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|---|---|---|
| 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) |
| | | REPORT FOR: MONTH November YEAR 2023 |
| MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS | | SIGNATURE Steven F. Piltz (Meteorologist-in-Charge) |
| TO: Hydrometeorological Information Center, W/OH2 NOAA / National Weather Service 1325 East West Highway, Room 7230 Silver Spring, MD 20910-3283 | | DATE December 14, 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)

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

November 2023 was a warm and dry month across eastern OK and northwest AR. Normal precipitation for November ranges from 2.6" in Pawnee County to 4.4" in Haskell County. Normal precipitation for the Ozark region of northwest Arkansas averages 4.2". 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 November 2023 ranged from around 0.25" to 5" across eastern OK and northwest AR, with much of the area receiving 1"-3". These rainfall totals correspond to around 10% to around 90% of the normal November rainfall (Fig. 1b).

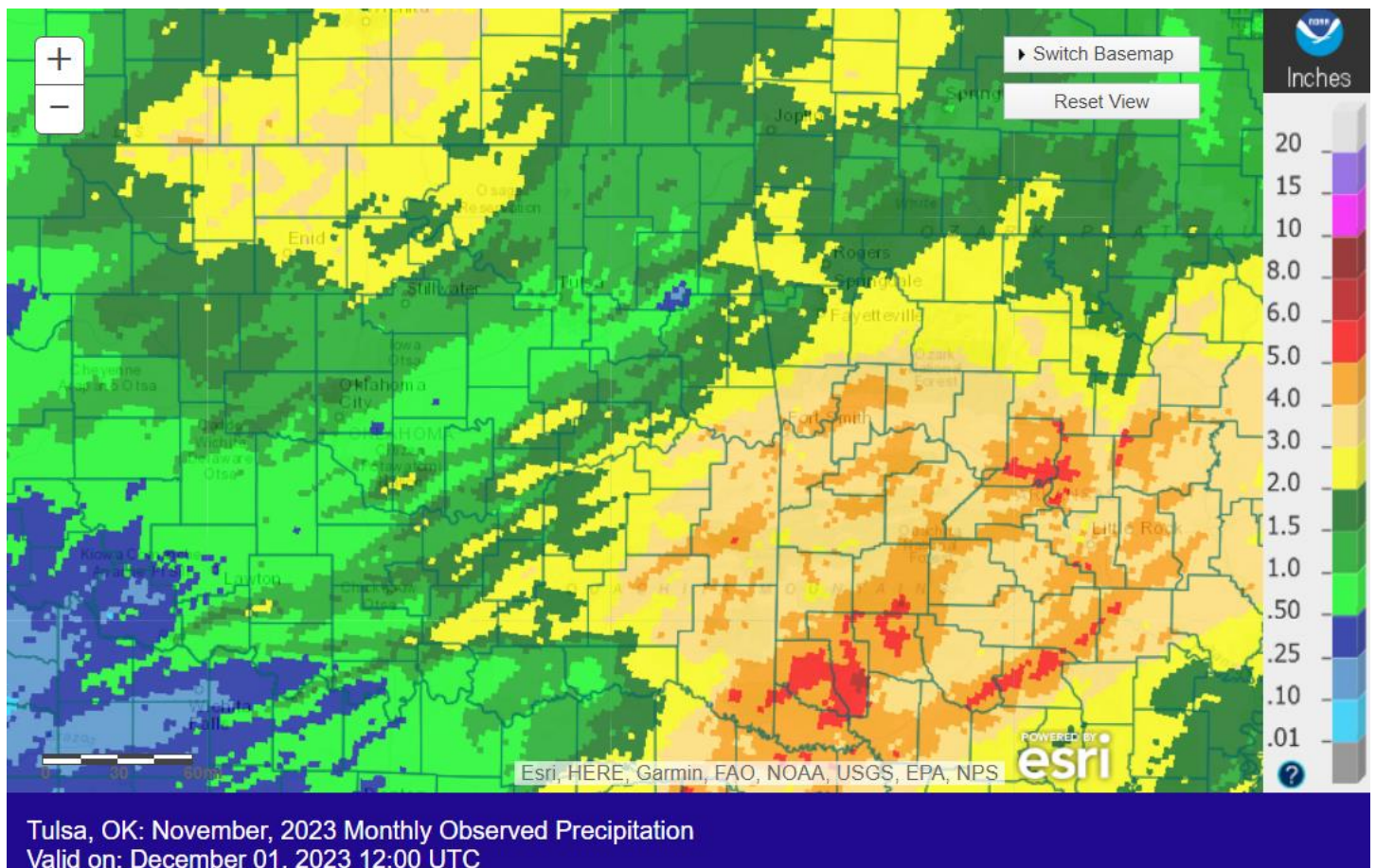
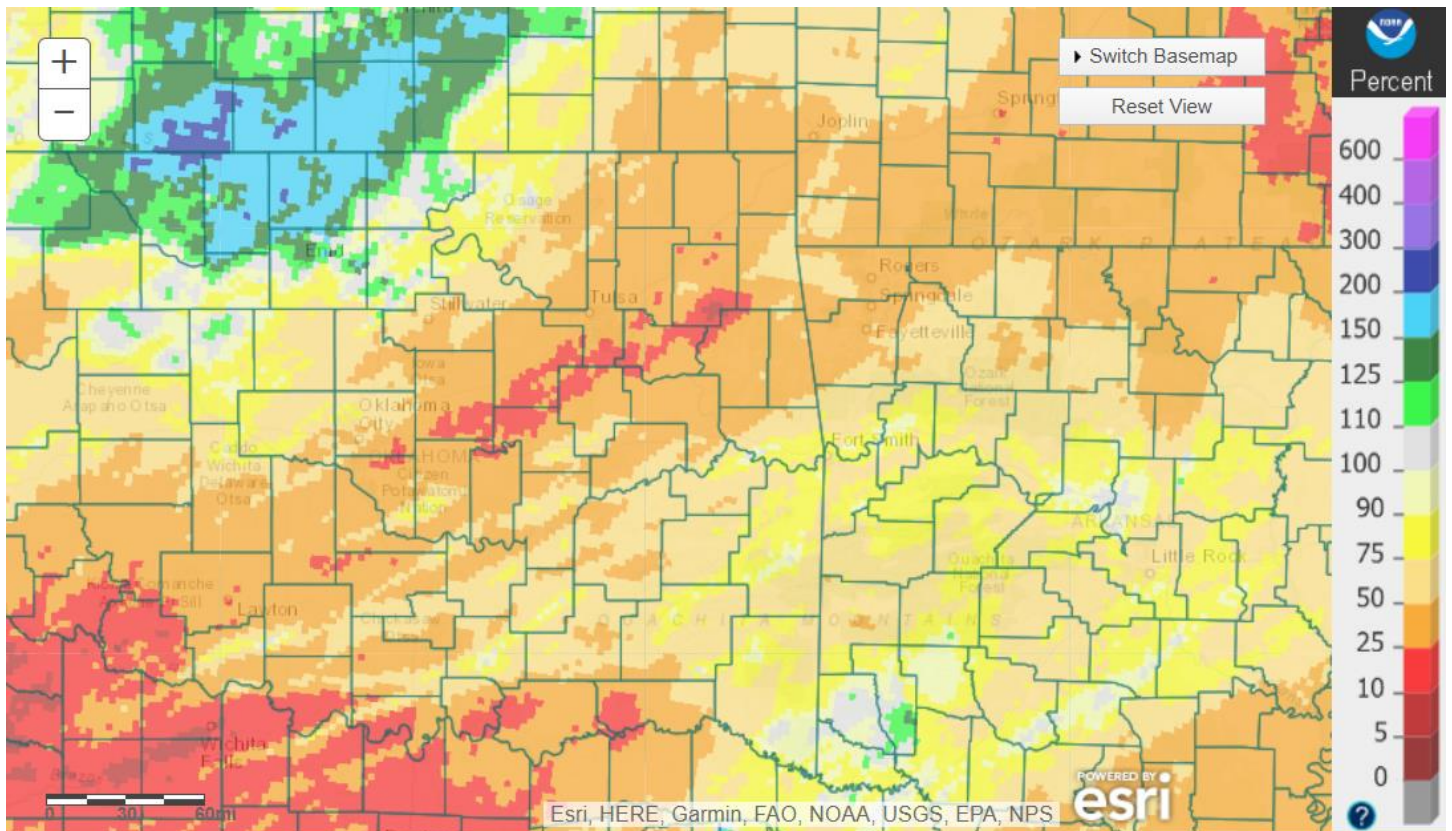


Fig. 1a. Estimated Observed Rainfall for November 2023



Tulsa, OK: November, 2023 Monthly Percent of Normal Precipitation
 Valid on: December 01, 2023 12:00 UTC

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

In Tulsa, OK, November 2023 ranked as the 35th warmest November (52.0°F, tied 1994; since records began in 1905) and the 26th driest November (0.91"; since records began in 1888). Fort Smith, AR had the 42nd warmest November (53.3°F; since records began in 1882) and the 56th wettest November (3.22"; since records began in 1882). Fayetteville, AR had the 18th warmest (50.1°F, tied 1985) and the 26th driest (1.94", tied 1963) November since records began in 1949.

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

| | | | | | |
|-----------------------|------|-----------------------|------|----------------------|------|
| Talihina, OK (meso) | 4.17 | Wister, OK (meso) | 4.03 | Cloudy, OK (meso) | 3.94 |
| Ozark 4.6S, AR (coco) | 3.69 | Clayton, OK (meso) | 3.65 | Sallisaw, OK (meso) | 3.43 |
| Stigler, OK (meso) | 3.32 | Fort Smith, AR (ASOS) | 3.22 | Wilburton, OK (meso) | 3.04 |

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

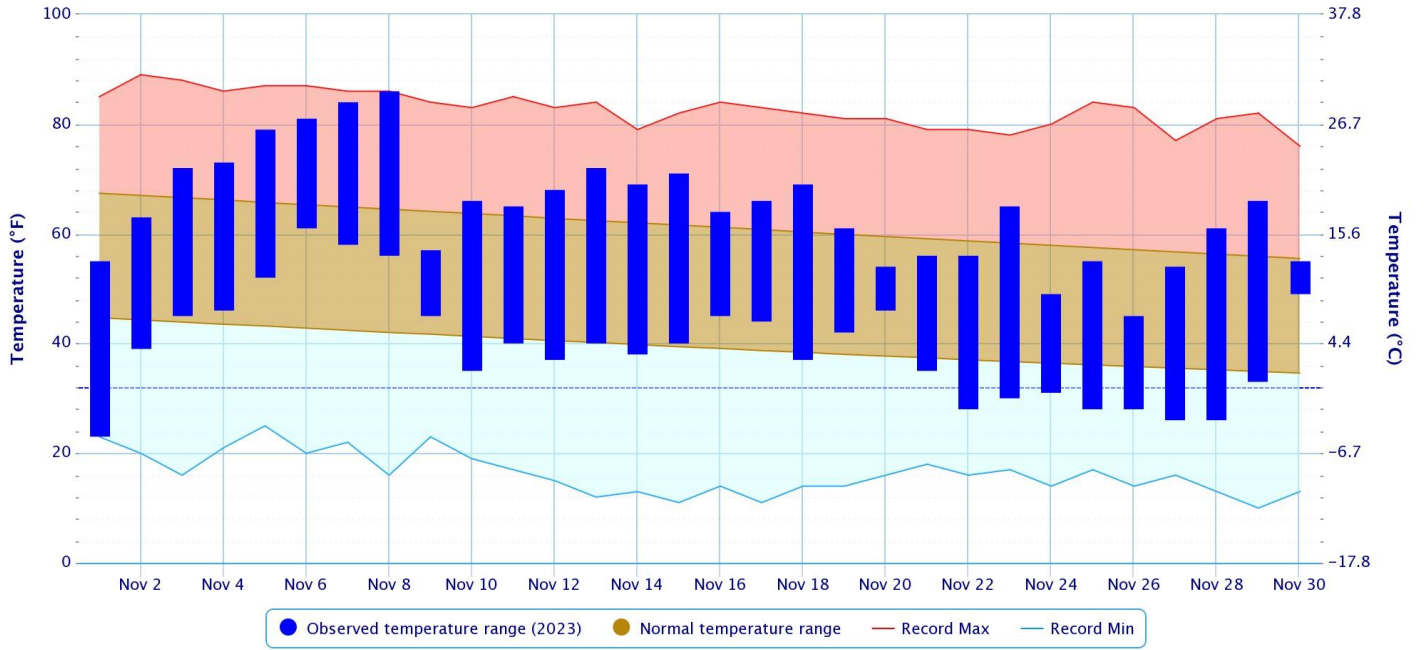
| | | | | | |
|---------------------------|------|--------------------------|------|--------------------------------|------|
| Vinita 8.6ESE, OK (coco) | 0.18 | Owasso 4.6ENE, OK (coco) | 0.38 | Broken Arrow 4.6SSW, OK (coco) | 0.39 |
| Claremore 7.5W, OK (coco) | 0.40 | Tulsa 7.7SSE, OK (coco) | 0.44 | Tulsa 6.3WSW, OK (coco) | 0.65 |
| Bristow, OK (meso) | 0.66 | Bixby, OK (meso) | 0.73 | Antlers 6.3SE, OK (coco) | 0.76 |

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

| Rank since 1921 | Last 30 Days (Nov 2 – Dec 1) | Autumn 2023 (Sep 1 – Nov 30) | Water Year-to-Date (Oct 1, 2023 – Dec 1, 2023) | Last 120 Days (Aug 4 – Dec 1) | Last 180 Days (Jun 5 – Dec 1) | Year-to-Date (Jan 1 – Dec 1) | Last 365 Days (Dec 2, 2022 – Dec 1, 2023) |
|-----------------|------------------------------|------------------------------|--|-------------------------------|-------------------------------|------------------------------|---|
| Northeast OK | 28 th driest | 36 th driest | 34 th driest | 51 st driest | 46 th driest | 39 th driest | 40 th driest |
| East Central OK | 38 th driest | 49 th wettest | 49 th wettest | 44 th wettest | 42 nd wettest | 48 th wettest | 44 th wettest |
| Southeast OK | 48 th wettest | 26 th wettest | 34 th wettest | 40 th wettest | 34 th wettest | 28 th wettest | 29 th wettest |
| Statewide | 37 th driest | 51 st wettest | 47 th wettest | 40 th driest | 40 th wettest | 49 th wettest | 49 th wettest |

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

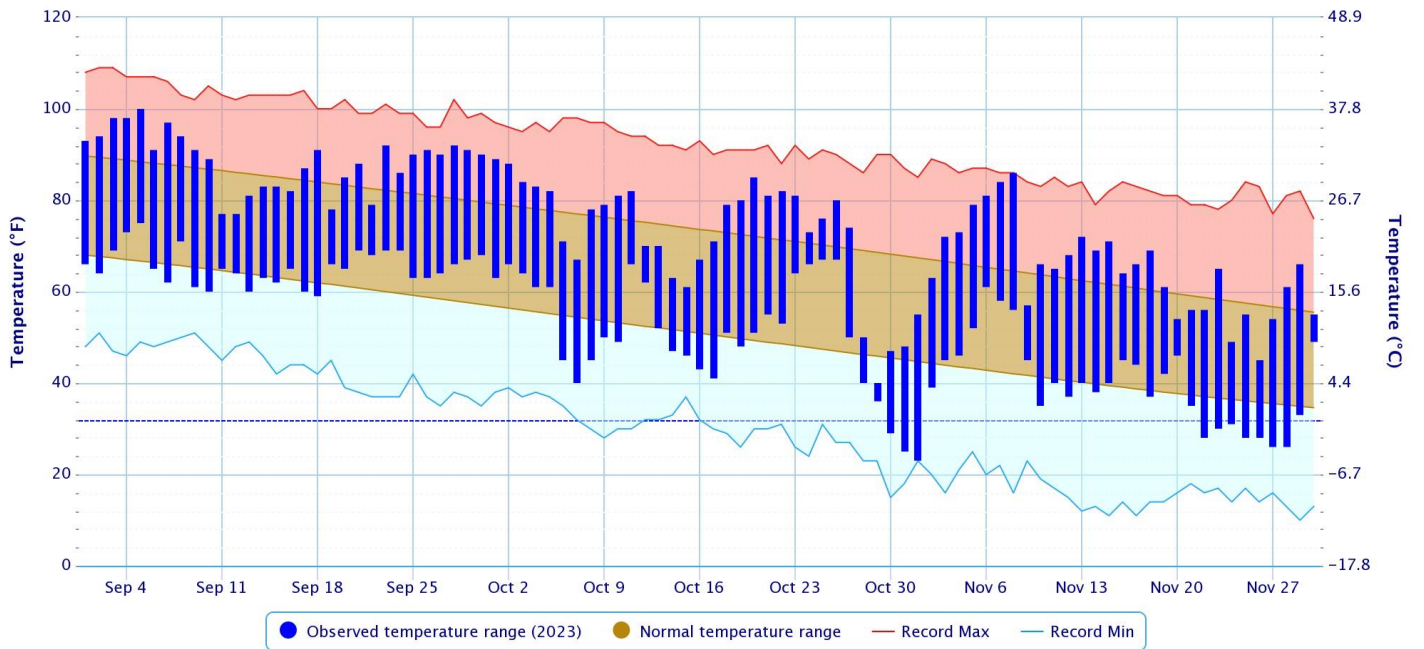
Period of Record – 1905-01-06 to 2023-12-11. Normals period: 1991-2020. Click and drag to zoom chart.



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Daily Temperature Data – Tulsa Area, OK (ThreadEx)

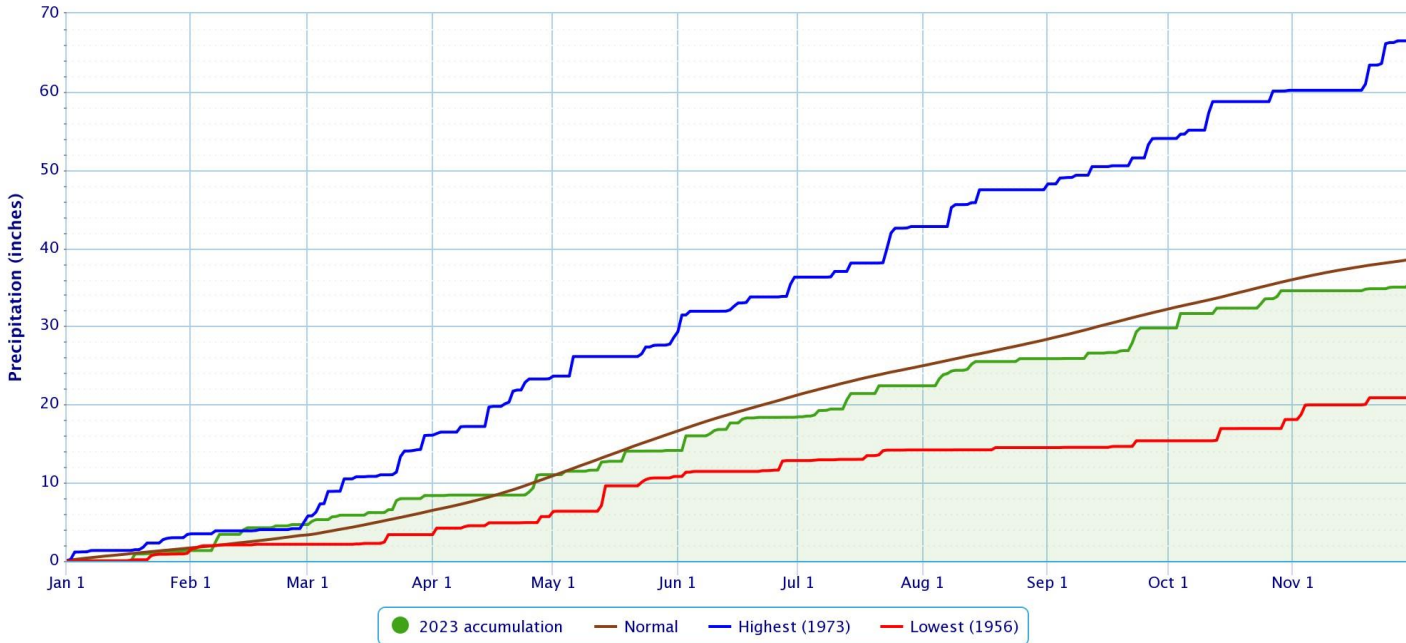
Period of Record – 1905-01-06 to 2023-12-11. Normals period: 1991-2020. Click and drag to zoom chart.



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Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

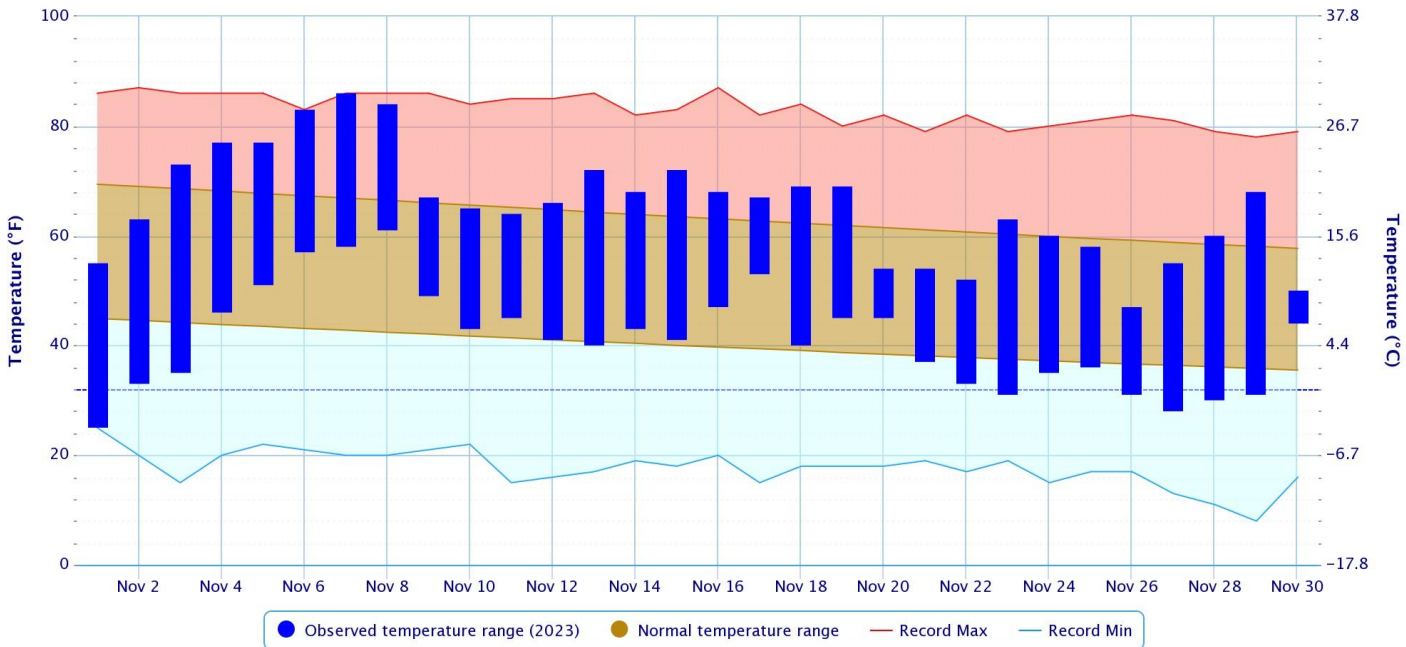
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

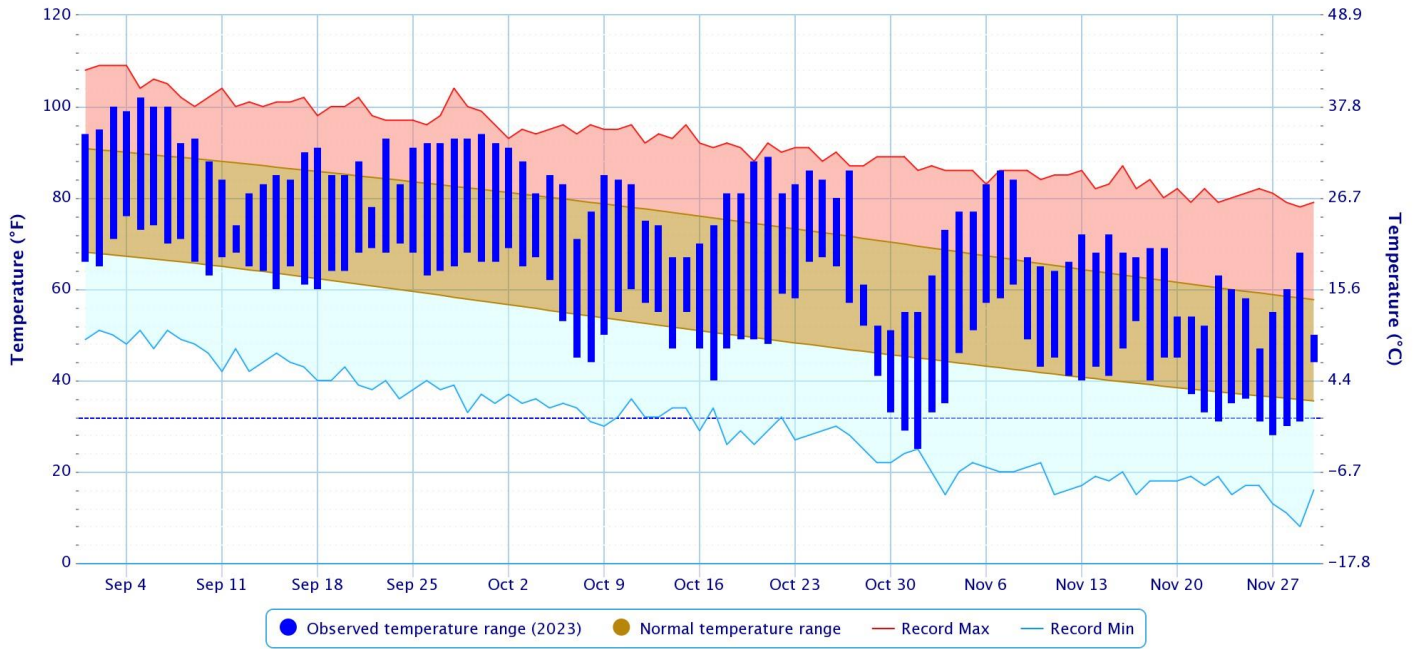
Period of Record – 1882-06-01 to 2023-12-11. Normals period: 1991-2020. Click and drag to zoom chart.



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

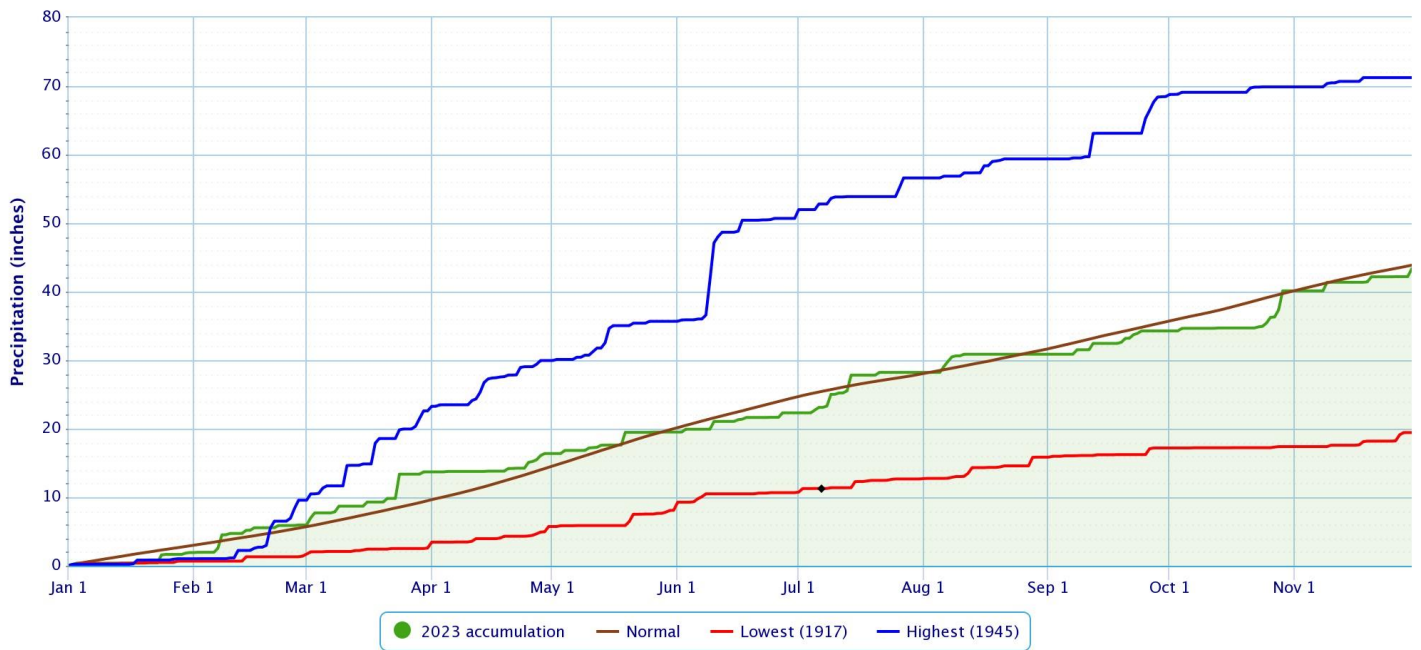
Period of Record – 1882-06-01 to 2023-12-11. Normals period: 1991-2020. Click and drag to zoom chart.



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Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

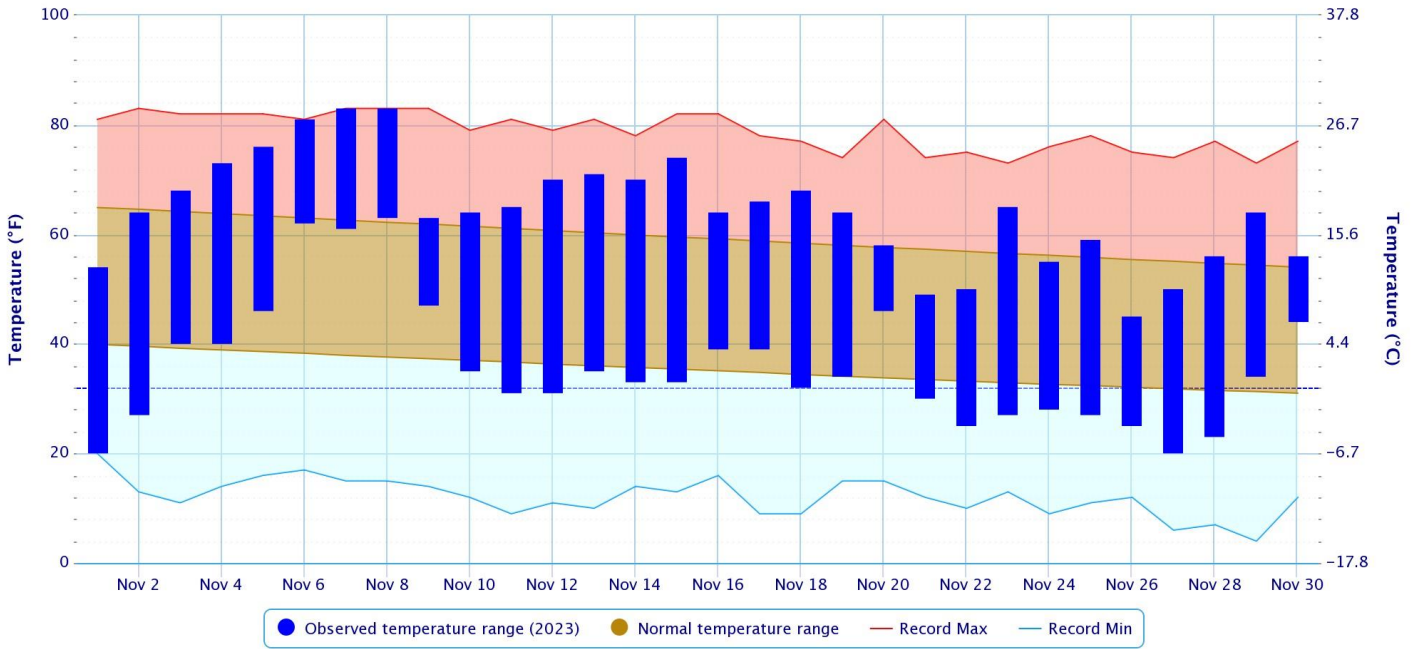
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

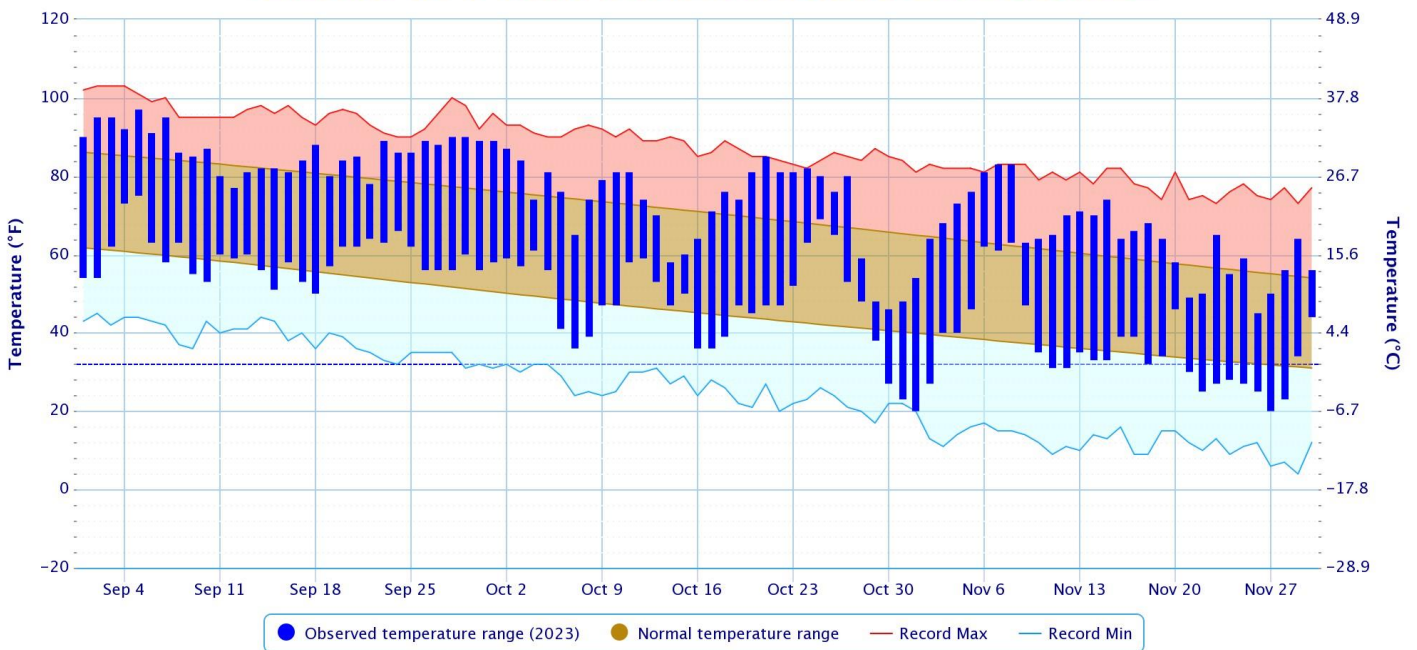
Period of Record – 1949-07-14 to 2023-12-11. Normals period: 1991-2020. Click and drag to zoom chart.



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Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

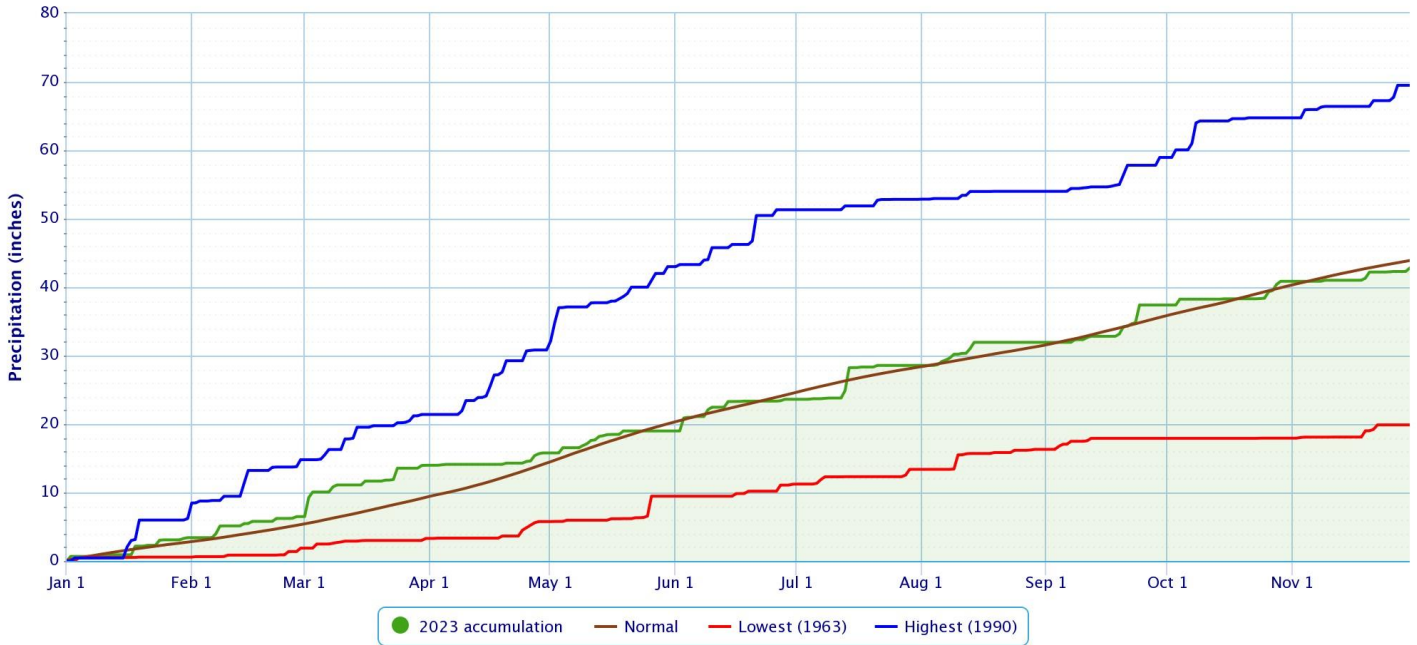
Period of Record – 1949-07-14 to 2023-12-11. Normals period: 1991-2020. Click and drag to zoom chart.



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Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

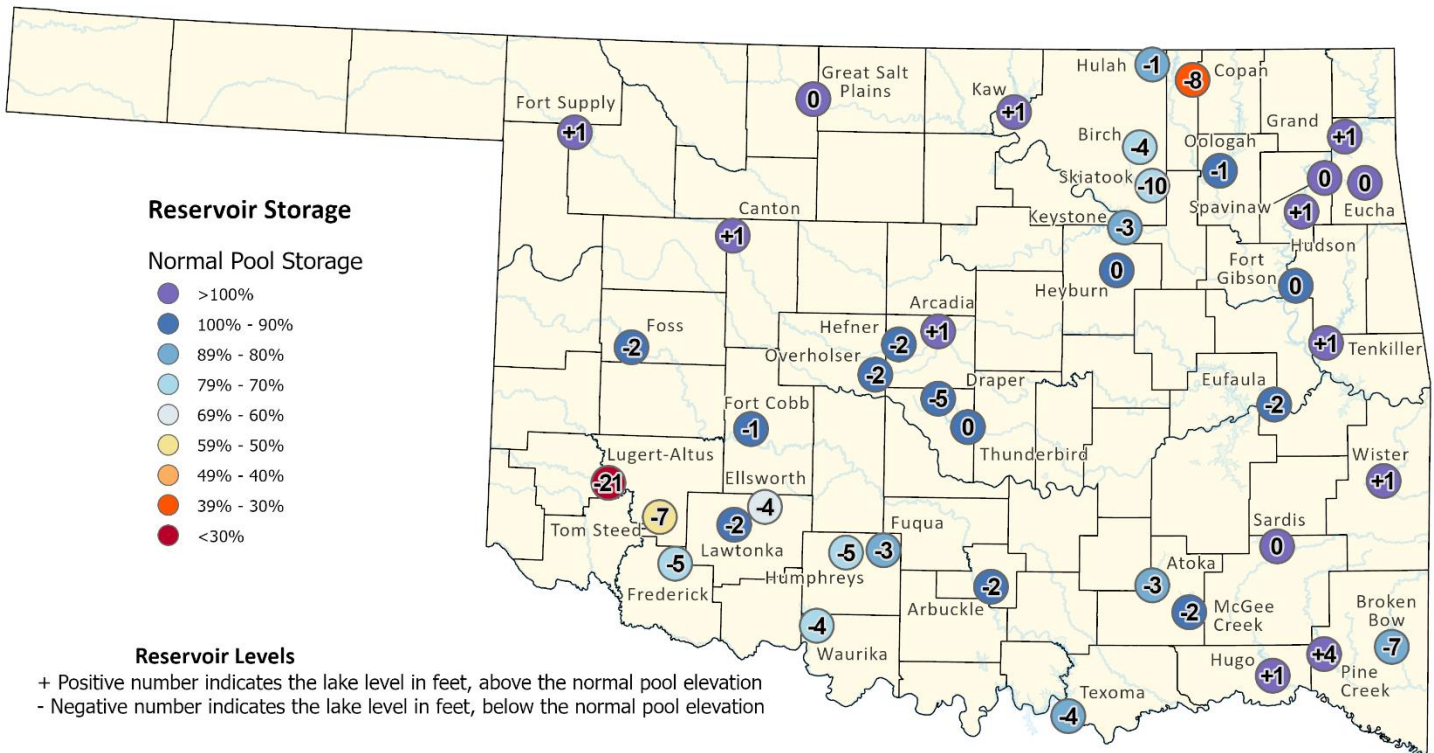
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



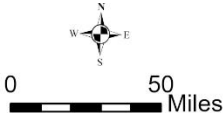
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Reservoirs

Oklahoma Reservoir Levels and Storage as of 11/27/2023



This map shows reservoir storage as a percentage of normal pool storage capacity. The source information was collected from real-time lake gages monitored by the U.S. Army Corps of Engineers (https://www.swt-wc.usace.army.mil/Daily_Morning_Reservoir_Report.pdf), and the U.S. Geological Survey (https://waterdata.usgs.gov/ok/nwis/current/?type=lake&group_key=basin_cd). For more information please visit the OWRB's website: (<https://www.owrb.ok.gov>).



According to the USACE, several of the lakes in the HSA were below 3% of top of their conservation pools as of 12/02/2023: Copan Lake 34%, Skiatook Lake 70%, Birch Lake 71%, Keystone Lake 77%, Beaver Lake 78%, Hulah Lake 81%, Fort Gibson 83%, Eufaula Lake 84%, and Oologah Lake 94%. Three lakes were above 3% of the top of their conservation pools: Sardis Lake 6%, Hudson Lake 5%, and Pensacola Lake 5%.

Autumn 2023 (September-October-November)

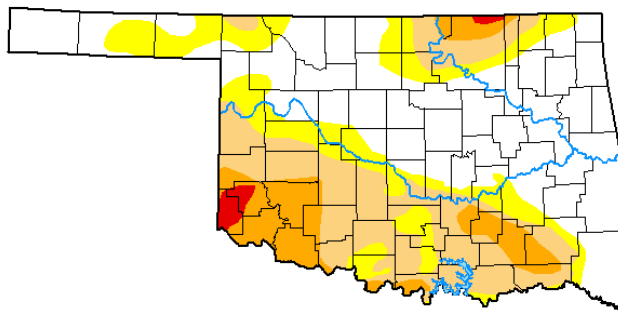
In Tulsa, OK, Autumn 2023 ranked as the 30th warmest Autumn (63.8°F, tied 1914, 1953, 2004; since records began in 1905) and the 61st wettest Autumn (9.59”; since records began in 1888). Fort Smith, AR had the 12th warmest Autumn (65.7°F, tied 2015; since records began in 1882) and the 42nd wettest Autumn (12.47”; since records began in 1882). Fayetteville, AR had the 6th warmest (61.3°F, tied 1990) and the 30th driest (10.86”) Autumn since records began in 1949.

Drought

According to the [U.S. Drought Monitor](https://droughtmonitor.unl.edu/) (USDM) from November 28, 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 Washington, Osage, eastern Kay, 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.

**U.S. Drought Monitor
Oklahoma**

November 28, 2023
(Released Thursday, Nov. 30, 2023)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|--|-------|-------|-------|-------|-------|-------|
| Current | 48.05 | 51.95 | 33.99 | 11.38 | 1.16 | 0.00 |
| Last Week <i>11-21-2023</i> | 44.68 | 55.32 | 36.34 | 13.68 | 1.16 | 0.00 |
| 3 Months Ago <i>08-29-2023</i> | 41.73 | 58.27 | 35.98 | 19.70 | 1.97 | 0.00 |
| Start of Calendar Year <i>01-03-2023</i> | 1.82 | 98.18 | 89.73 | 80.92 | 56.13 | 11.65 |
| Start of Water Year <i>09-26-2023</i> | 34.29 | 65.71 | 46.76 | 30.93 | 12.91 | 0.00 |
| One Year Ago <i>11-29-2022</i> | 0.03 | 99.97 | 91.21 | 85.98 | 64.01 | 19.77 |

Intensity:
 None
 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. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

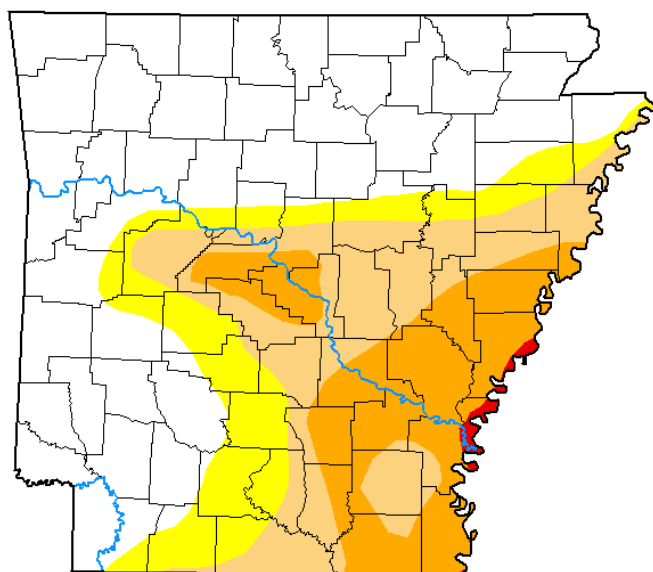
Author:
David Simeral
Western Regional Climate Center



Fig. 2. Drought Monitor for Oklahoma

U.S. Drought Monitor Arkansas

November 28, 2023
(Released Thursday, Nov. 30, 2023)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|-------|-------|-------|-------|-------|------|
| Current | 52.82 | 47.18 | 34.20 | 16.31 | 0.51 | 0.00 |
| Last Week 11-21-2023 | 52.82 | 47.18 | 34.30 | 16.33 | 0.53 | 0.00 |
| 3 Months Ago 08-29-2023 | 80.59 | 19.41 | 3.21 | 0.00 | 0.00 | 0.00 |
| Start of Calendar Year 01-03-2023 | 53.09 | 46.91 | 2.26 | 0.00 | 0.00 | 0.00 |
| Start of Water Year 09-26-2023 | 38.45 | 61.55 | 25.37 | 3.70 | 0.00 | 0.00 |
| One Year Ago 11-29-2022 | 0.29 | 99.71 | 78.64 | 40.32 | 0.00 | 0.00 |

Intensity:

- None
- 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. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:
David Simeral
Western Regional Climate Center



droughtmonitor.unl.edu

Fig. 3. Drought Monitor for Arkansas

Outlooks

The [Climate Prediction Center](#) (CPC) outlook for December 2023 (issued November 30, 2023) indicates an enhanced chance for above normal temperatures and above median precipitation across all of eastern OK and northwest AR. This outlook was based on dynamical model output, the Madden-Julian Oscillation (MJO), and ENSO.

For the 3-month period December-January-February 2023-24, CPC is forecasting an enhanced chance for above median precipitation across eastern OK and northwest AR, an enhanced chance for near normal temperatures across a portion of southeast OK, and an equal chance for above, near, and below normal temperatures elsewhere across eastern OK and northwest AR (outlook issued November 16, 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, strong El Niño conditions are present in the equatorial Pacific Ocean. El Niño is expected to persist through the winter 2023-24, with a 55% chance for a strong El Niño event continuing and a 35% chance for an historically strong El Niño event. There is a 62% 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 isolated thunderstorms developed during the morning of the 9th within an area of isentropic lift over southeast OK into northwest AR ahead of an upper-level trough moving into the region. Widespread activity continued through the morning and afternoon before ending from northwest to southeast during the evening hours. Rainfall totals ranged from around 0.25" to around 2.5" (Fig. 4).

An area of showers with isolated embedded thunderstorms moved into eastern OK north of I-40 during the pre-dawn hours of the 19th in response to a lead disturbance associated with a stronger approaching storm system. This activity continued through the morning hours, entering northwest AR by mid-morning. A second wave of showers and isolated thunderstorms entered eastern OK from the west at noon. This activity also moved east across eastern OK and northwest AR during the afternoon through mid-evening. While the bulk of the rain shifted east of the area, scattered showers lingered through the evening. Convection then renewed by midnight as mid-level lapse rates steepened and pockets of elevated instability overspread the region. This activity continued through the early morning hours, before becoming more widely scattered by mid-morning on the 20th. By 6 am on the 20th, the 24-hour rainfall totals ranged from 0.10" to around 2" across eastern OK and northwest AR (Fig. 5). The shower activity continued to weaken and shift east through the remainder of the morning and afternoon. By late afternoon, new development occurred across southeast OK in the vicinity of a warm front. However, these isolated storms did not last long and marked the end of the active weather pattern. An additional 0.10" to 1.5" of rain fell across far eastern OK and northwest AR through 6am on the 21st (Fig. 6). The two-day event resulted in a total of around 0.10" to around 2" (Fig. 7).

Light showers affected eastern OK and northwest AR during the morning hours of the 30th in response to a shortwave lifting into southern KS and low-level warm advection. By afternoon, showers and isolated thunderstorms became more widespread as the main upper-level low approached the region. Scattered showers and thunderstorms then continued through the evening hours, coming to an end by midnight as the upper-low shifted east of the area. Rainfall totals ranged from 0.10" to near 2" (Fig. 8).

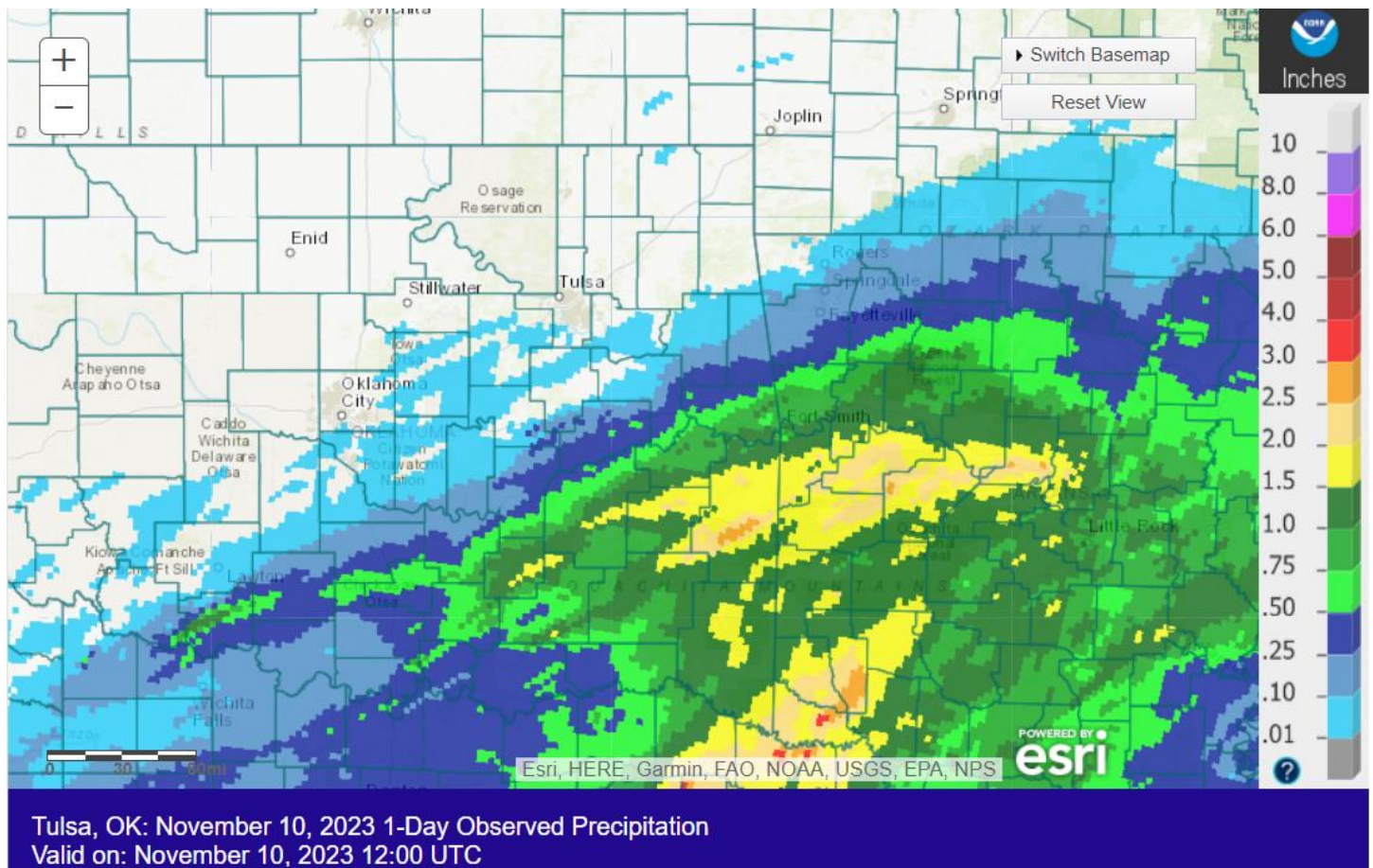
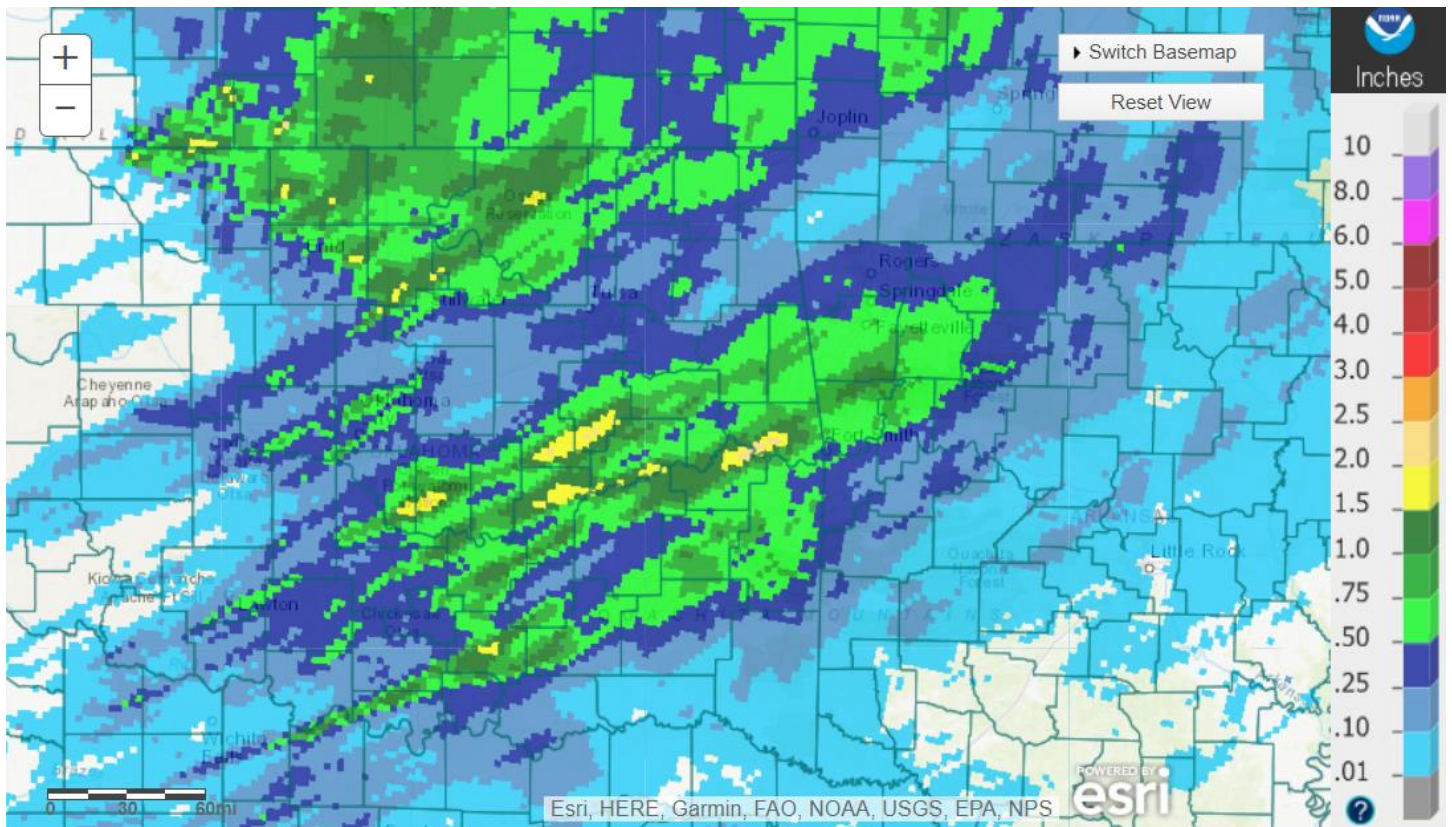
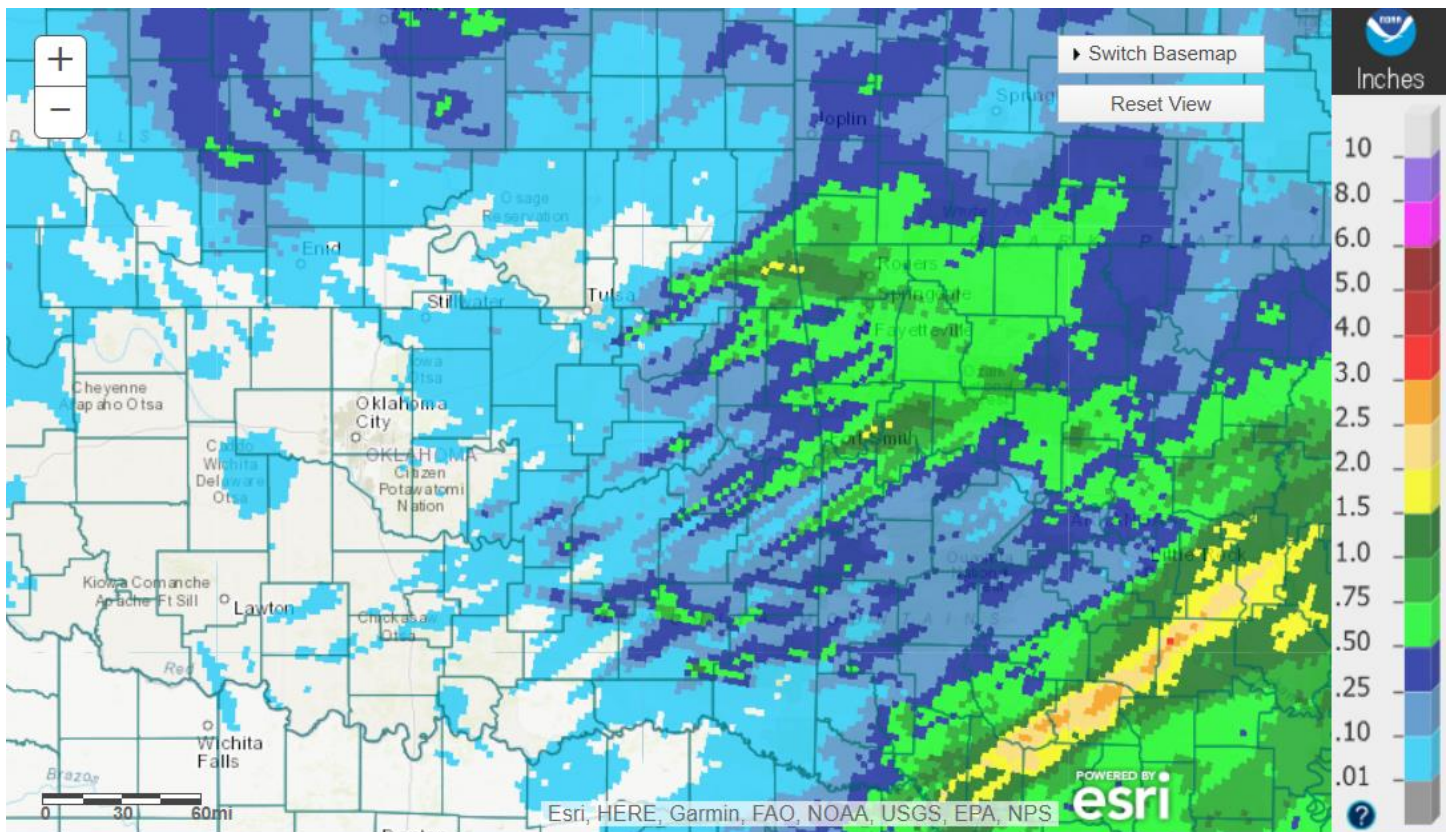


Fig. 4. 24-hour Estimated Observed Rainfall ending at 6am CST 11/10/2023.



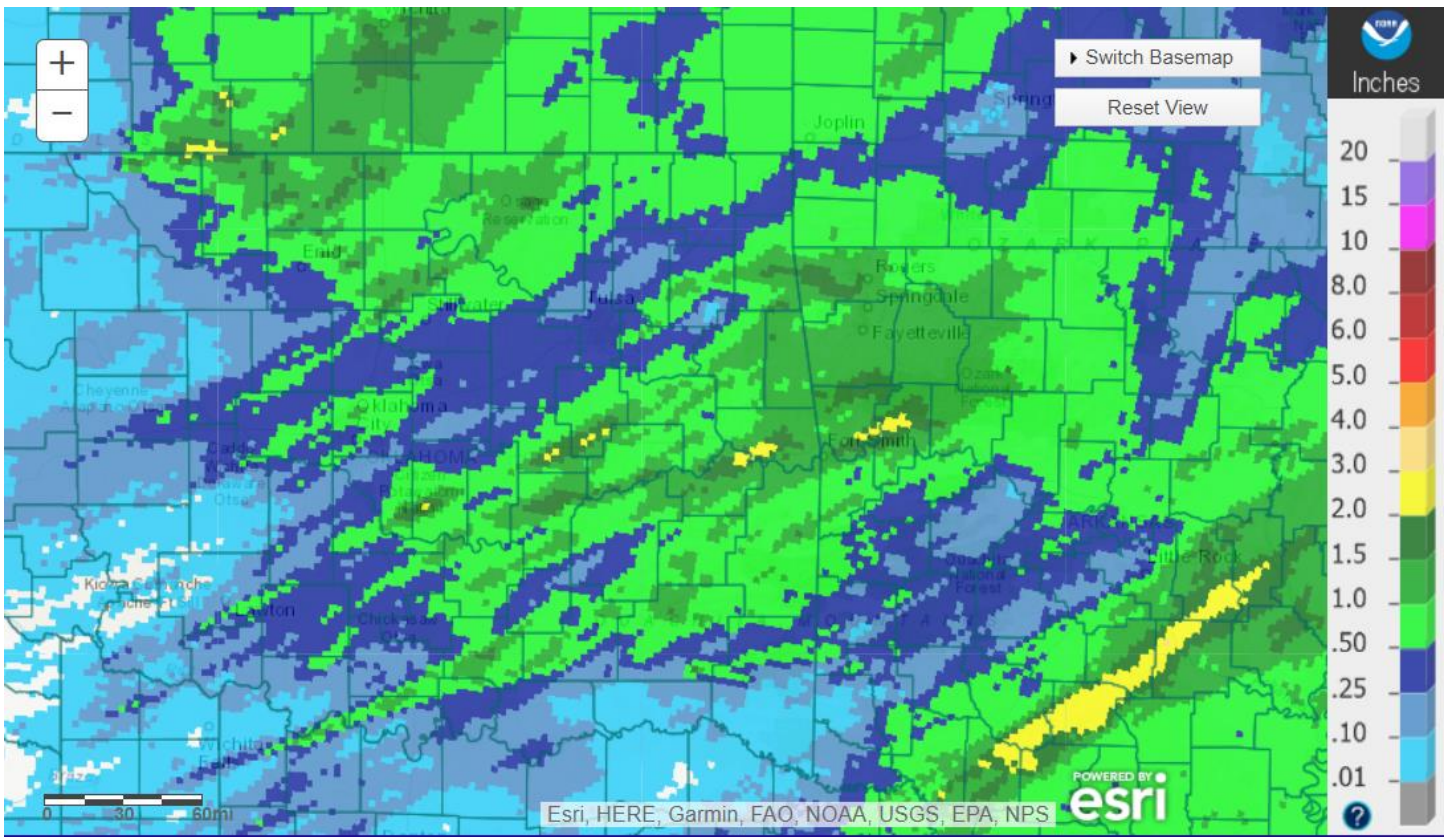
Tulsa, OK: November 20, 2023 1-Day Observed Precipitation
Valid on: November 20, 2023 12:00 UTC

Fig. 5. 24-hour Estimated Observed Rainfall ending at 6am CST 11/20/2023.



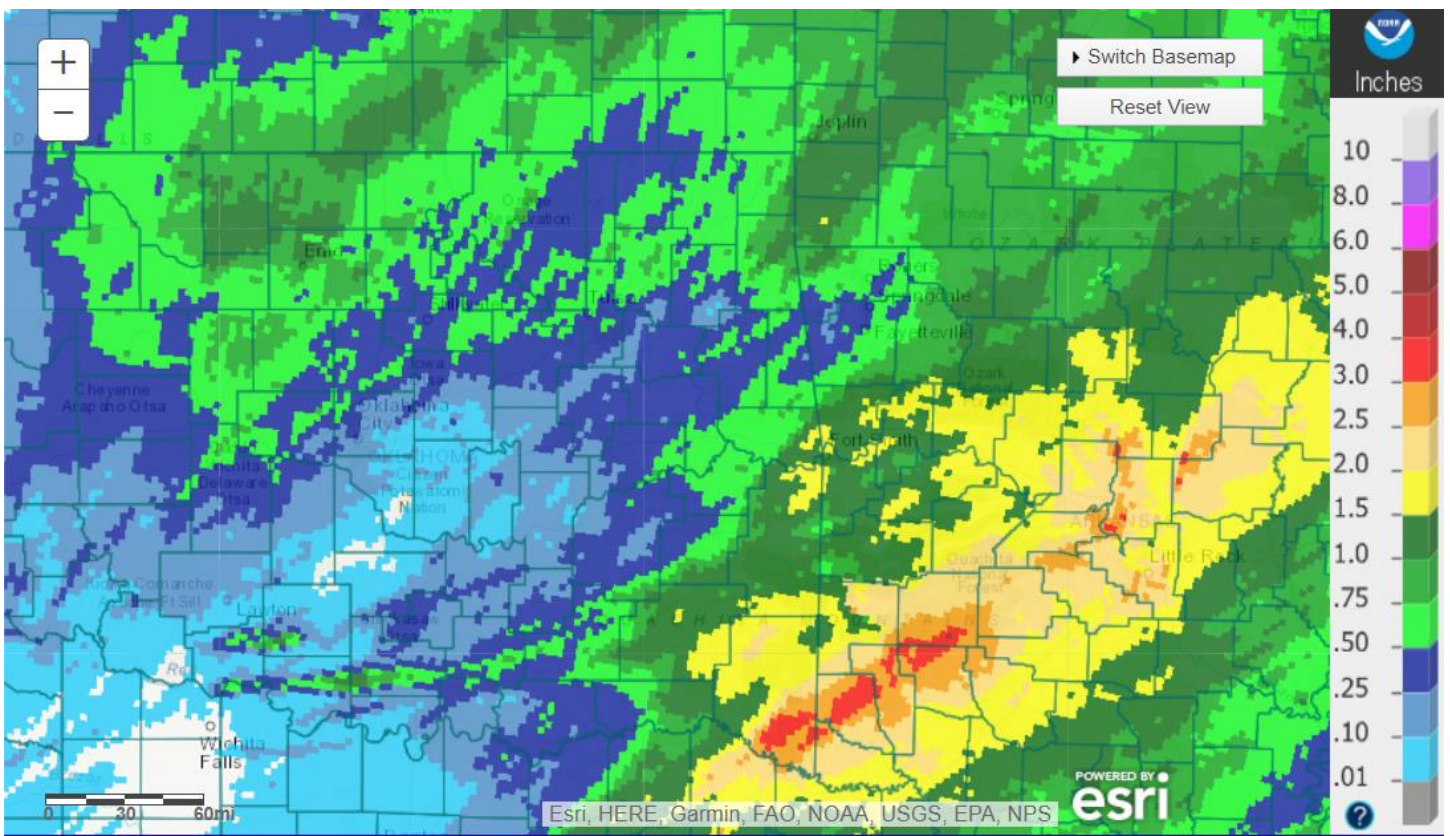
Tulsa, OK: November 21, 2023 1-Day Observed Precipitation
Valid on: November 21, 2023 12:00 UTC

Fig. 6. 24-hour Estimated Observed Rainfall ending at 6am CST 11/21/2023.



Tulsa, OK: Last 7-Day Observed Precipitation
Valid on: November 21, 2023 12:00 UTC

Fig. 7. 7-day Estimated Observed Rainfall ending at 6am CST 11/21/2023.



Tulsa, OK: December 01, 2023 1-Day Observed Precipitation
Valid on: December 01, 2023 12:00 UTC

Fig. 8. 24-hour Estimated Observed Rainfall ending at 6am CST 12/01/2023.

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in November 2023:

- 0 Flash Flood Warnings (FFW)
- 0 Flash Flood Statements (FFS)
- 0 Flash/Areal Flood Watches (FFA) (0 Watch FFA CON/EXT/EXA/EXB/CAN)
- 0 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)
- 0 Drought Information Statements (DGT)

Preliminary Hydrographs:

None