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: **October** 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: **November 2, 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.**

Heavy rain occurred across southeast OK and west central AR, as well as across north central into northeast OK this month, resulting in some minor to moderate river flooding. Normal rainfall for October ranges from 2.9 inches in Pawnee County to 4.4 inches in Sequoyah County. 3.7 inches is normal across the Ozark region of northwest Arkansas. West central Arkansas averages just under 4 inches, while southeast Oklahoma averages slightly higher amounts of 4.5 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 October 2018 ranged from 2" to isolated amounts around 10" across eastern OK and northwest AR. The lowest rainfall totals of 2"-4" were primarily from just north of the I-44 corridor to I-40 in northeast OK and northwest AR. This corresponds to 50% to 300% of the normal October rainfall across the area (Fig. 1b).

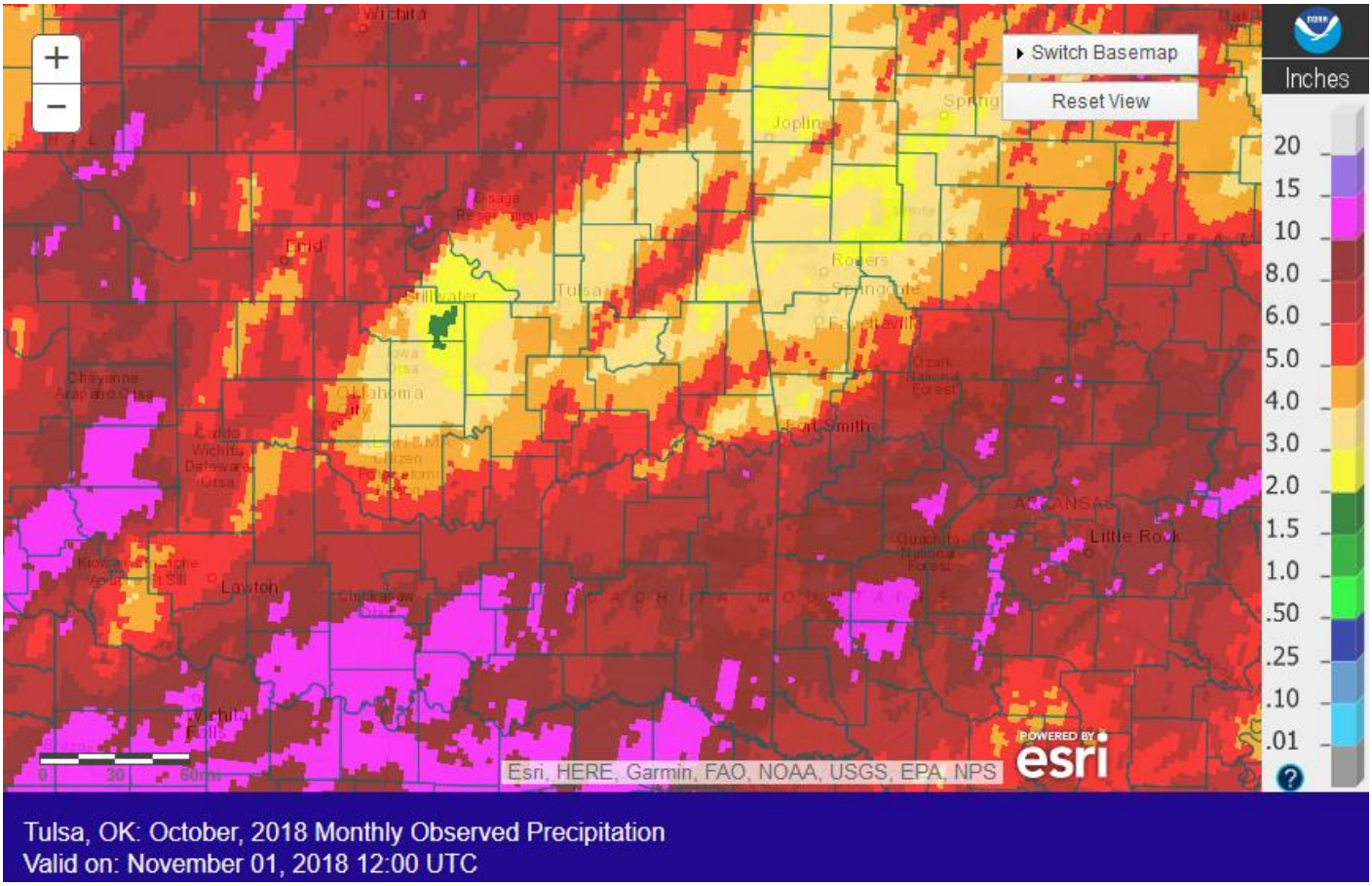


Fig. 1a. Estimated Observed Rainfall for October 2018

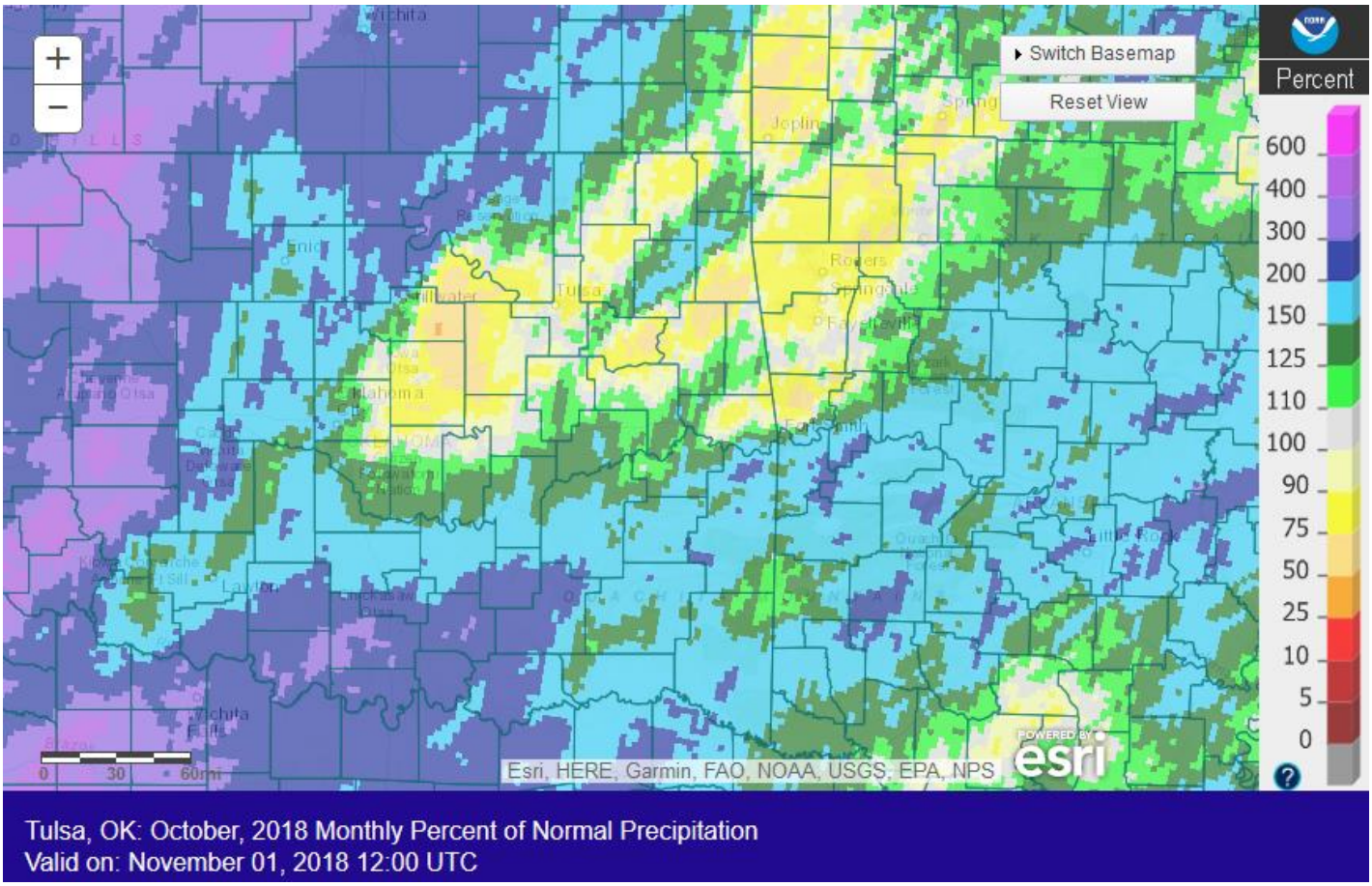


Fig. 1b. Estimated % of Normal Rainfall for October 2018

In Tulsa, OK, October 2018 ranked as the 39th coldest October (61.5°F, tied 1980; since records began in 1905) and the 55th wettest October (3.09"; since records began in 1888). Fort Smith, AR had the 54th warmest October (63.7°F, tied 1991, 1985, 1916, 1902; since records began in 1882) and the 14th wettest October (6.70"; since records began in 1882). Fayetteville, AR had the 28th warmest (59.1°F, tied 2005, 1961) and the 35th driest/36th wettest (3.25") October since records began in 1949.

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

Hindsville 10NNE, AR (coop)	11.08	Talihina, OK (meso)	9.17	Wister, OK (meso)	8.65
Clayton, OK (meso)	8.58	Hugo, OK (meso)	8.57	Burbank, OK (meso)	8.33
Spavinaw, OK (coop)	8.22	Foraker, OK (meso)	8.21	Cloudy, OK (meso)	7.99

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

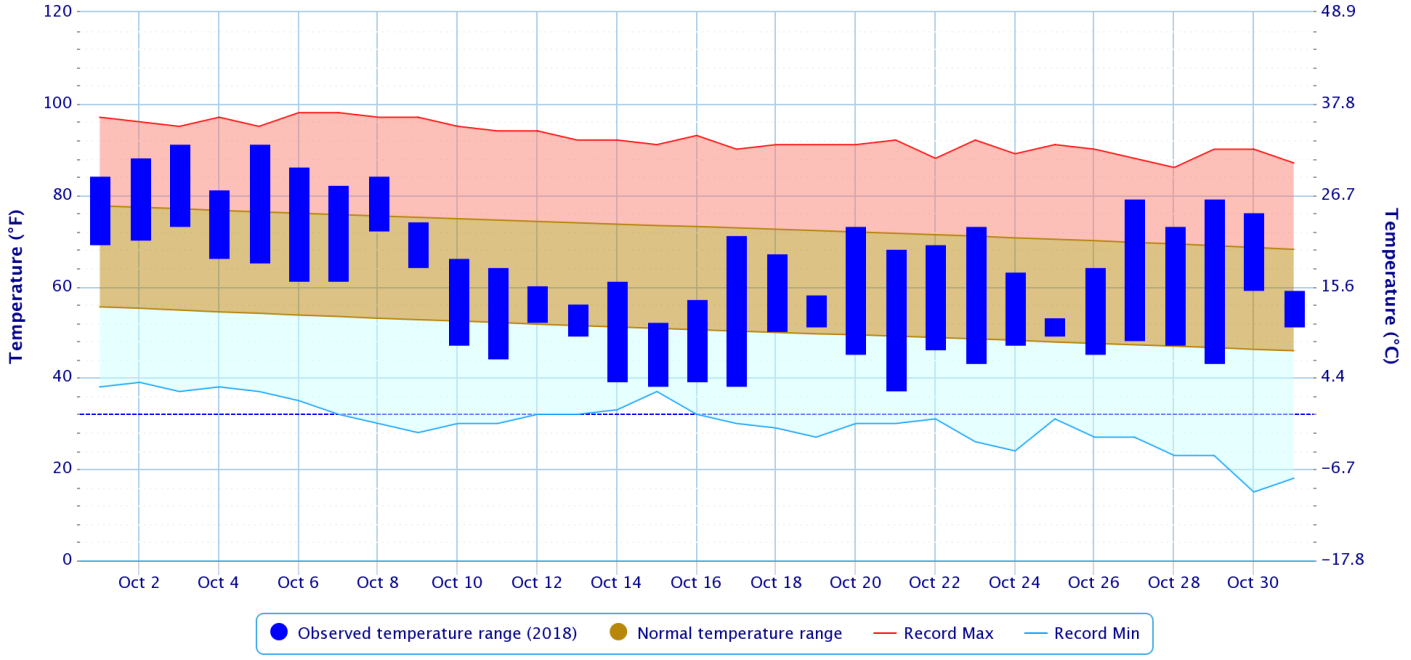
Oilton, OK (meso)	2.82	Pawnee, OK (meso)	2.94	Tahlequah, OK (meso)	2.97
Tulsa, OK (ASOS)	3.09	NW AR Reg. Airport (ASOS)	3.17	Vinita, OK (meso)	3.17
Fayetteville, OK (ASOS)	3.25	Tulsa, OK (meso)	3.38	Talala, OK (meso)	3.52

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

Rank since 1921	October 2018	Fall-to-Date (Sep 1 – Oct 31)	Last 90 Days (Aug 3 – Oct 31)	Last 120 Days (Jul 4 – Oct 31)	Last 180 Days (May 5 – Oct 31)	Year-to-Date (Jan 1 – Oct 31)	Last 365 Days (Nov 1, 2017–Oct 31, 2018)
Northeast OK	25th wettest	43rd wettest	35th wettest	38th wettest	37th driest	39th driest	21st driest
East Central OK	24th wettest	28th wettest	19th wettest	24th wettest	49th wettest	14th wettest	34th wettest
Southeast OK	**7th wettest**	**5th wettest**	**3rd wettest**	**6th wettest**	20th wettest	**9th wettest**	20th wettest
Statewide	**6th wettest**	**4th wettest**	**5th wettest**	**6th wettest**	13th wettest	19th wettest	35th wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

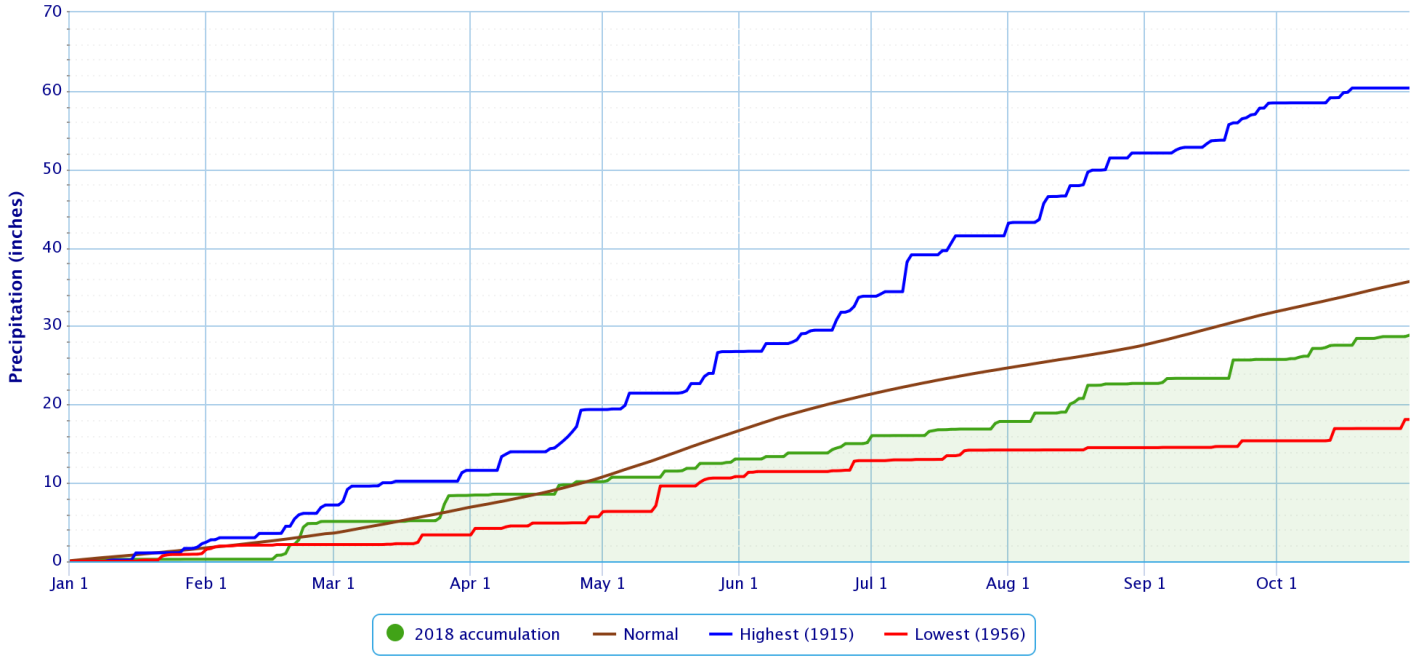
Period of Record – 1905-01-06 to 2018-10-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

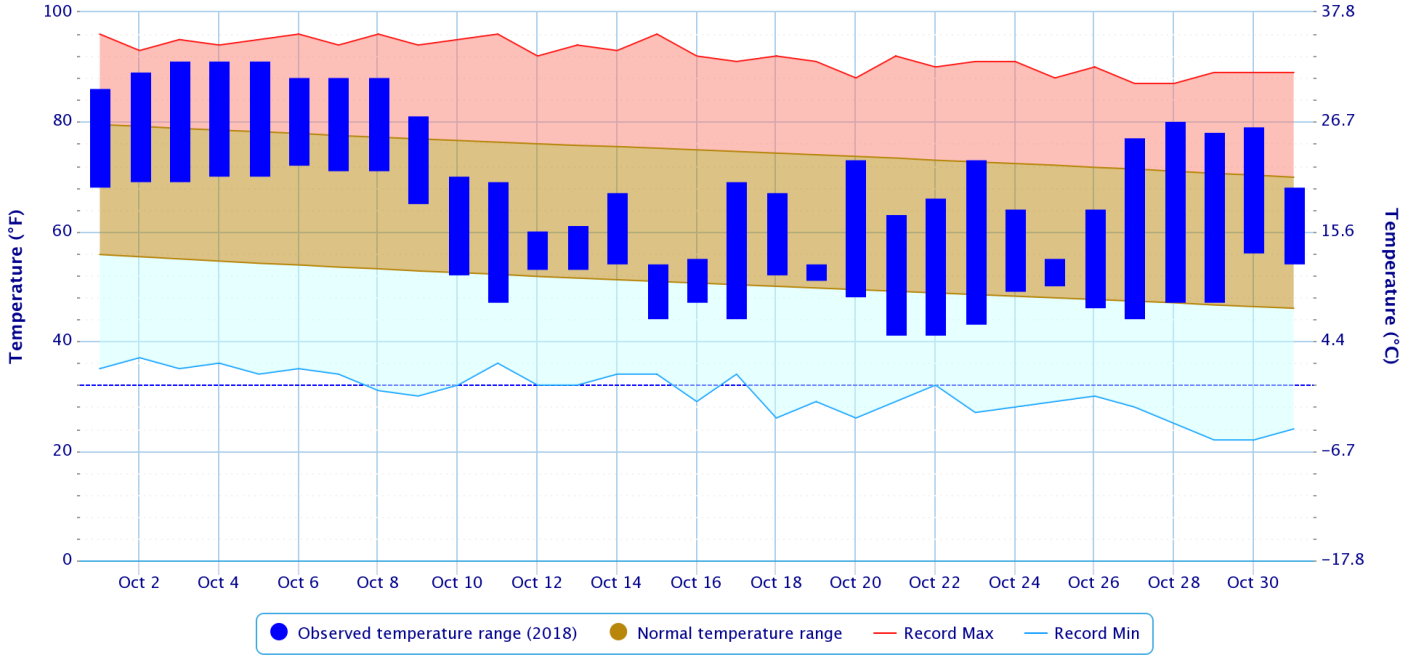
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

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

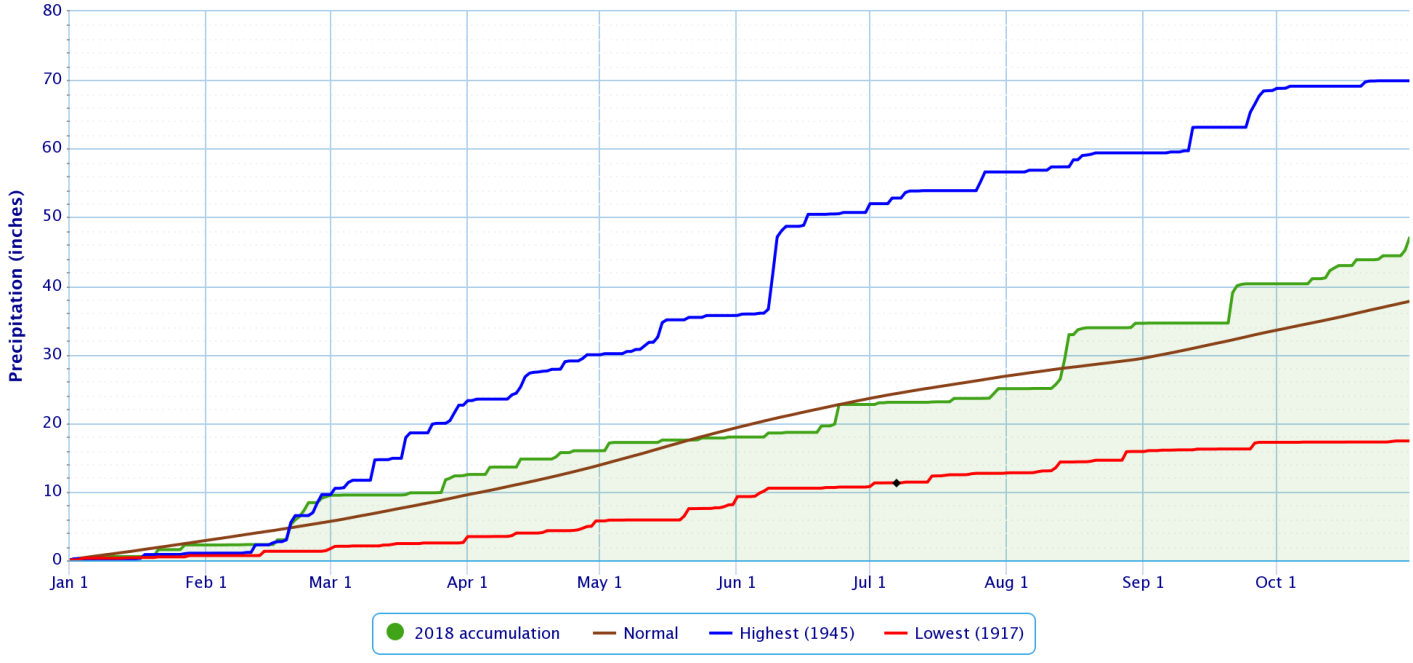
Period of Record – 1882-06-01 to 2018-10-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

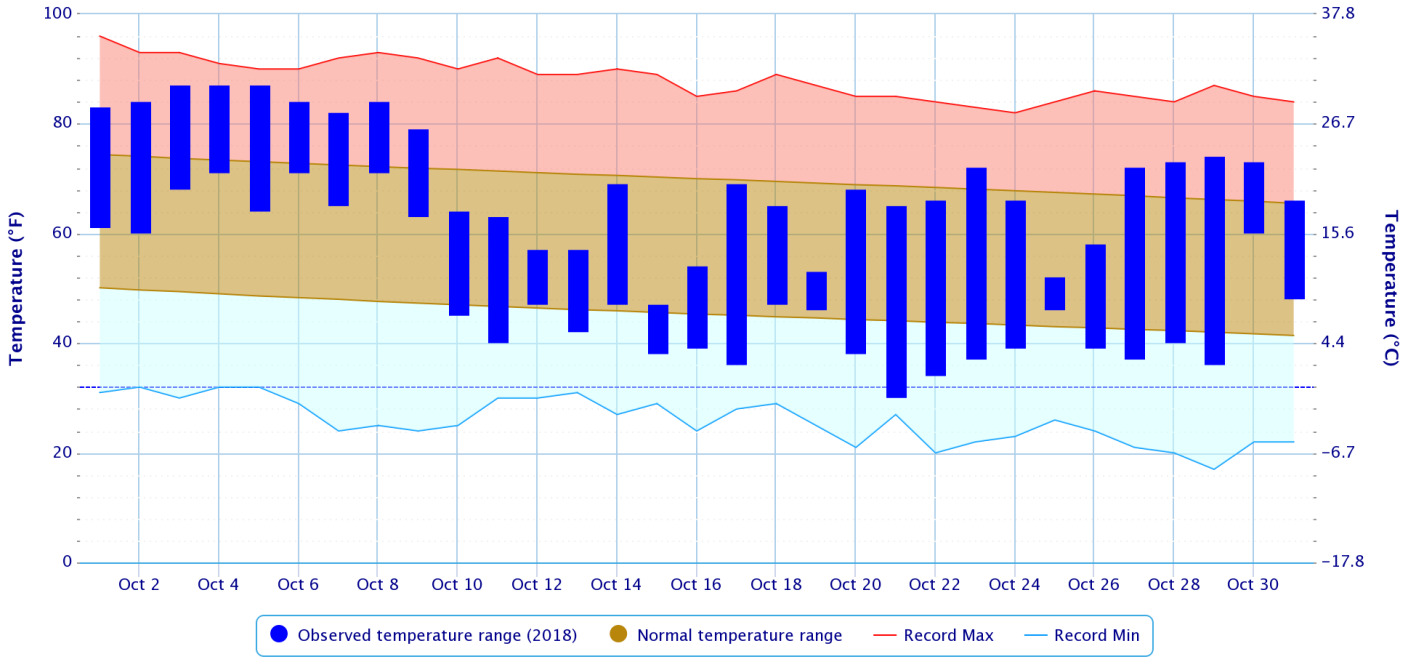
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

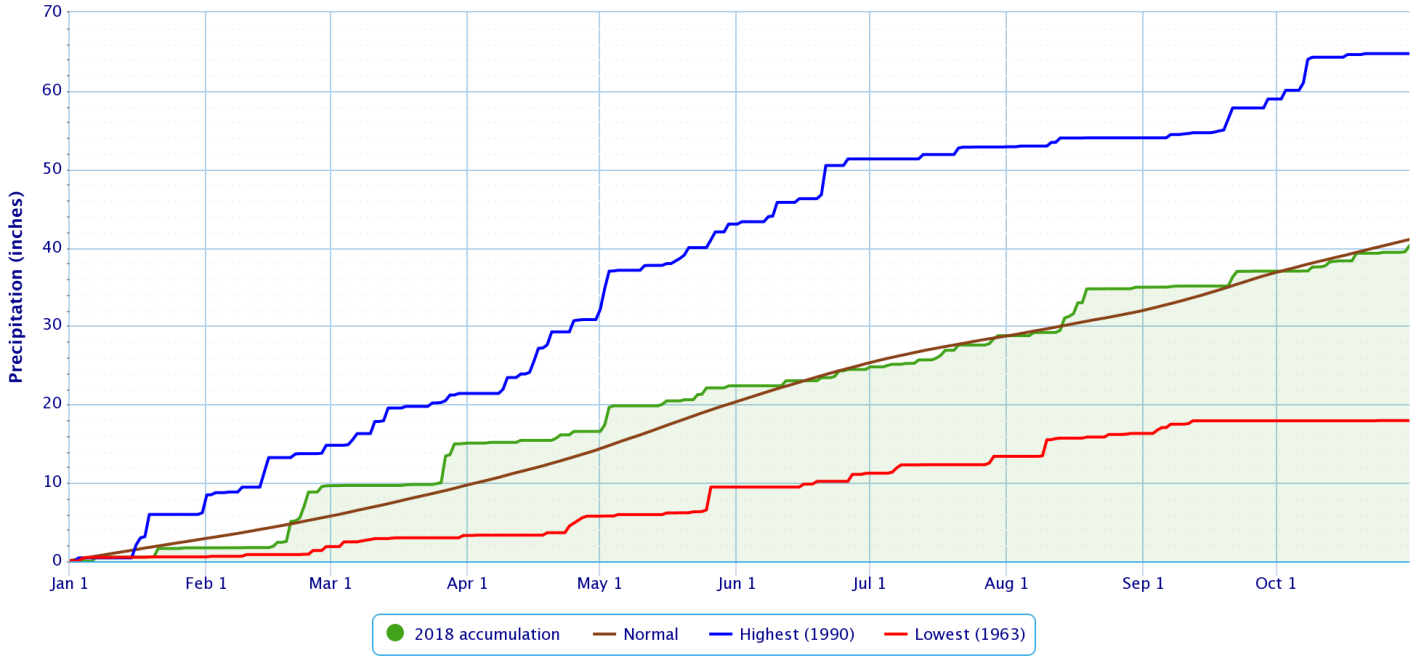
Period of Record – 1949-07-14 to 2018-10-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

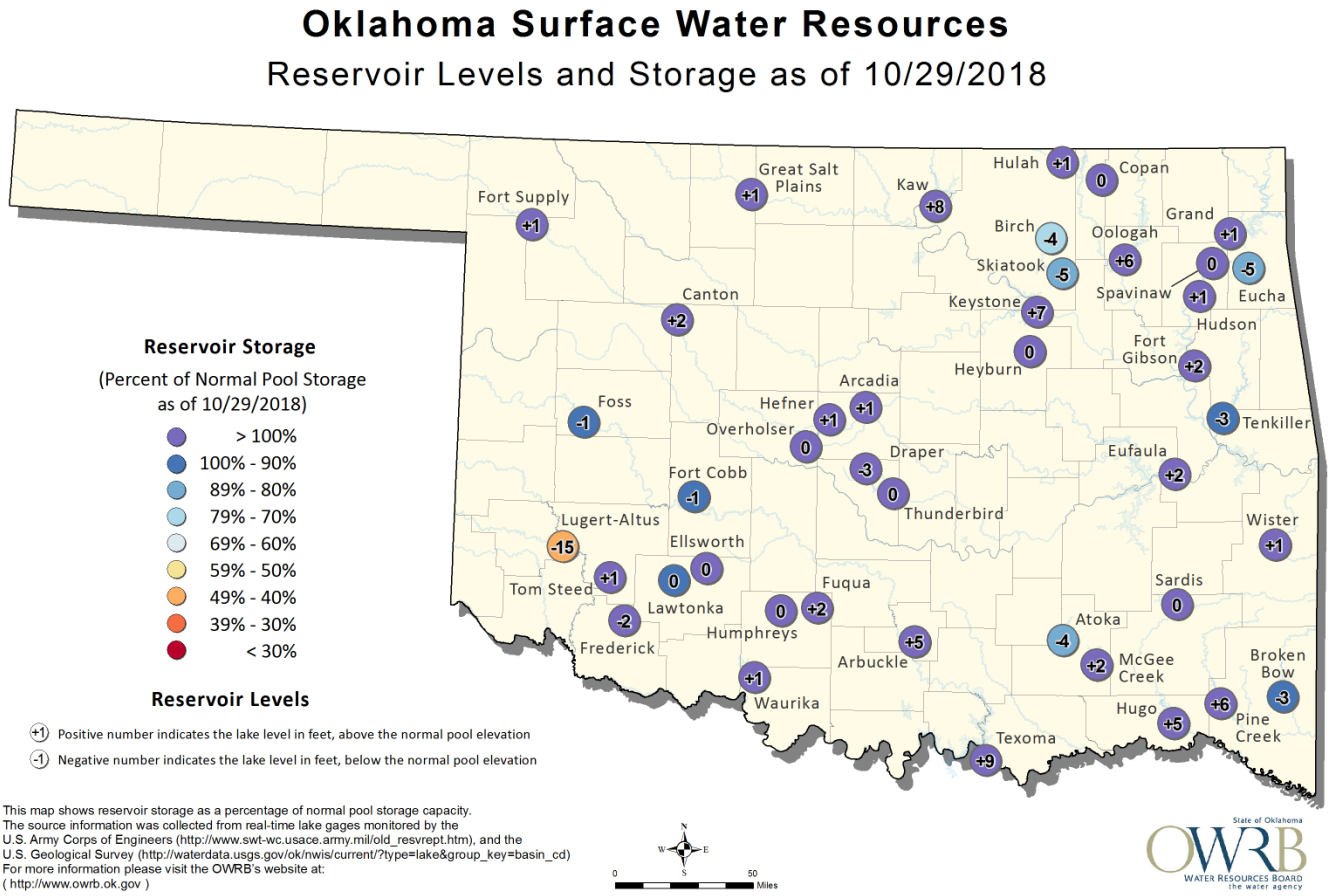
Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

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



Powered by ACIS

Reservoirs



According to the USACE, some lakes in the HSA were within ±3% of their conservation pool level. Reservoirs below 3% of their conservation pool storage as of 10/31/2018: Birch Lake 73%, Skiatook Lake 85%, Tenkiller Lake 90%, and Beaver Lake 91%. Reservoirs above 3% of its conservation pool storage as of 10/31/2018: Oologah Lake 118%, Kaw Lake 114%, Keystone Lake 113%, Eufaula Lake 113%, Hugo Lake 108%, and Hudson Lake 105%.

Drought

According to the U.S. Drought Monitor (USDM) from October 30, 2018 (Figs. 2, 3), Moderate (D1) drought conditions were present across portions of Osage, Washington, Nowata, Tulsa, Rogers, Mayes, Delaware, and Cherokee Counties in eastern OK. Abnormally Dry (D0) but not in drought conditions encompassed portions of Pawnee, Osage, Creek, Washington, Tulsa, Rogers, Mayes, Nowata, Craig, Delaware, Cherokee, and Adair Counties in eastern Oklahoma and Benton, Carroll, and Washington Counties in northwest Arkansas.

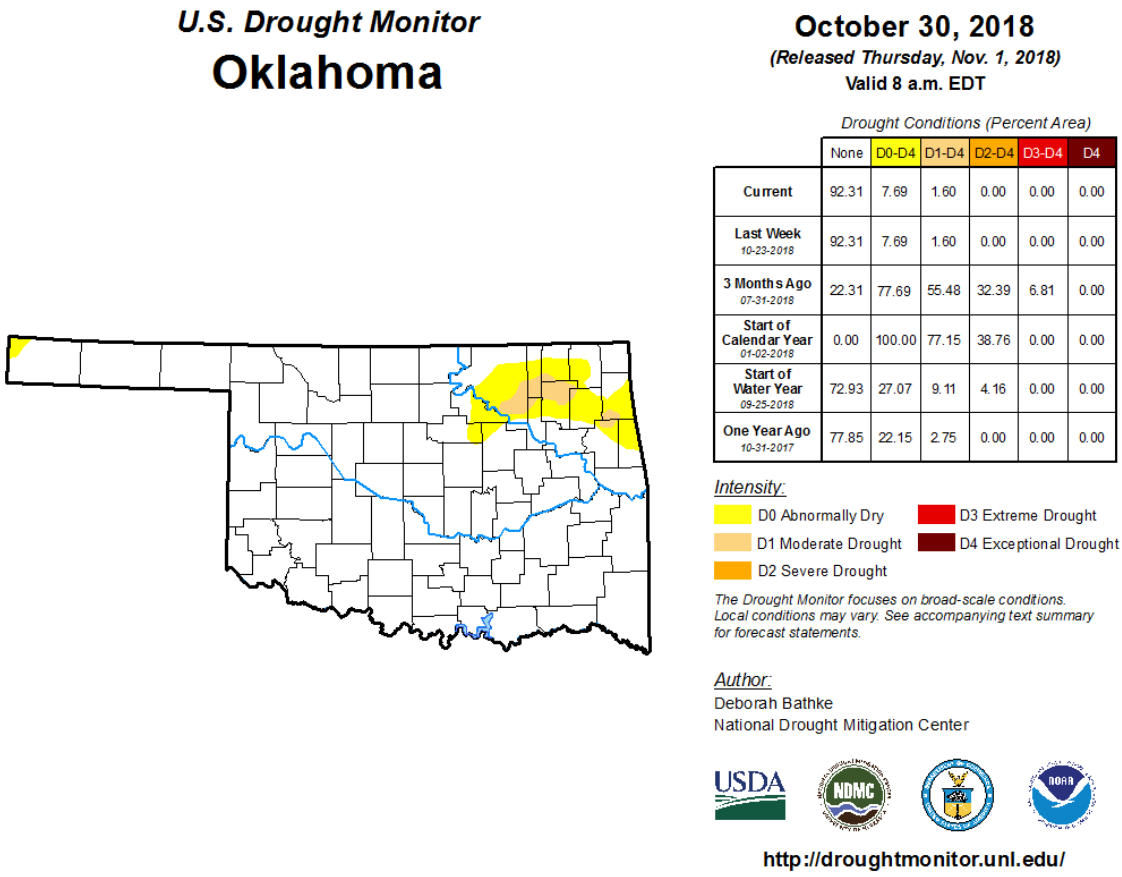


Fig. 2. Drought Monitor for Oklahoma

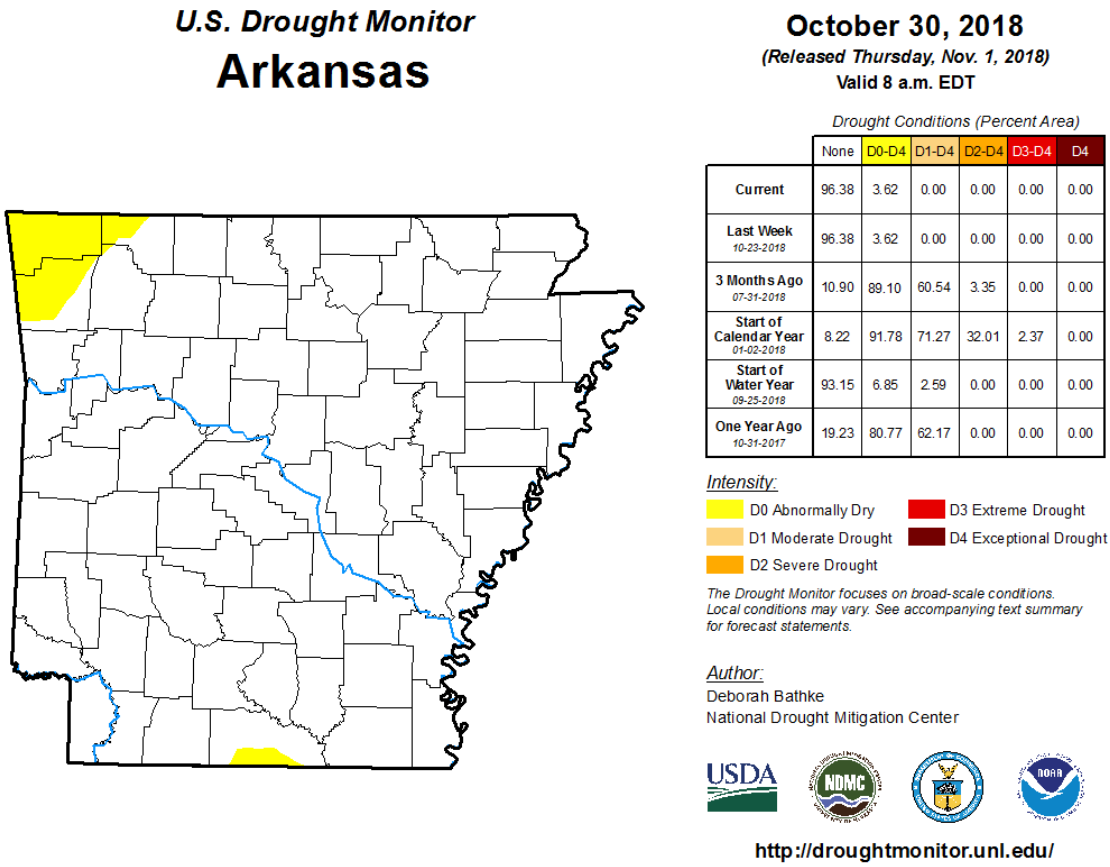


Fig. 3. Drought Monitor for Arkansas

Outlooks

The Climate Prediction Center (CPC) outlook for November 2018 (issued October 31, 2018) indicates an enhanced chance for below normal temperatures and an enhanced chance for above median precipitation across all of eastern OK and northwest AR. This outlook takes into account weather conditions forecast over the first week of November for the rainfall, weeks 3-4 forecast for the temperatures, and sub-seasonal climate signals.

For the 3-month period November-December-January 2018-19, CPC is forecasting an enhanced chance for above normal temperatures and an equal chance for above, near, and below median precipitation across all of eastern OK and northwest AR (outlook issued October 18, 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 October. 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. An 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

Shortly after midnight on the 4th, a line of showers and thunderstorms moved south out of KS and into northeast OK. Most of this activity remained north of I-44 and dissipated by noon. Rainfall totals ranged from around 0.25" to around 2.5" (Fig. 4), with the highest totals across eastern Kay, Osage, Washington, and Nowata Counties.

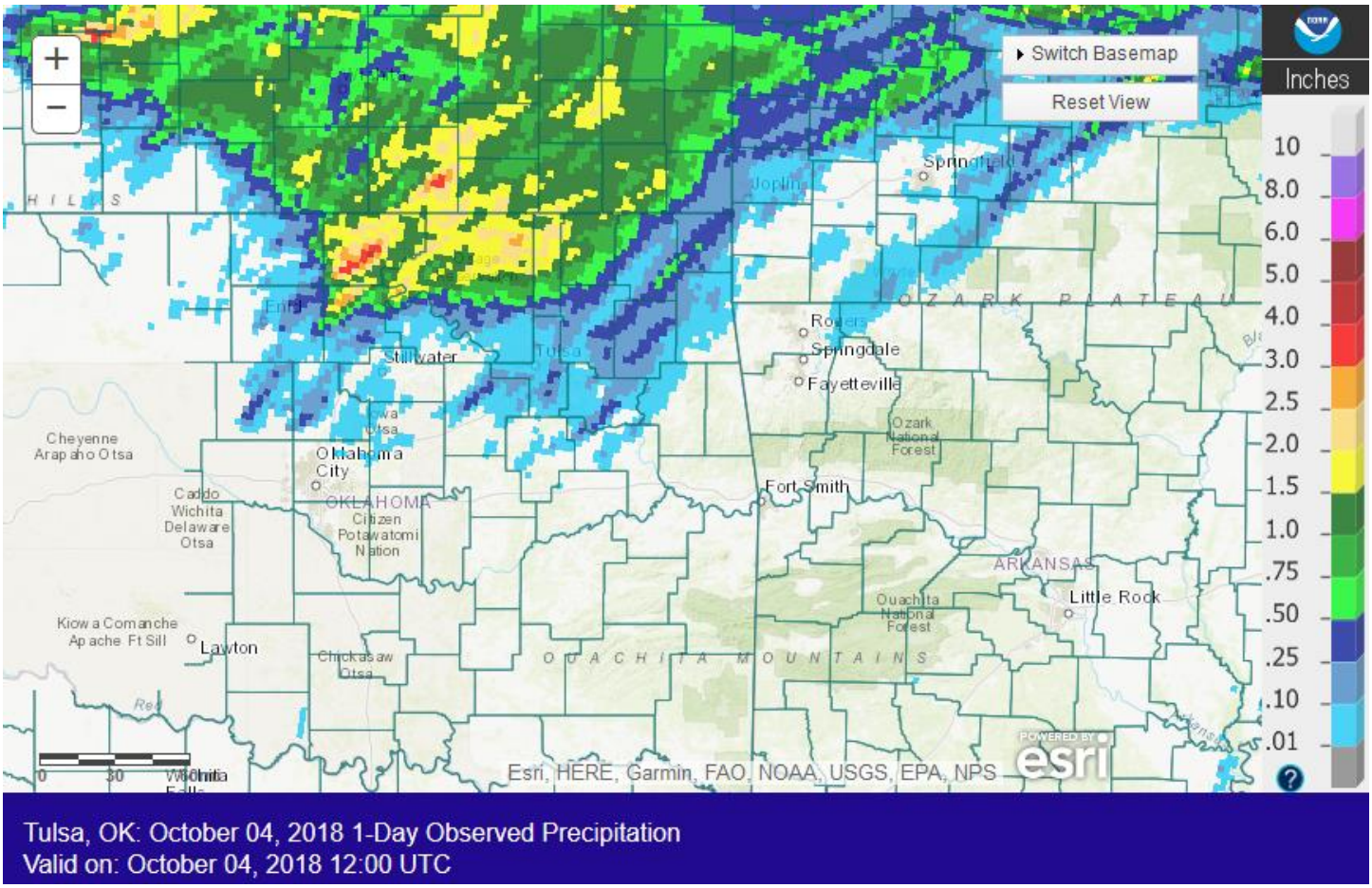


Fig. 4. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/04/2018.

A frontal boundary waffled back and forth over the Plains on the 6th-7th. The front moved south into northeast OK on the 6th and eventually stalled from far northwest AR to between Tulsa and McAlester. Shower and thunderstorms developed primarily along and north of the boundary during the afternoon and continuing through the overnight hours, with isolated storms south of the boundary. By 7am on the 7th, a portion of northeast OK from Wagoner through Ottawa Counties received 1.5"-3" of rain (Fig. 5). Scattered showers and thunderstorms then continued for much of the 7th. During the evening hours, convection increased across eastern Kay, Pawnee, Osage, and Washington Counties, before lifting back north into KS after midnight as the quasi-stationary boundary slowly retreated north. While rainfall totals were generally 0.25"-1.5", eastern Kay, northwest Pawnee and northwest Osage Counties received 2"-4" of rain (Fig. 6). An EF-0 tornado also occurred near Fairfax in Osage County (see https://arcg.is/1f5Ob4 for details).

Thunderstorms then moved back south into eastern Kay, western Pawnee, and western Osage Counties during the evening of the 8th. Additional showers and thunderstorms spread over eastern OK through the overnight hours. This activity brought an additional 1"-3" to eastern Kay, far western Pawnee, and northwest Osage Counties (Fig. 7), and brought the 2-day total in the area to 3"-6" (Fig. 8).

A quasi-linear convective system then moved into eastern OK during the late morning of the 9th, stretching from the KS/OK state line to the TX/OK state line. Numerous transient low-level circulations occurred along the line, resulting in areas of wind damage, as the line moved across eastern OK and northwest AR. However, no tornadoes occurred, as determined by the damage survey team. Showers and thunderstorms continued behind the line through the mid-evening, before finally exiting the region. Rainfall totals from this activity ranged from 0.25" to 1.5" across all of eastern OK and northwest AR. This additional rainfall brought the 7-day totals to 5"-8" across eastern Kay, western Pawnee, and northwest Osage Counties (Figs. 9, 10). This rainfall, plus the heavy rain further upstream across the Upper Arkansas River Basin, resulted in minor flooding along the Arkansas River at Ralston (see preliminary hydrographs at the end of this report; see E3 Report for details). Heavy rain fell across eastern KS during this time frame as well (Fig. 10), affecting the Neosho River. Moderate flooding occurred along the Neosho River near Commerce for several days (see preliminary hydrographs at the end of this report; see E3 Report for details).

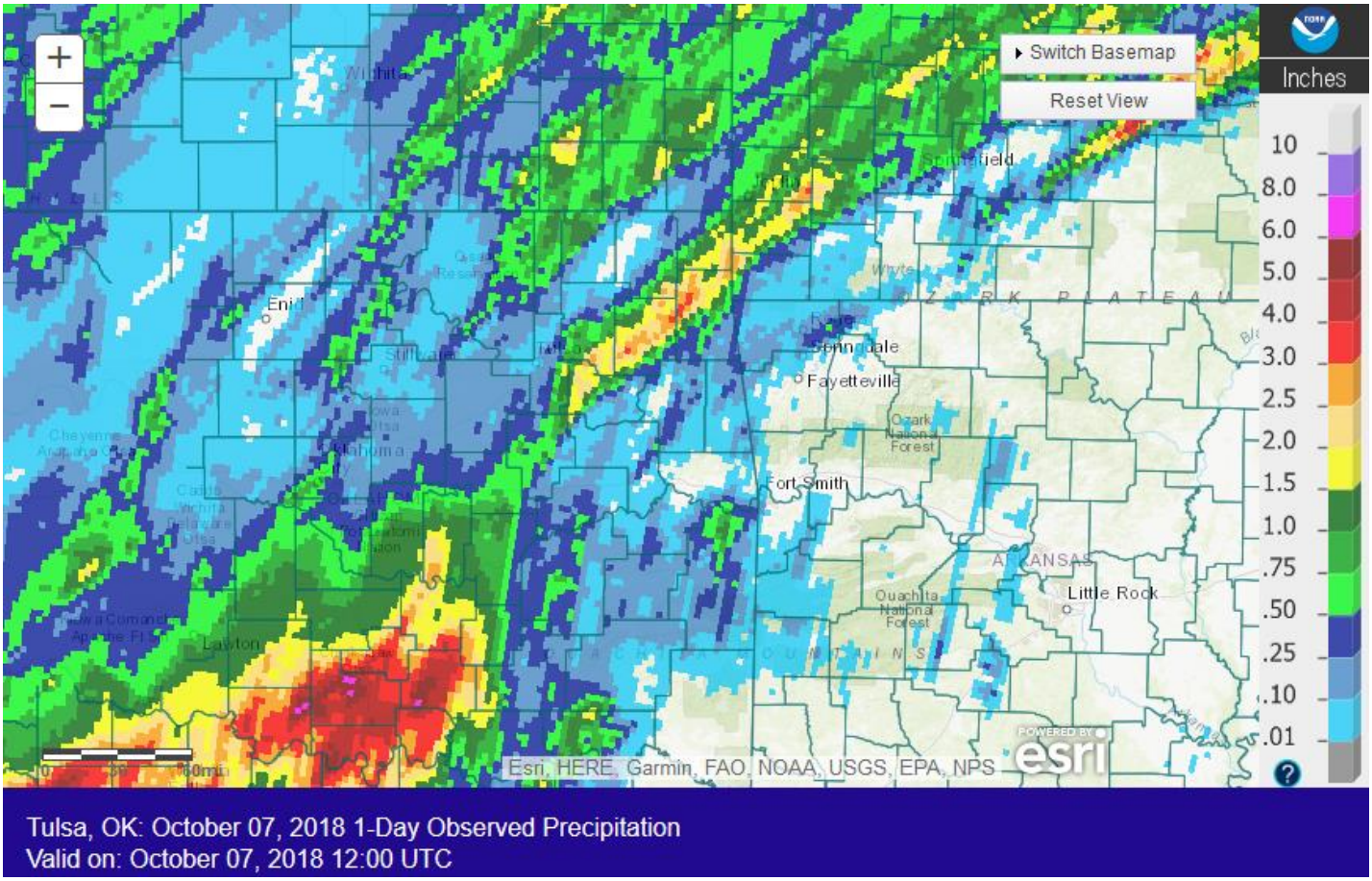


Fig. 5. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/07/2018.

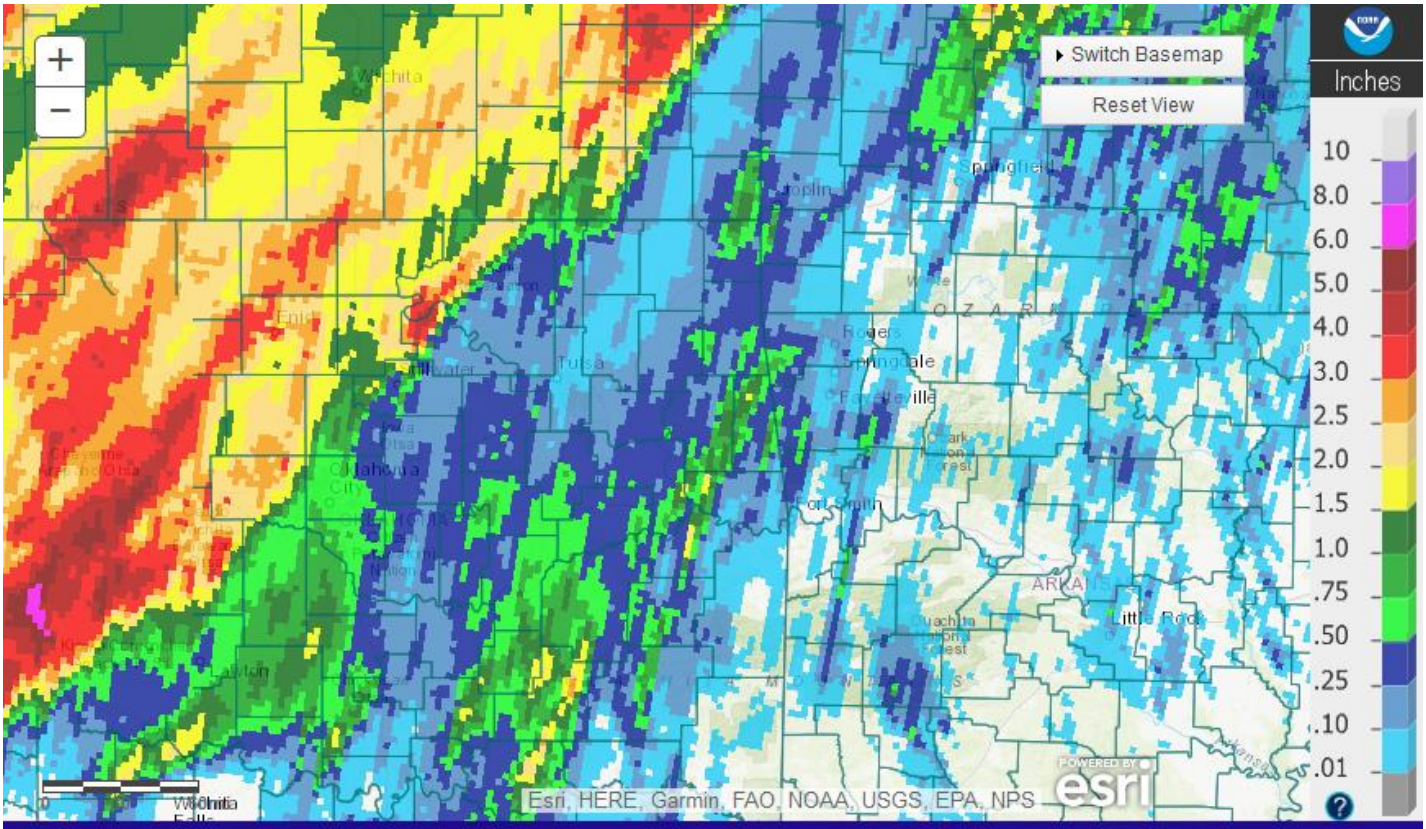


Fig. 6. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/08/2018.

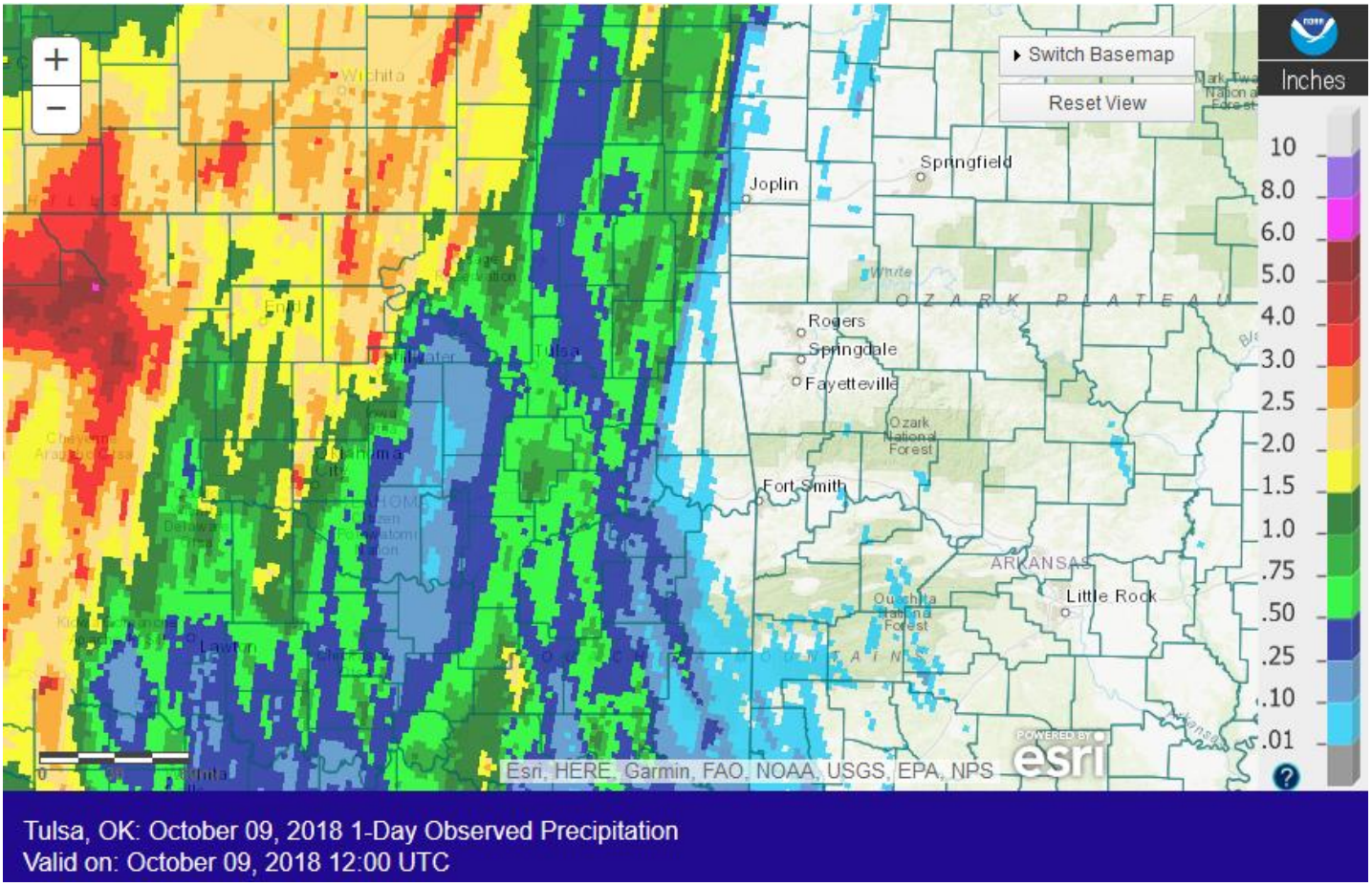


Fig. 7. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/09/2018.

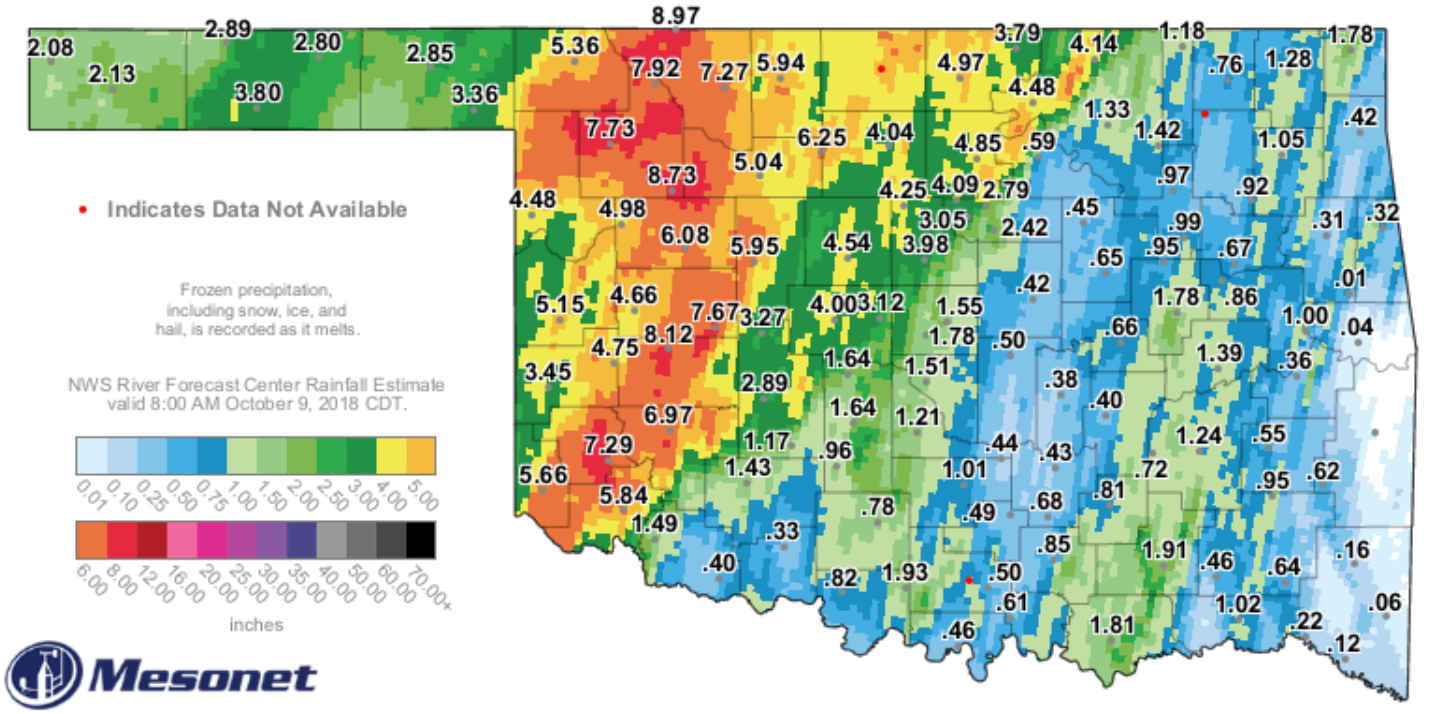


Fig. 8. 2-Day Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 9:30 am CDT 10/09/2018.

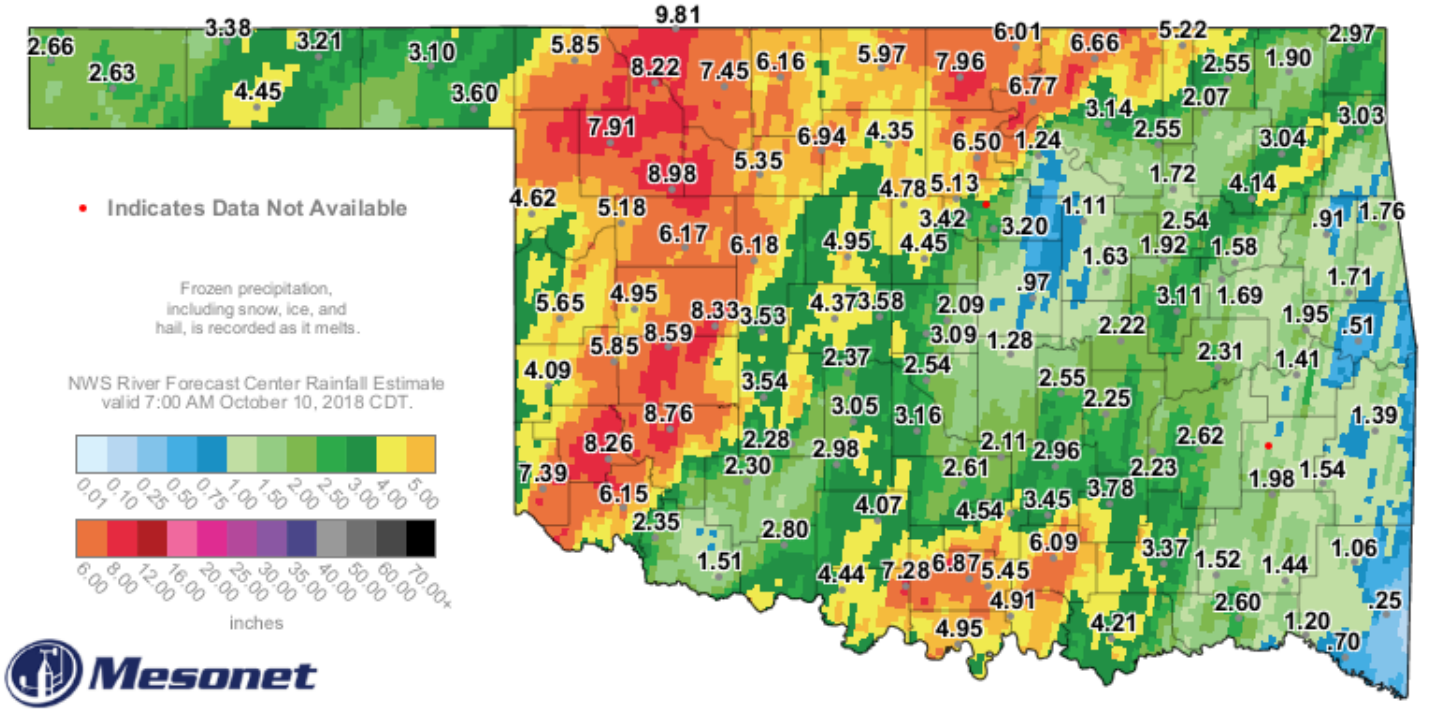


Fig. 9. 7-Day Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 8:30 am CDT 10/10/2018.

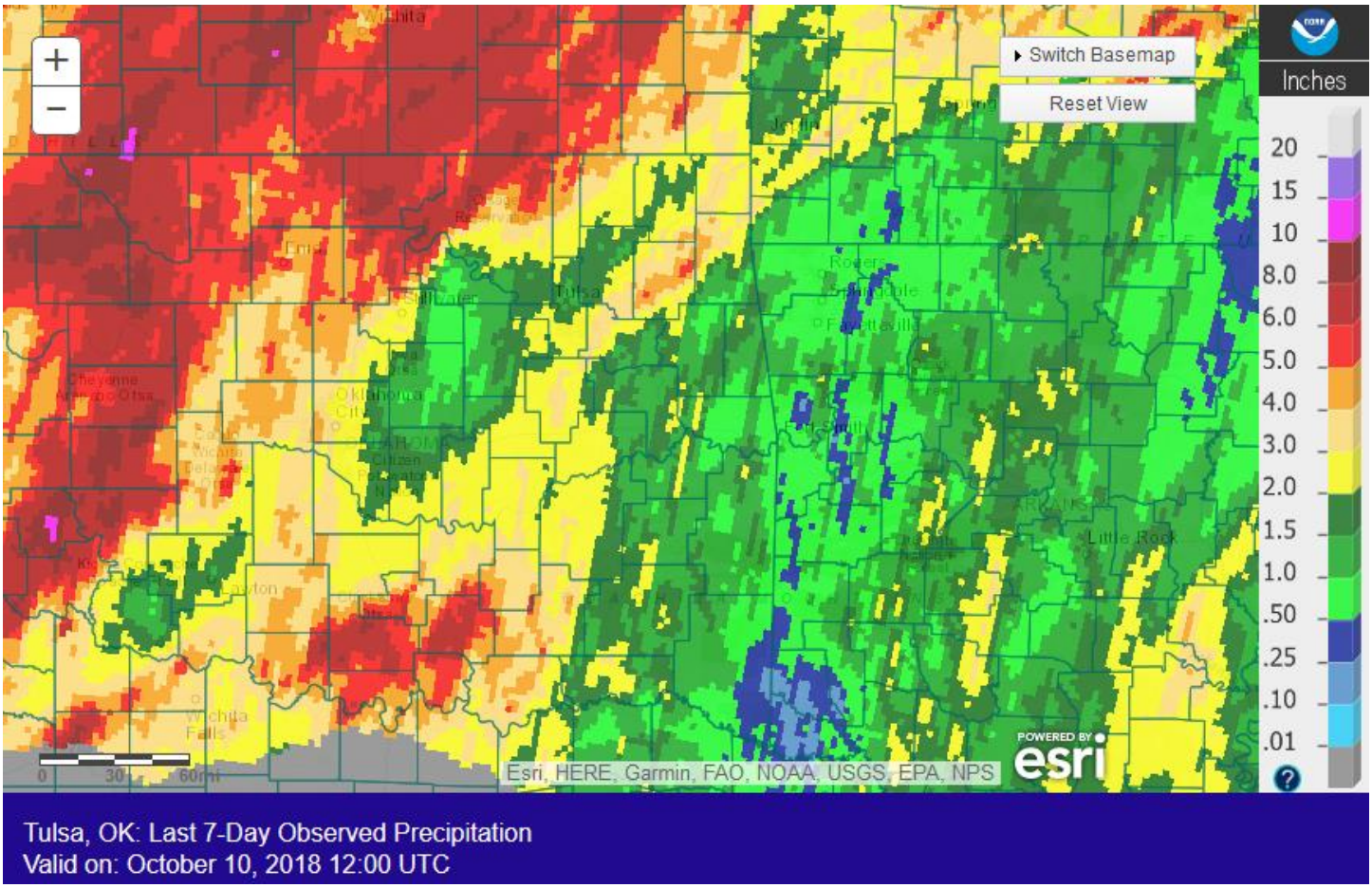


Fig. 10. 7-Day Estimated Observed Rainfall ending at 7am CDT 10/10/2018.

Widespread showers and isolated thunderstorms affected eastern OK and northwest AR mid-morning through late afternoon on the 13th as the remnants of Pacific Hurricane Sergio interacted with a frontal zone. The heaviest rain axis was along and south of I-40, where 1”-2.5” of rain fell (Fig. 11).

Isolated to widely scattered showers and thunderstorms occurred across eastern OK and northwest AR during the afternoon and evening hours of the 14th as a strong cold front moved through the area, with additional widespread activity across southeast OK and west central AR during the overnight hours and continuing through the morning of the 15th. This activity finally came to an end during the afternoon. An additional 0.50”-1.5” of rain fell across southeast OK into west central AR (Fig. 12).

Showers and thunderstorms increased across eastern OK and western AR mid-morning on the 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. 13, 14). 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).

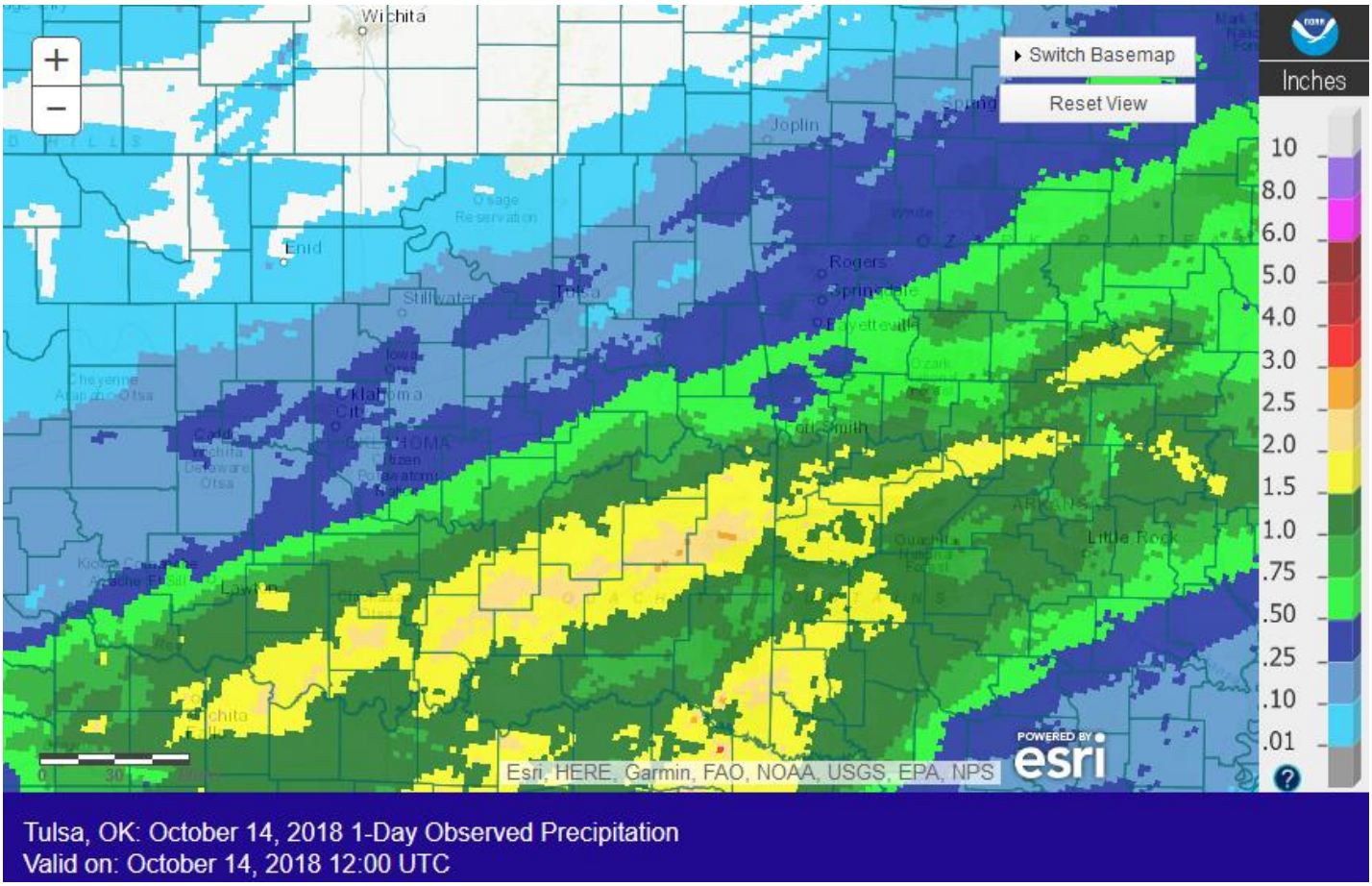


Fig. 11. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/14/2018.

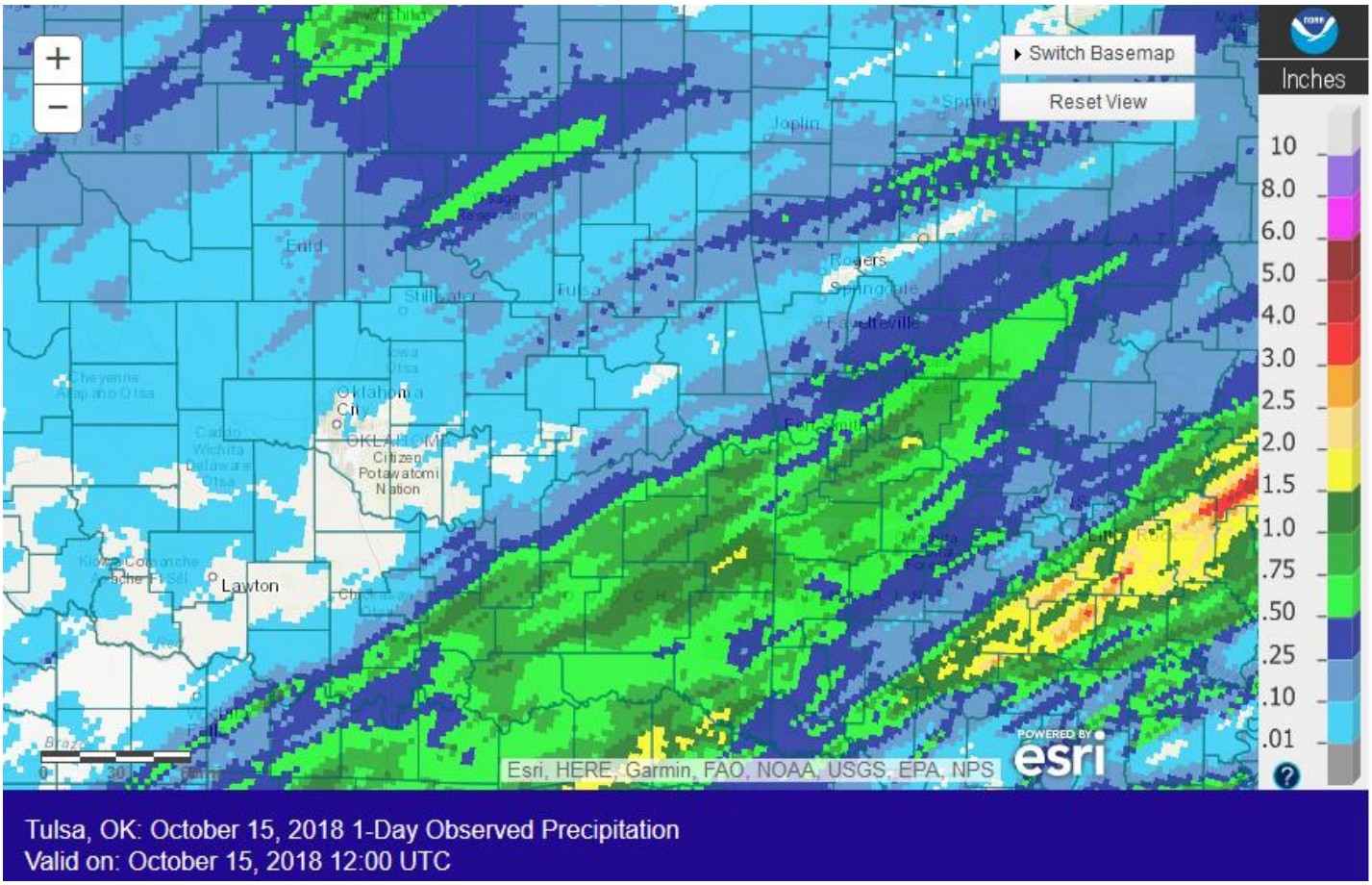


Fig. 12. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/15/2018.

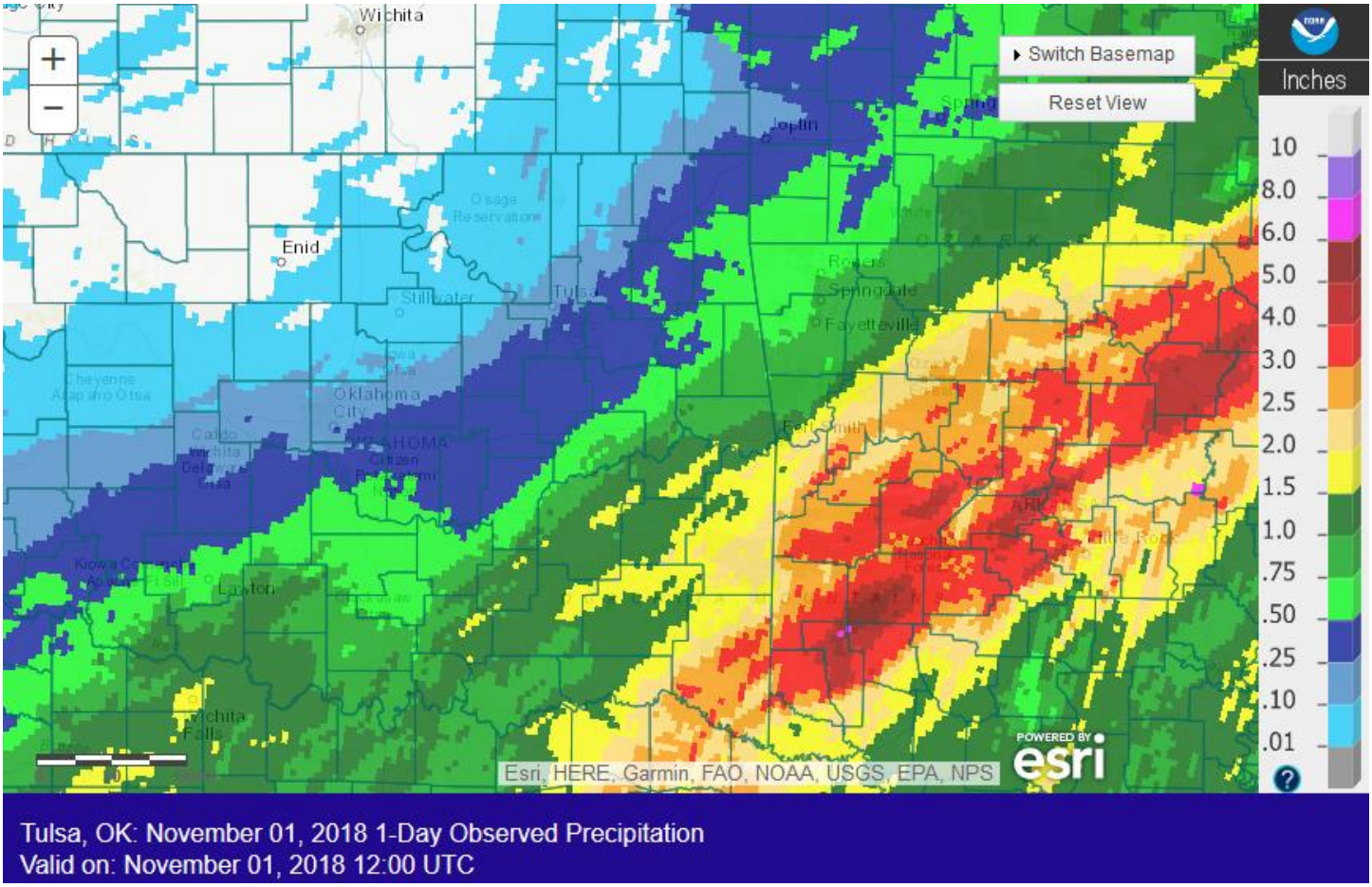


Fig. 13. 24-hour Estimated Observed Rainfall ending at 7am CDT 11/01/2018.

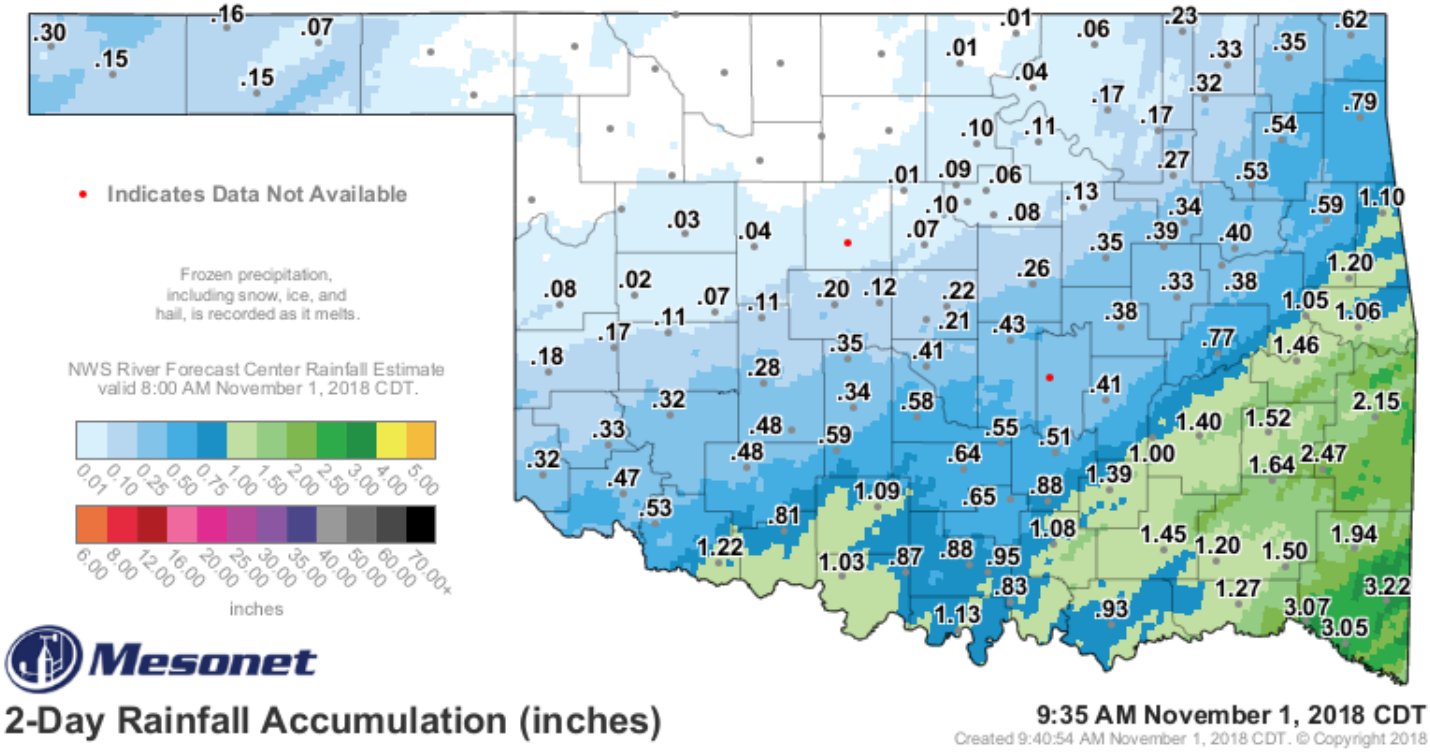


Fig. 14. 2-Day Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 9:35 am CDT 11/01/2018.

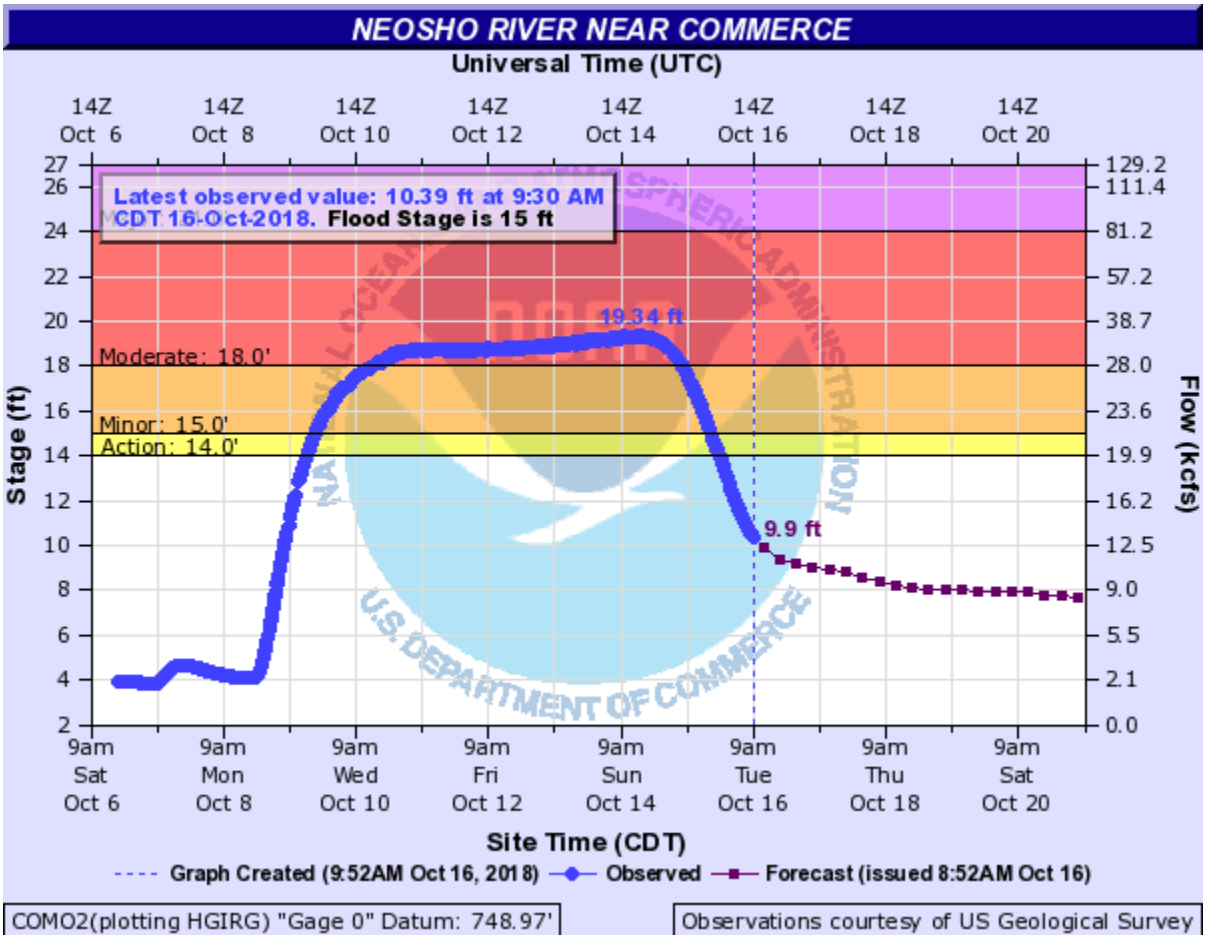
Written by:
Nicole McGavock
Service Hydrologist
WFO Tulsa

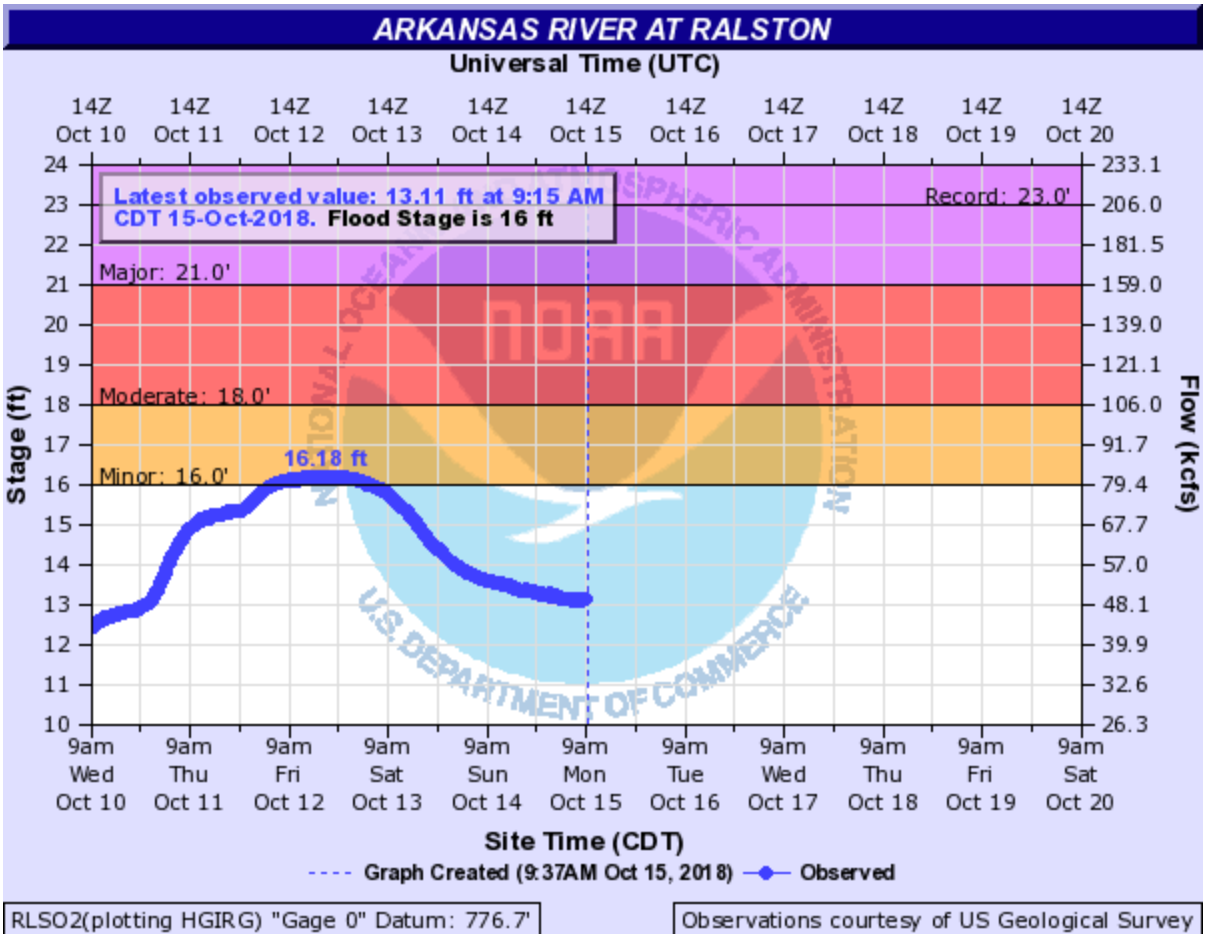
Products issued in October 2018:

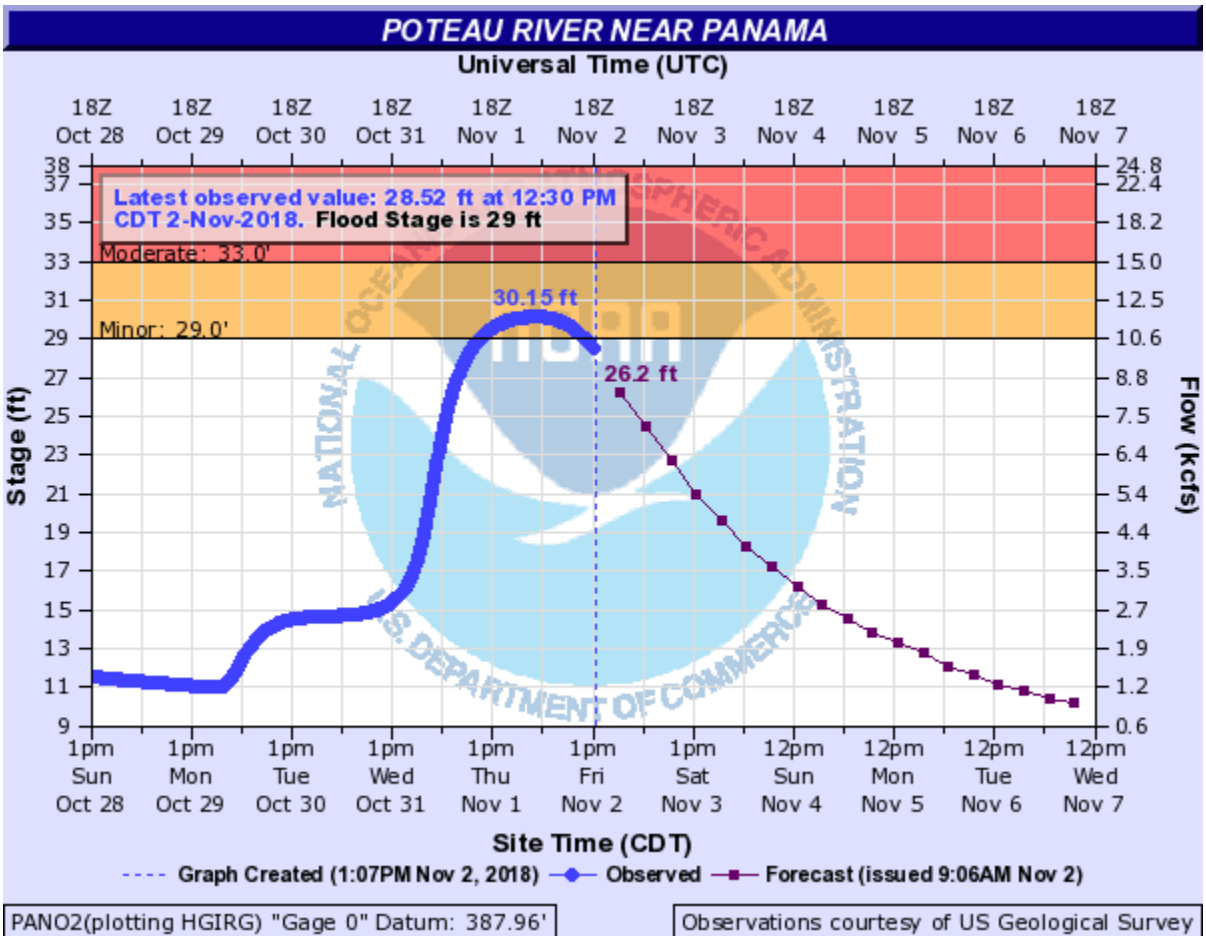
*CWYO2 became a daily river forecast point September 7, 2016
*MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014
*Mixed case River Flood products began July 31, 2013

0 Flash Flood Warnings (FFW)
0 Flash Flood Statements (FFS)
1 Flash/Areal Flood Watches (FFA) (4 Watch FFA CON/EXT/EXA/EXB/CAN)
4 Urban and Small Stream Advisories (FLS)
0 Areal Flood Warnings (FLW)
0 Areal Flood Statements (FLS)
3 River Flood Warnings (FLW) (includes category increases)
39 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)
0 Drought Information Statements (DGT)

Preliminary Hydrographs:




ARKANSAS RIVER AT RALSTON
Universal Time (UTC)
14Z Oct 10
14Z Oct 11
14Z Oct 12
14Z Oct 13
14Z Oct 14
14Z Oct 15
14Z Oct 16
14Z Oct 17
14Z Oct 18
14Z Oct 19
14Z Oct 20
Latest observed value: 13.11 ft at 9:15 AM CDT 15-Oct-2018. Flood Stage is 16 ft
Record: 23.0'
Major: 21.0'
Moderate: 18.0'
Minor: 16.0'
16.18 ft
Stage (ft)
Flow (kcfs)
9am Wed Oct 10
9am Thu Oct 11
9am Fri Oct 12
9am Sat Oct 13
9am Sun Oct 14
9am Mon Oct 15
9am Tue Oct 16
9am Wed Oct 17
9am Thu Oct 18
9am Fri Oct 19
9am Sat Oct 20
Site Time (CDT)
Graph Created (9:37AM Oct 15, 2018)
Observed
RLSO2(plotting HGIRG) "Gage 0" Datum: 776.7'
Observations courtesy of US Geological Survey


POTEAU RIVER NEAR PANAMA
Universal Time (UTC)
18Z Oct 28
18Z Oct 29
18Z Oct 30
18Z Oct 31
18Z Nov 1
18Z Nov 2
18Z Nov 3
18Z Nov 4
18Z Nov 5
18Z Nov 6
18Z Nov 7
Latest observed value: 28.52 ft at 12:30 PM CDT 2-Nov-2018. Flood Stage is 29 ft
Moderate: 33.0'
Minor: 29.0'
30.15 ft
26.2 ft
Stage (ft)
Flow (kcfs)
1pm Sun Oct 28
1pm Mon Oct 29
1pm Tue Oct 30
1pm Wed Oct 31
1pm Thu Nov 1
1pm Fri Nov 2
1pm Sat Nov 3
12pm Sun Nov 4
12pm Mon Nov 5
12pm Tue Nov 6
12pm Wed Nov 7
Site Time (CDT)
Graph Created (1:07PM Nov 2, 2018)
Observed
Forecast (issued 9:06AM Nov 2)
PANO2(plotting HGIRG) "Gage 0" Datum: 387.96'
Observations courtesy of US Geological Survey