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
MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS	HYDROLOGIC SERVICE AREA (HSA): **Tulsa, Oklahoma (TSA)** REPORT FOR: MONTH **October** YEAR **2023**
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 7, 2023**

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.

Despite a couple of rounds of heavy rainfall this month, most of eastern OK and northwest AR received below normal precipitation in October 2023. 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 https://www.weather.gov/tsa/climo_summary_e5list.

Monthly Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for October 2023 ranged from 1" to 8" across eastern OK and northwest AR, with much of the area receiving 3"-5". These rainfall totals correspond to 25% to near 200% of the normal October rainfall (Fig. 1b).

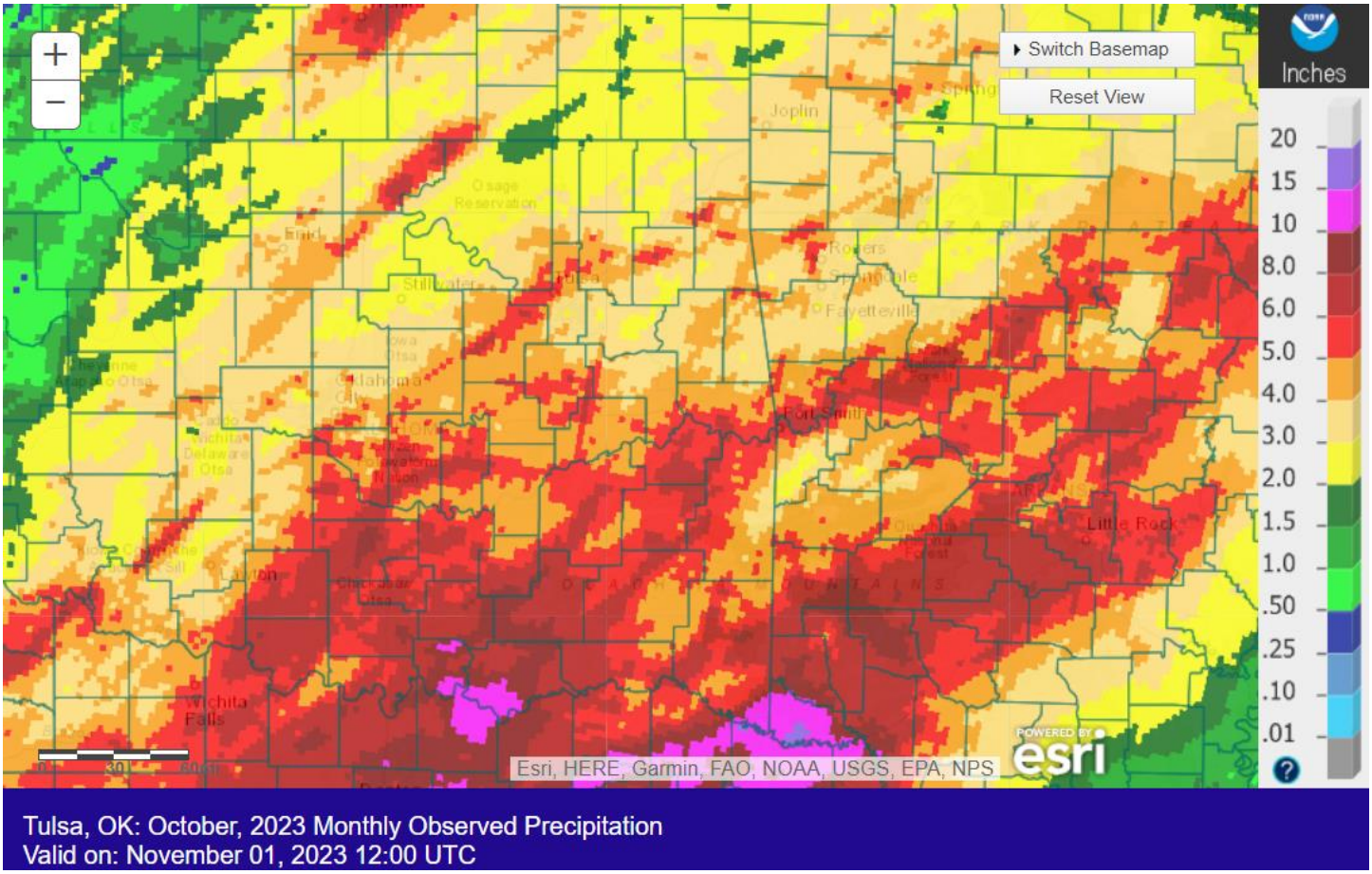


Fig. 1a. Estimated Observed Rainfall for October 2023

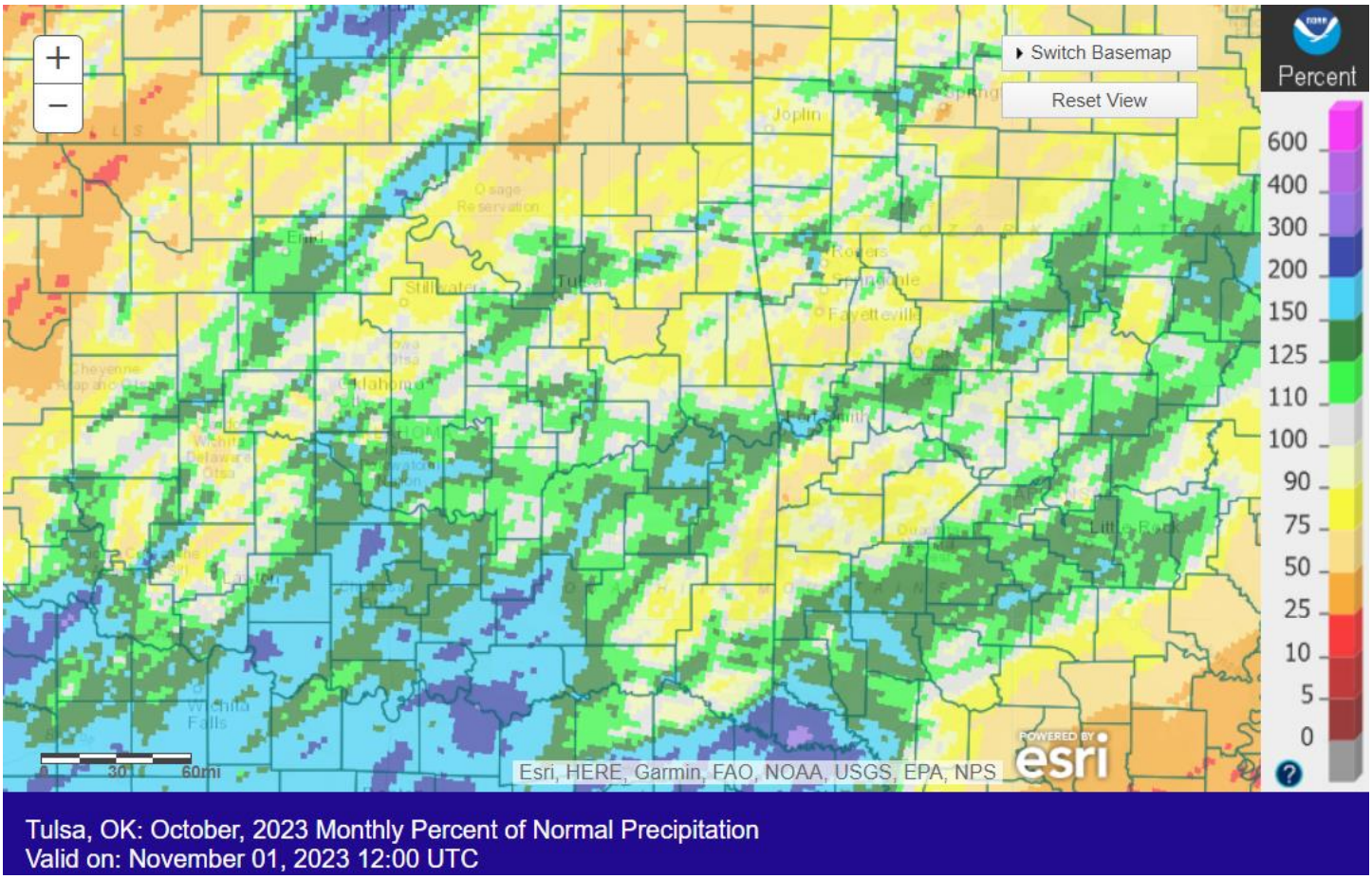


Fig. 1b. Estimated % of Normal Rainfall for October 2023

In Tulsa, OK, October 2023 ranked as the 54th coolest October (62.3°F, tied 1999, 1958, 1933; since records began in 1905) and the 40th wettest October (4.76"; since records began in 1888). Fort Smith, AR had the 32nd warmest October (65.5°F, tied 2015; since records began in 1882) and the 25th wettest October (5.85"; since records began in 1882). Fayetteville, AR had the 12th warmest (60.8°F, tied 2000) and the 38th wettest and driest (3.47") September since records began in 1949.

Some of the larger precipitation reports (in inches) for October 2023 included:

Antlers, OK (meso)	7.07	McAlester, OK (meso)	6.72	Clayton, OK (meso)	6.70
Talihina, OK (meso)	6.08	Stigler, OK (meso)	6.04	McAlester Arpt, OK (ASOS)	5.86
Fort Smith, AR (ASOS)	5.85	Sallisaw, OK (meso)	5.76	Hugo, OK (meso)	5.55

Some of the lowest precipitation reports (in inches) for October 2023 included:

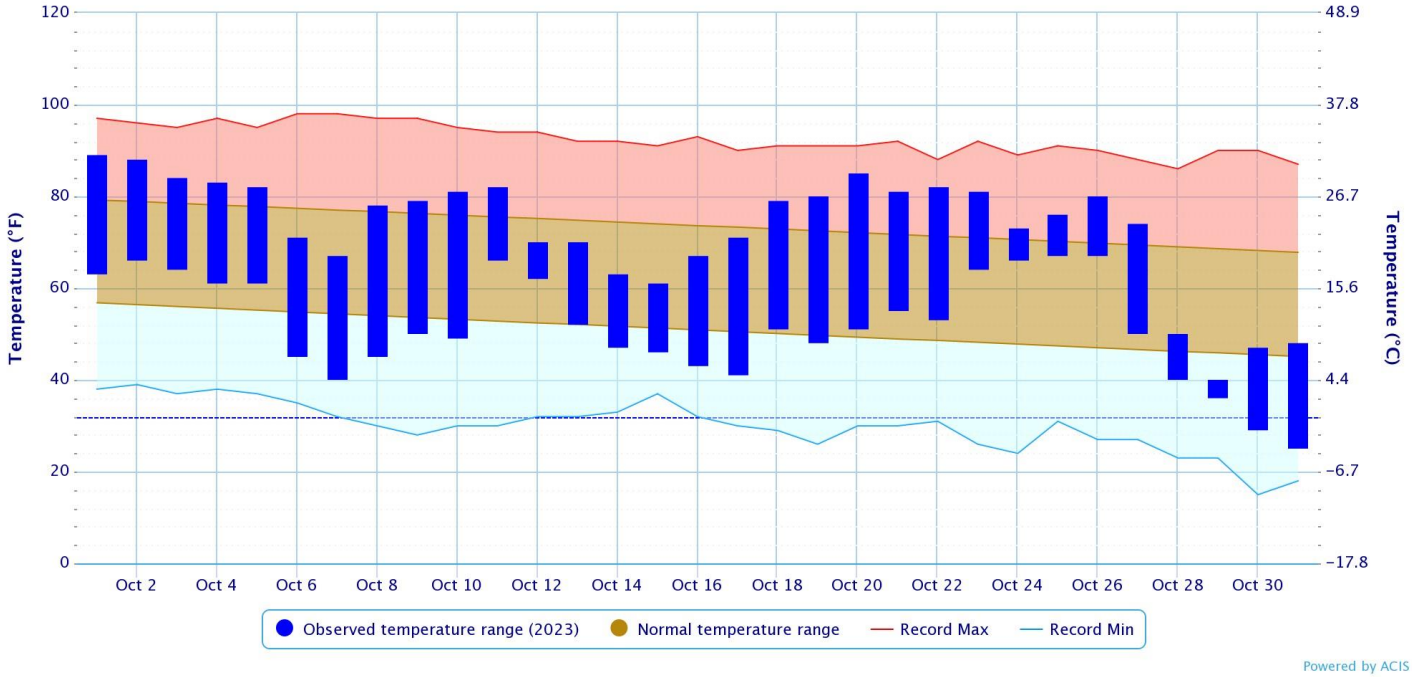
Foraker, OK (meso)	2.21	Bartlesville, OK (ASOS)	2.34	Pawnee, OK (meso)	2.52
Copan, OK (meso)	2.52	Burbank, OK (meso)	2.63	Wynona, OK (meso)	2.84
Vinita, OK (meso)	3.02	Kingston 2S, AR (coop)	3.05	Nowata, OK (meso)	3.07

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

Rank since 1921	October 2023	Autumn-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, 2022 – Oct 31, 2023)
Northeast OK	49th wettest	50th wettest	38th wettest	33rd wettest	50th driest	50th driest	51st driest
East Central OK	32nd wettest	31st wettest	34th wettest	25th wettest	50th driest	37th wettest	29th wettest
Southeast OK	27th wettest	21st wettest	31st wettest	32nd wettest	52nd wettest	25th wettest	30th wettest
Statewide	31st wettest	41st wettest	49th wettest	28th wettest	38th wettest	40th wettest	40th wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

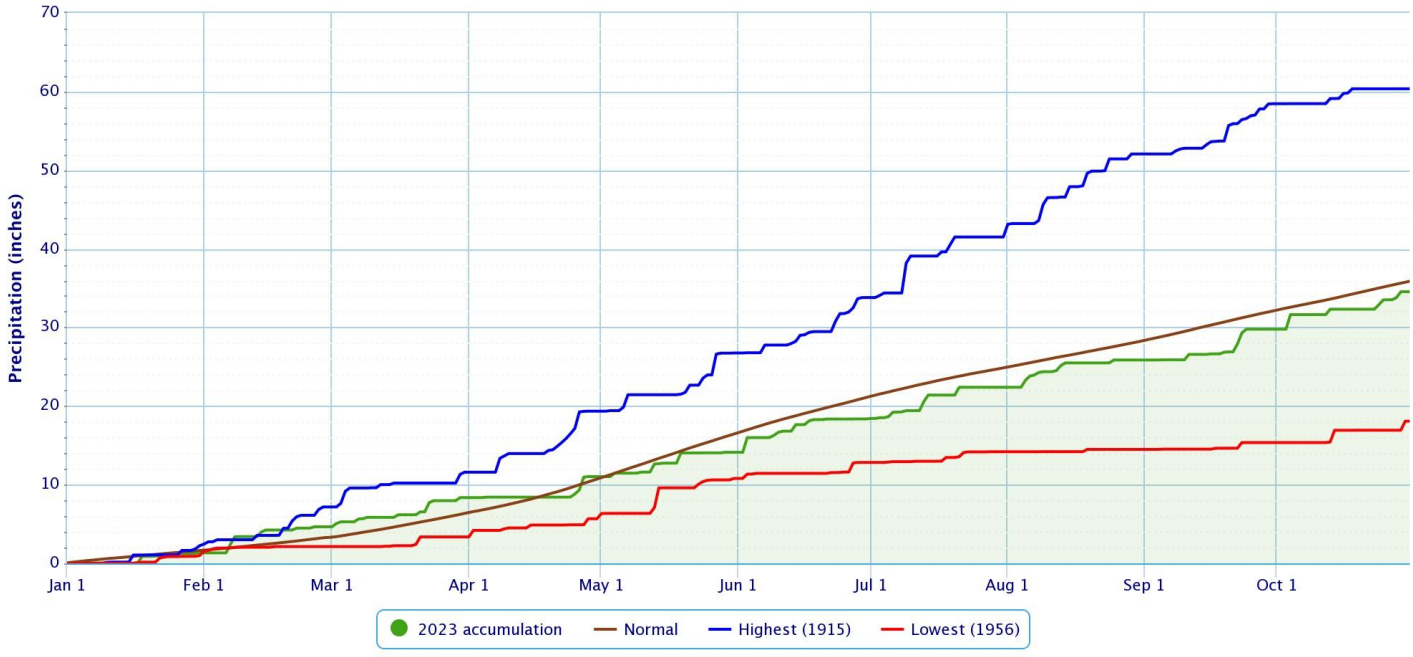
Period of Record – 1905-01-06 to 2023-11-01. Normals period: 1991-2020. Click and drag to zoom chart.



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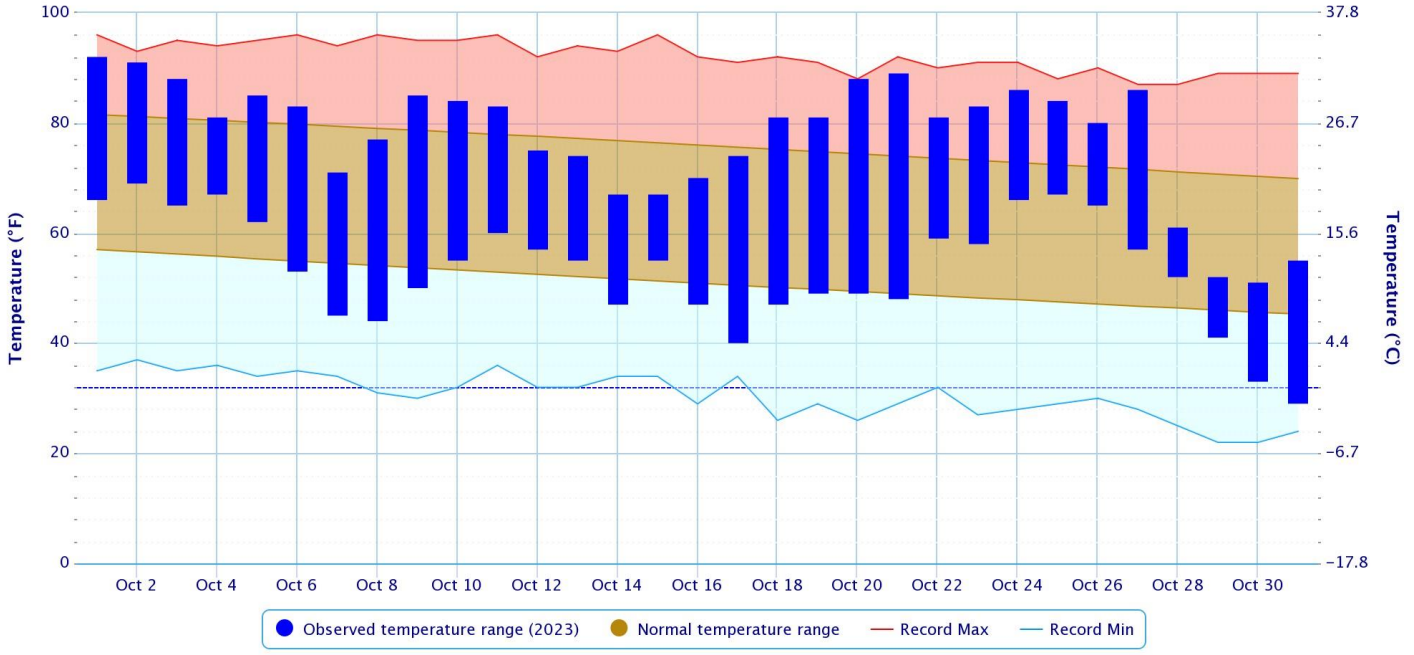
Daily Temperature Data – Fort Smith Area, AR (ThreadEx)

Period of Record – 1882-06-01 to 2023-11-01. Normals period: 1991-2020. Click and drag to zoom chart.



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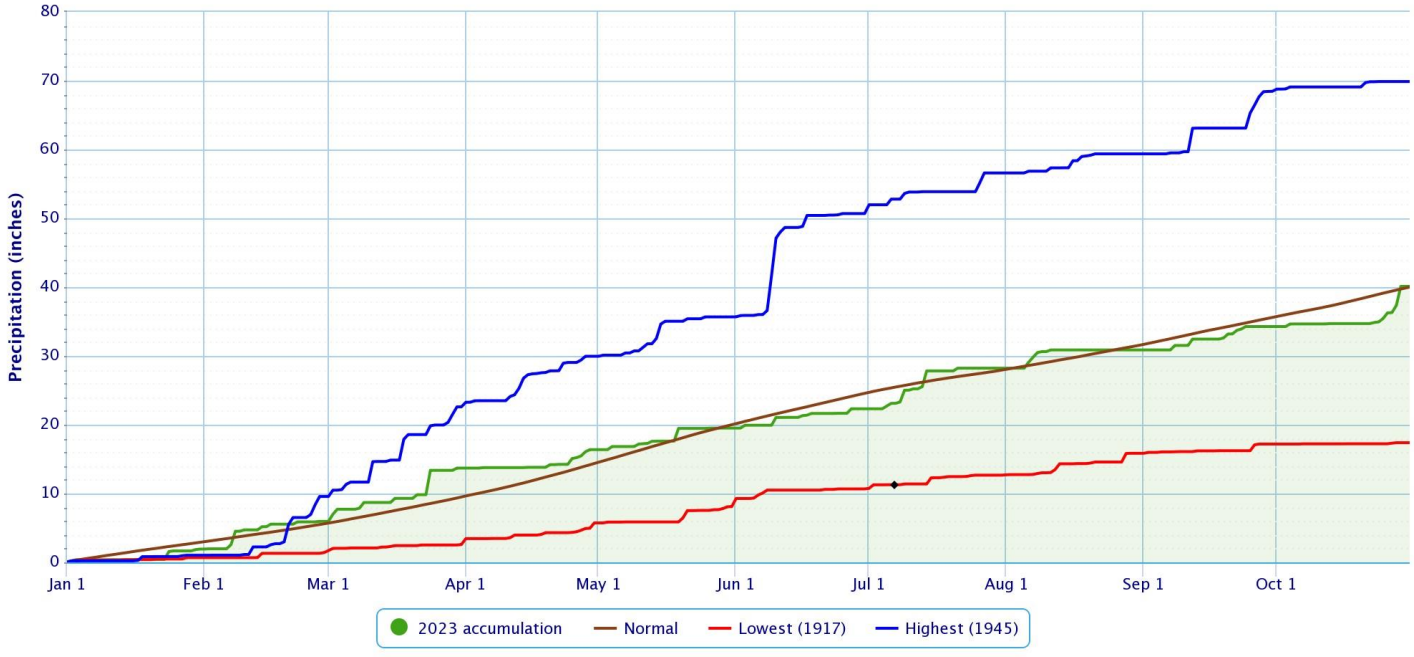
Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

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



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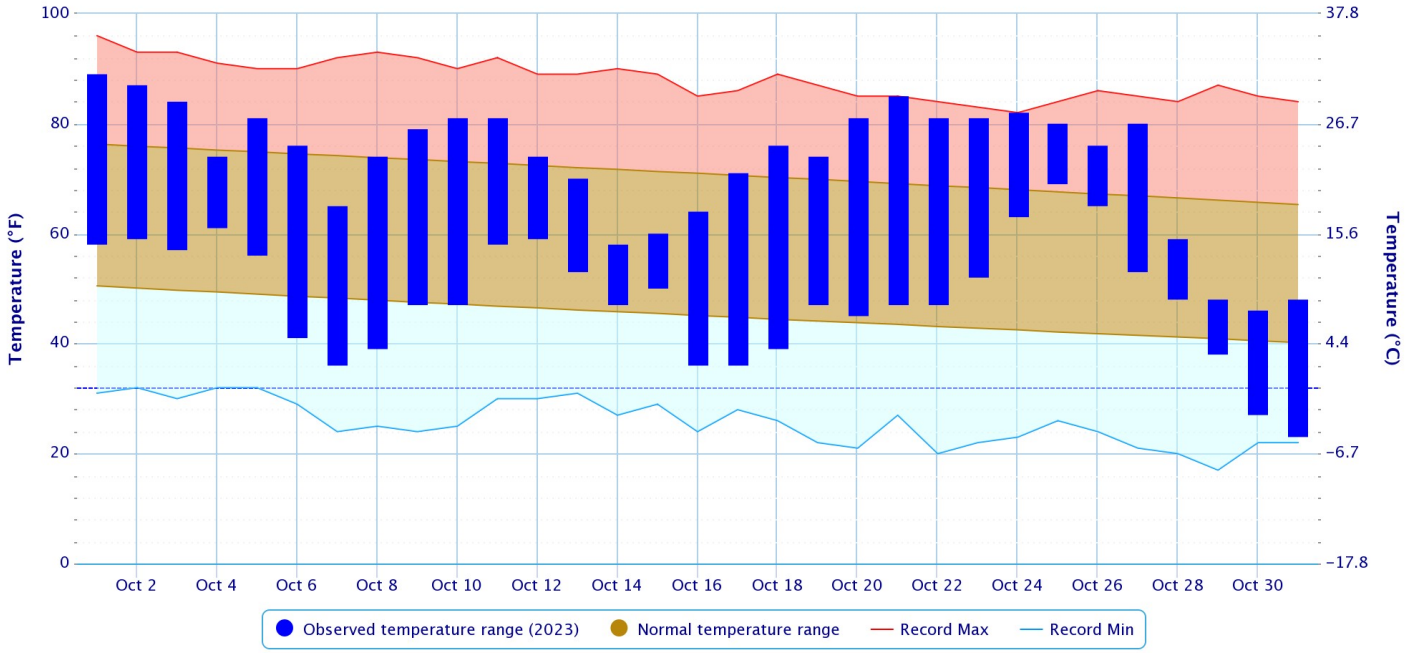
Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

Period of Record – 1949-07-14 to 2023-11-01. Normals period: 1991-2020. Click and drag to zoom chart.



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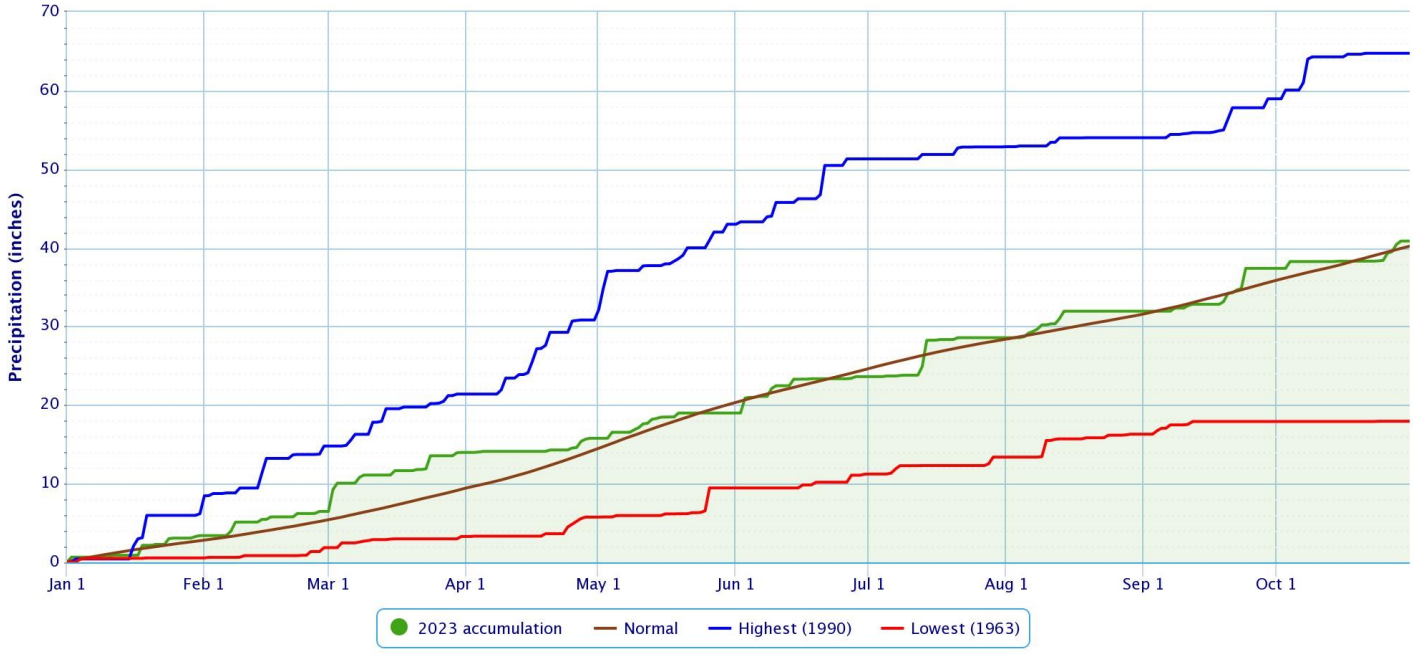
Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

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



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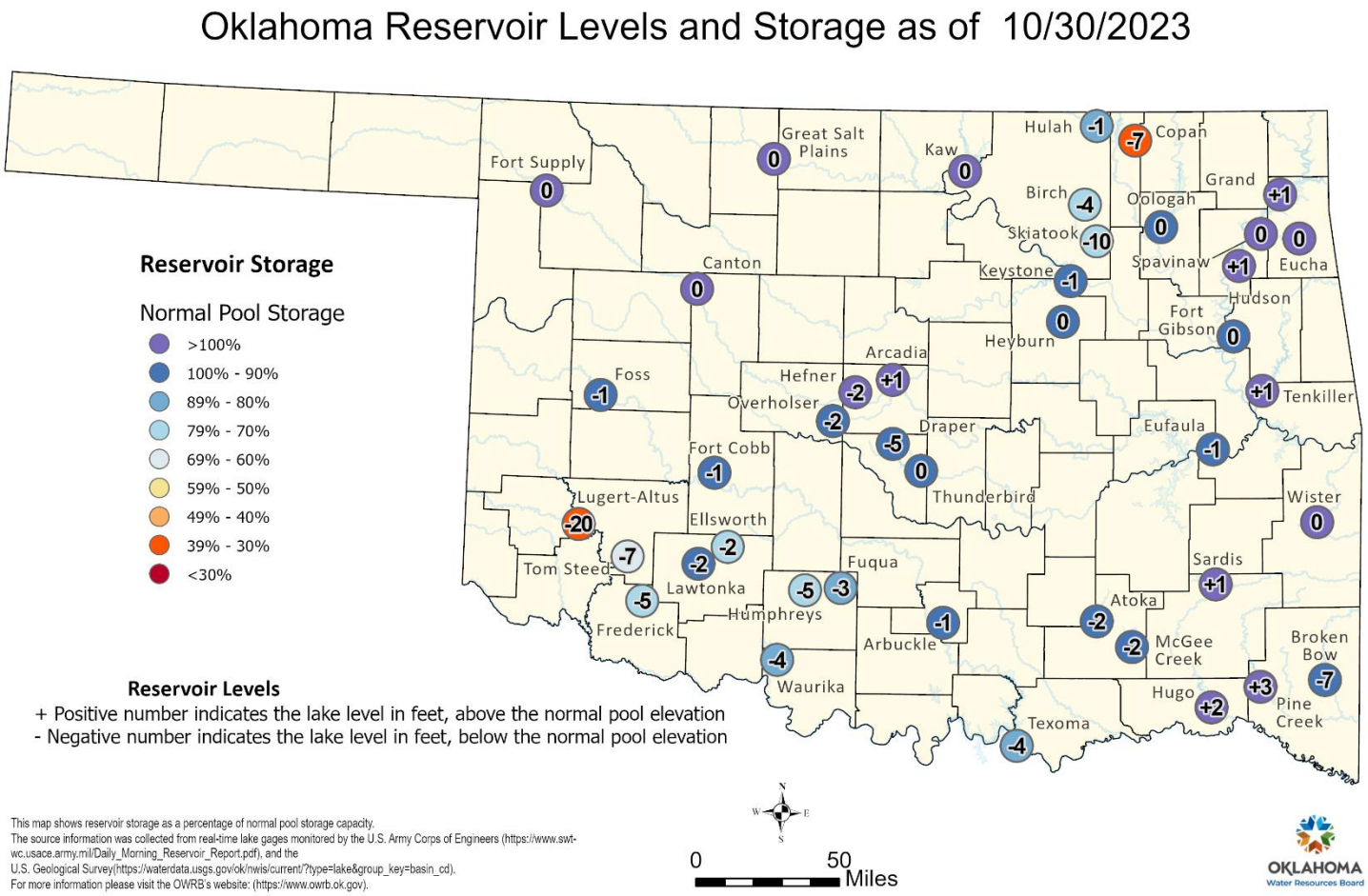
Reservoirs



According to the USACE, several of the lakes in the HSA were below 3% of top of their conservation pools as of 10/30/2023: Copan Lake 36%, Skiatook Lake 71%, Beaver Lake 82%, Hulah Lake 85%, Fort Gibson Lake 89%, Heyburn Lake 92%, Keystone Lake 90%, and Eufaula Lake 95%. Two lakes were above 3% of the top of their conservation pools: Sardis Lake 12% and Pensacola Lake 4%.

Drought

According to the U.S. Drought Monitor (USDM) from October 31, 2023 (Figs. 2, 3), Extreme (D3) Drought conditions were occurring in northeast Osage County in eastern Oklahoma. Severe (D2) Drought conditions exist in portions of Nowata, Washington, Osage, Pawnee, Choctaw, and Pushmataha Counties in eastern Oklahoma. Moderate (D1) Drought conditions were present in portions of Nowata, Washington, Osage, Pawnee, Pittsburg, Pushmataha, and Choctaw Counties in eastern Oklahoma. Abnormally Dry (D0) but not in drought conditions were occurring in Ottawa, Craig, Nowata, Washington, Rogers, Osage, Pawnee, Pittsburg, Latimer, Pushmataha, and Choctaw Counties in eastern OK. No drought or abnormally dry conditions were occurring in northwest AR.

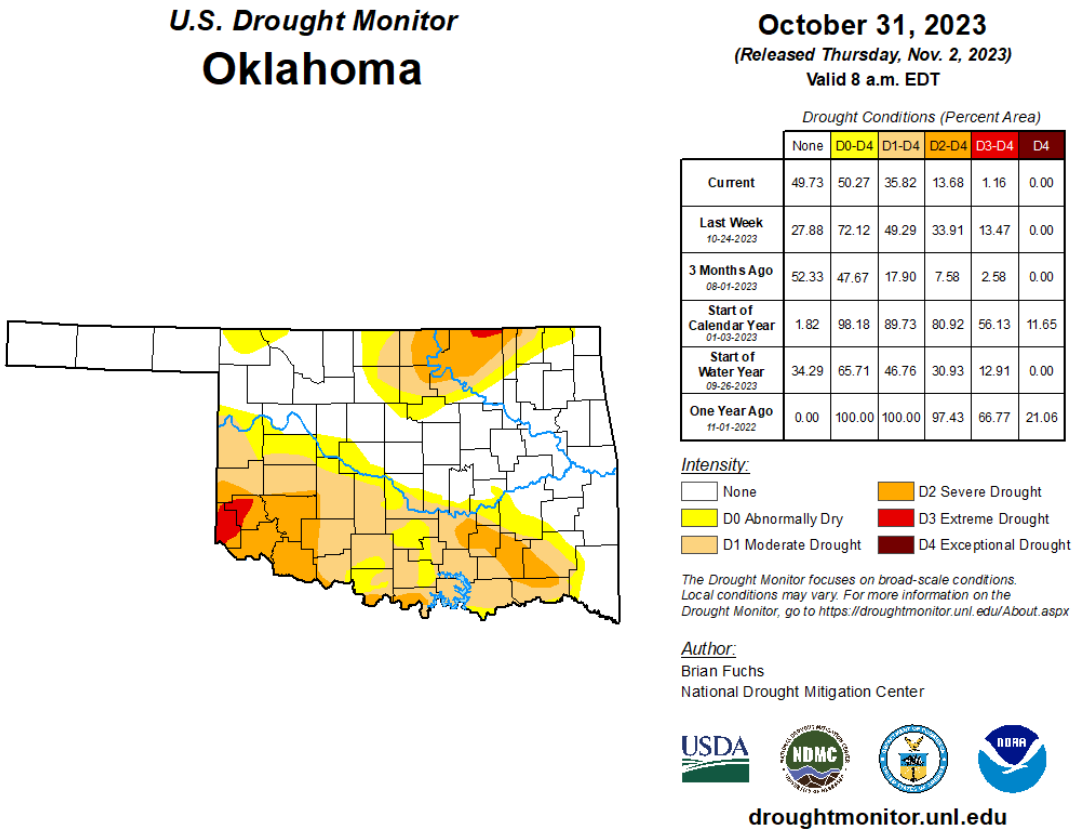


Fig. 2. Drought Monitor for Oklahoma

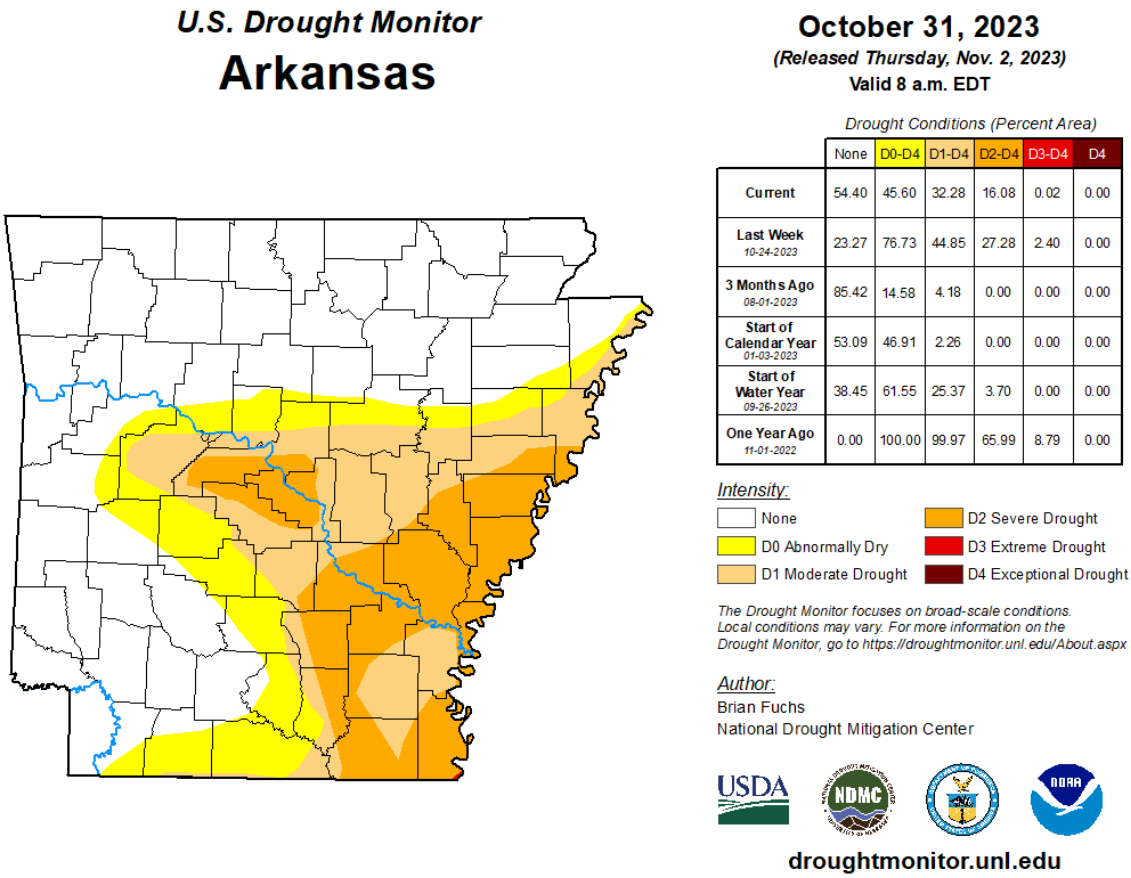


Fig. 3. Drought Monitor for Arkansas

Outlooks

The Climate Prediction Center (CPC) outlook for November 2023 (issued October 31, 2023) indicates 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. This outlook was based on dynamical model output and ENSO this month.

For the 3-month period November-December-January 2023-24, CPC is forecasting an enhanced chance for above median precipitation across eastern OK and northwest AR, an enhanced chance for above normal temperatures across far northeast OK and far northwest AR, and an equal chance for above, near, and below normal temperatures elsewhere across eastern OK and northwest AR (outlook issued October 19, 2023). This outlook is based on long-term trends, ENSO state, and incorporates both statistical and dynamical forecast tools. The odds for above median precipitation are primarily due to the influence of El Niño. According to CPC, El Niño conditions are present in the equatorial Pacific Ocean. El Niño is expected to strengthen and persist through the winter 2023-24, with a 75%-85% chance for a strong El Niño event and a 30% chance for an historically strong El Niño event. There is an 80% chance of El Niño continuing through the Spring. CPC continues the El Niño Advisory.

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 developed over northeast OK along an outflow boundary early on the 4th. This activity continued through the morning hours as the boundary moved from northeast OK into northwest AR. Additional thunderstorms developed in eastern OK during the afternoon as a strong upper-level jet streak rounded the base of an upper trough. These storms were primarily focused along the remnant outflow boundary and within a region of low- to mid-level warm advection. By early evening, thunderstorms that had developed further west in OK moved into eastern OK, with widespread showers and thunderstorms impacting eastern OK and northwest AR through the evening hours. This activity ended from northwest to southeast from the late evening through 3 am on the 5th. Rainfall totals ranged from around 0.10” to 4” (Figs. 4, 5).

Showers and thunderstorms moved into eastern OK and far northwest AR on the morning of the 24th as tropical moisture from the remnants of Hurricane Norma streamed into the region. This activity became more scattered and confined to eastern OK during the afternoon hours. The heaviest rain fell across eastern Kay and far northwestern Osage Counties. By evening, the showers shifted southeast, affecting southeast OK into northwest AR, and finally dissipated around midnight. Rainfall totals ranged from a few hundredths of an inch to 1” for most of eastern OK and northwest AR, with higher totals of 1” to 5” across far western Osage and eastern Kay Counties (Figs. 6, 7)

A mid-level shortwave trough lifted northeast from west TX/southeast NM into OK/KS during the evening through overnight hours of the 25th into the 26th. Showers and thunderstorms began to move into eastern OK from the west by early evening and increased in coverage and intensity through the evening hours. This activity reached northwest AR around midnight as the wide area of storms slowly shifted eastward. The rain continued through the overnight hours, finally shifting east of the area by mid-morning of the 26th. The rainfall ranged from 0.10” to around 4” (Figs. 8, 9). The two rainfall events combined resulted in widespread 0.50” to 5” of rain (Fig. 10).

A quasi-stationary frontal boundary was located across southeast OK on the 28th. Scattered showers and isolated thunderstorms developed near/north of the boundary just before sunrise and became widespread through the morning hours across eastern OK and northwest AR, primarily southeast of I-44, as an upper-level jet streak approached the area. This activity continued for much of the afternoon before dissipating and shifting east of the area by early evening. Some isolated showers moved through the region during the evening. Southwesterly flow continued to stream moisture into the region, with precipitable water (PWAT) values at or above the 90th percentile for this time of year. Just before midnight, a band of showers and thunderstorms associated with an elevated front moved south into northeast OK, where it slowed and became nearly stationary northwest of I-44 through the early morning hours. Additional scattered showers and isolated thunderstorms redeveloped closer to the stalled boundary across southeast OK into west central AR. By 7am on the 29th, rainfall totals ranged from around 0.25” to near 5” across eastern OK and northwest AR (Fig. 11).

Through the remainder of the morning, the band of scattered showers spread further to the southeast. Another round of more widespread showers and isolated thunderstorms then developed along the elevated frontal zone during the afternoon across northeast OK and far northwest AR as the right-rear quadrant of the departing strong upper-level jet streak was leaving the area. A shallow cold airmass was in place across the northern portion of the area, with some reports of sleet mixed in with the rain. The elevated front finally began to move southeast during the evening hours, with showers and isolated thunderstorms continuing along it. This activity slowly shifted southeast through the overnight hours, finally exiting the region in the pre-dawn hours of the 30th. The additional 24-hour rainfall ranged from 0.10” to near 2” (Fig. 12).

The active week of weather, ending on the morning of the 30th, resulted in widespread 4”-7” of rain across a large portion of southeast OK into west central AR, and across eastern Kay and far northwest Osage Counties (Fig. 13). While rivers did rise from this rain, no flooding occurred.

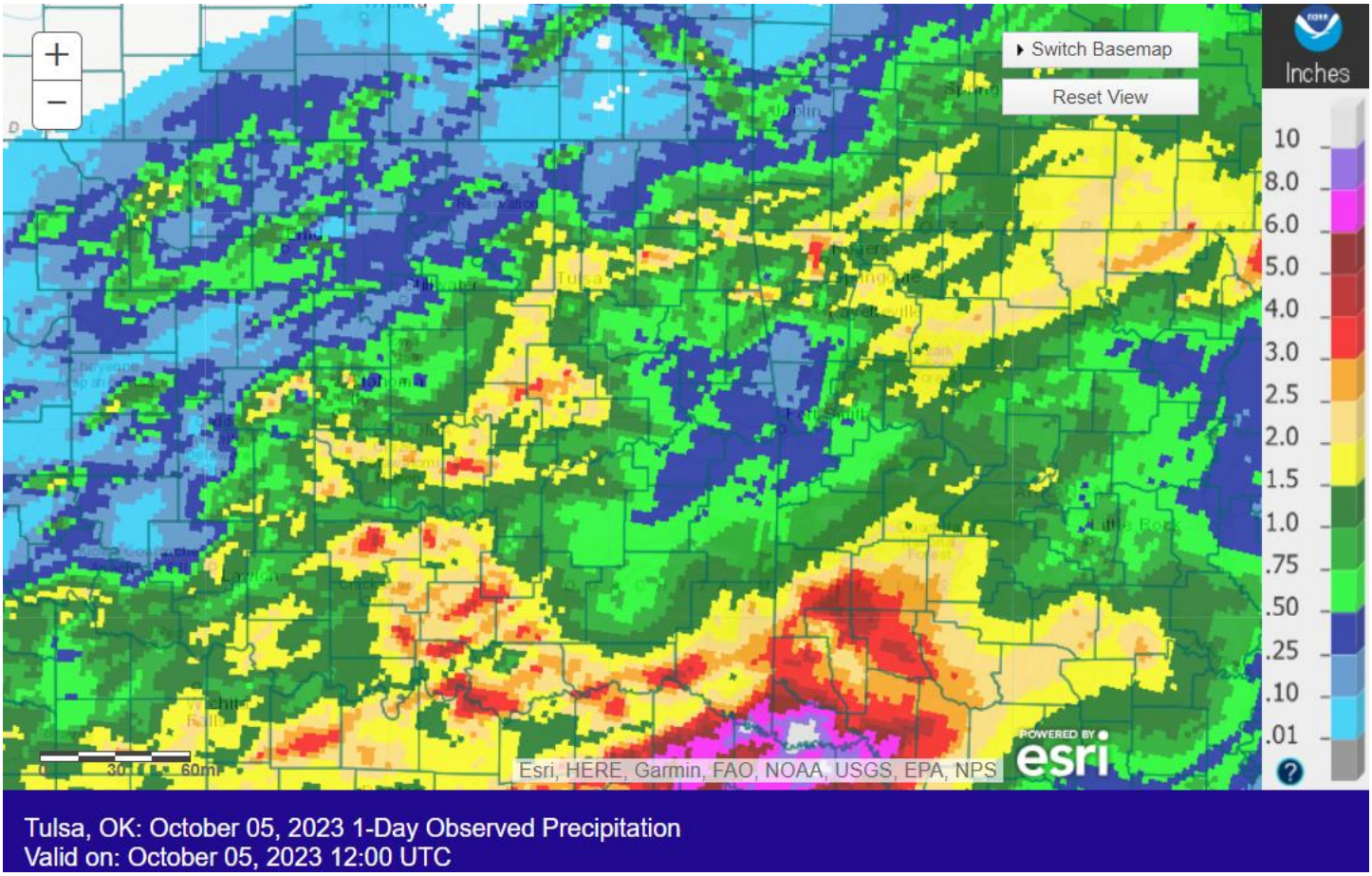


Fig. 4. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/05/2023.

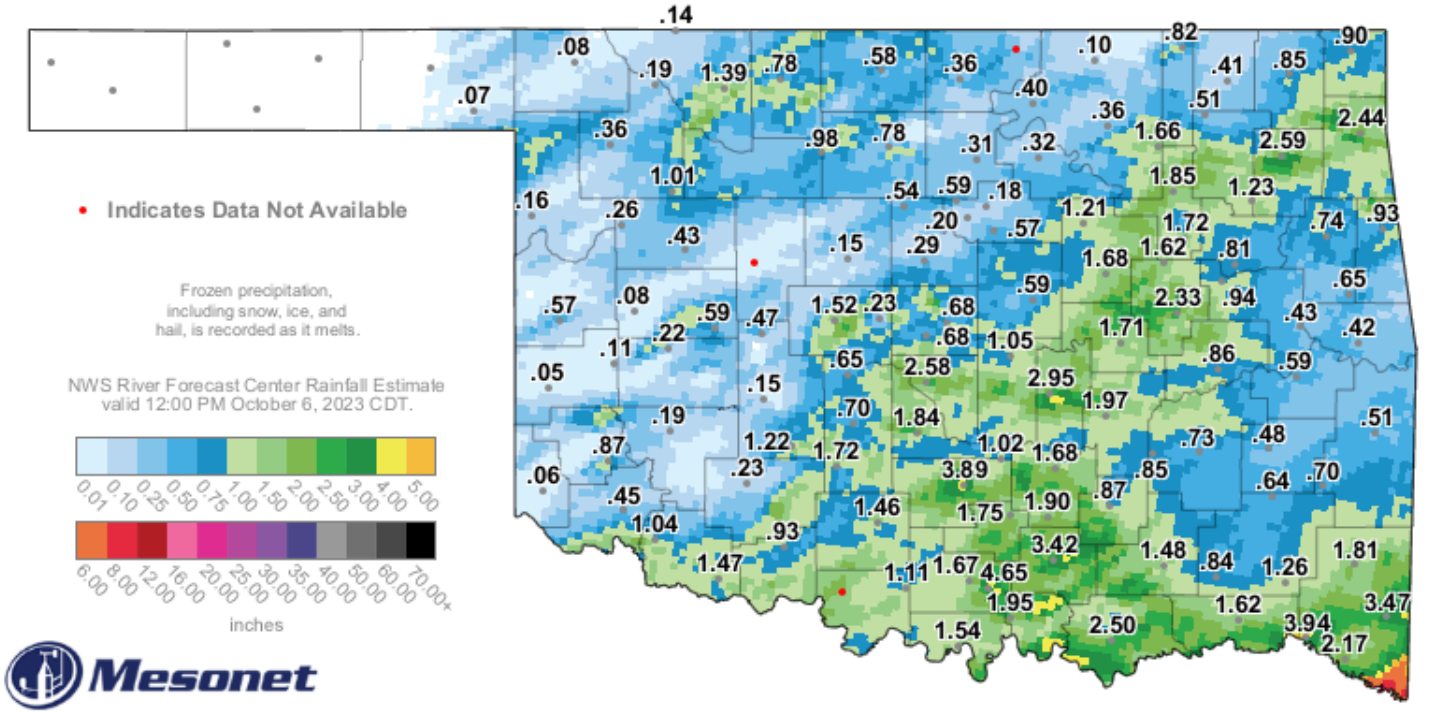


Fig. 5. OK Mesonet (values) and NWS RFC rainfall estimate (image) 3-day rainfall ending at 1:25 pm CDT 10/06/2023.

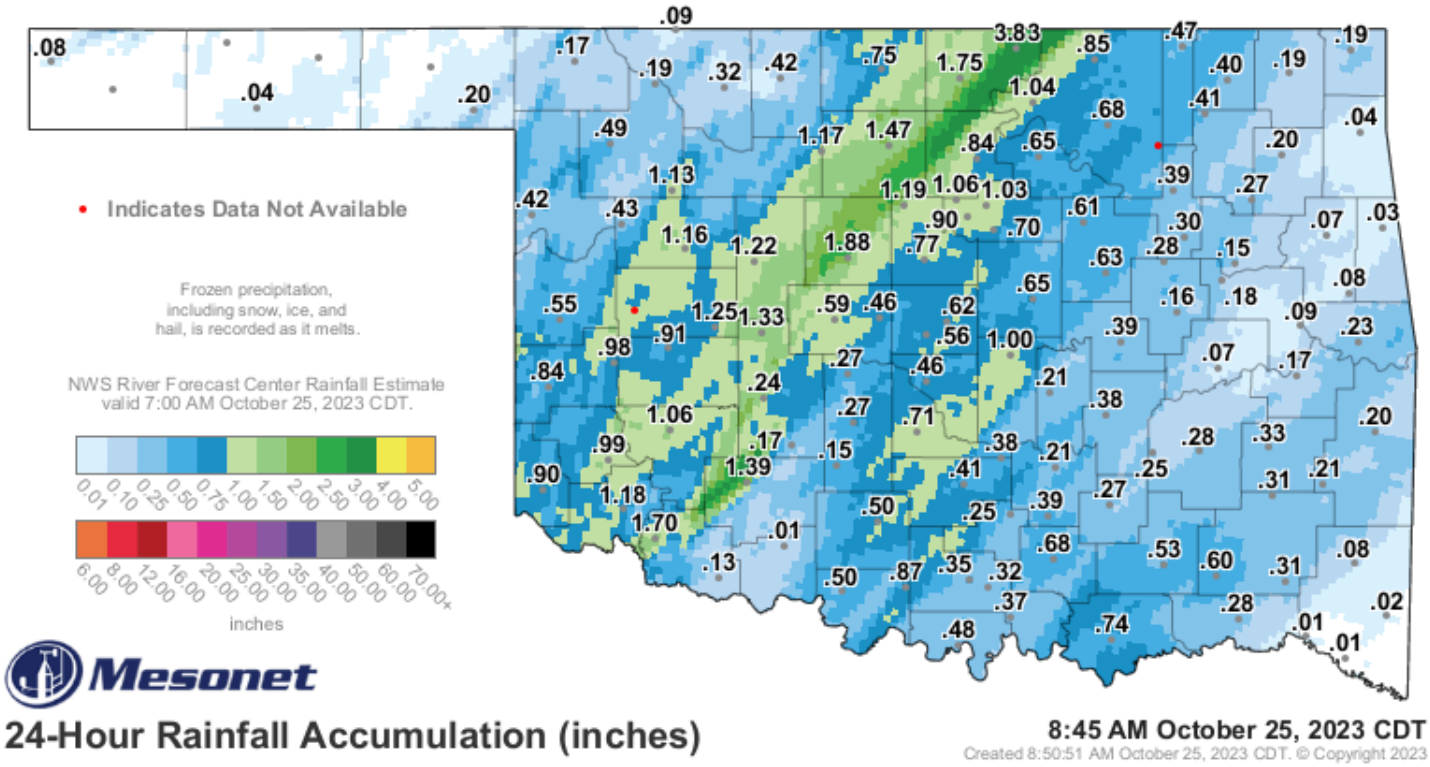


Fig. 6. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 8:45 am CDT 10/25/2023.

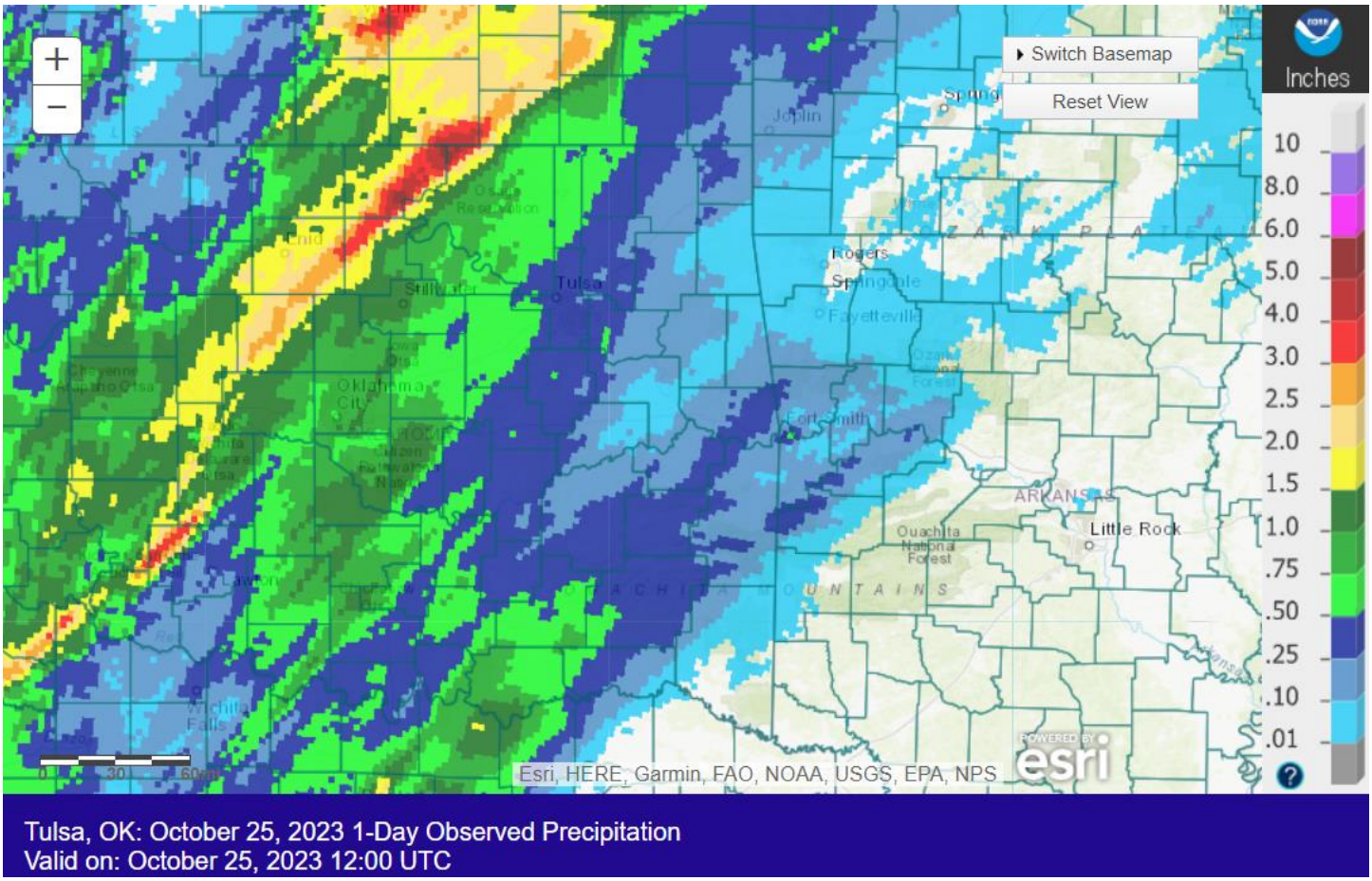


Fig. 7. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/25/2023.

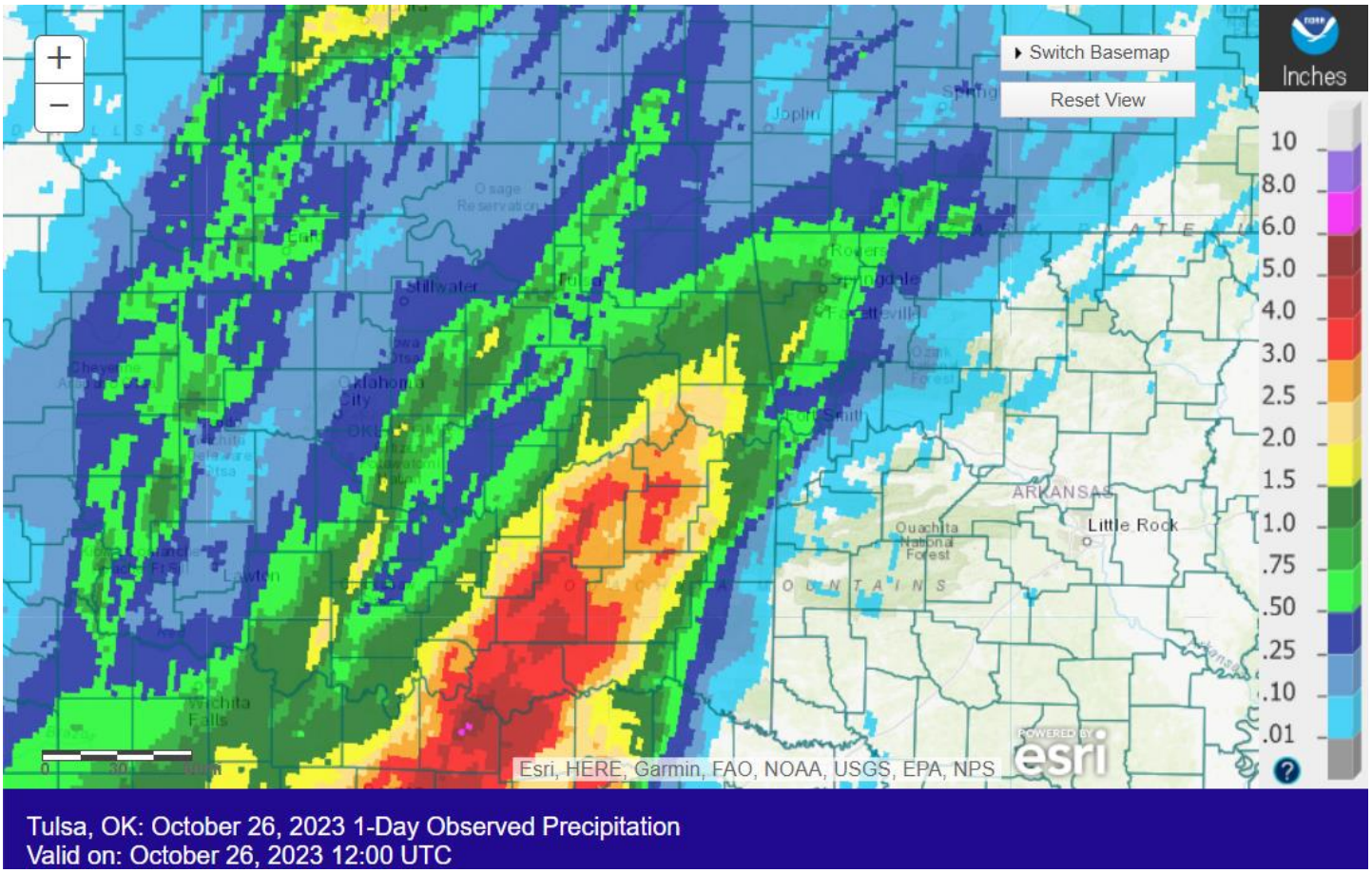


Fig. 8. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/26/2023.

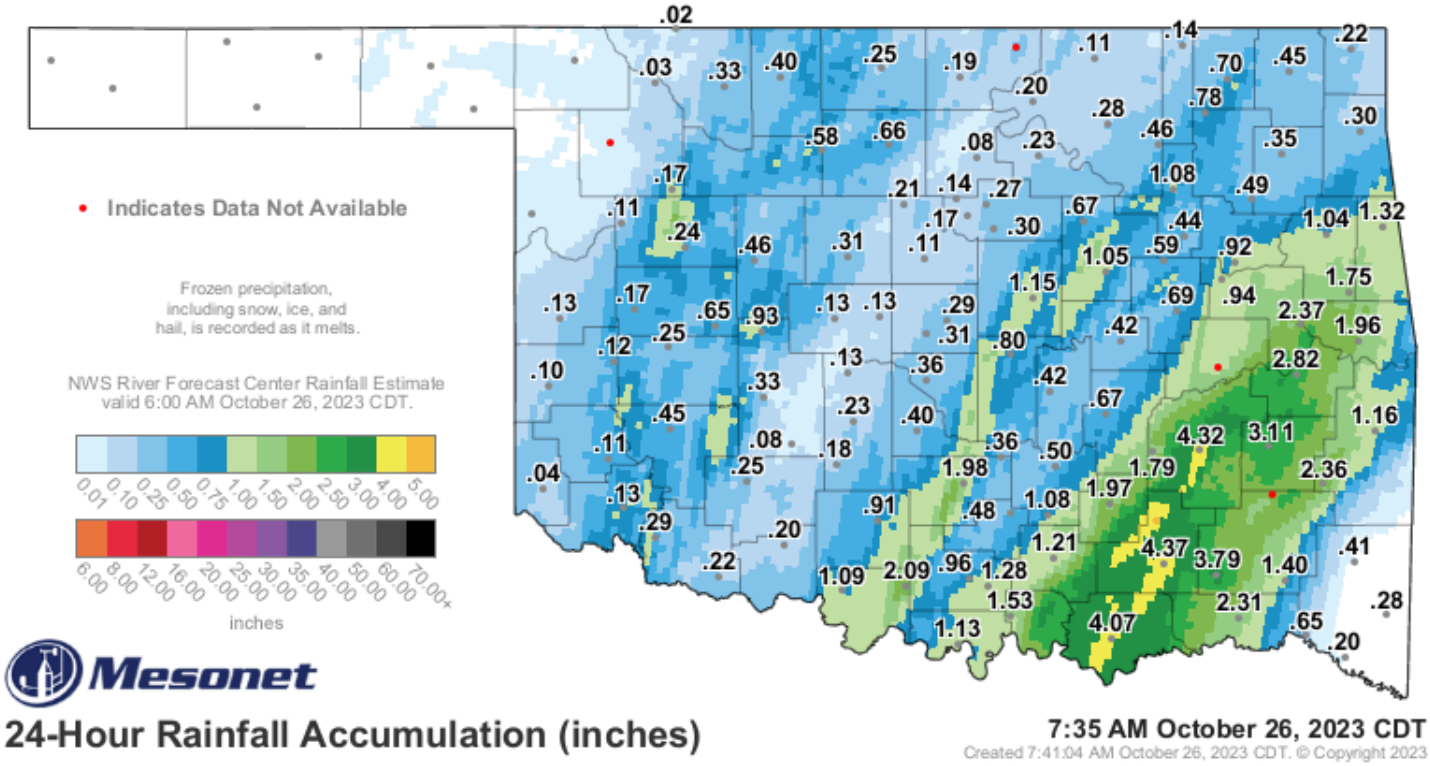


Fig. 9. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 7:35 am CDT 10/26/2023.

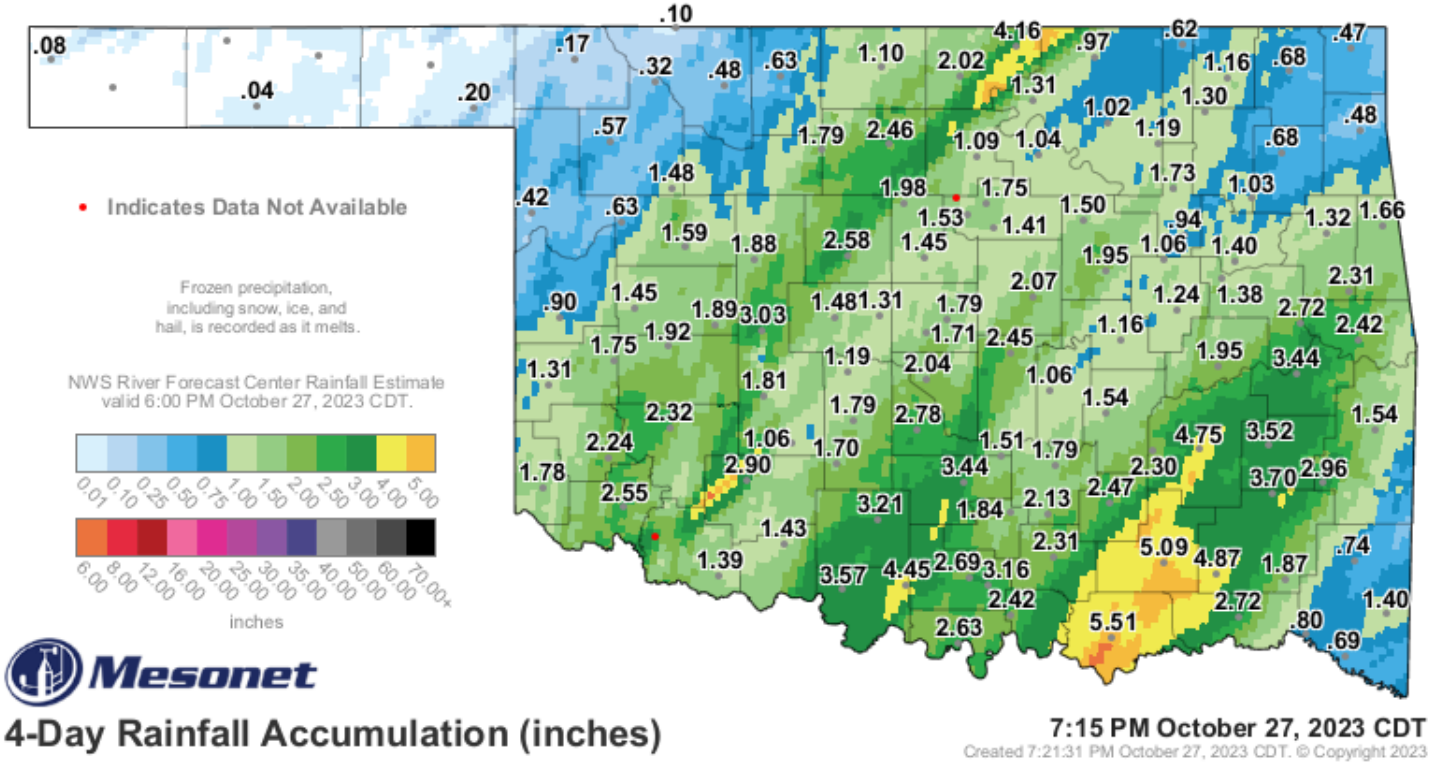


Fig. 10. OK Mesonet (values) and NWS RFC rainfall estimate (image) 4-day rainfall ending at 7:15 pm CDT 10/27/2023.

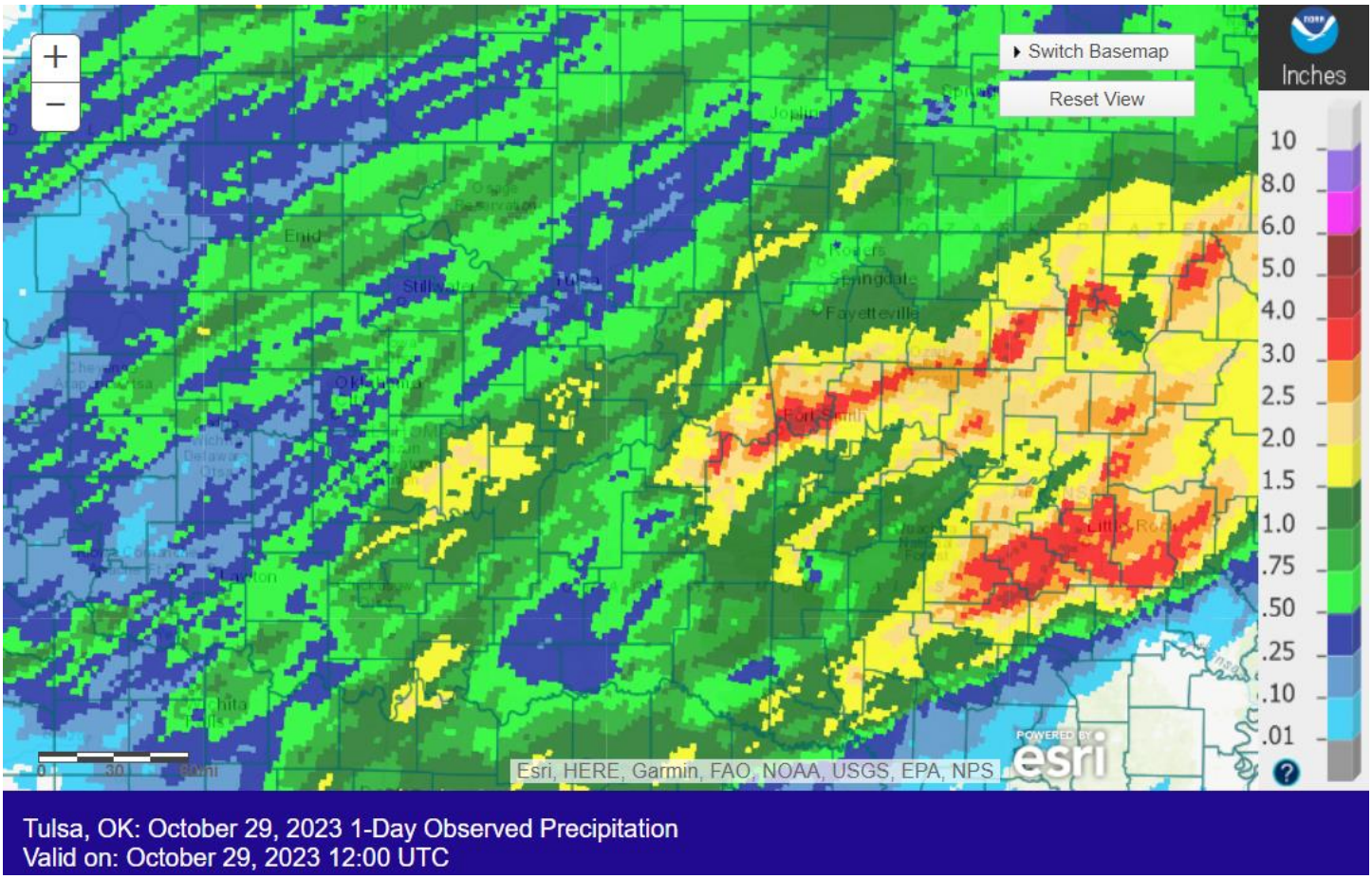


Fig. 11. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/29/2023.

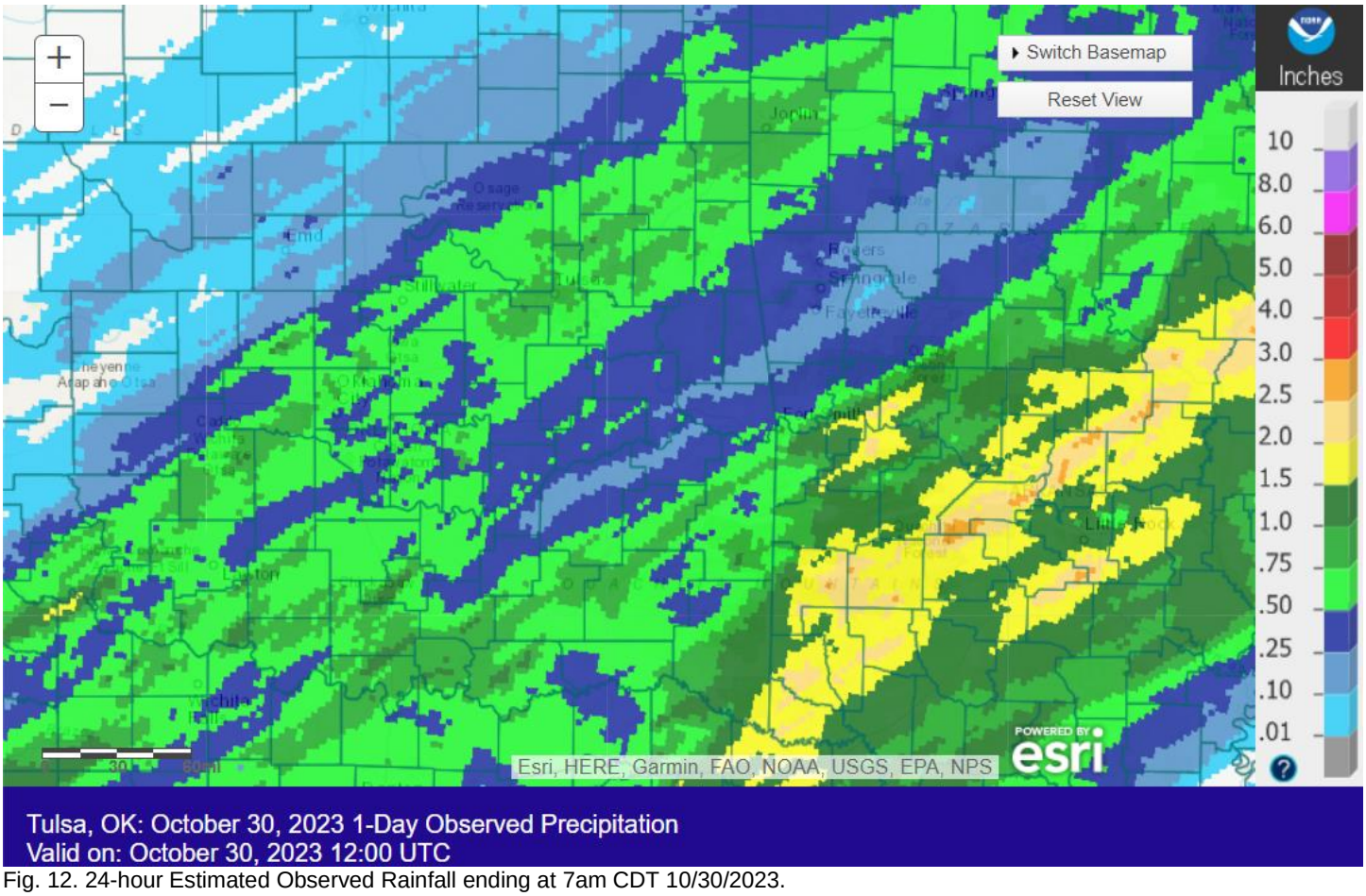


Fig. 12. 24-hour Estimated Observed Rainfall ending at 7am CDT 10/30/2023.

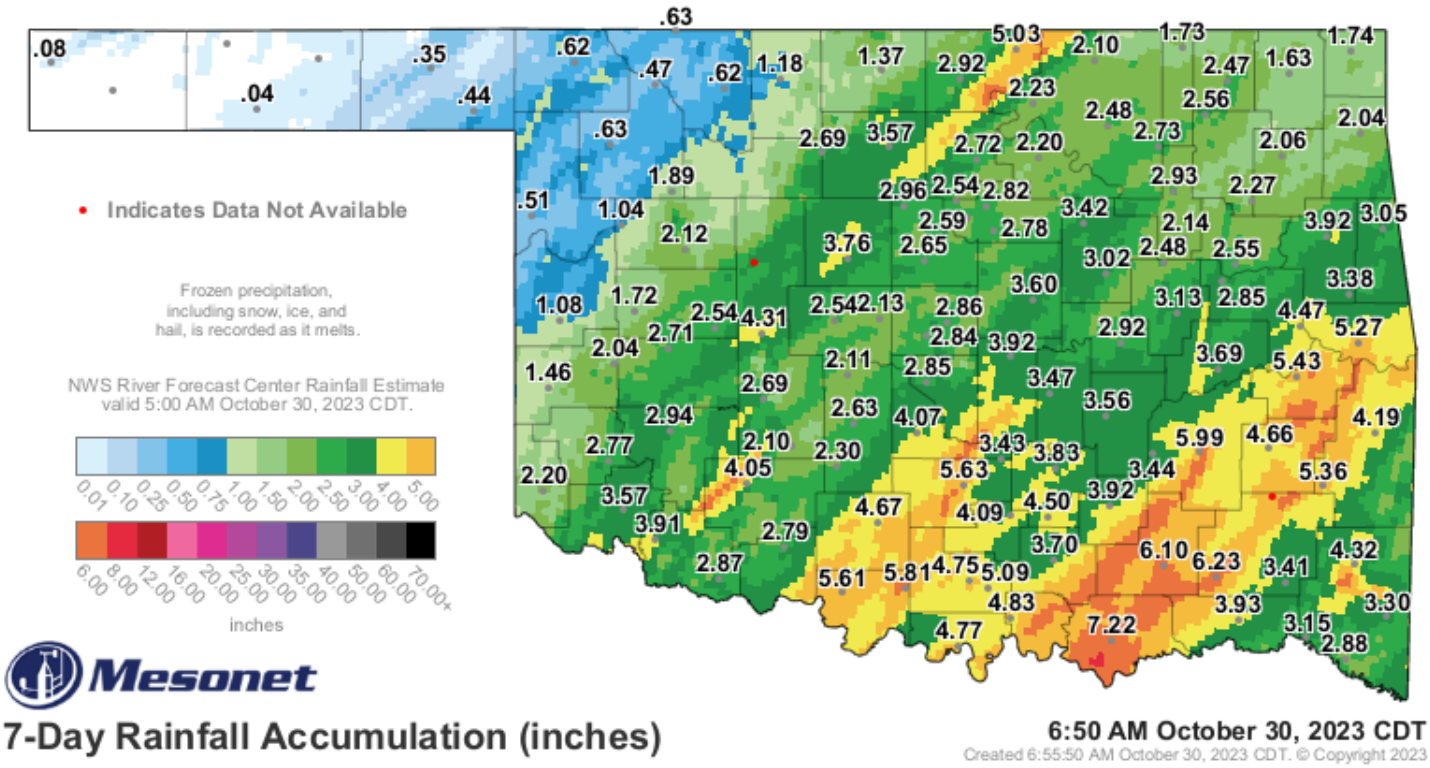


Fig. 13. OK Mesonet (values) and NWS RFC rainfall estimate (image) 7-day rainfall ending at 6:50 am CDT 10/30/2023.

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in October 2023:

0 Flash Flood Warnings (FFW)
0 Flash Flood Statements (FFS)
1 Flash/Areal Flood Watches (FFA) (8 Watch FFA CON/EXT/EXA/EXB/CAN)
2 Urban and Small Stream Advisories (FLS)
0 Areal Flood Warnings (FLW)
0 Areal Flood Statements (FLS)
0 River Flood Warnings (FLW) (includes category increases)
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