NWS FORM E-5 (11-88) (PRES. by NWS Instruction 10-924)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE	HYDROLOGIC SERVICE AREA (HSA) Tulsa, Oklahoma (TSA)
MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS		REPORT FOR: MONTH: **November** YEAR: **2016**
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 7, 2016**

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)

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

November 2016 was another very warm and dry month across eastern Oklahoma and northwest Arkansas. 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. This report, past E-5 reports, and monthly hydrology and climatology summaries can be found at http://www.weather.gov/tsa/hydro-monthly-summary.

Monthly Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for November 2016 ranged from a measly 0.20" in eastern Kay and western Osage Counties to around 4" in southeast Le Flore County. This corresponds to 50% or less of the normal November rainfall for the majority of eastern OK and northwest AR (Fig. 1b). Portions of eastern Kay, eastern Okfuskee, southern Okmulgee, and northwestern McIntosh Counties received less than 5% of the normal November rain. A few areas had 50% to 90% of the normal November rainfall.

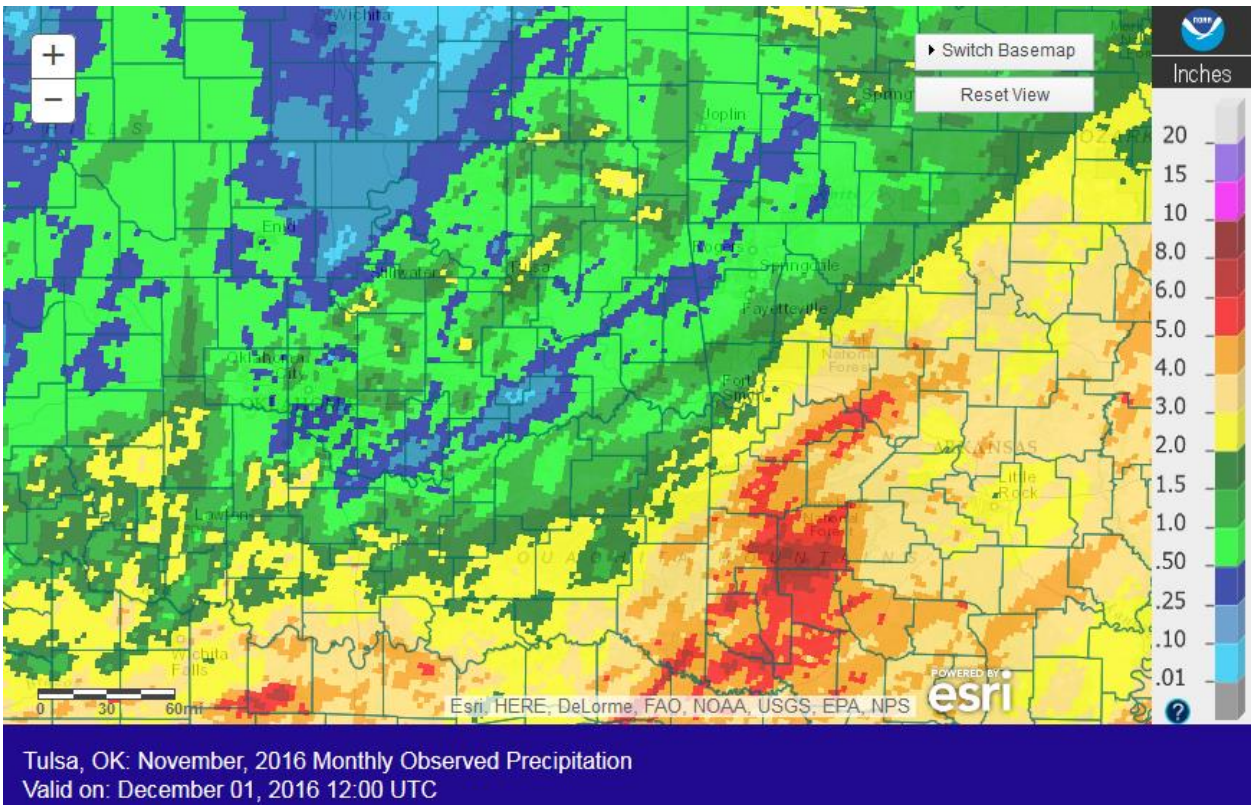


Fig. 1a. Estimated Observed Rainfall for November 2016

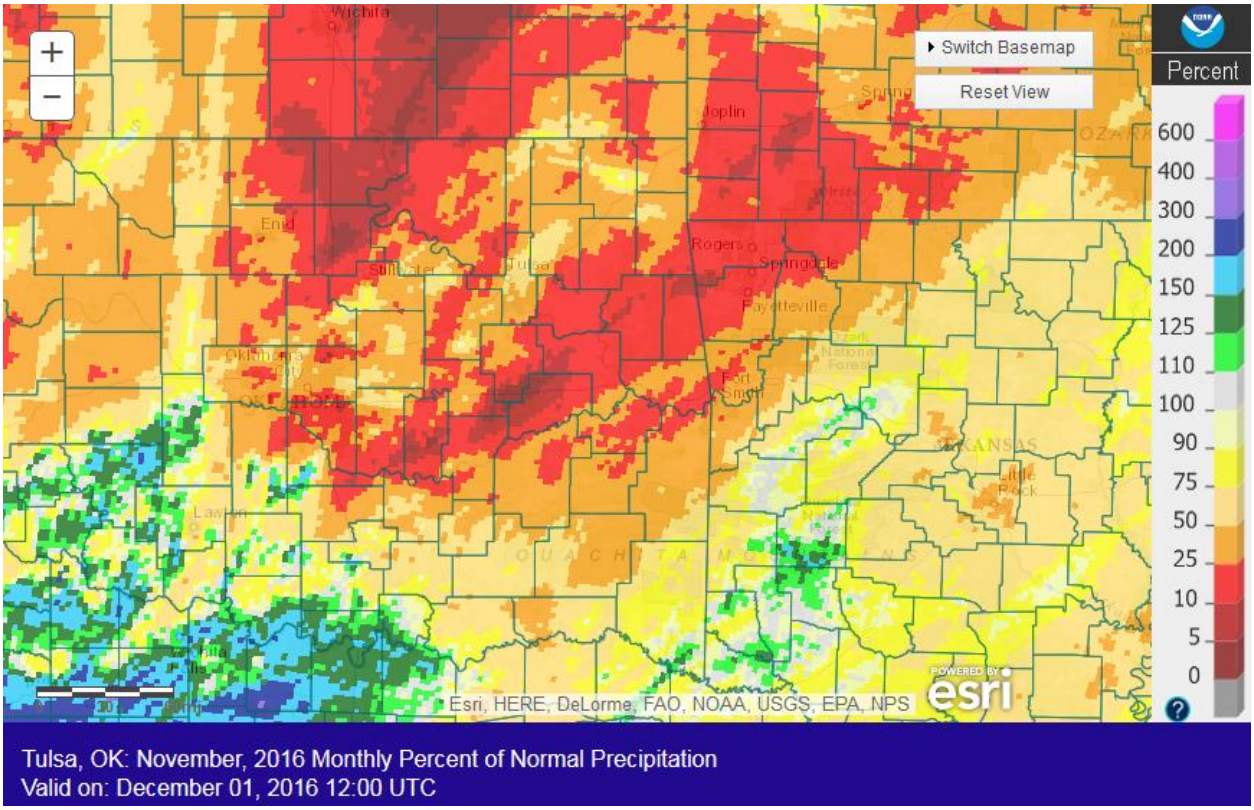


Fig. 1b. Estimated % of Normal Rainfall for November 2016

In Tulsa, OK, November 2016 ranked as the 6th warmest November (56.2°F; since records began in 1905) and the 59th driest November (1.88"; since records began in 1888). Fort Smith, AR had the 4th warmest November (57.0°F, tied 1931; since records began in 1882) and the 36th driest November (1.59", tied 2009; since records began in 1882). Fayetteville, AR had the 6th warmest (51.8°F) and the 5th driest (0.83") November since records began in 1949.

Some of the larger precipitation reports (in inches) for November 2016 included:

Hugo, OK (meso)	3.49	St. Paul 1E, AR (coop)	3.28	Ozark 4.6S, AR (coco)	3.13
Charleston 1.7E, AR (coco)	3.00	Vinita, OK (meso)	2.99	Cloudy, OK (meso)	2.82
Greenwood 1.9WNW, AR (coco)	2.60	Antlers, OK (meso)	2.42	Upper Spavinaw Port, OK (coop)	2.30
Winslow 7NE, AR (coop)	2.30				

Some of the lowest precipitation reports (in inches) for November 2016 included:

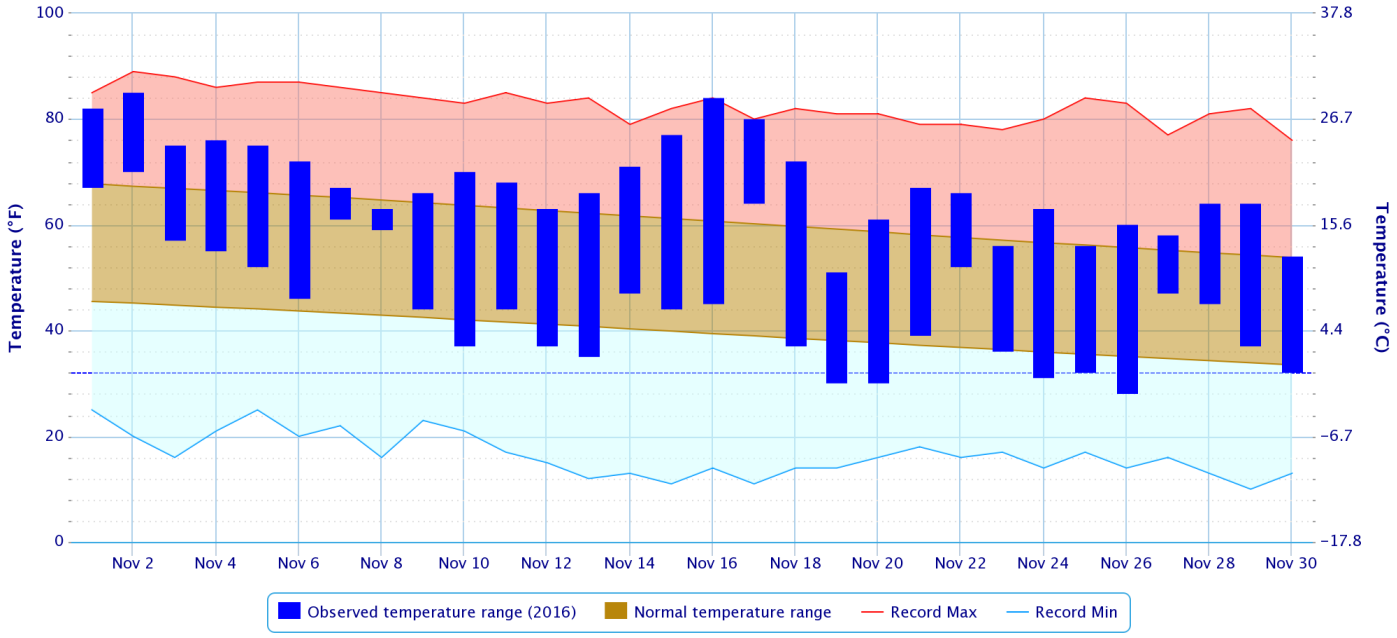
Burbank, OK (meso)	0.22	Foraker, OK (meso)	0.38	Sperry 6.7WNW, OK (coco)	0.38
Okmulgee, OK (meso)	0.44	Eufaula, OK (meso)	0.45	Skiatook, OK (meso)	0.46
Haskell, OK (meso)	0.53	Morris 2.4SW, OK (coco)	0.53	Tahlequah, OK (meso)	0.55
Muskogee, OK (ASOS)	0.55	NW AR Reg. Arpt. (ASOS)	0.55		

According to statistics from the Oklahoma Climatological Survey (OCS) Mesonet:

Rank since 1921	November 2016	Water Year-to-Date (Oct 1 – Nov 30)	Autumn-to-Date (Sep 1 – Nov 30)	Last 120 Days (Aug 3 – Nov 30)	Last 180 Days (Jun 4 – Nov 30)	Year-to-Date (Jan 1 – Nov 30)	Last 365 Days (Dec 2, 2015–Nov 30, 2016)
Northeast OK	22nd driest	45th driest	30th driest	29th driest	20th driest	20th driest	45th wettest
East Central OK	15th driest	17th driest	**10th driest**	**8th driest**	**10th driest**	13th driest	43rd wettest
Southeast OK	43rd driest	12th driest	11th driest	34th driest	19th driest	39th driest	21st wettest
Statewide	30th driest	20th driest	21st driest	25th driest	25th driest	37th driest	34th wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

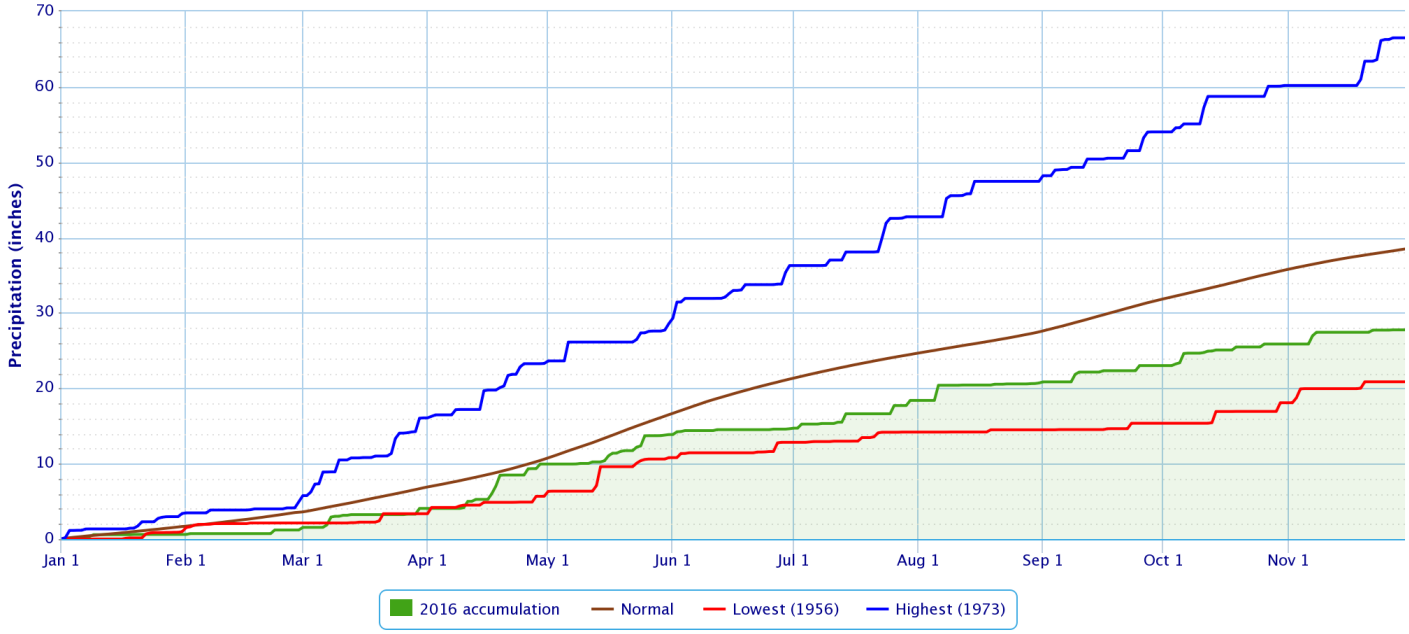
Period of Record – 1905-01-06 to 2016-12-06. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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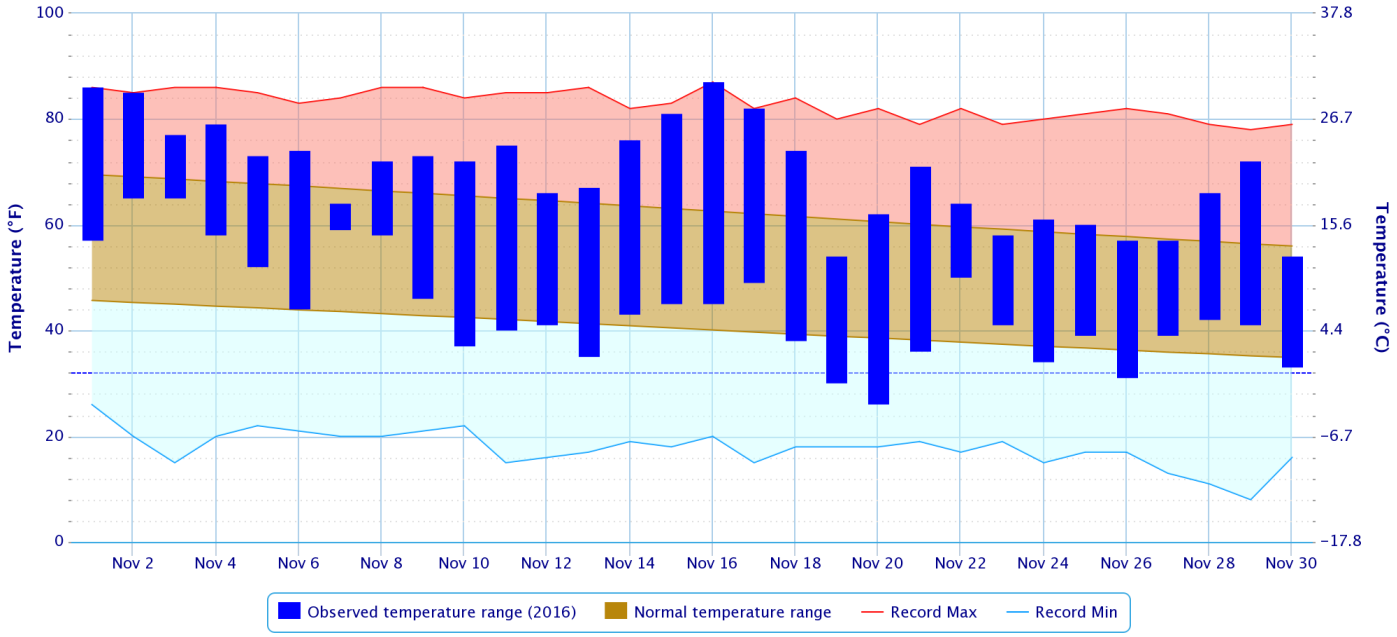
Daily Temperature Data – Fort Smith Area, AR (ThreadEx)

Period of Record – 1882-06-01 to 2016-12-06. Normals period: 1981-2010. Click and drag to zoom chart.



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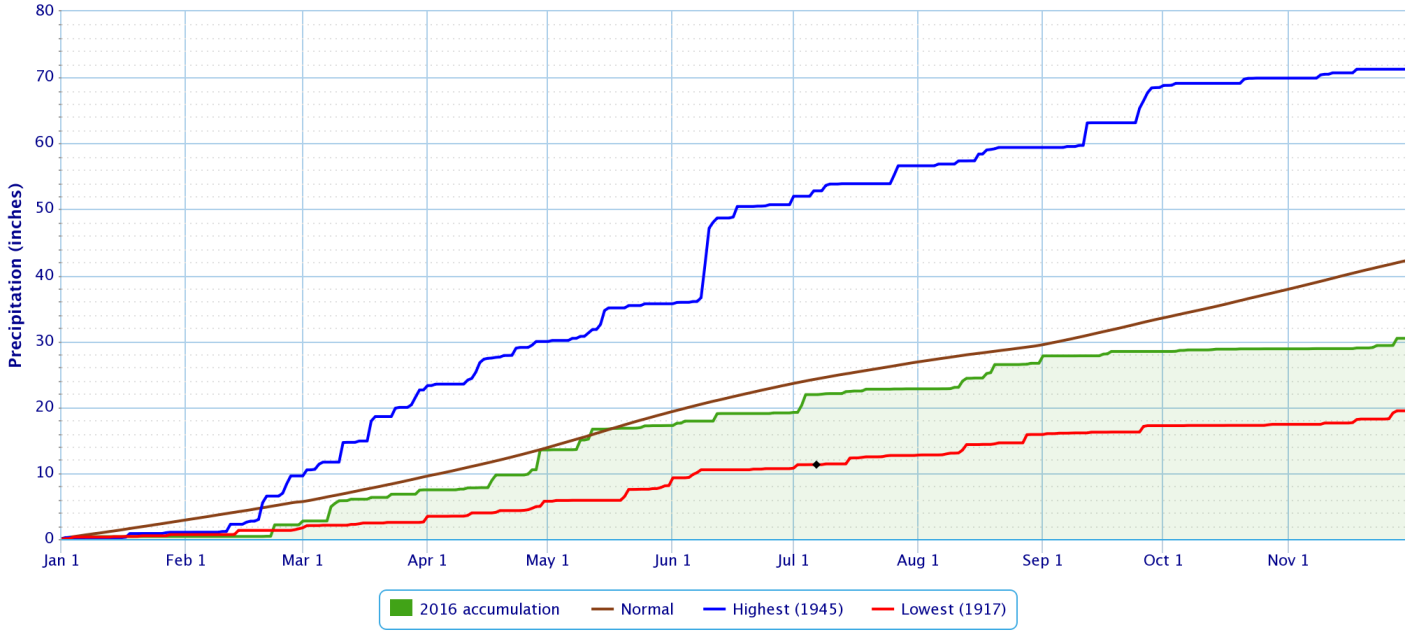
Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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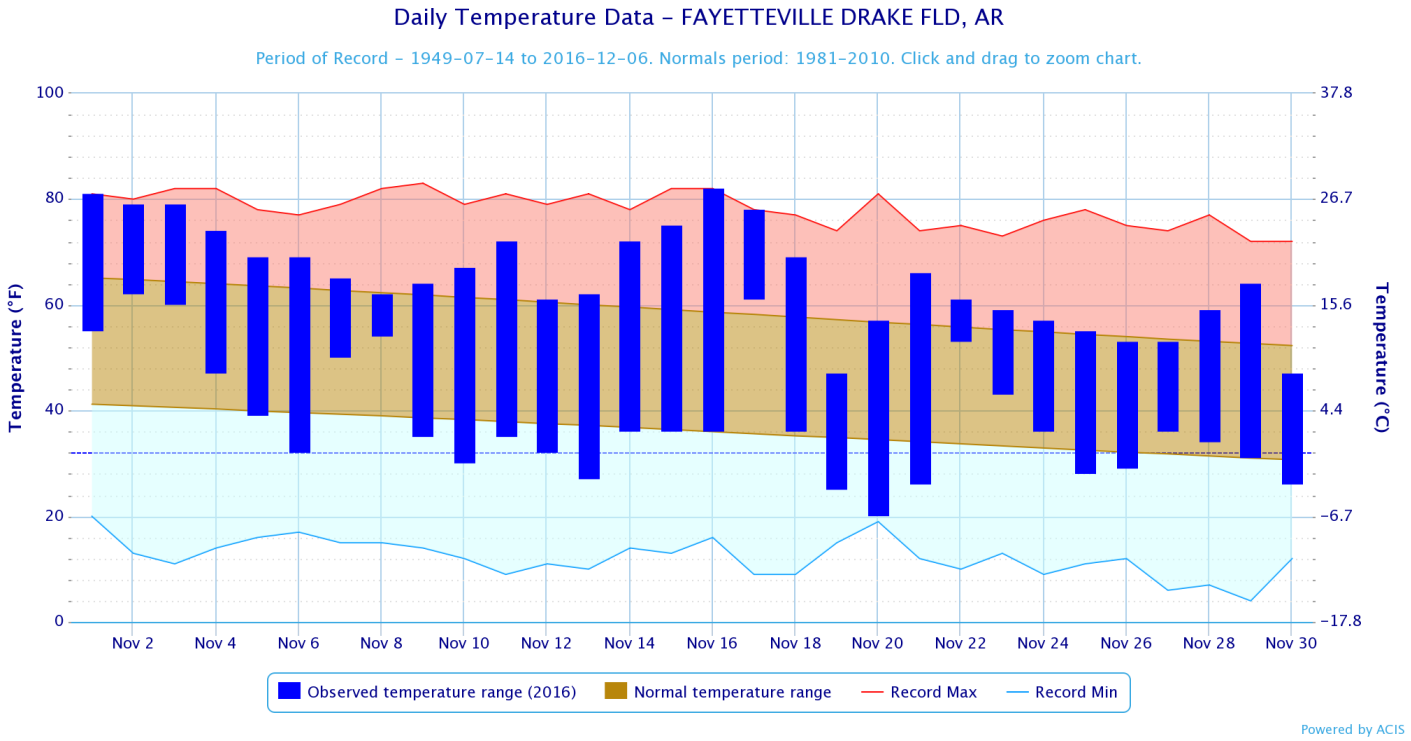
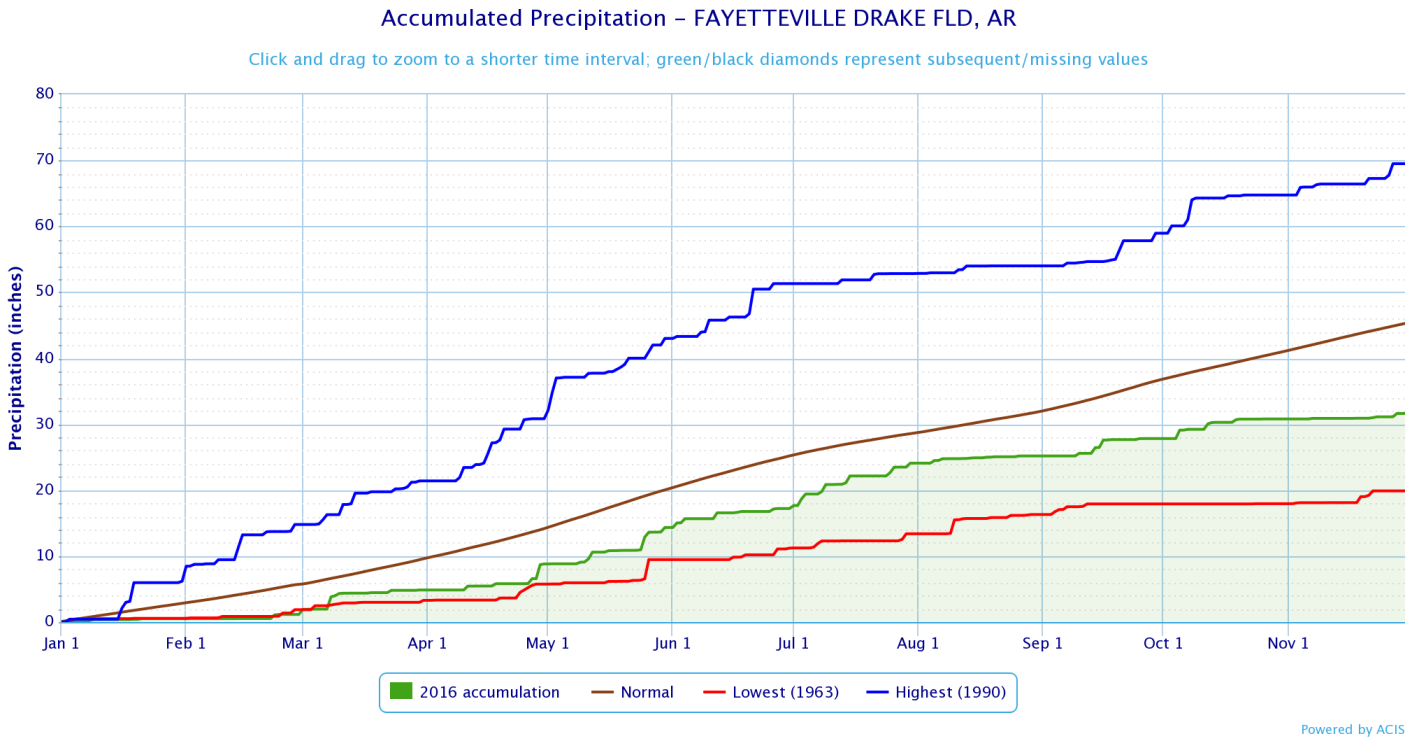




Drought

According to the U.S. Drought Monitor (USDM) from November 29, 2016 (Figs. 2, 3), D3 (Extreme Drought) conditions developed over western Pushmataha and western Choctaw Counties in southeast OK. D2 (Severe Drought) encompassed portions of Pittsburg, Haskell, Sequoyah, Latimer, Le Flore, Choctaw, and Pushmataha Counties in eastern OK, and Sebastian, Crawford, and Franklin Counties in west central AR. D1 (Moderate Drought) conditions existed over portions of Pawnee, Tulsa, Creek, Okmulgee, Okfuskee, McIntosh, Wagoner, Muskogee, Cherokee, and Adair Counties in eastern OK and Washington, Crawford, Madison, and Franklin Counties in northwest AR. D0 (abnormally dry conditions but not in drought) were present across portions of Pawnee, Osage, Tulsa, Washington, Nowata, Rogers, Mayes, Delaware, and Adair Counties in eastern OK, and Benton, Washington, Madison, and Carroll Counties in northwest AR.

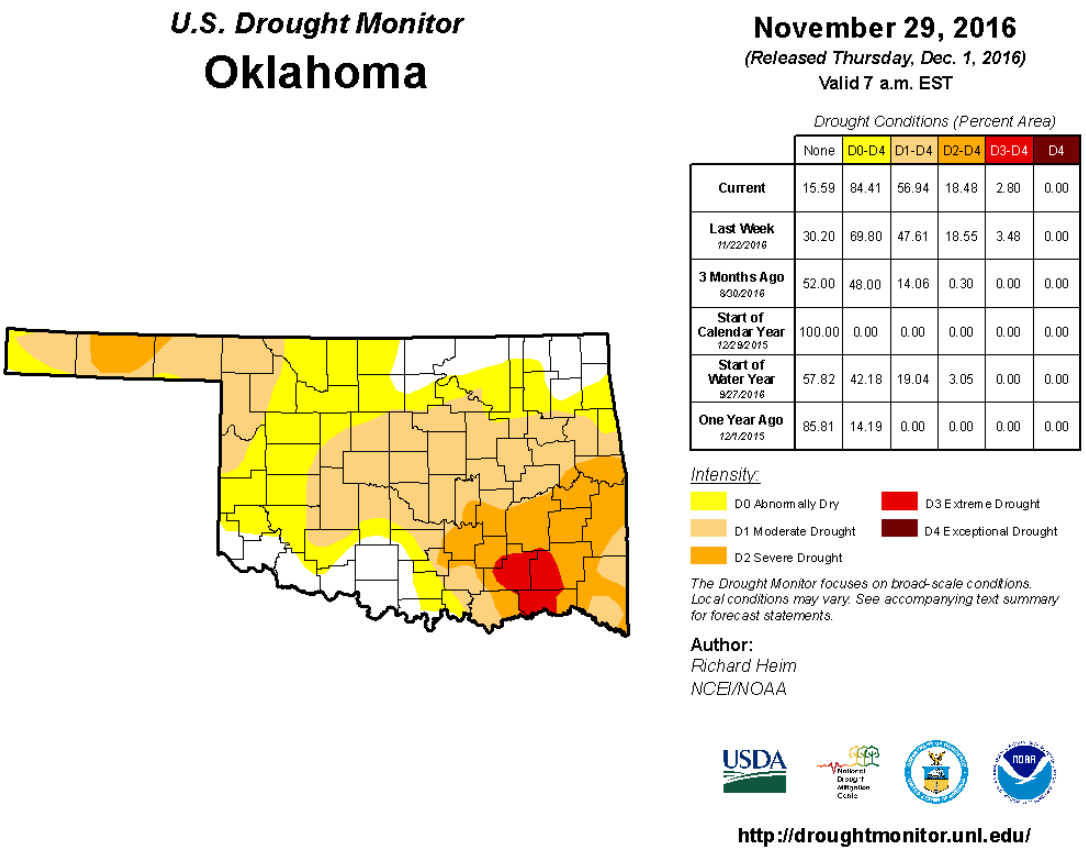


Fig. 2. Drought Monitor for Oklahoma

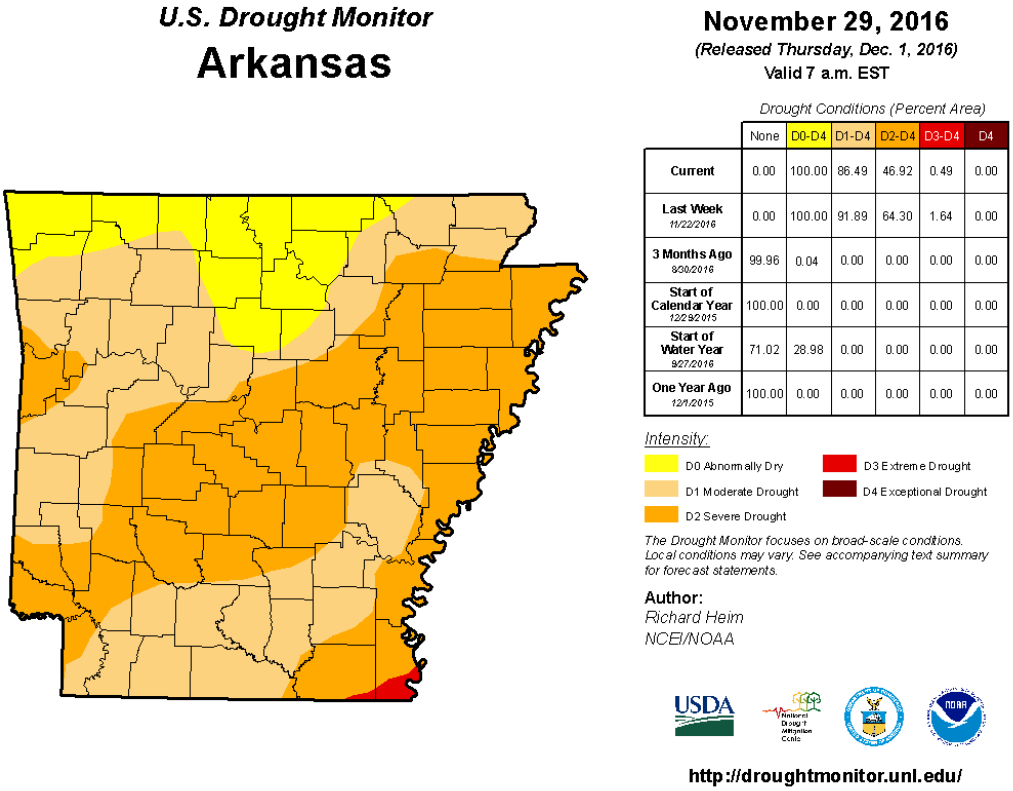
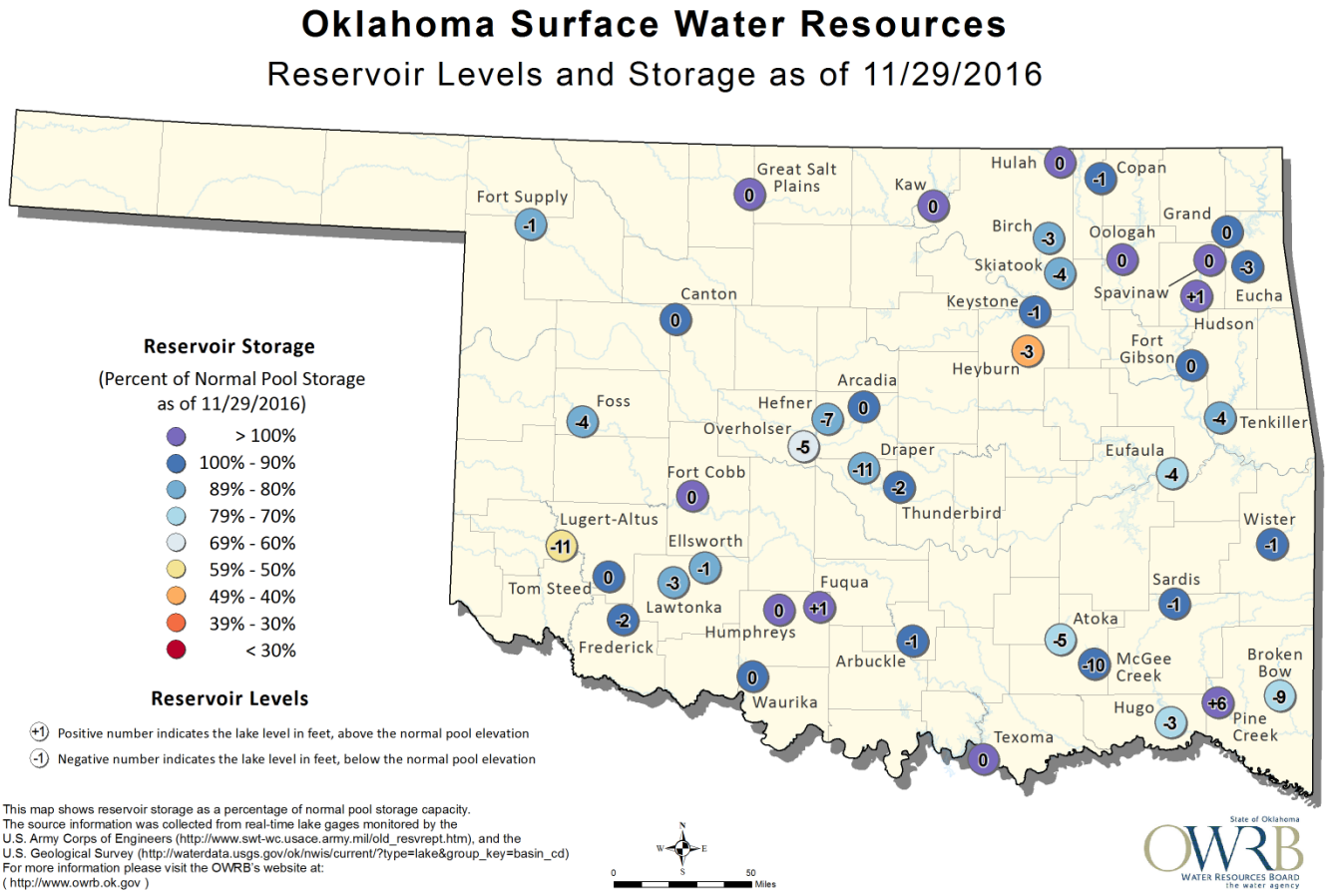


Fig. 3. Drought Monitor for Arkansas

Reservoirs



According to the USACE, several lakes in the HSA were well below the top of their conservation pool levels as of 11/30/2016. Reservoirs operating more than 3% below of the top of their conservation level include: Heyburn Lake 44%, Hugo Lake 75%, Eufaula Lake 76%, Beaver Lake 79%, Birch Lake 83%, Skiatook Lake 87%, Tenkiller Lake 87%, Copan Lake 90%, Wister Lake 92%, Keystone Lake 94%, and Sardis Lake 96%.

Outlooks

The Climate Prediction Center (CPC) outlook for December 2016 (issued November 30, 2016) indicates an equal chance of above, near, and below normal temperatures across all of eastern OK and northwest AR. This outlook also calls for a slightly enhanced chance for above median rainfall over southeast OK through northwest AR and equal chances for above, near, and below median precipitation elsewhere across northeast OK. This outlook takes into account weather conditions forecast over the next 1-2 weeks, as well as subseasonal climate signals in the weeks 2-4 time frame. The enhanced chance for above normal rainfall in primarily due to the rain expected during the first week of December.

For the 3-month period December-January-February 2016-17, CPC is forecasting an enhanced chance for above normal temperatures across all of eastern OK and northwest AR. This outlook as calls for an equal chance for above, near, and below median rainfall over northwest AR and an enhanced chance for below median precipitation elsewhere (outlook issued November 17, 2016). According to CPC, Pacific sea surface temperatures along the equator reflect weak La Niña conditions. This outlook is based on La Niña impacts, both statistical and dynamical forecast tools, and decadal timescale climate trends. The temperature outlook is highly uncertain and may be more dependent on low-frequency extratropical variability and subseasonal

tropical variability, including the Arctic Oscillation and the Madden-Julian Oscillation. CPC has issued a La Niña Advisory. La Niña has a 55% chance to continue into the December-January-February period.

Summary of Precipitation Events Daily quality controlled rainfall maps can be found at: http://water.weather.gov/precip/index.php?location_type=wfo&location_name=tsa

November 1-15

Late on the 2nd, a line of showers and thunderstorms developed from northeast into south central Oklahoma ahead of an approaching cold front. This activity affected locations near and north of I-44 through the early morning hours. These storms produced 0.10" to around 1.5" of rain, with 1.5" to around 2" in Craig County. The storms over south central OK moved east and also affected far southeast OK, bringing a few hundredths to around 0.50" to Choctaw, southern Pushmataha, and southwestern Pittsburg Counties. Some scattered showers developed over east central OK and west central AR during the late morning and early afternoon hours on the 3rd near the 850mb front (behind the surface front). This activity brought around 0.50" or less to primarily Latimer, Haskell, Le Flore, Sebastian, and southern Madison Counties.

Scattered light rain showers moved northeast across eastern OK and northwest AR during the late evening of the 6th through the morning of the 7th ahead of a short wave digging into southwest OK. Most locations that saw rain received less than 0.10", with 0.10"-0.25" over eastern Benton and northeast Washington (AR) Counties. These showers expanded in coverage through the afternoon hours as the short wave moved further east ahead of the main upper-level low over central OK. Widely scattered showers then persisted through the overnight hours before dissipating by mid-morning on the 8th. Most of the area received 0.10" to around 1.5" of rain, though portions of east central OK and west central AR remained dry (Fig. 4).

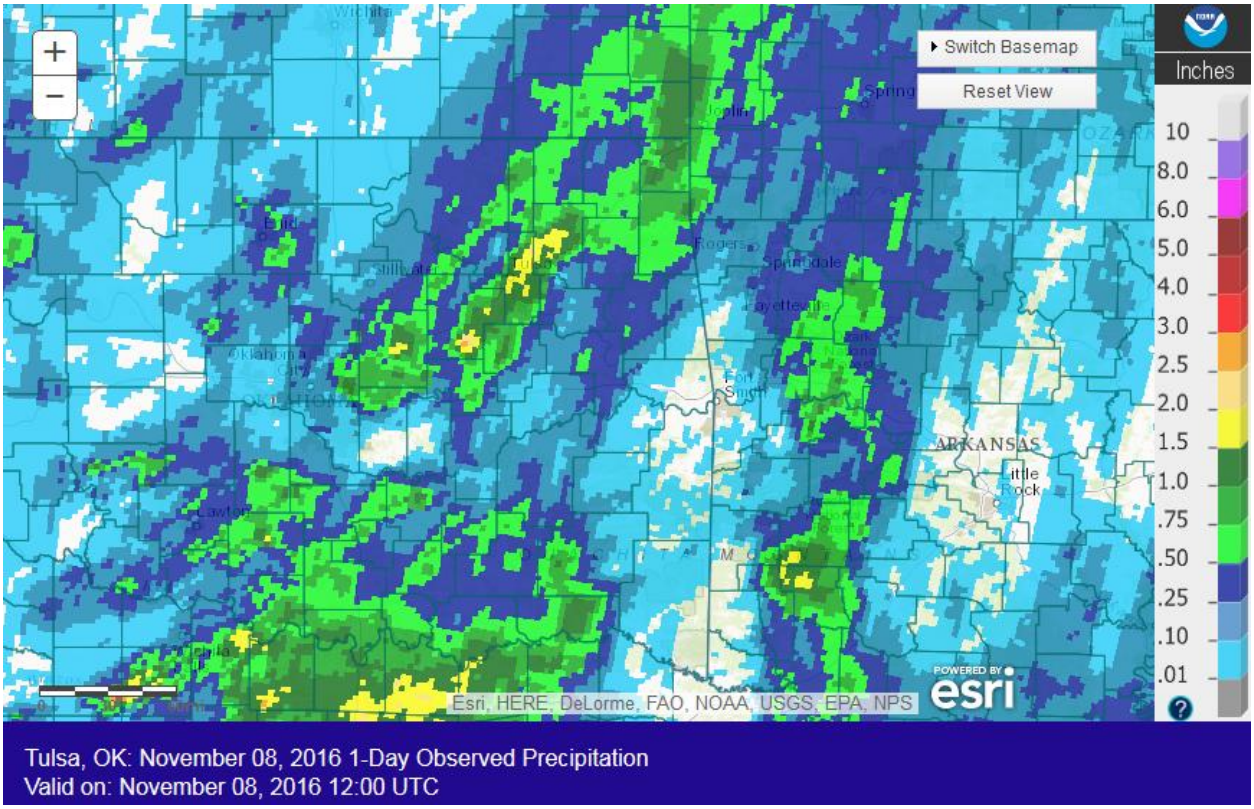


Fig. 4. 24-hr Estimated Observed Rainfall ending at 7am CDT 11/08/2016.

November 16-31

A strong cold front moved quickly through the area during the early morning hours of the 18th. Low-level moisture was minimal except for a narrow band of higher moisture across southeast OK into west central AR, where showers and thunderstorms developed. These storms moved east of the area by mid-morning. Due to the quick movement, rainfall totals remained light at around 0.25" or less.

Widely scattered showers affected northeast OK during the pre-dawn through mid-morning hours of the 22nd as an upper-level disturbance moved through the area. This activity moved eastward across the remainder of eastern OK and northwest AR through the afternoon. A cold front then moved into the area mid-evening, sparking a line of thunderstorms from Osage and Pawnee Counties into south central OK. This line of storms move eastward across the HSA through the evening and late-night hours. Rainfall totals ranged from a few hundredths to 1", with southeast Le Flore County receiving 1"-3" of rain (Fig. 5).

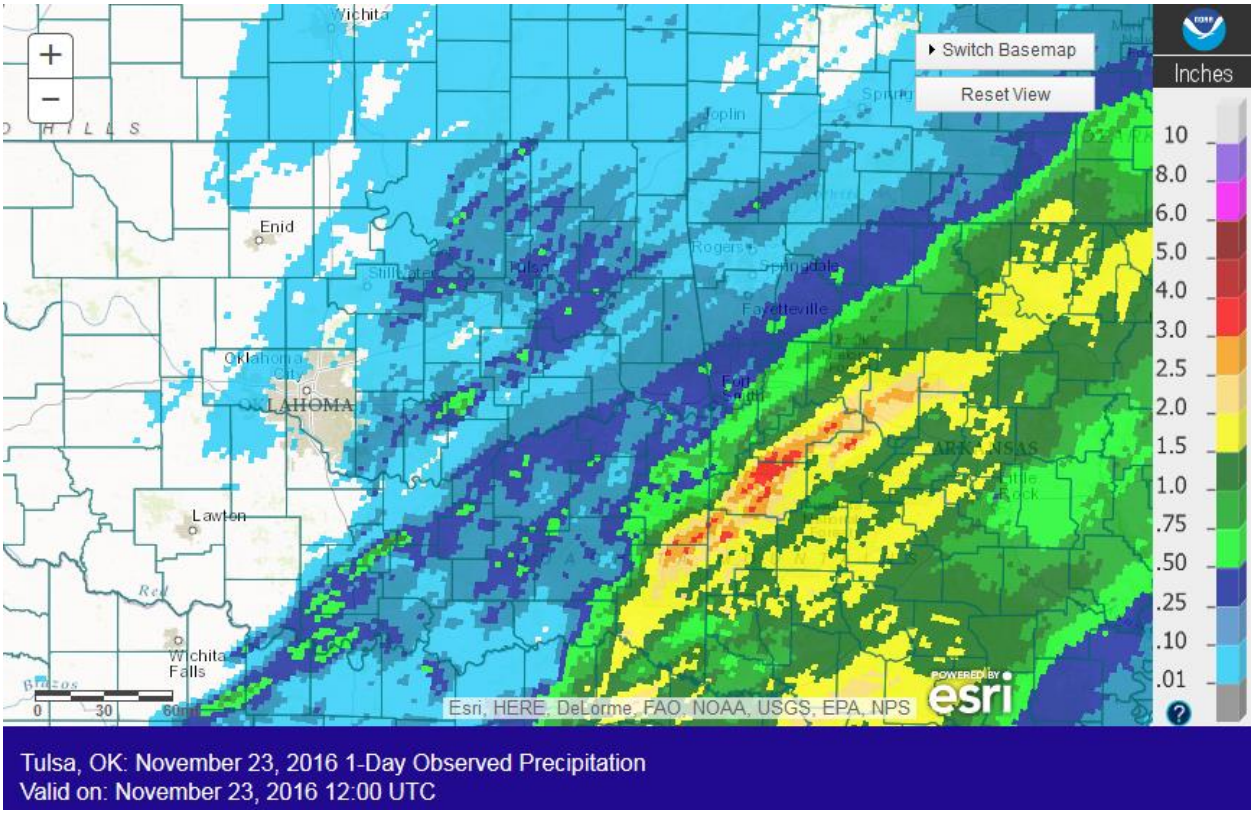


Fig. 5. 24-hr Estimated Observed Rainfall ending at 6am CST 11/23/2016.

A line of showers and weak thunderstorms moved across KS and OK on the 27th, entering eastern OK around noon. This activity moved through eastern OK and western AR and was east of the area by late afternoon. A more significant area of showers and thunderstorms developed over south central OK and north central TX shortly after midnight on the 28th. These storms spread across eastern OK and northwest AR along and south of a Eufaula Lake to Rogers line through the morning hours, exiting the region around noon. Rainfall totals ranged from 0.10" to 2", with the highest totals across southeast OK.

Written by:

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Products issued in November 2016:

*CWYO2 became a daily river forecast point September 7, 2016
*MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014
*Mixed case River Flood products began July 31, 2013

0 Flash Flood Warnings (FFW)
0 Flash Flood Statements (FFS)
0 Flash/Areal Flood Watches (FFA) (0 Watch FFA CON/EXT/EXA/EXB/CAN)
1 Urban and Small Stream Advisories (FLS)
0 Areal Flood Warnings (FLW)

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

Preliminary Hydrographs:
None