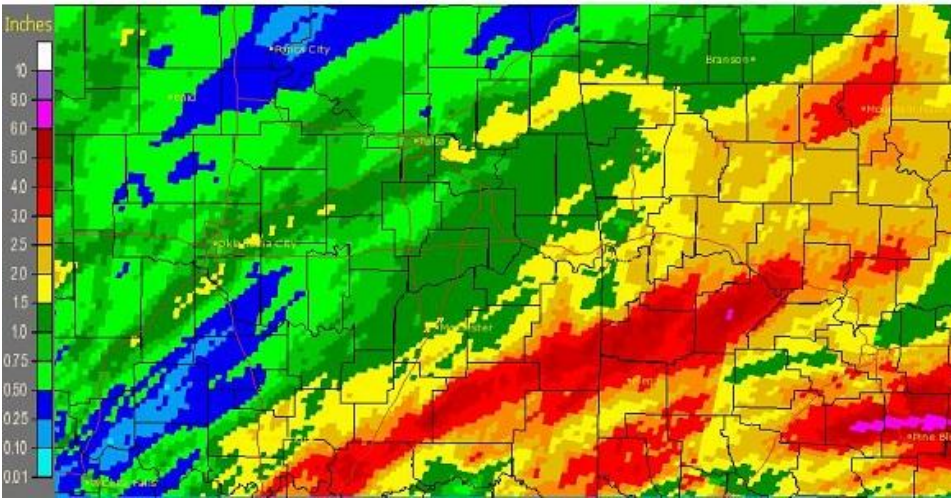


Fig. 14. Estimated 24-hr observed rainfall ending 6am CST 11/22/2011.

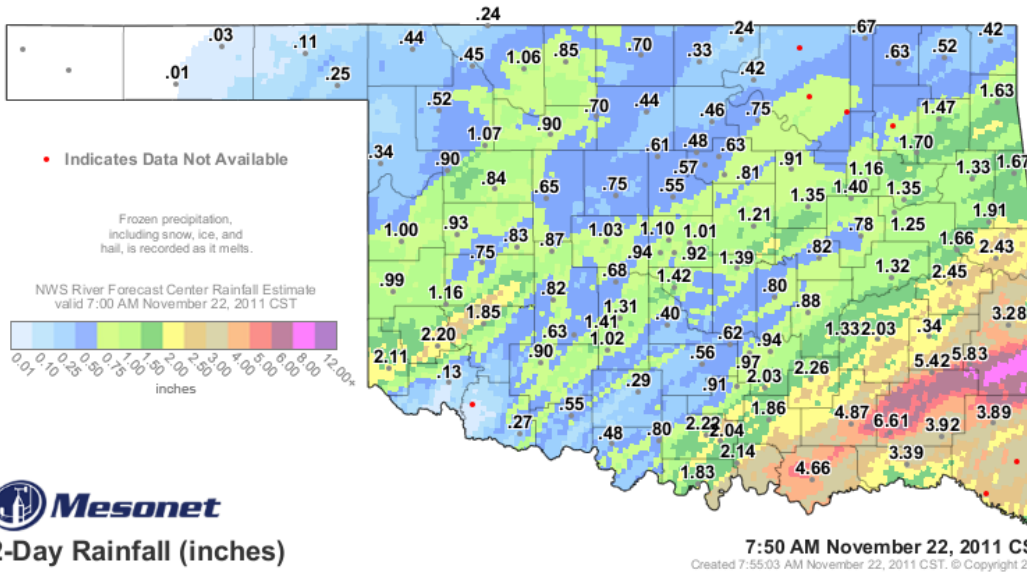


Fig. 15. Oklahoma Mesonet rainfall measurements & RFC estimated (image) storm total rainfall ending 7:50am CST 11/22/2011.



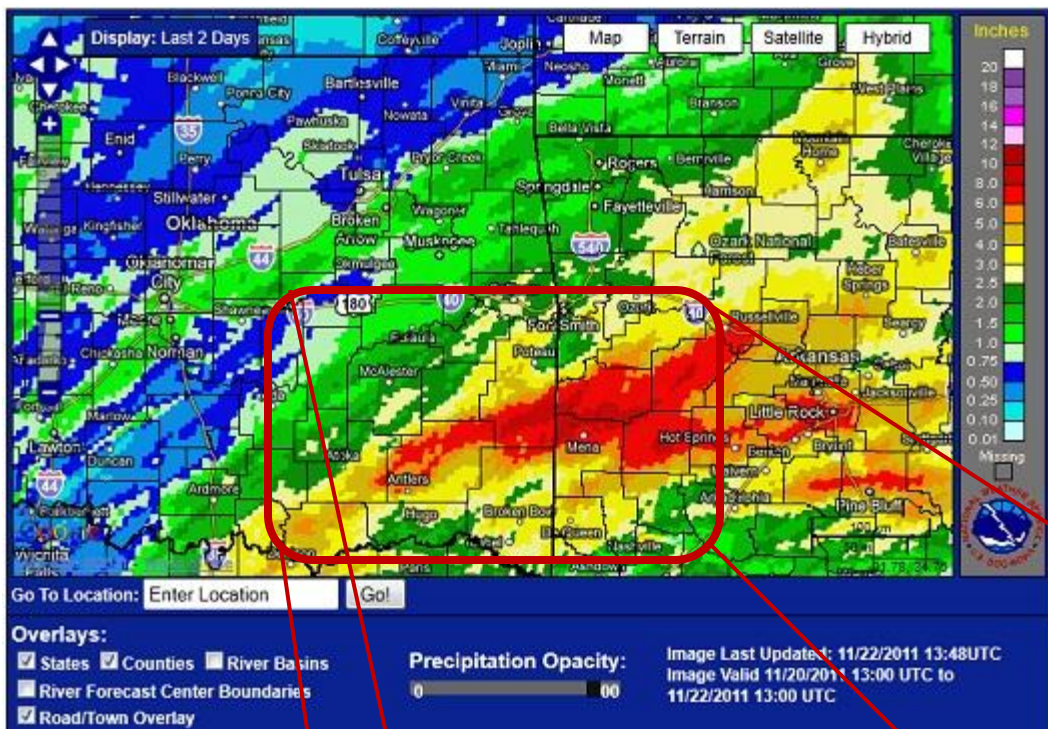


Fig. 16. Estimated 48-hr observed rainfall ending 7am CST 11/22/2011.



Written by:

Nicole McGavock  
 Service Hydrologist  
 WFO Tulsa

Products issued:

- 5 River Flood Warnings (FLW)
- 21 River Flood Statements (FLS)
- 1 River Flood Advisories (FLS) (1 Advisory FLS CON/EXT/CAN)
- 0 River Flood Watches (FFA) (0 Watch FFA CON/EXT/CAN)
- 0 River Statements (RVS)
- 2 Hydrologic Outlooks (ESF)
- 1 Drought Information Statements (DGT)