

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 2018
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 3, 2018	

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.

It was a fairly quiet November across eastern OK and northwest AR, though there was minor river flooding (from late Oct. rainfall) at the beginning, snow in the middle, and tornadoes at the end of the month. Temperatures were generally cold this month, with most locations 5°-6°F below normal. 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 2018 ranged from 0.50" to near 5" across eastern OK and northwest AR. This corresponds to 10% to 75% of the normal November rainfall across the majority of the area (Fig. 1b). Only a small portion of Benton County AR received 75%-110% of the normal rainfall this month.

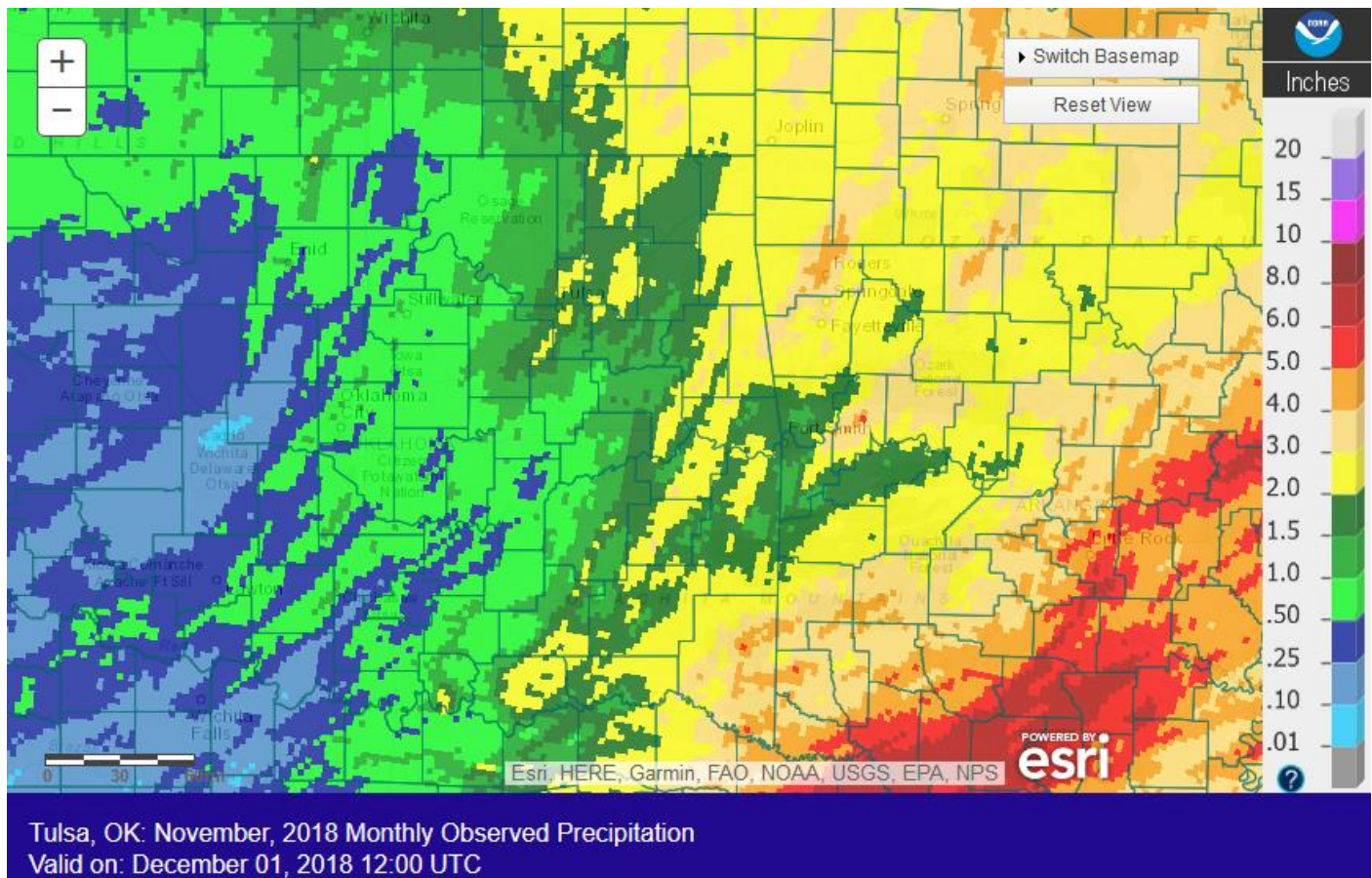


Fig. 1a. Estimated Observed Rainfall for November 2018

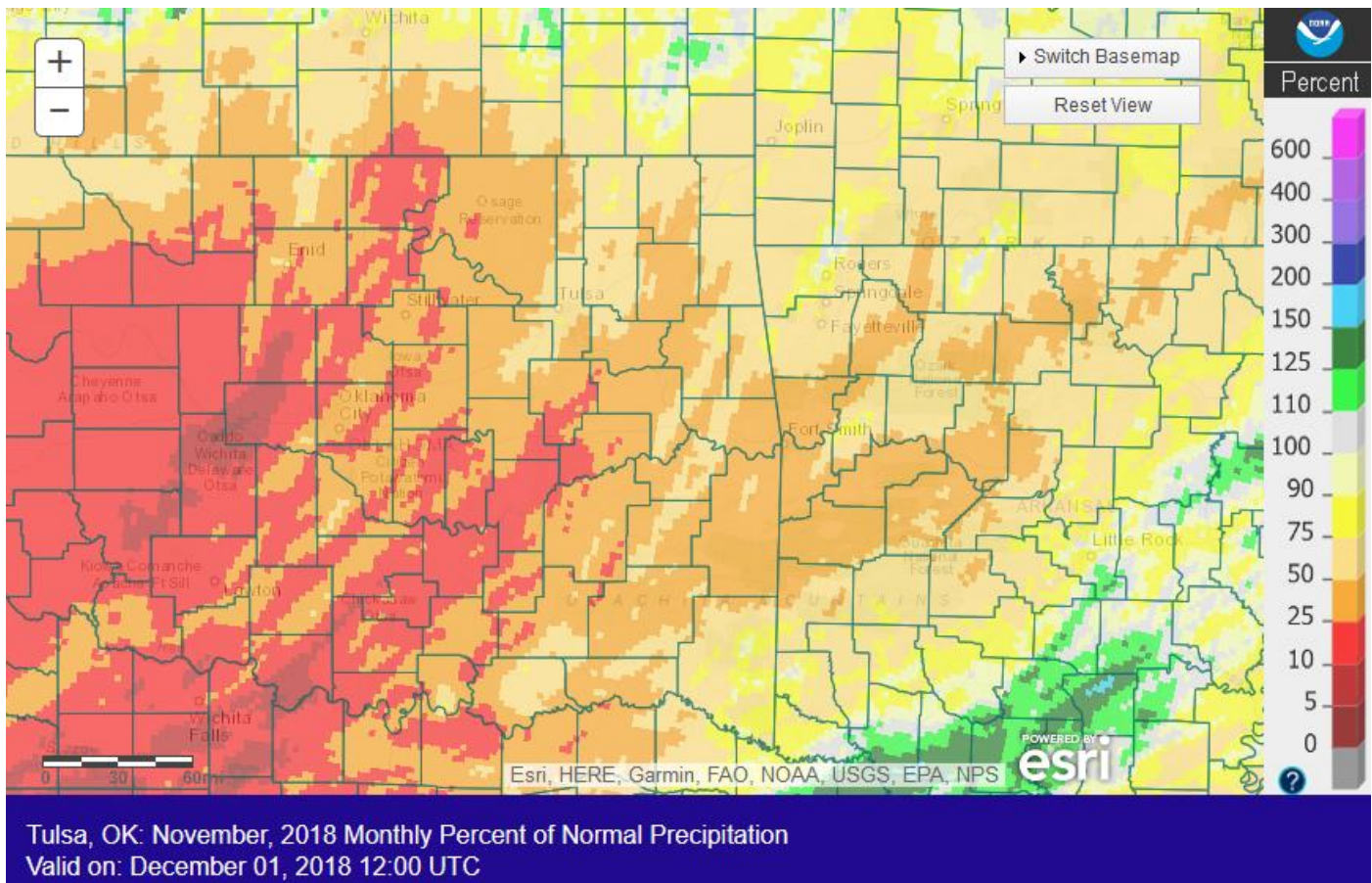


Fig. 1b. Estimated % of Normal Rainfall for November 2018

In Tulsa, OK, November 2018 ranked as the 13th coldest November (45.4°F; since records began in 1905), the 51st driest November (1.67"; since records began in 1888), and the 13th snowiest November (1.6"; since records began in 1900). Fort Smith, AR had the 11th coldest November (46.5°F; since records began in 1882) and the 40th driest November (1.67"; since records began in 1882). Fayetteville, AR had the 2nd coldest (41.3°F, tied 2000, 1972), the 33rd driest (2.72"), and the 12th snowiest (0.3") November since records began in 1949.

Some of the larger precipitation reports (in inches) for November 2018 included:

Ozark, AR (coop)	4.49	Riverdale 4.2E, AR (coco)	4.19	Charleston 1.7E, AR (coco)	4.00
Greenwood 1.4W, AR (coco)	3.86	Greenwood 1.9WNW (coco)	3.68	NW AR Reg. Airport (ASOS)	3.62
Bentonville 6.6SSW, AR (coco)	2.95	Garfield 3.9E, AR (coco)	2.88	Upper Spavinaw Port, OK (coop)	2.85

Some of the lowest precipitation reports (in inches) for November 2018 included:

Terlton 3.7ESE, OK (coco)	0.48	Drumright 0.6SW, OK (coco)	0.52	Burbank, OK (meso)	0.63
Pawnee, OK (meso)	0.74	Sand Springs 4.6WNW, OK (coco)	0.84	Okmulgee, OK (meso)	0.85
Ochelata 5.6N, OK (coco)	0.86	Foraker, OK (meso)	0.98	Okemah, OK (meso)	0.99

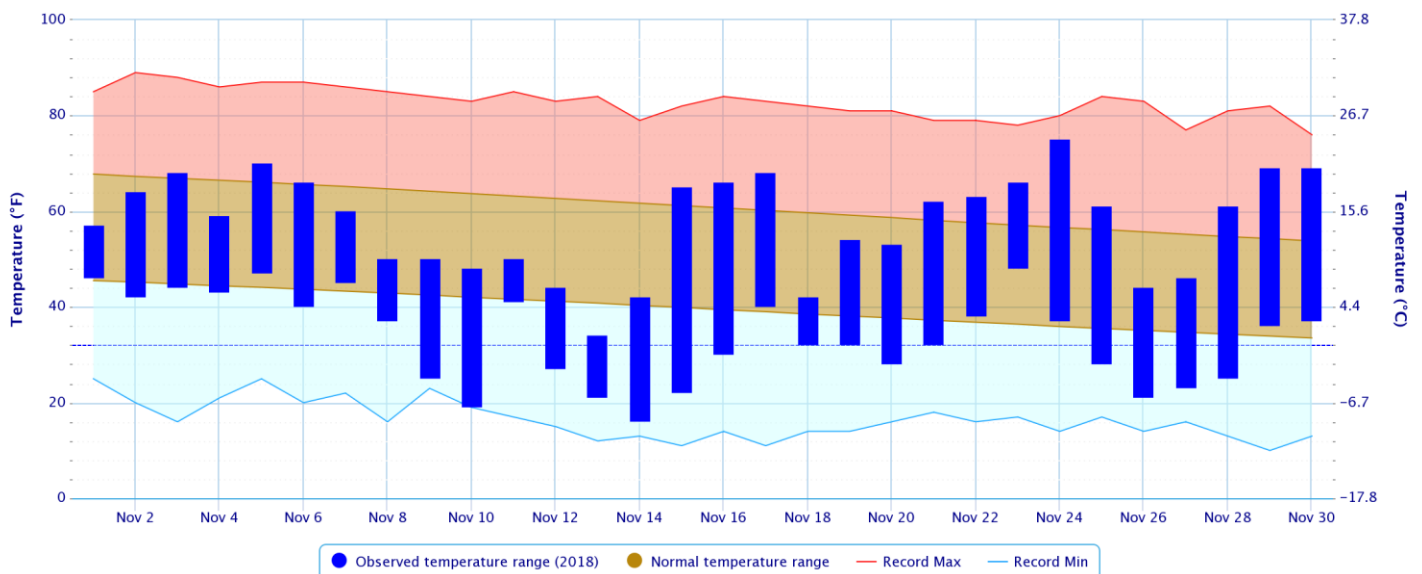
In Tulsa, OK, Autumn (Sep-Oct-Nov) 2018 ranked as the 27th coldest Autumn (60.9°F; since records began in 1905) and the 46th driest Autumn (7.82"; since records began in 1888). Fort Smith, AR had the 60th coldest Autumn (62.4°F, tied 1988, 1896; since records began in 1882) and the 25th wettest Autumn (14.12"; since records began in 1882). Fayetteville, AR had the 17th coldest (57.4°F, tied 2009, 2000, 1972, 1949) and the 20th driest (8.02", tied 1995) Autumn since records began in 1949.

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

Rank since 1921	November 2018	Water Year-to-Date (Oct 1 – Nov 30)	Fall 2018 (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 1, 2017– Nov 30, 2018)
Northeast OK	31 st driest	41 st wettest	41 st driest	47 th wettest	42 nd driest	30 th driest	25 th driest
East Central OK	28 th driest	46 th wettest	47 th wettest	34 th wettest	37 th wettest	20 th wettest	22 nd wettest
Southeast OK	40 th driest	19 th wettest	13 th wettest	5th wettest	9th wettest	12 th wettest	12 th wettest
Statewide	25 th driest	19 th wettest	9th wettest	6th wettest	12 th wettest	26 th wettest	30 th wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

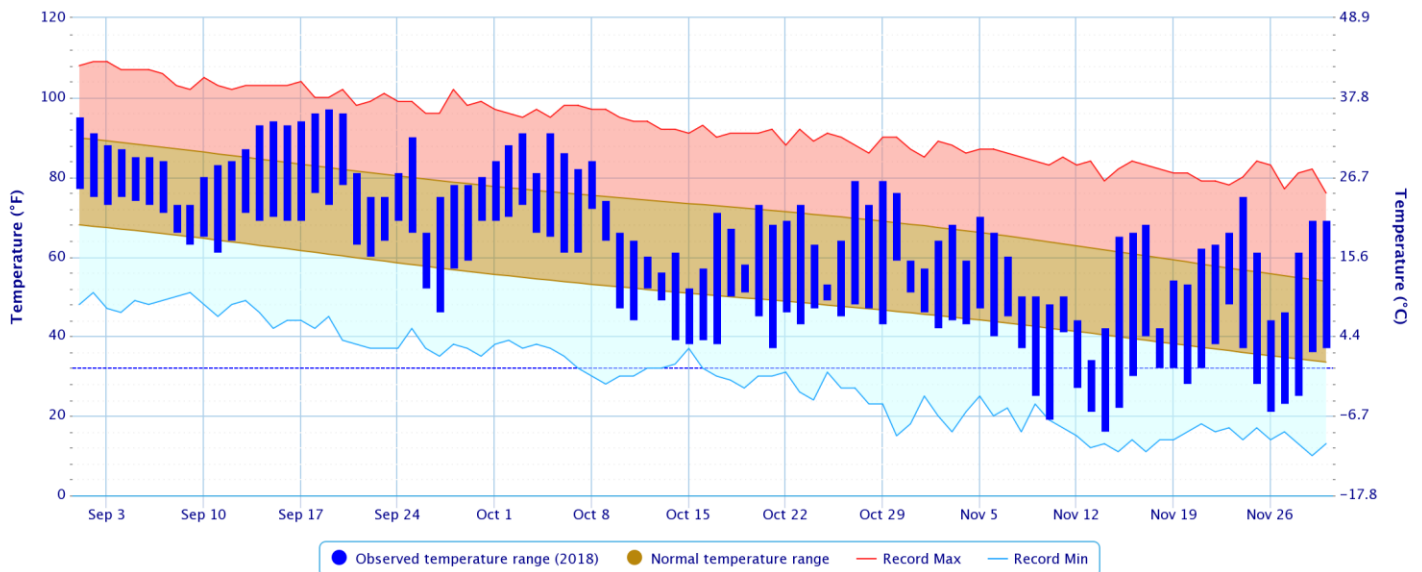
Period of Record – 1905-01-06 to 2018-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



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Daily Temperature Data – Tulsa Area, OK (ThreadEx)

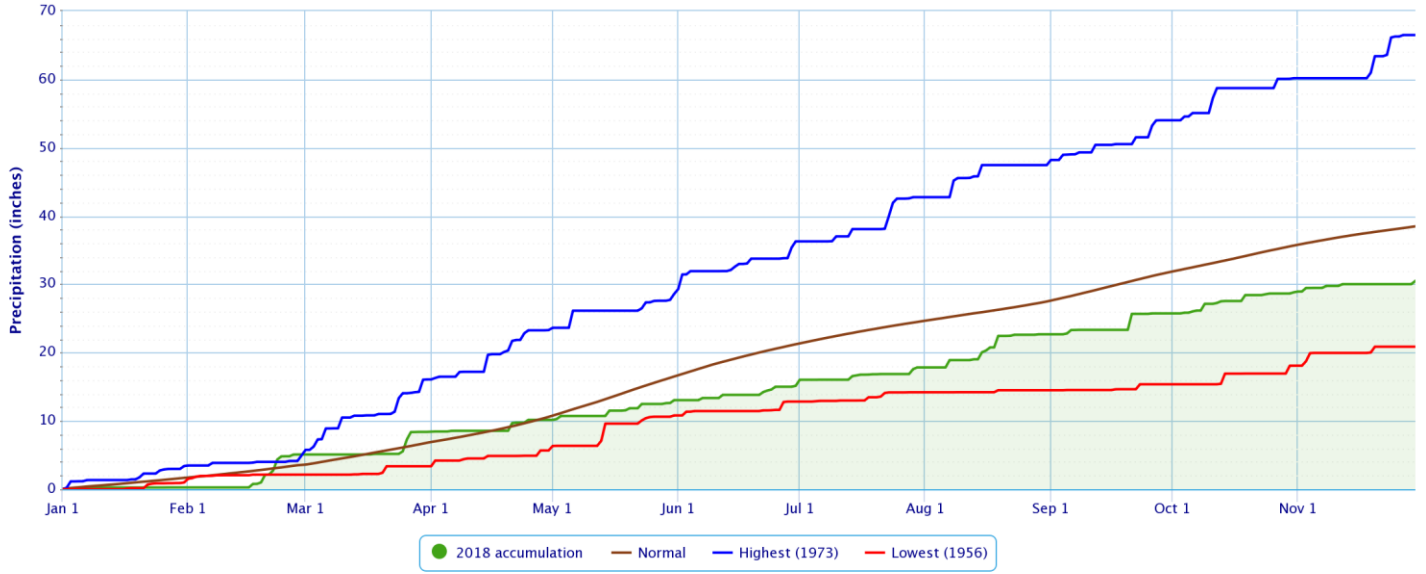
Period of Record – 1905-01-06 to 2018-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



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Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

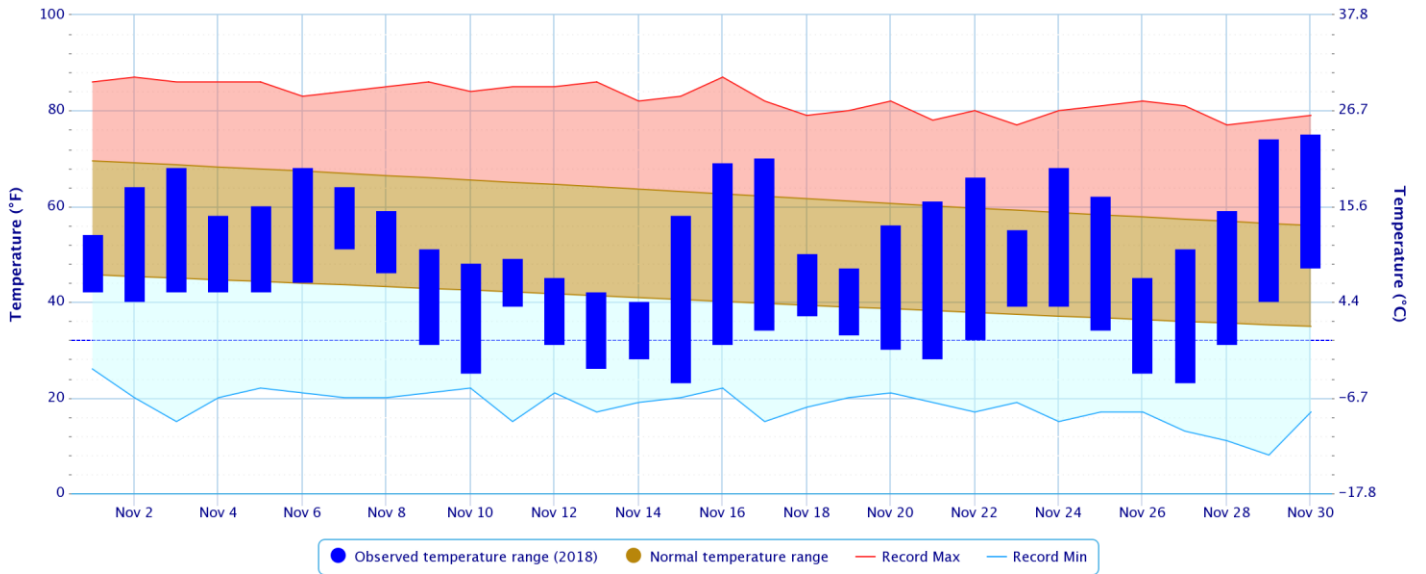
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Daily Temperature Data – FORT SMITH REGIONAL AP, AR

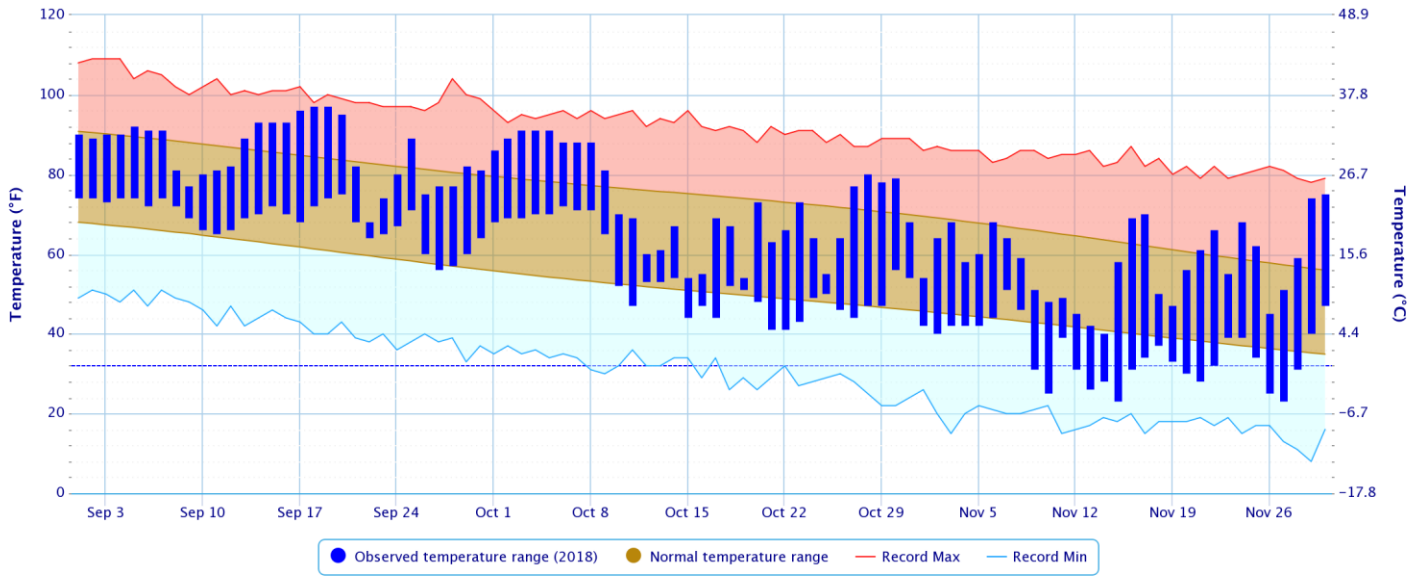
Period of Record – 1945-09-27 to 2018-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



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

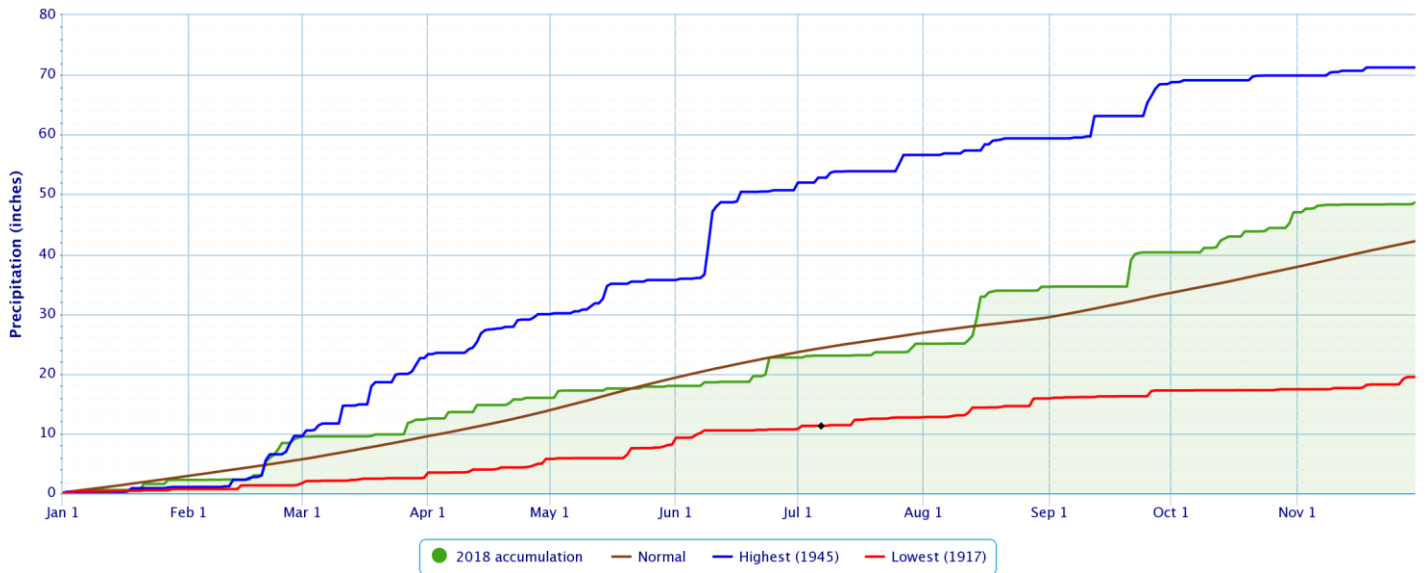
Period of Record – 1882-06-01 to 2018-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



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Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

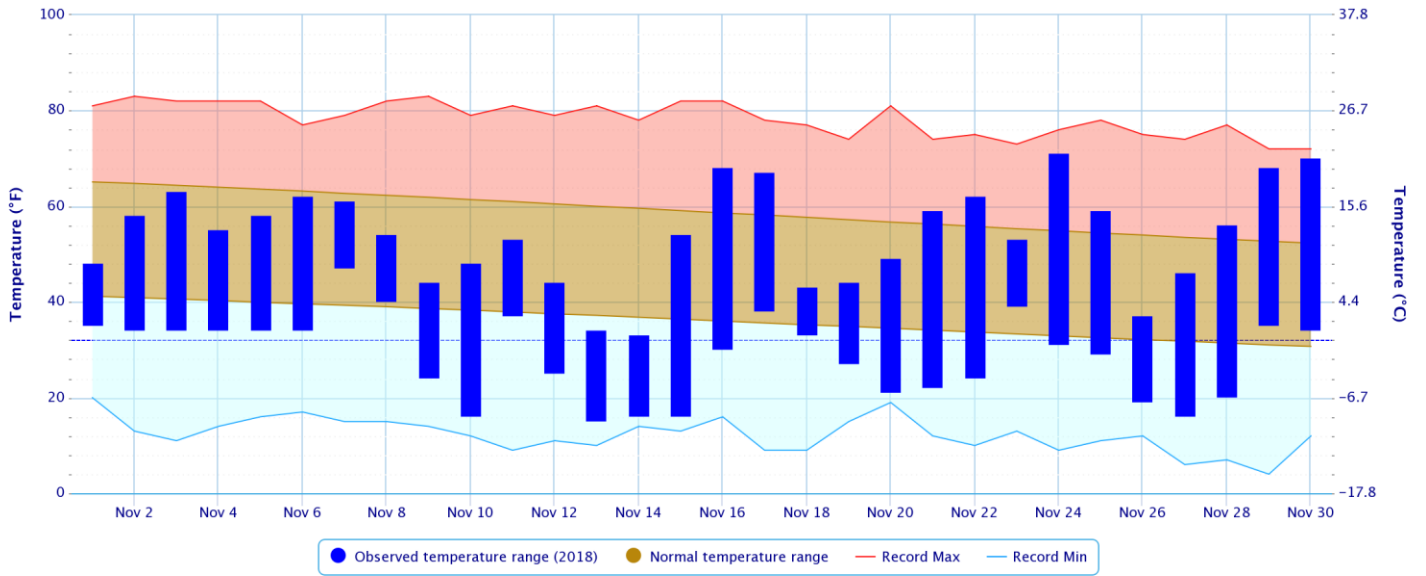
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

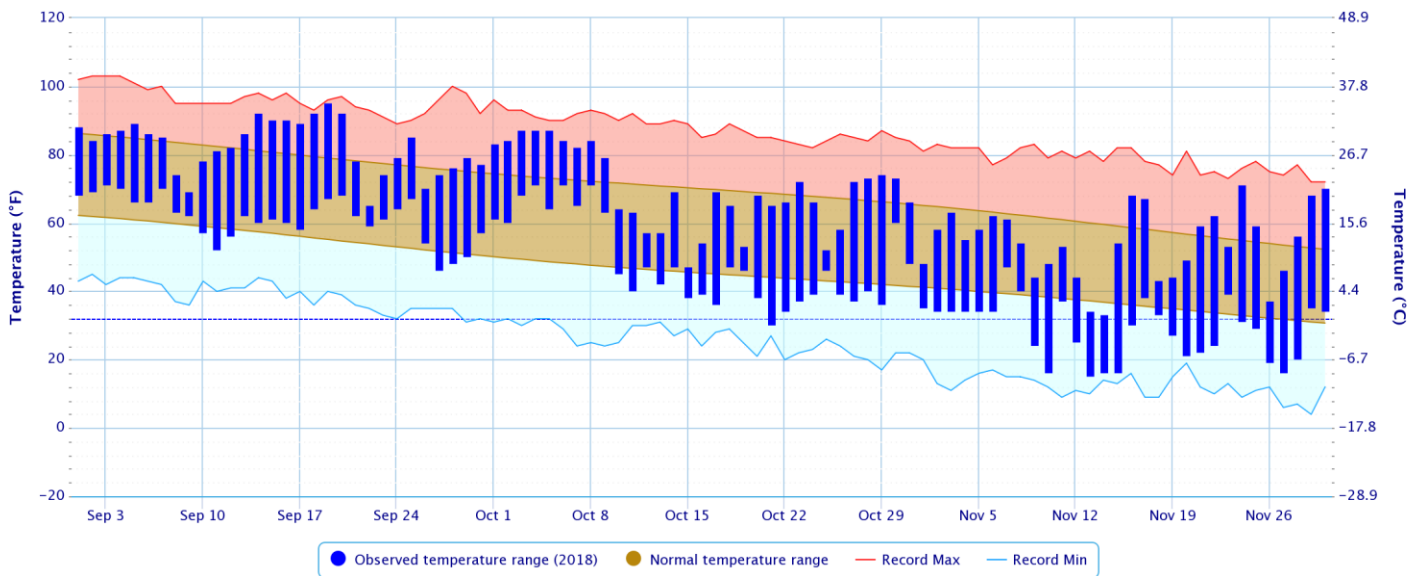
Period of Record – 1949-07-14 to 2018-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



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Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

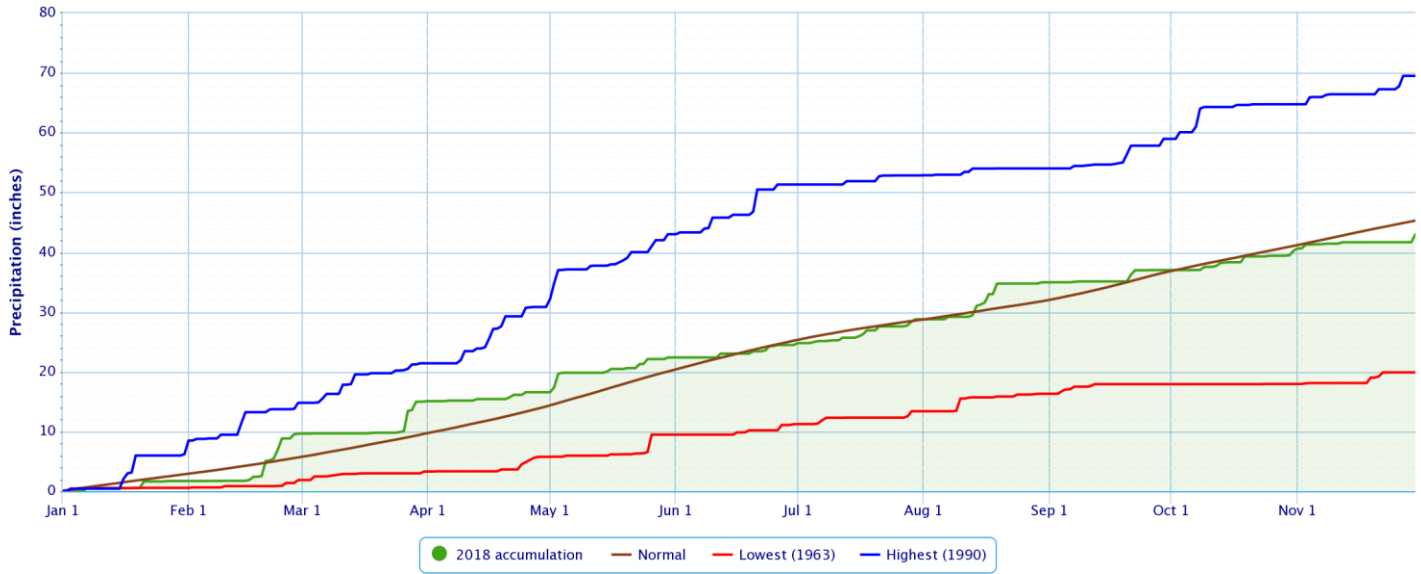
Period of Record – 1949-07-14 to 2018-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



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Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

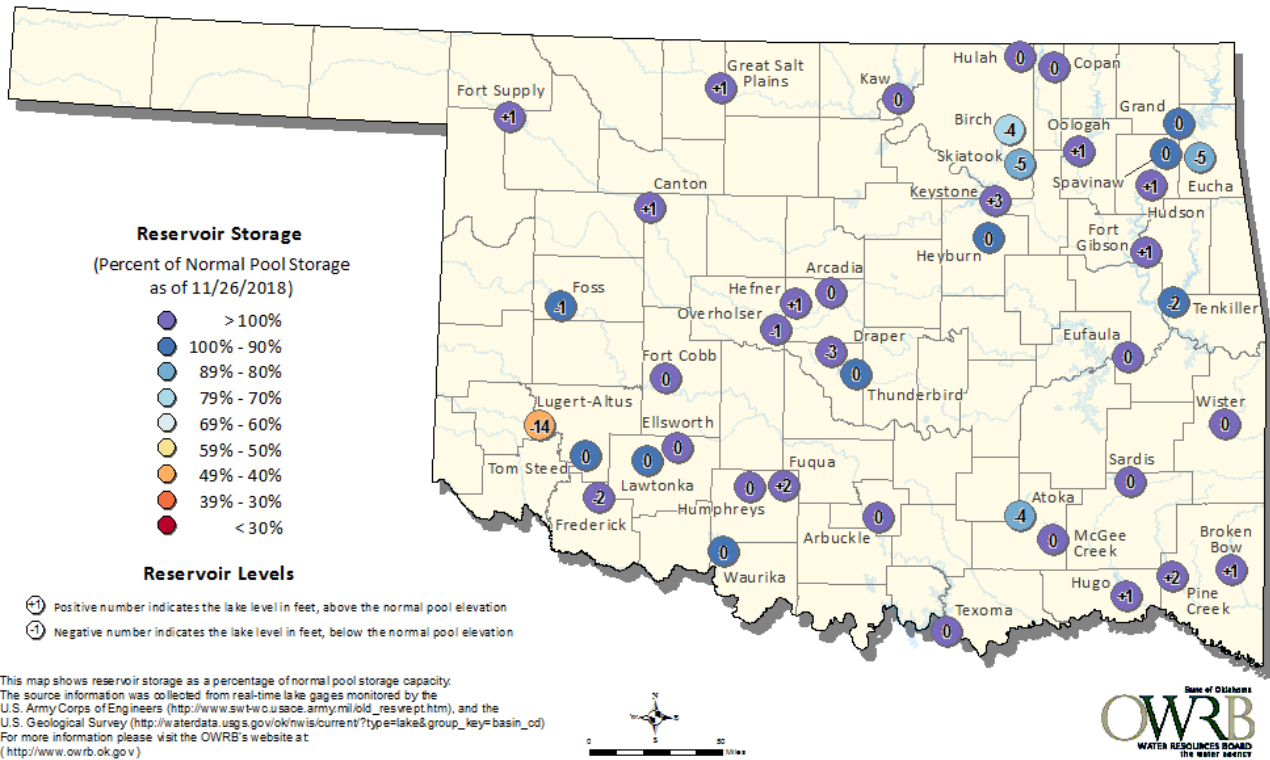
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Reservoirs

Oklahoma Surface Water Resources Reservoir Levels and Storage as of 11/26/2018



According to the USACE, most lakes in the HSA were within $\pm 3\%$ of their conservation pool level. Reservoirs below 3% of their conservation pool storage as of 11/30/2018: Birch Lake 71%, Skiatook Lake 83%, Tenkiller Lake 92%, and Beaver Lake 93%. One reservoir was above 3% of its conservation pool storage as of 11/30/2018: Keystone Lake 104%.

Drought

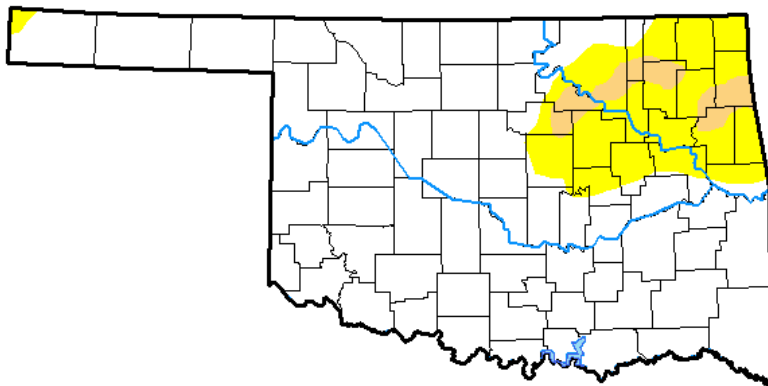
According to the [U.S. Drought Monitor](#) (USDM) from November 27, 2018 (Figs. 2, 3), Moderate (D1) drought conditions were present across portions of Pawnee, Osage, Washington, Rogers, Mayes, Delaware, and Cherokee Counties in eastern OK, and Benton County in northwest AR. Abnormally Dry (D0) but not in drought conditions encompassed portions of Pawnee, Osage, Creek, Washington, Tulsa, Rogers, Mayes, Nowata, Craig, Ottawa, Delaware, Okfuskee, Okmulgee, McIntosh, Wagoner, Muskogee, Cherokee, Sequoyah, and Adair Counties in eastern Oklahoma and Benton, Carroll, Washington, Madison, Crawford, and Franklin Counties in northwest Arkansas.

**U.S. Drought Monitor
Oklahoma**

November 27, 2018
(Released Thursday, Nov. 29, 2018)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	81.67	18.33	3.27	0.00	0.00	0.00
Last Week <i>11-20-2018</i>	92.22	7.78	2.12	0.00	0.00	0.00
3 Months Ago <i>08-28-2018</i>	53.85	46.15	31.47	18.63	5.65	0.00
Start of Calendar Year <i>01-02-2018</i>	0.00	100.00	77.15	38.76	0.00	0.00
Start of Water Year <i>09-29-2018</i>	72.93	27.07	9.11	4.16	0.00	0.00
One Year Ago <i>11-28-2017</i>	27.12	72.88	39.90	20.80	0.78	0.00



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.

Author:

Richard Heim
NCEI/NOAA

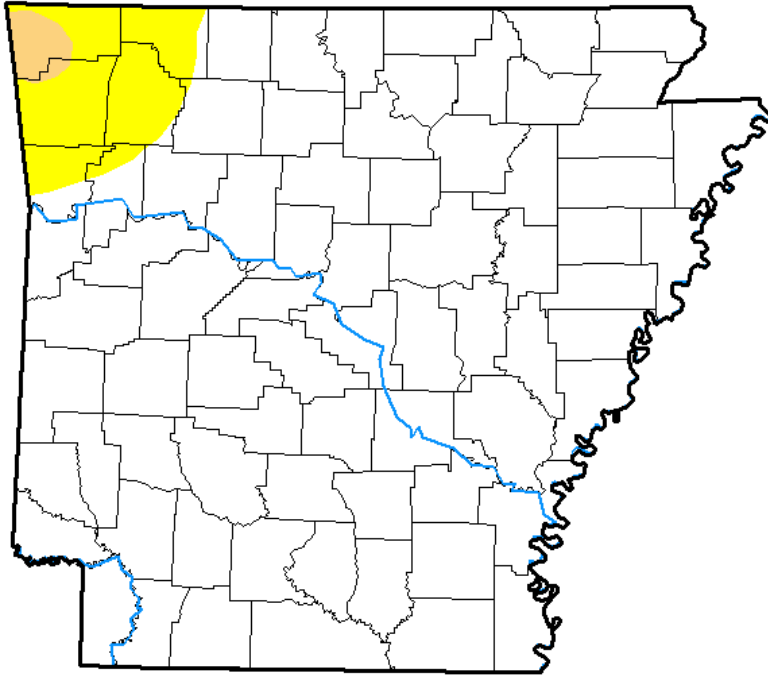


<http://droughtmonitor.unl.edu/>

Fig. 2. Drought Monitor for Oklahoma

U.S. Drought Monitor Arkansas

November 27, 2018
(Released Thursday, Nov. 29, 2018)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	93.02	6.98	0.90	0.00	0.00	0.00
Last Week 11-20-2018	98.71	1.29	0.00	0.00	0.00	0.00
3 Months Ago 08-28-2018	85.49	14.51	6.08	0.43	0.00	0.00
Start of Calendar Year 01-02-2018	8.22	91.78	71.27	32.01	2.37	0.00
Start of Water Year 09-25-2018	93.15	6.85	2.59	0.00	0.00	0.00
One Year Ago 11-28-2017	1.39	98.61	85.20	61.27	14.66	0.00

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.

Author:

Richard Heim
NCEI/NOAA



<http://droughtmonitor.unl.edu/>

Fig. 3. Drought Monitor for Arkansas

Outlooks

The [Climate Prediction Center](#) (CPC) outlook for December 2018 (issued , 2018) indicates a slightly enhanced chance for above normal temperatures and above median precipitation across all of eastern OK and northwest AR. This outlook takes into account weather conditions forecast over the first week of December, 8-10day outlook, weeks 3-4 outlook, and sub-seasonal climate signals. The Madden-Julian Oscillation (MJO) also played a role in the outlook since it will favor a transition to a warmer pattern for much of the CONUS later in the month. A colder start to the month is expected to transition to warmer than normal by the end of the month.

For the 3-month period December-January-February 2018-19, CPC is forecasting an equal chance for above, near, and below normal temperatures and precipitation across all of eastern OK and northwest AR (outlook issued November 15, 2018). This outlook is based on both statistical and dynamical forecast tools, decadal timescale climate trends, and influence from a weak El Niño. According to CPC, ENSO neutral conditions persisted through early November. El Niño conditions are still favored to begin in the next couple of months based on current oceanic trends, with probabilities of El Niño conditions greater than 70% for winter 2018-19. The El Niño Watch issued by CPC continues.

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

Showers and thunderstorms increased across eastern OK and western AR mid-morning on October 31st as an upper-level trough approached the region. The system was slow to clear the area, resulting in lingering rainfall and soggy trick-or-treating across southeast OK and west central AR during the evening hours. Rainfall totals ranged from 1"-3" southeast of a McAlester to Springdale line (Figs. 4, 5). This rain also resulted in minor flooding along the Poteau River near Panama (see preliminary hydrographs at the end of this report; see E3 Report for details).

A low pressure system moved into the region on the 12th, and strong frontogenetic forcing produced bands of snow across northeast OK and northwest AR. A large portion of northeast OK and northwest AR received 0.5"-2" of snow, with isolated totals of 2"-3" (Fig. 6). Further south, the precipitation remained liquid. Rain and snow liquid equivalent totals were around 0.25" or less (Fig. 8). The next morning, the snow on the ground was still visible on satellite (Fig. 7).

There were two rounds of thunderstorms during the evening of the 30th. A warm front across southeast OK early on the 30th lifted north through the day, with storms developing in the warm sector across eastern OK and western AR during the early evening hours. These storms moved northeast and exited the region by mid-evening. A second area of showers and thunderstorms developed in association with an upper trough moving into the region. This line of storms formed across central OK and north central TX and moved into eastern OK during by mid-evening and into western AR by late evening. These storms were strong to severe, with additional severe storms developing ahead of the line. These storms produced damaging winds and several tornadoes. Information about the tornadoes can be found at <https://arcg.is/1f5Ob4>. All of this activity quickly came to an end by 2 am CST on 1st as the system moved east of the area. Rainfall from this event ranged from around 0.25" to around 2.5" (Fig. 9).

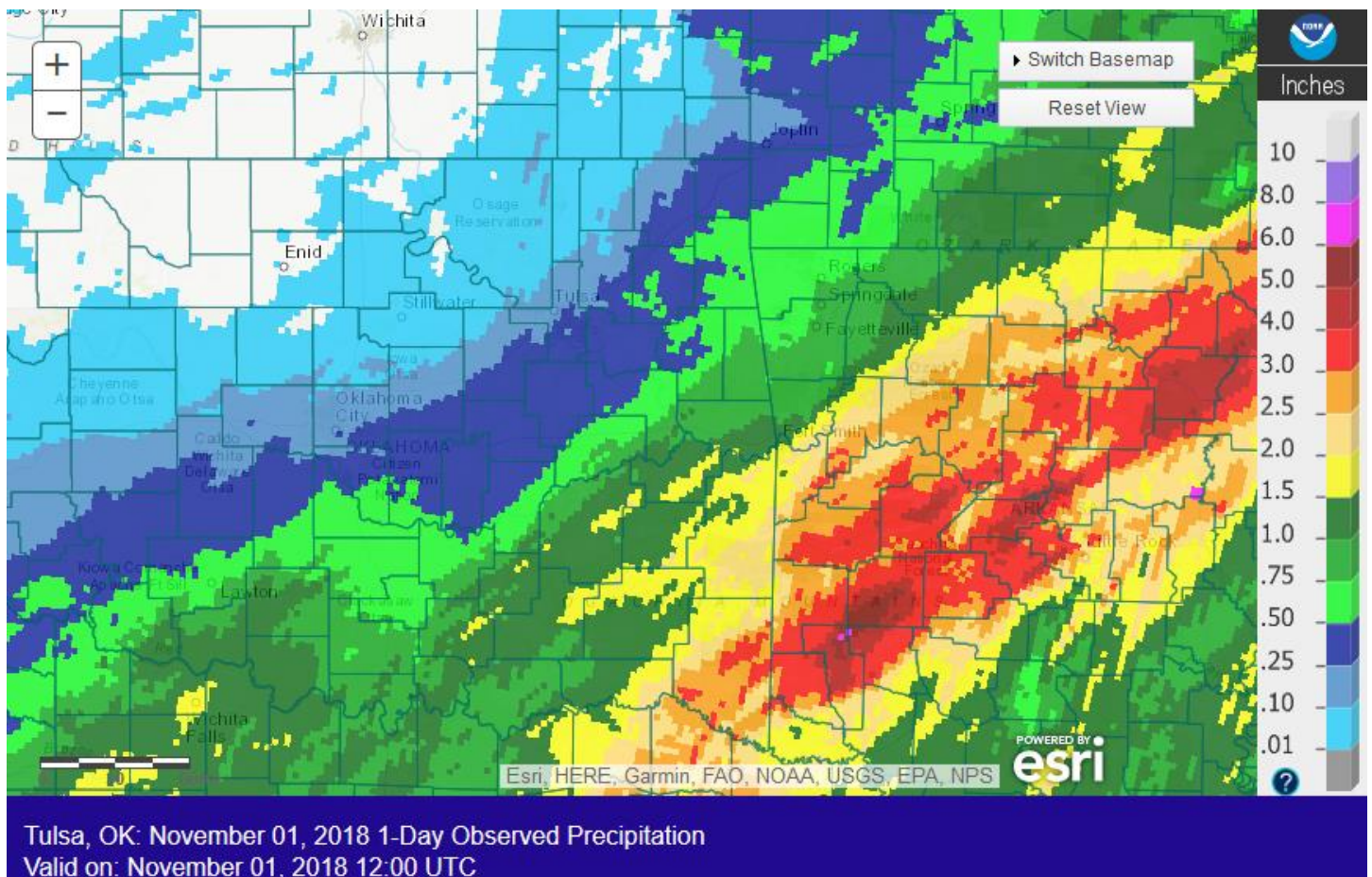
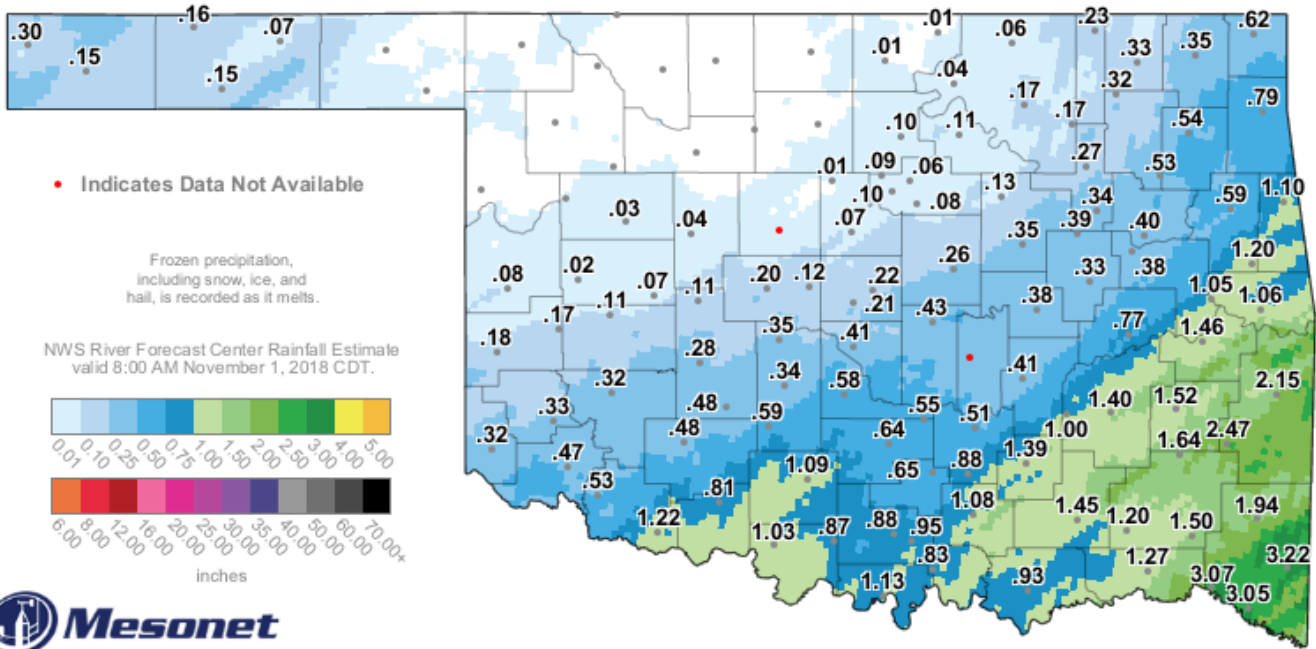


Fig. 4. 24-hour Estimated Observed Rainfall ending at 7am CDT 11/01/2018.



2-Day Rainfall Accumulation (inches)

9:35 AM November 1, 2018 CDT
Created 9:40:54 AM November 1, 2018 CDT. © Copyright 2018

Fig. 5. 2-Day Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 9:35 am CDT 11/01/2018.

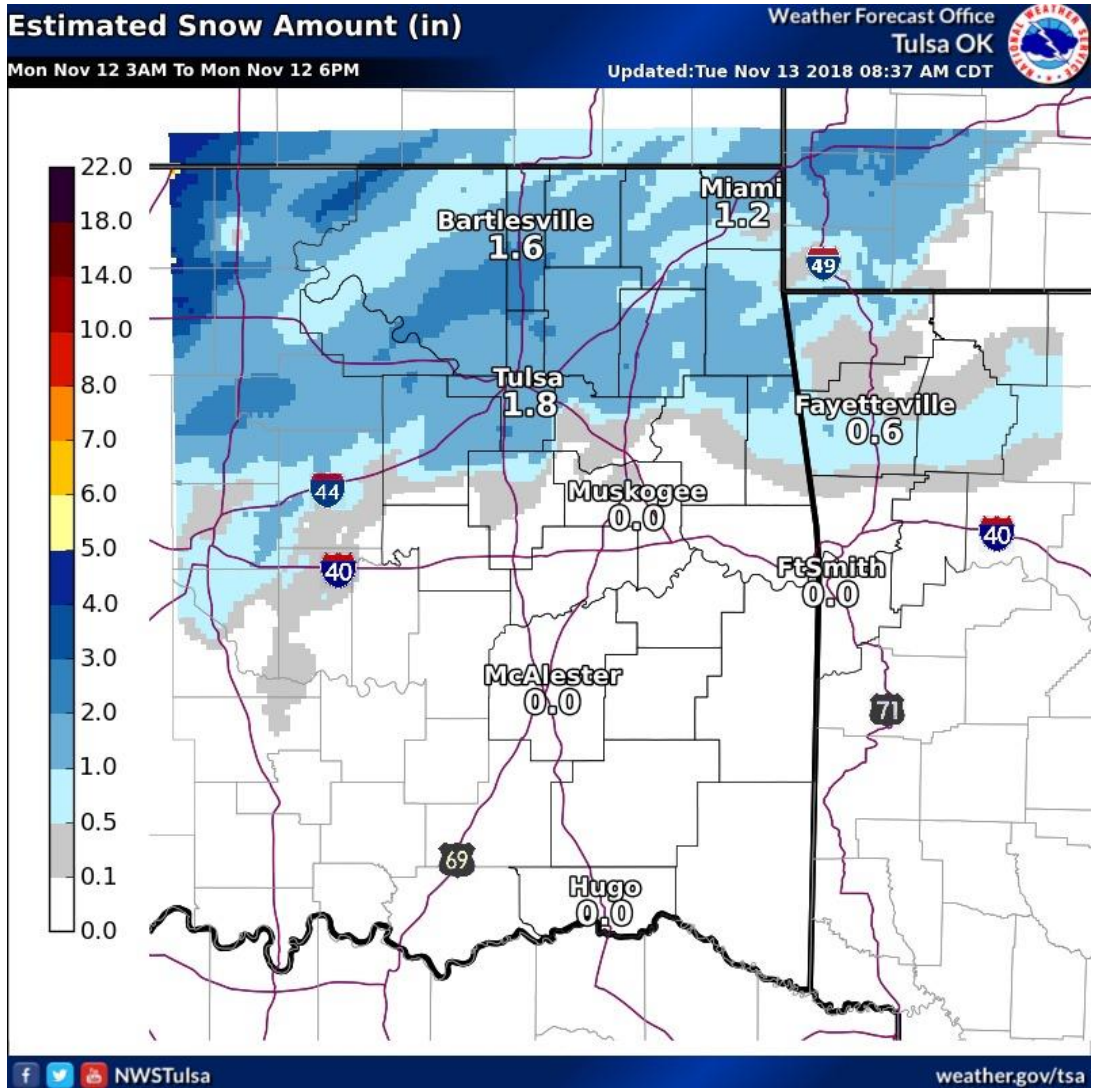


Fig. 6. Estimated snowfall total from 3am - 6pm CST 11/12/18.

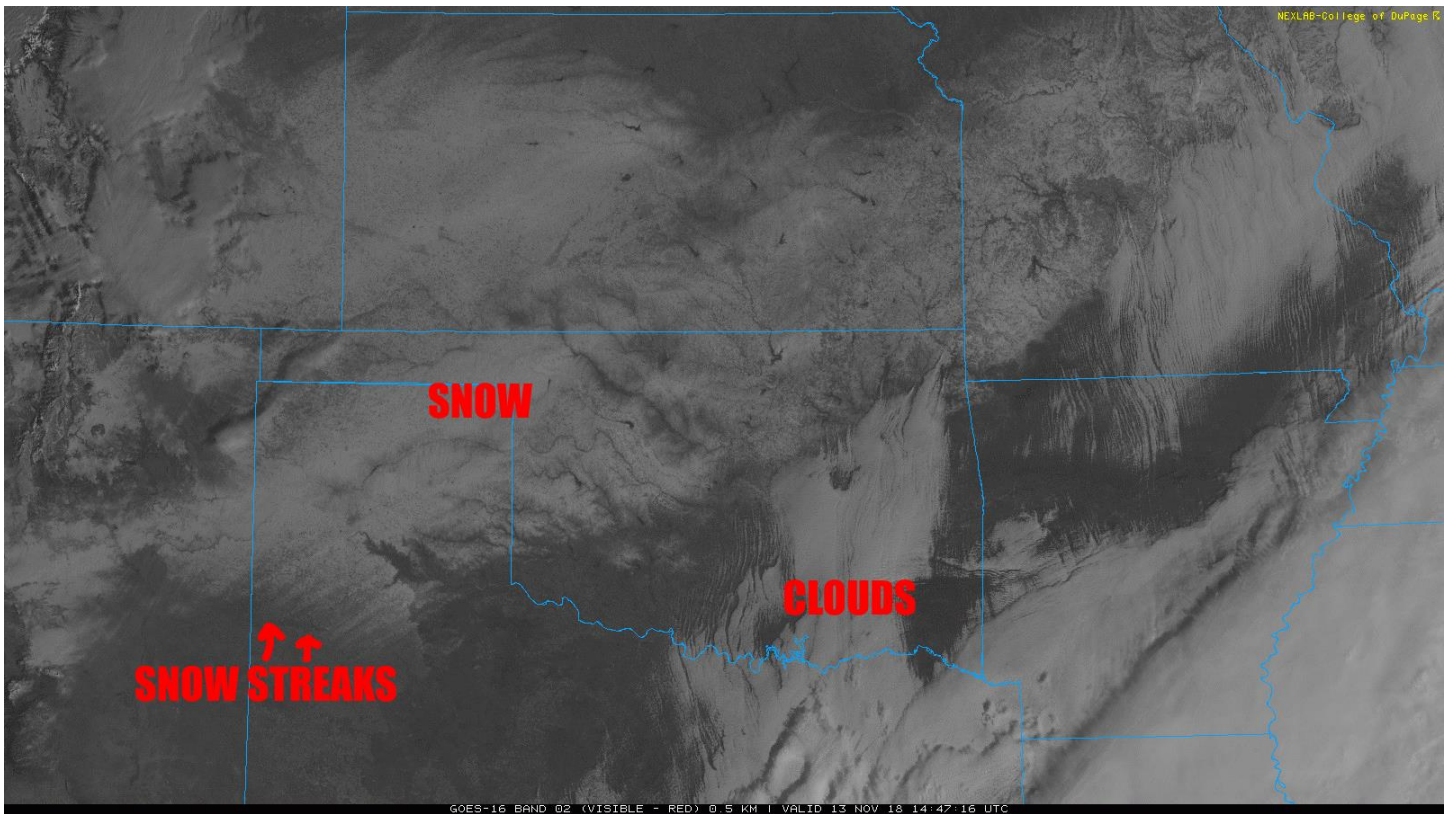


Fig. 7. Visible satellite image showing snow and clouds at 8:47am CST 11/13/18. Image courtesy of OCS.

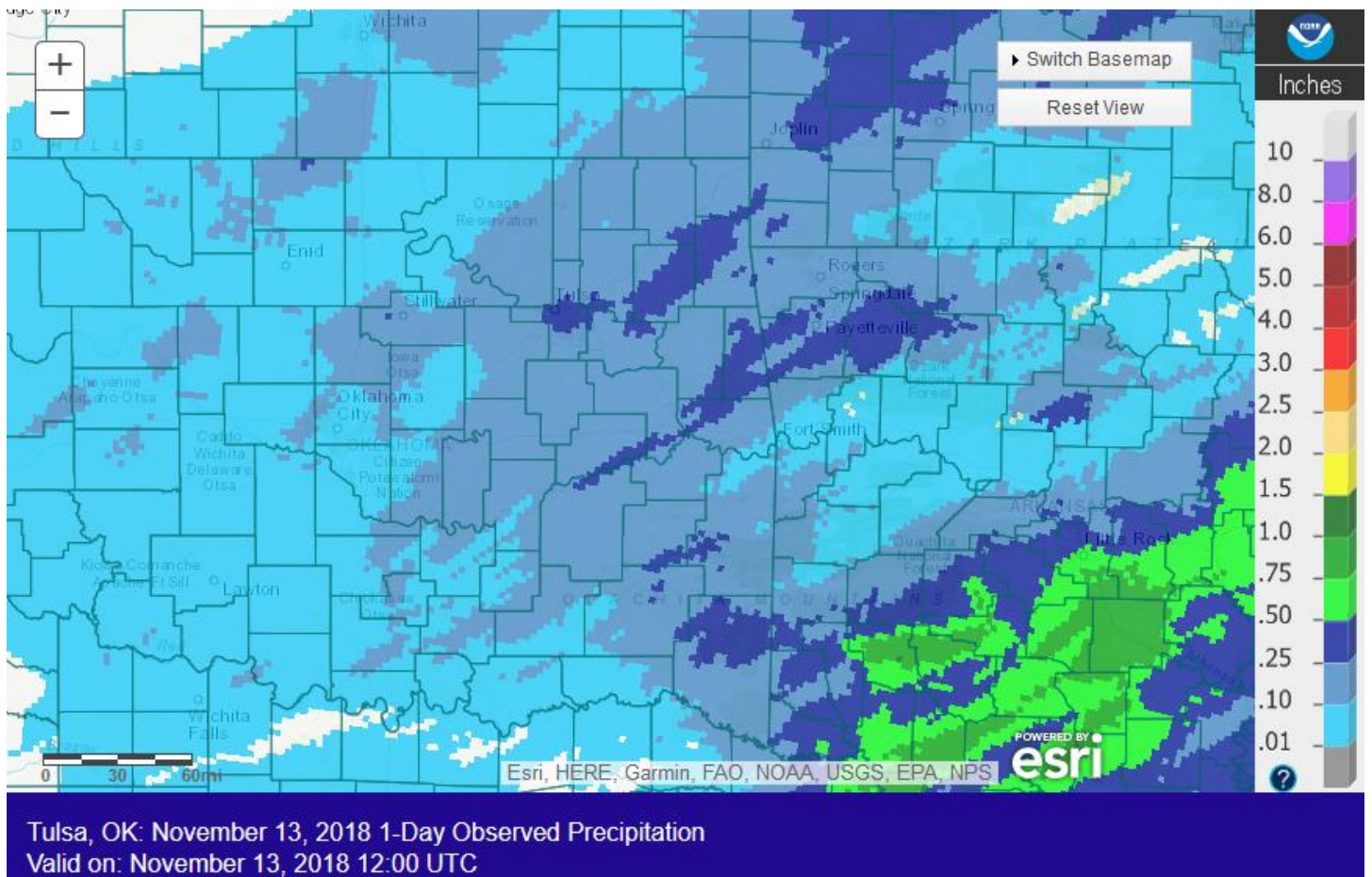
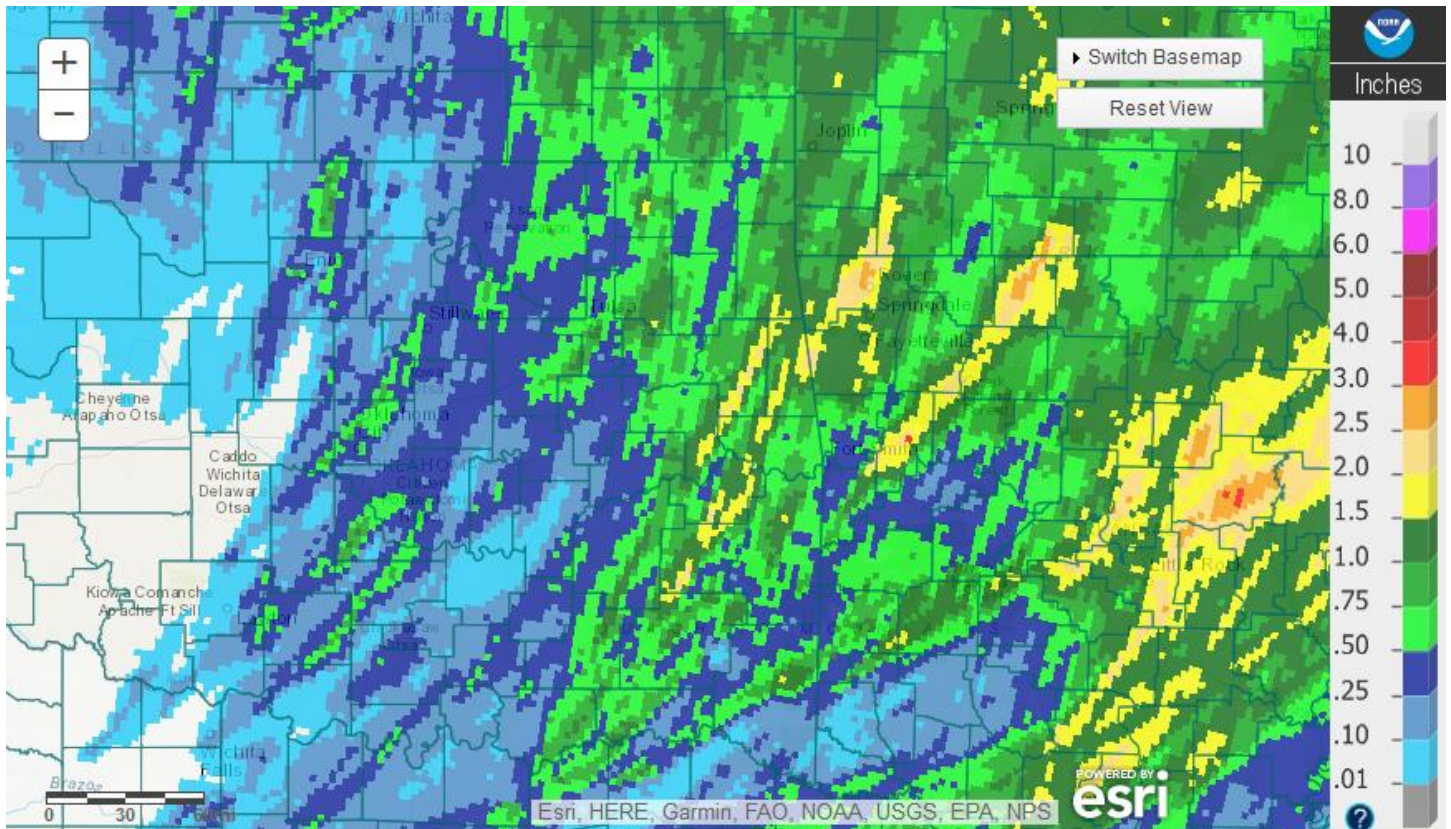


Fig. 8. 24-hour Estimated Observed Rainfall ending at 6am CST 11/13/2018.



Tulsa, OK: December 01, 2018 1-Day Observed Precipitation
 Valid on: December 01, 2018 12:00 UTC

Fig. 9. 24-hour Estimated Observed Rainfall ending at 6am CST 12/01/2018.

Written by:

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 Service Hydrologist
 WFO Tulsa

Products issued in November 2018:

- *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) (includes category increases)
- 7 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:

