

<b>NWS FORM E-5</b> (11-88) (PRES. by NWS Instruction 10-924)	<b>U.S. DEPARTMENT OF COMMERCE</b> NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE	HYDROLOGIC SERVICE AREA (HSA)	
		<b>Tulsa, Oklahoma (TSA)</b>	
<b>MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS</b>		REPORT FOR:	MONTH
		YEAR	<b>February</b>
TO: Hydrometeorological Information Center, W/OH2 NOAA / National Weather Service 1325 East West Highway, Room 7230 Silver Spring, MD 20910-3283		SIGNATURE	<b>Steven F. Piltz</b> (Meteorologist-in-Charge)
		DATE	<b>March 8, 2024</b>

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.

This leap year month was very warm, with the monthly average temperature ~8°F above normal. Rainfall, however, was below normal for most of the region. Normal precipitation across the Hydrologic Service Area (HSA) in February ranges from 1.8 inches in Osage County to 3.2 inches in Choctaw County. In the Ozark region of northwest Arkansas, the normal monthly precipitation is 2.9 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](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 February 2024 ranged from around 0.50" to 3" across eastern OK and northwest AR, with much of the area receiving 1"-2". These rainfall totals correspond to 75% to around 125% of the normal February rainfall in Osage County, and 25% to around 90% of the normal February rainfall elsewhere across eastern OK and northwest AR (Fig. 1b).

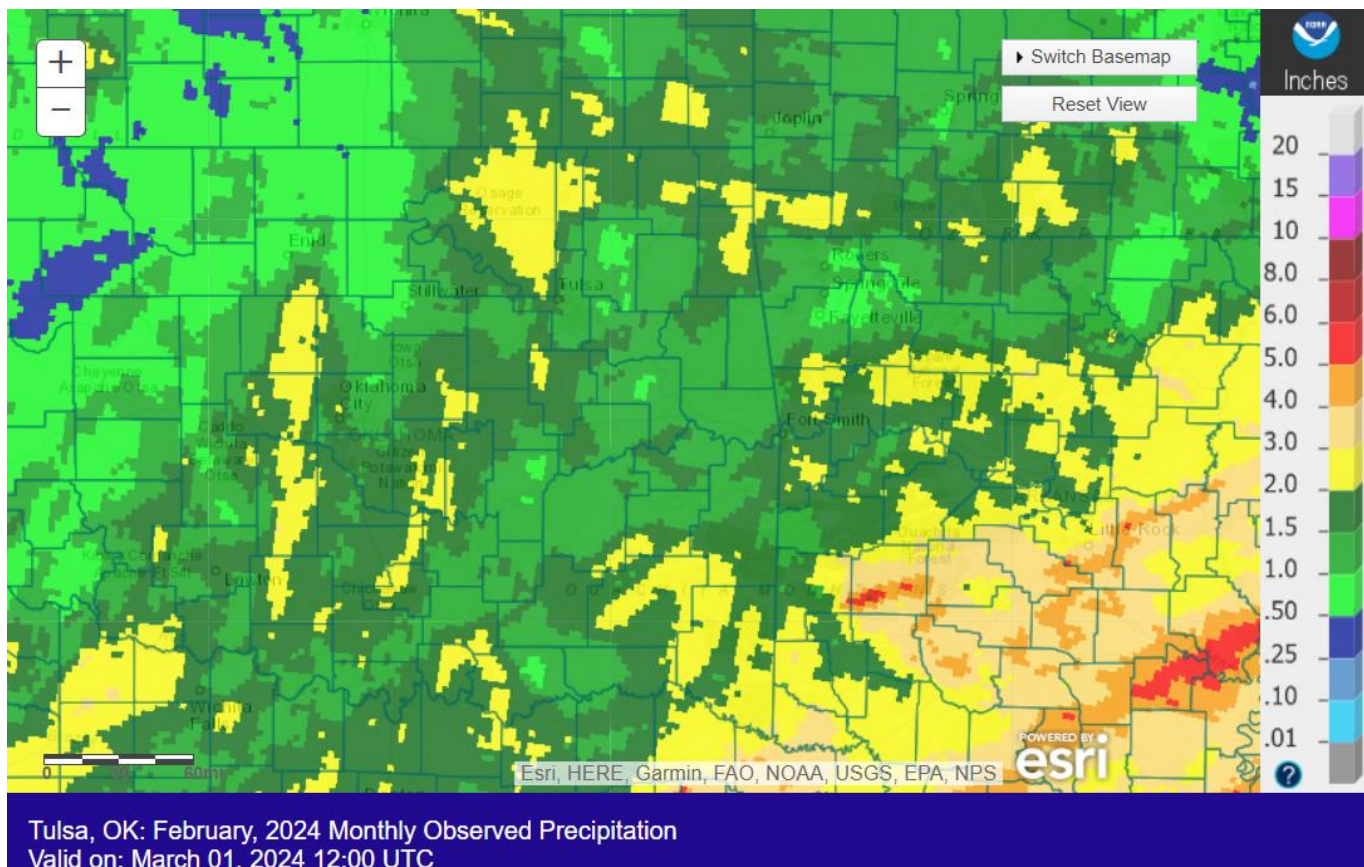


Fig. 1a. Estimated Observed Rainfall for February 2024

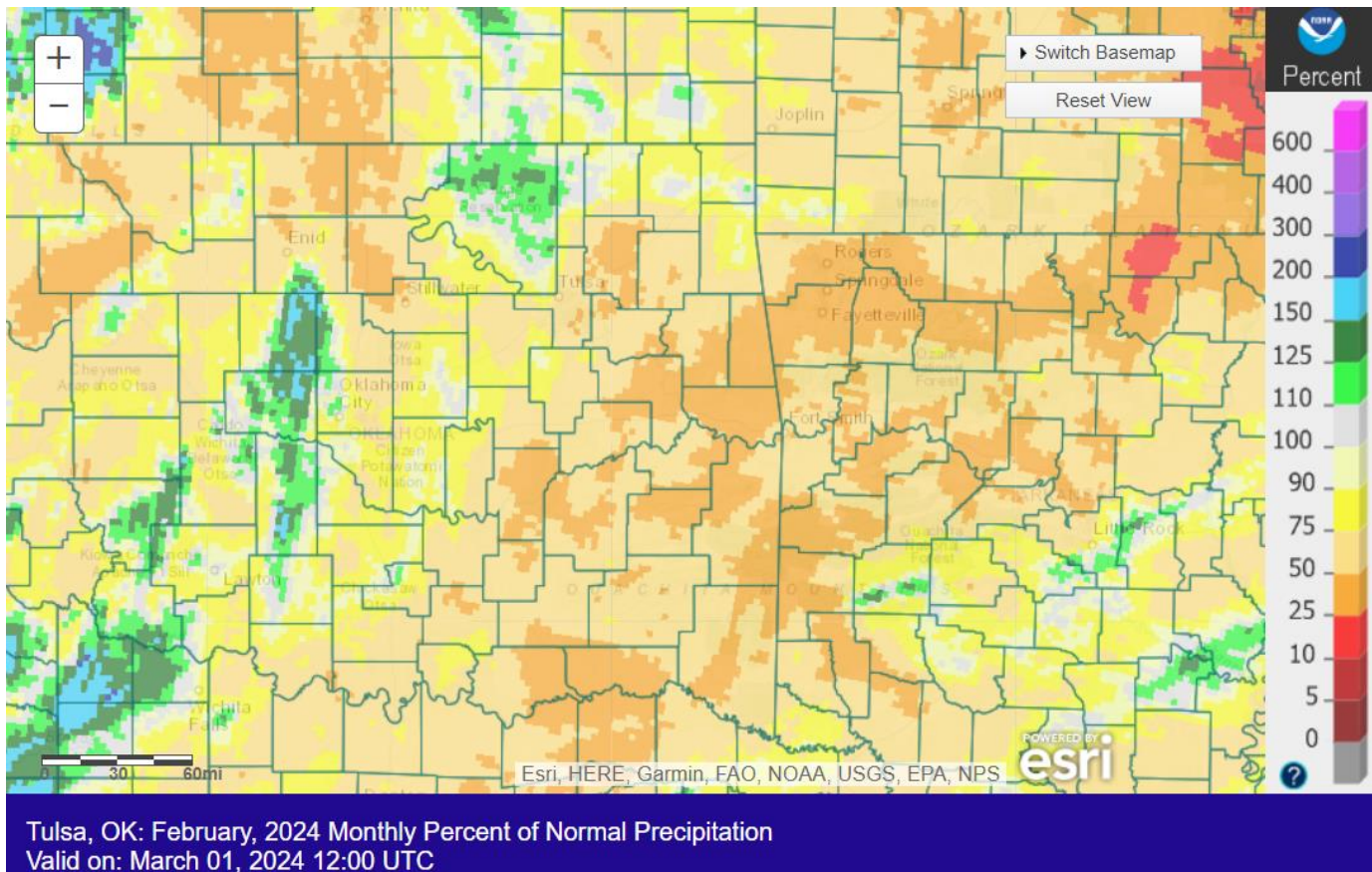


Fig. 1b. Estimated % of Normal Rainfall for February 2024

In Tulsa, OK, February 2024 ranked as the 3<sup>rd</sup> warmest February (51.1°F, tied 1976; since records began in 1905), the 49<sup>th</sup> driest February (1.16", tied 1932; since records began in 1888), and the 40<sup>th</sup> least snowy February (0.1", tied 2007, 1950, 1934, 1916; since records began in 1900). Fort Smith, AR had the 2<sup>nd</sup> warmest February (53.1°F; since records began in 1883), the 43<sup>rd</sup> driest February (1.42"; since records began in 1883), and the 37<sup>th</sup> least snowy February (Trace, tied 25 other years; since records began in 1884). Fayetteville, AR had the Record warmest (49.0°F, tied 2017), the 13<sup>th</sup> driest (1.17"), and 29<sup>th</sup> least snowy (0.3", tied 1974) February since records began in 1950.

Some of the larger precipitation reports (in inches) for February 2024 included:

Skiatook, OK (meso)	2.66	Ochelata 5.6N, OK (coco)	2.63	Jay, OK (meso)	2.34
Foraker, OK (meso)	2.30	Tulsa 6.1S, OK (coco)	2.28	Jay 3.3NNE, OK (coco)	2.27
Bartlesville, OK (coop)	2.26	Copan, OK (meso)	2.26	Winslow 7NE, AR (coop)	2.23

Some of the lowest precipitation reports (in inches) for February 2024 included:

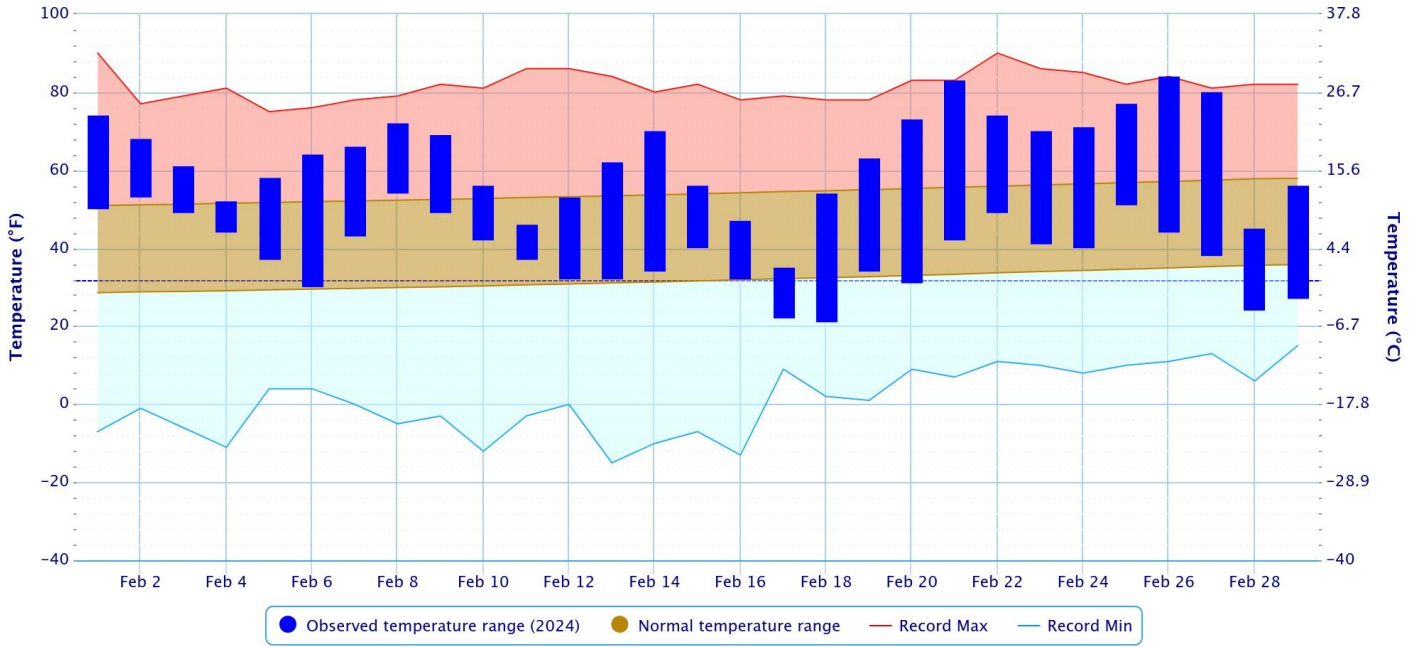
Owasso 3.6NNE, OK (coco)	0.70	Owasso 3.6ENE, OK (coco)	0.78	Muskogee, OK (ASOS)	0.89
Springdale 6.4WSW, AR (coco)	0.91	Elkins 1.7SE, AR (coco)	0.95	Bunch 0.8N, OK (coco)	0.96
Tulsa 7.7SSE, OK (coco)	0.98	Huntsville 10N, AR (coop)	1.00	Eureka Springs 1.4WSW, AR (coco)	1.07

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

Rank since 1921 <small>*Rankings ending Feb 29 are only compared to the past 26 leap years</small>	Last 30 Days (Jan 30 – Feb 28)	Winter* (Dec 1, 2023 – Feb 29, 2024)	Cool Growing Season* (Sep 1 – Feb 29)	Water Year-to-Date* (Oct 1, 2023 – Feb 29, 2024)	Year-to-Date (Jan 1 – Feb 28)	Last 365 Days* (Mar 2, 2023 – Feb 29, 2024)
Northeast OK	43 <sup>rd</sup> driest	11 <sup>th</sup> wettest	8 <sup>th</sup> driest	9 <sup>th</sup> driest	31 <sup>st</sup> wettest	9 <sup>th</sup> driest
East Central OK	23 <sup>rd</sup> driest	13 <sup>th</sup> wettest	13 <sup>th</sup> wettest	13 <sup>th</sup> wettest	51 <sup>st</sup> driest	11 <sup>th</sup> driest
Southeast OK	16 <sup>th</sup> driest	7 <sup>th</sup> driest	12 <sup>th</sup> wettest	13 <sup>th</sup> driest	40 <sup>th</sup> driest	11 <sup>th</sup> driest
Statewide	29 <sup>th</sup> driest	10 <sup>th</sup> wettest	12 <sup>th</sup> wettest	10 <sup>th</sup> wettest	42 <sup>nd</sup> wettest	13 <sup>th</sup> wettest

### Daily Temperature Data – Tulsa Area, OK (ThreadEx)

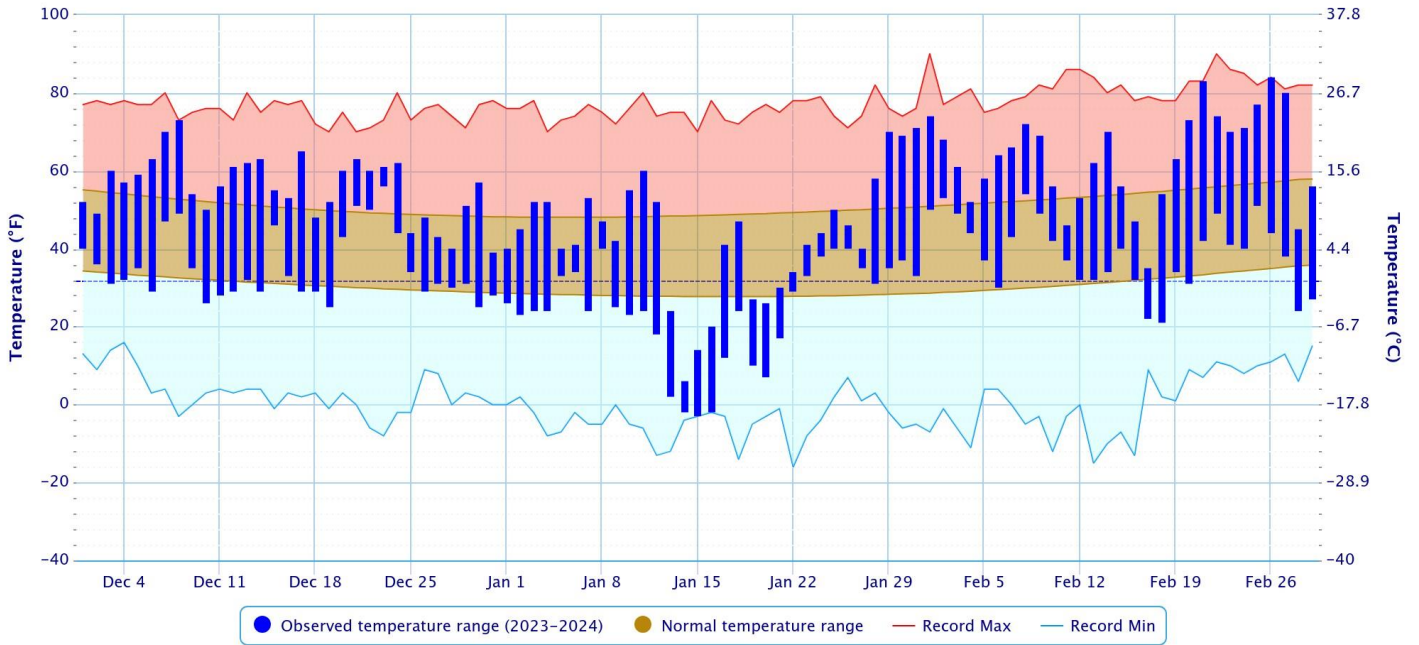
Period of Record – 1905-01-06 to 2024-02-29. Normals period: 1991-2020. Click and drag to zoom chart.



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### Daily Temperature Data – Tulsa Area, OK (ThreadEx)

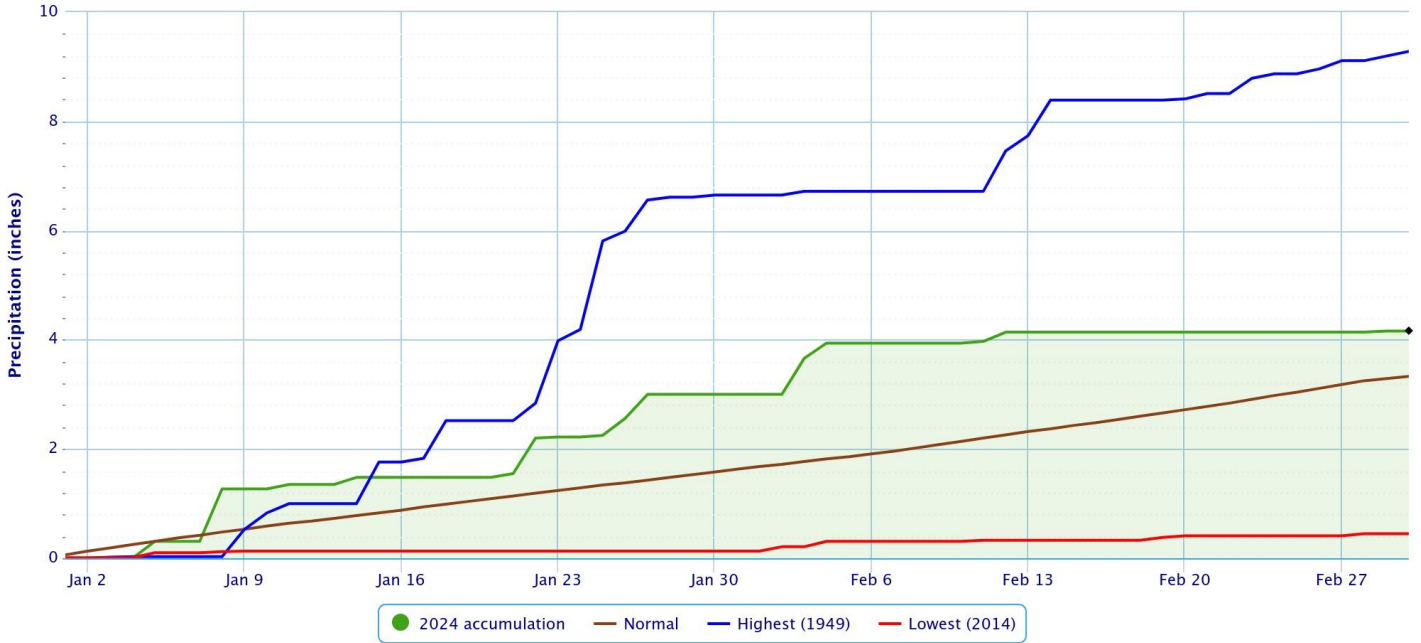
Period of Record – 1905-01-06 to 2024-02-29. Normals period: 1991-2020. Click and drag to zoom chart.



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### Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

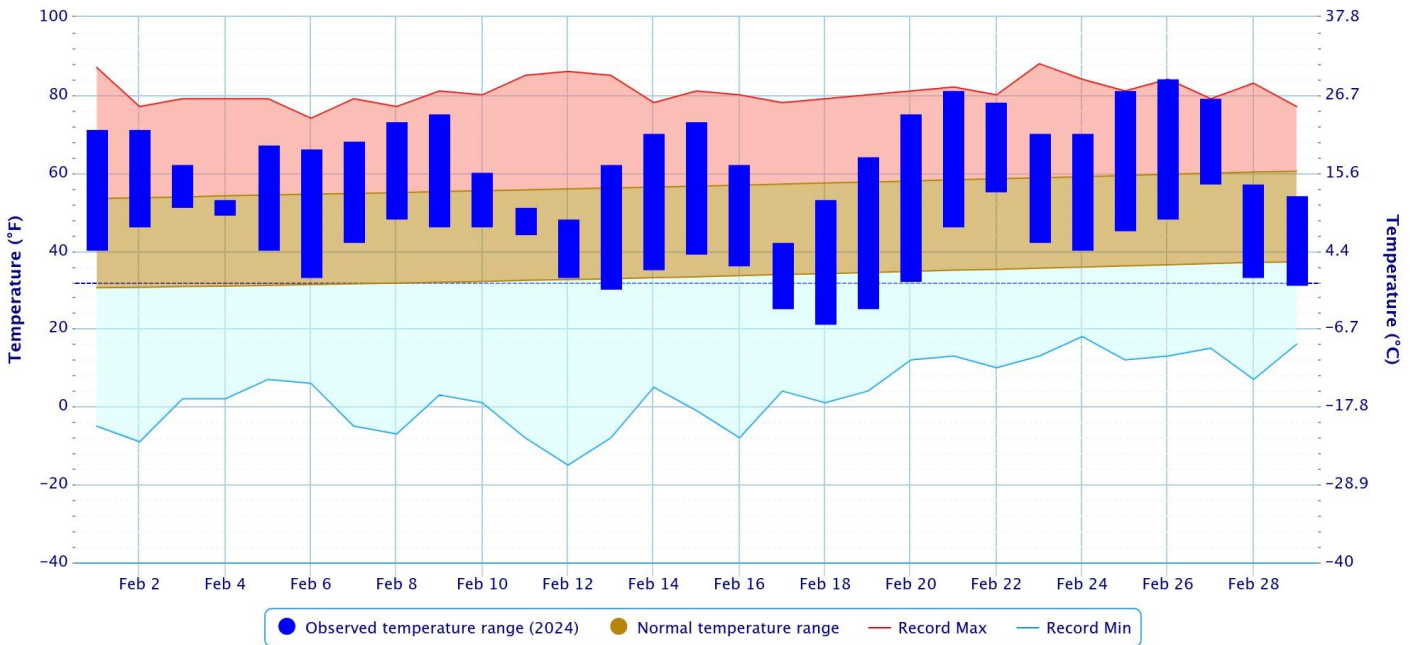
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

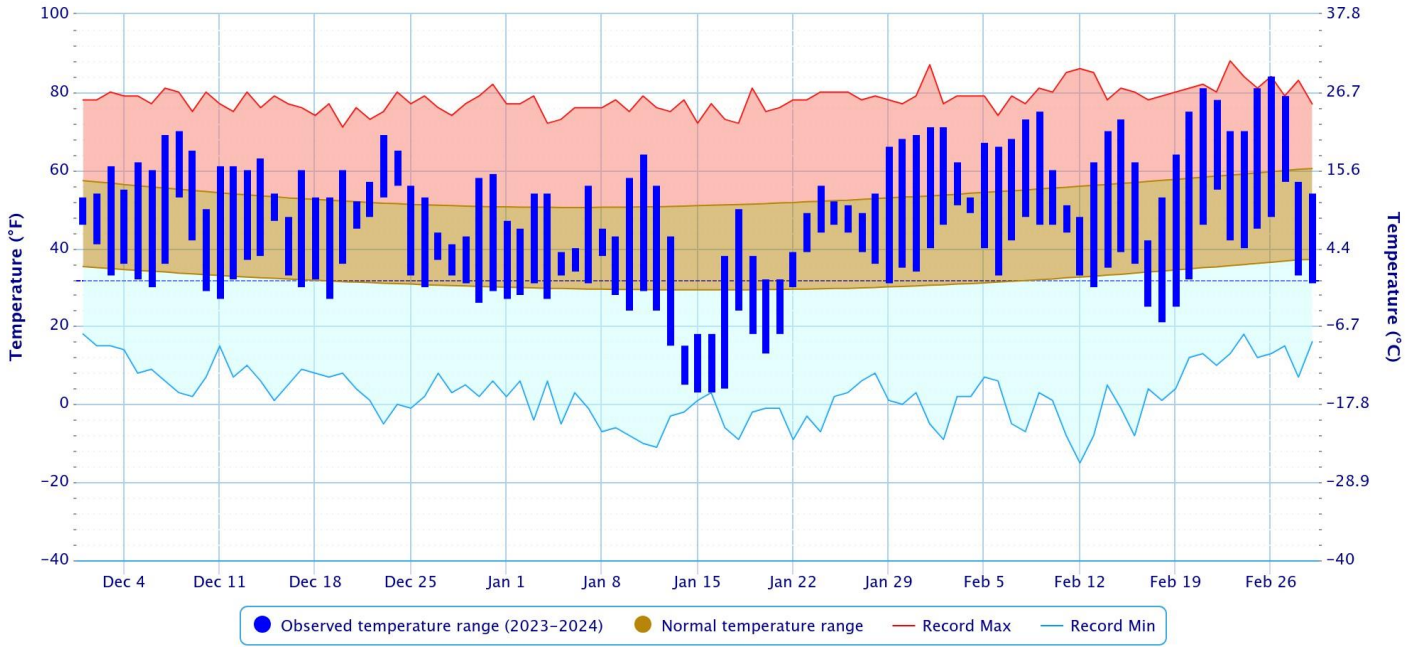
Period of Record – 1882-06-01 to 2024-02-29. Normals period: 1991-2020. Click and drag to zoom chart.



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

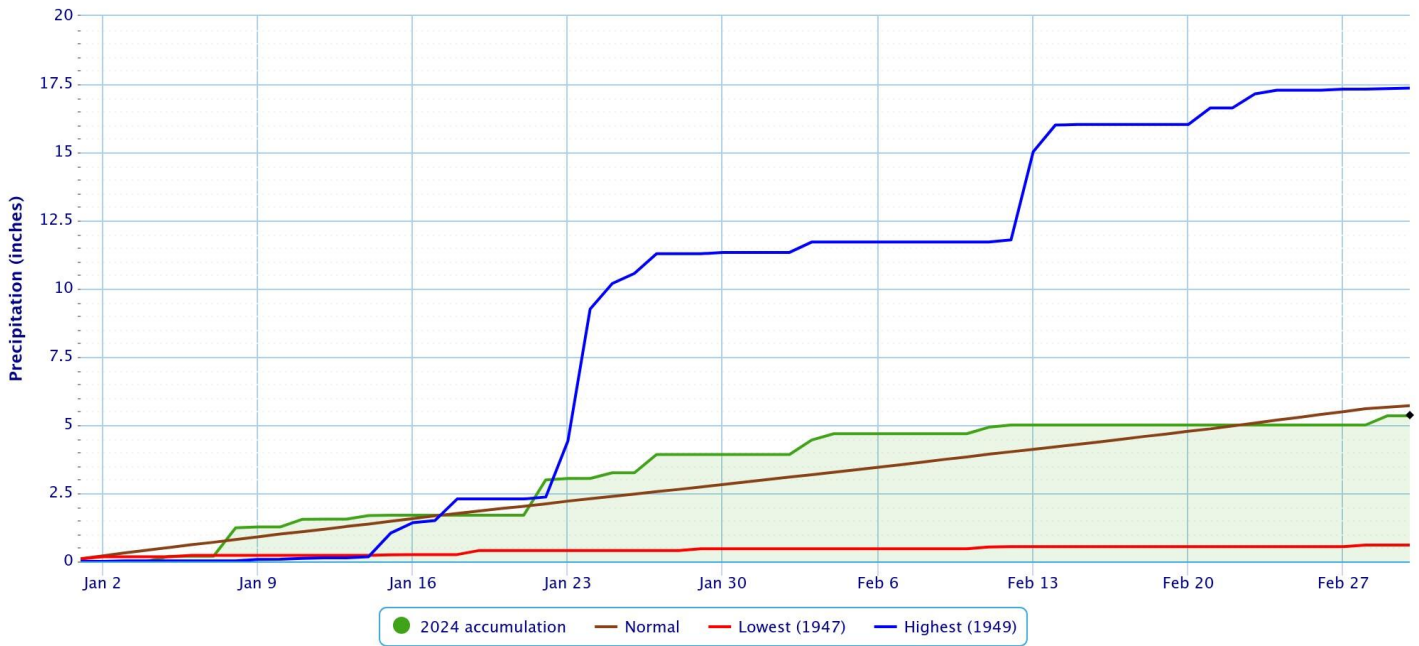
Period of Record – 1882-06-01 to 2024-02-29. Normals period: 1991-2020. Click and drag to zoom chart.



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### Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

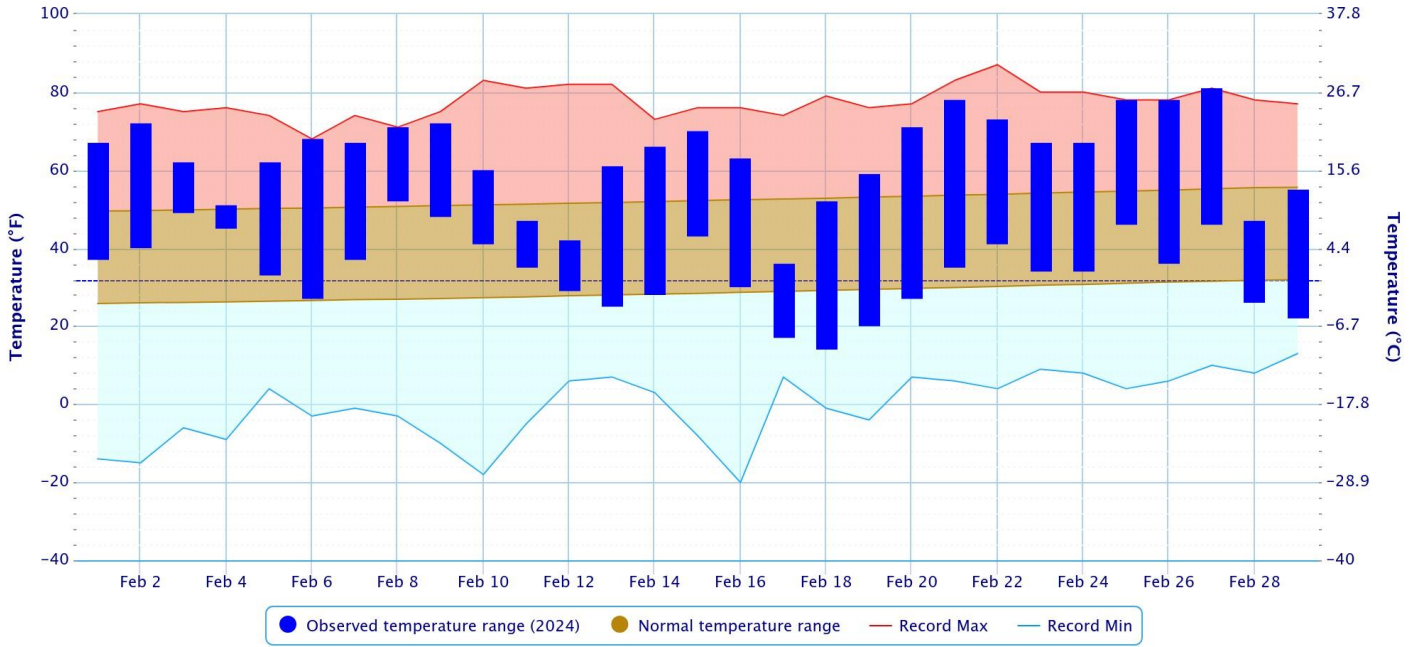
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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### Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

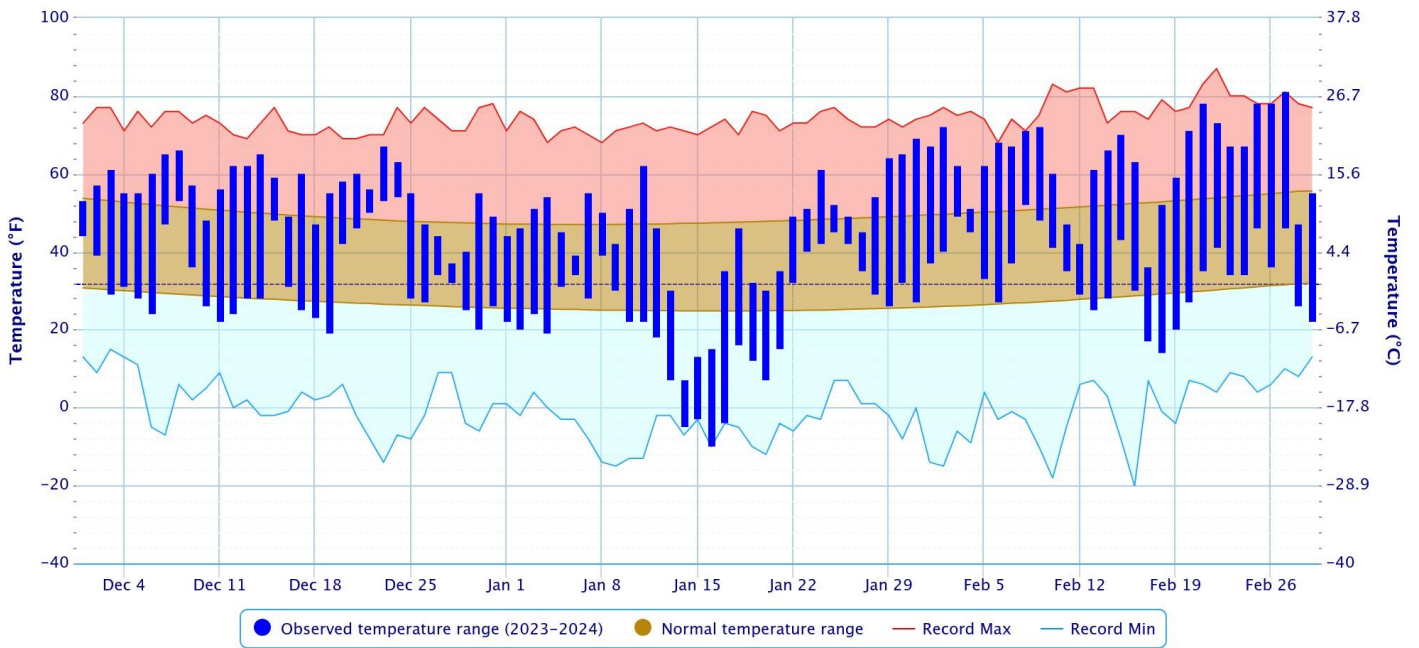
Period of Record – 1949-07-14 to 2024-02-29. Normals period: 1991-2020. Click and drag to zoom chart.



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### Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

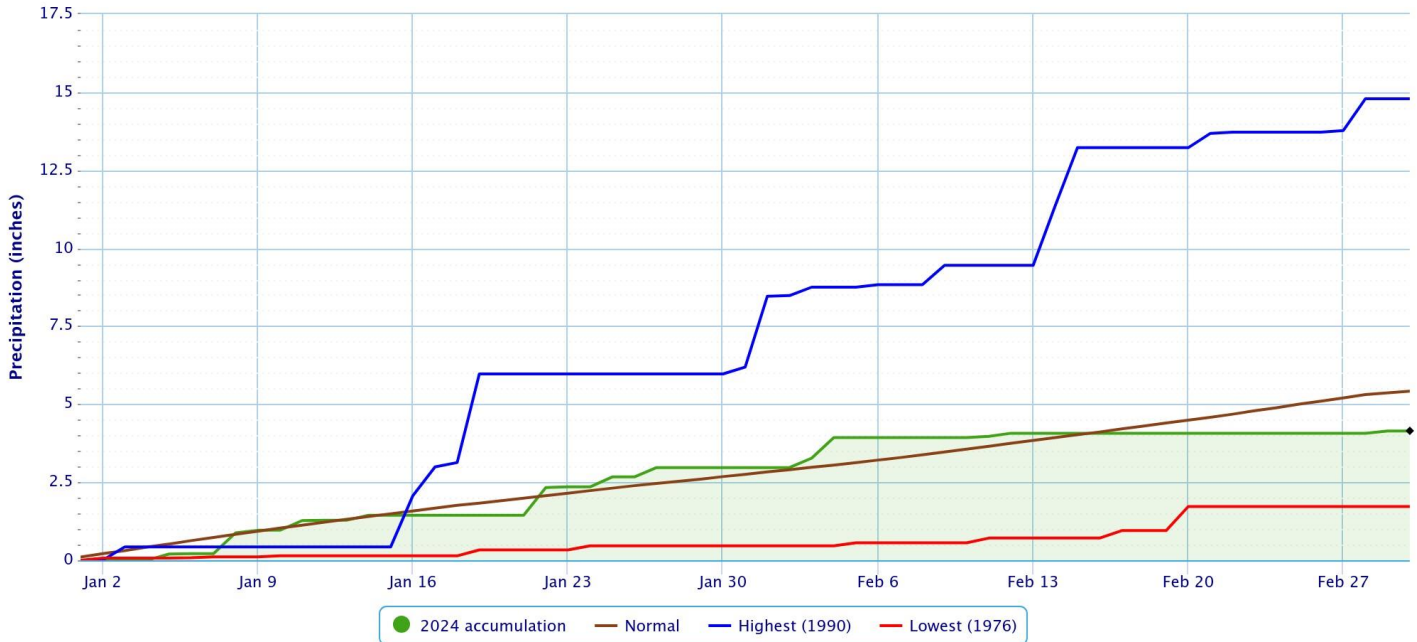
Period of Record – 1949-07-14 to 2024-02-29. Normals period: 1991-2020. Click and drag to zoom chart.



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## Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

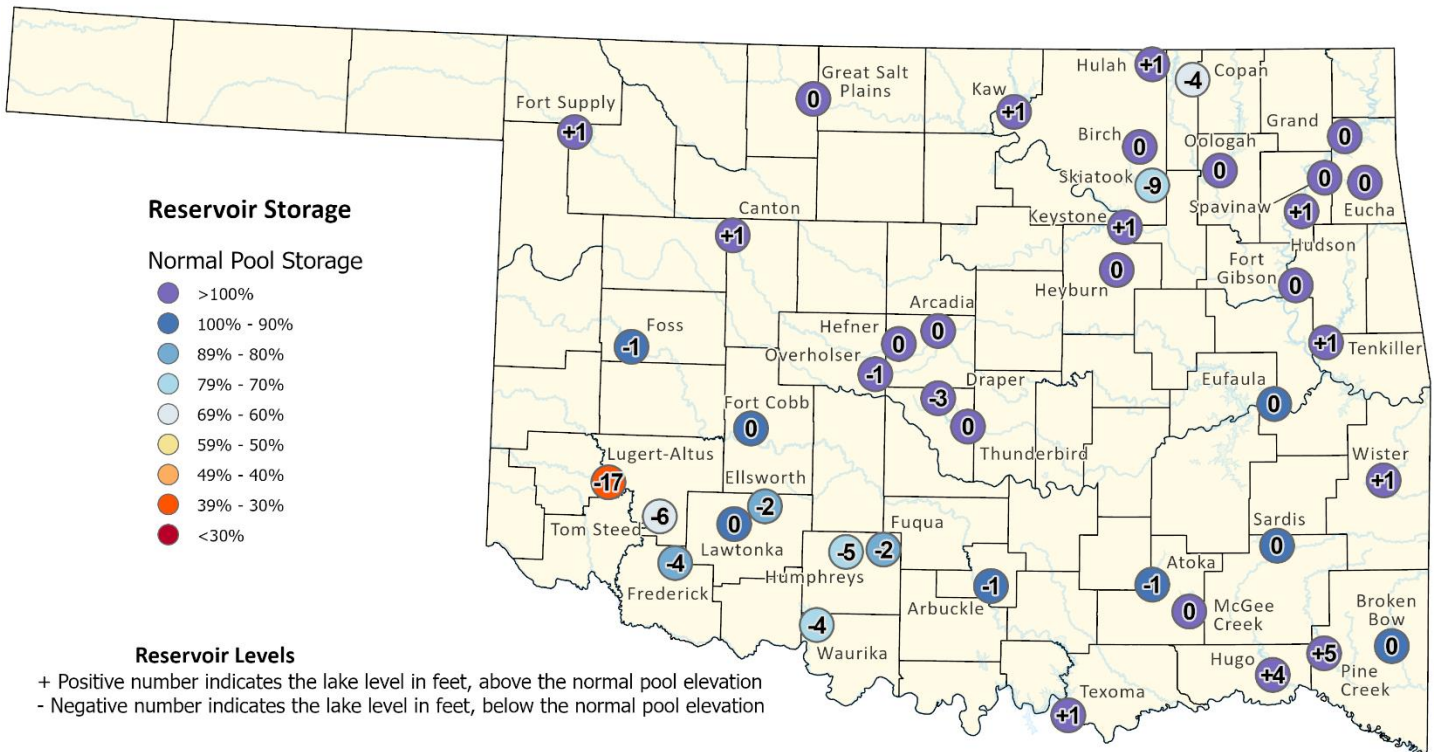
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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## Reservoirs

### Oklahoma Reservoir Levels and Storage as of 2/26/2024



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](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](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/>).



0 50 Miles



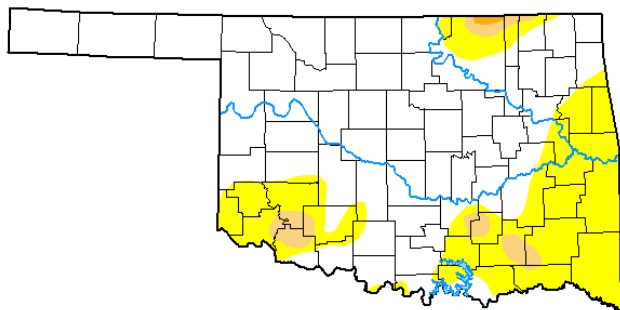
According to the USACE, a few of the lakes in the HSA were below 3% of top of their conservation pools as of 3/01/2024: Copan Lake 60%, Skiatook Lake 74%, and Beaver Lake 85%. A couple of lakes were above 3% of the top of their conservation pools: Hudson Lake 4% and Hugo Lake 4%.

**Drought**

According to the [U.S. Drought Monitor](#) (USDM) from February 27, 2024 (Figs. 2a, b), Severe (D2) Drought conditions exist in a portion of northern Osage County in eastern Oklahoma. Moderate (D1) Drought conditions were present in portions of Nowata, Washington, Osage, Pushmataha, and Choctaw Counties in eastern Oklahoma. Abnormally Dry (D0) but not in drought conditions were occurring in Craig, Nowata, Washington, Osage, eastern Kay, Pittsburg, Pushmataha, Choctaw, Latimer, Le Flore, Haskell, McIntosh, Muskogee, Wagoner, Sequoyah, Cherokee, Adair, and Delaware Counties in eastern OK, and in Benton, Carroll, Washington, Madison, Crawford, and Sebastian Counties in northwest AR.

**U.S. Drought Monitor  
Oklahoma**

**February 27, 2024**  
(Released Thursday, Feb. 29, 2024)  
Valid 7 a.m. EST



*Drought Conditions (Percent Area)*

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	69.20	30.80	3.23	0.19	0.00	0.00
<b>Last Week</b> <i>02-20-2024</i>	83.39	16.61	3.23	0.19	0.00	0.00
<b>3 Months Ago</b> <i>11-28-2023</i>	48.05	51.95	33.99	11.38	1.16	0.00
<b>Start of Calendar Year</b> <i>01-02-2024</i>	55.32	44.68	21.64	3.08	0.00	0.00
<b>Start of Water Year</b> <i>09-26-2023</i>	34.29	65.71	46.76	30.93	12.91	0.00
<b>One Year Ago</b> <i>02-28-2023</i>	22.85	77.15	66.88	53.52	36.64	8.86

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:  
Richard Heim  
NCEI/NOAA



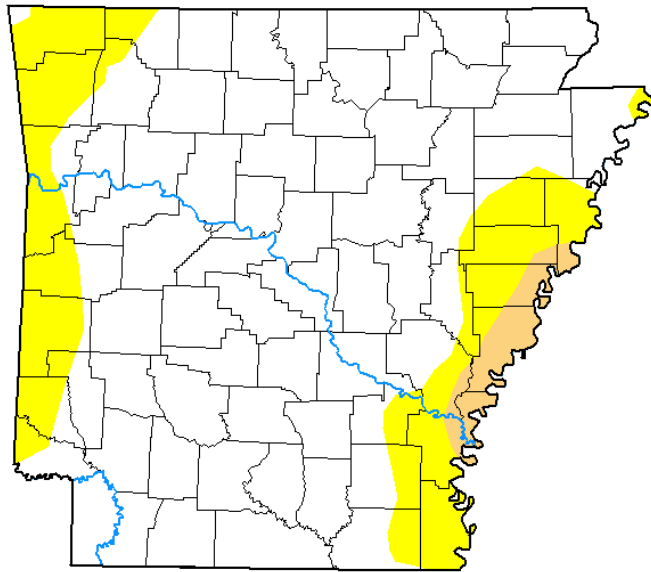
[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

Fig. 2a. Drought Monitor for Oklahoma



**U.S. Drought Monitor**  
**Arkansas**

**February 27, 2024**  
(Released Thursday, Feb. 29, 2024)  
Valid 7 a.m. EST



*Drought Conditions (Percent Area)*

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	78.92	21.08	2.74	0.00	0.00	0.00
<b>Last Week</b> <i>02-20-2024</i>	88.09	11.91	2.74	0.00	0.00	0.00
<b>3 Months Ago</b> <i>11-28-2023</i>	52.82	47.18	34.20	16.31	0.51	0.00
<b>Start of Calendar Year</b> <i>01-02-2024</i>	15.06	84.94	44.54	23.39	13.71	0.79
<b>Start of Water Year</b> <i>09-26-2023</i>	38.45	61.55	25.37	3.70	0.00	0.00
<b>One Year Ago</b> <i>02-28-2023</i>	100.00	0.00	0.00	0.00	0.00	0.00

Intensity:

None	D2 Severe Drought
D0 Abnormally Dry	D3 Extreme Drought
D1 Moderate 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:  
Richard Heim  
NCEI/NOAA



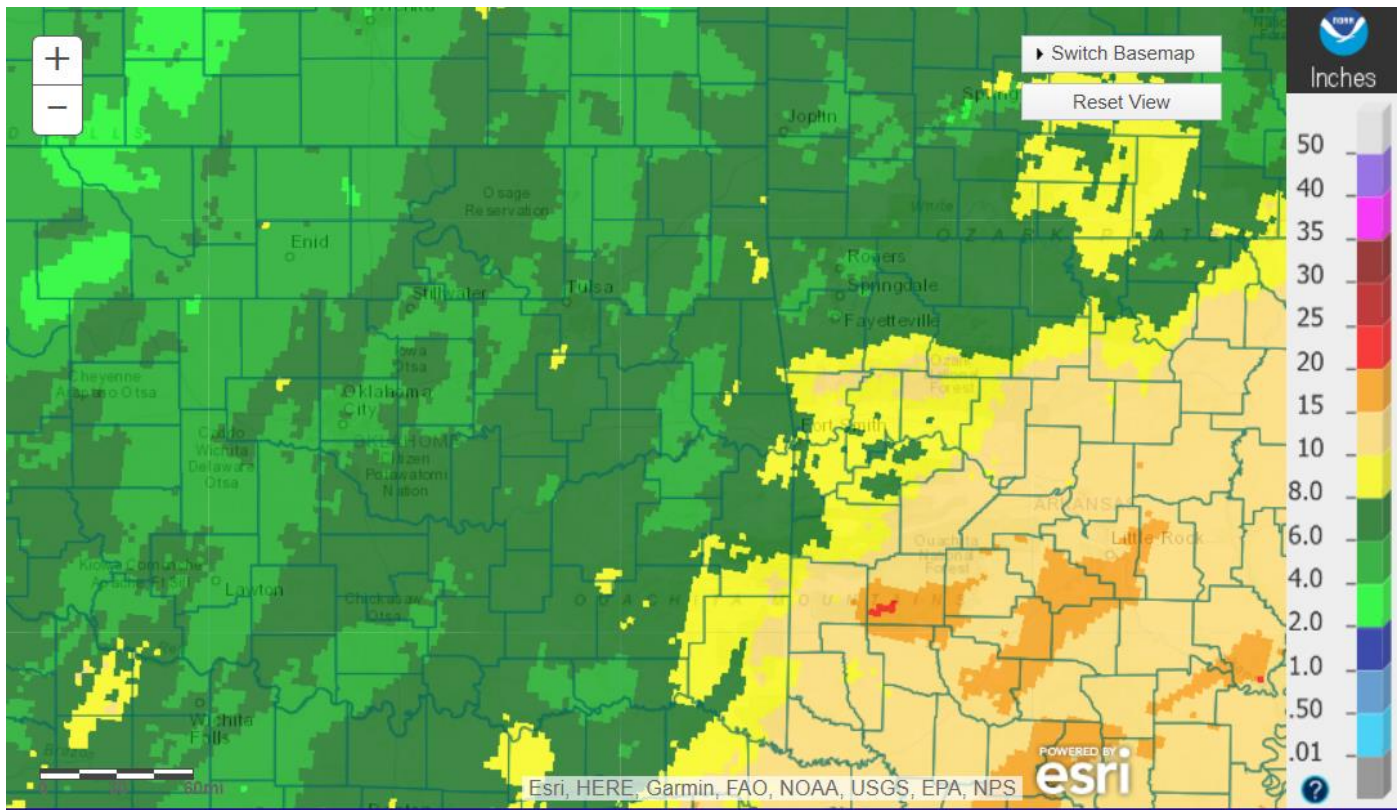
[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

Fig. 2b. Drought Monitor for Arkansas

**Winter 2023-24 (December-January-February) Summary**

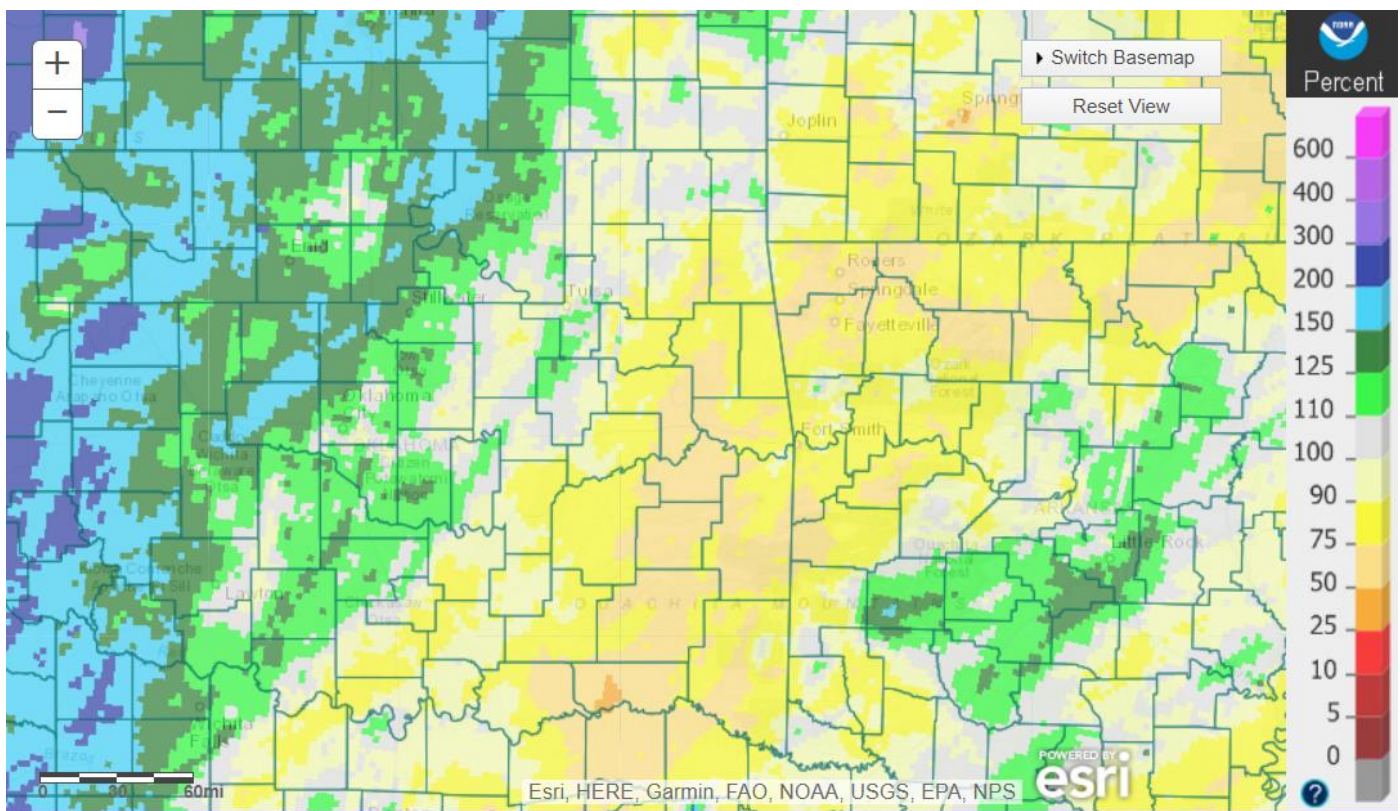
Using the radar-derived estimated observed precipitation from the RFCs (Fig. 3a), rainfall totals for Winter 2023-24 ranged from around 4” to around 12” across eastern OK and northwest AR, with much of the area receiving 6”-8”. These rainfall totals correspond to around 50% to near 200% of the normal Winter rainfall (Fig. 3b). The areas with above normal rainfall were primarily along and northwest of I-44, with the majority of the region receiving below normal rainfall for the season.

In Tulsa, OK, Winter 2023-24 ranked as the 13<sup>th</sup> warmest Winter (43.2°F; since records began in 1905-06) and the 54<sup>th</sup> wettest Winter (5.99”; since records began in 1888-89). Fort Smith, AR had the 12<sup>th</sup> warmest Winter (45.4°F; since records began in 1882-83) and the 60<sup>th</sup> driest Winter (7.29”; since records began in 1882-83). Fayetteville, AR had the 5<sup>th</sup> warmest (42.1°F, tied 1949-50) and the 20<sup>th</sup> driest (6.23”) Winter since records began in 1949-50.



Tulsa, OK: Last 90-Day Observed Precipitation  
Valid on: March 01, 2024 12:00 UTC

Fig. 3a. Estimated Observed Rainfall for Winter 2023-24 (Last 90 days ending at 6am CST March 1, 2024)



Tulsa, OK: Last 90-Day Percent of Normal Precipitation  
Valid on: March 01, 2024 12:00 UTC

Fig. 3b. Estimated % of Normal Rainfall for Winter 2023-24 (Last 90 days ending at 6am CST March 1, 2024)

## **Outlooks**

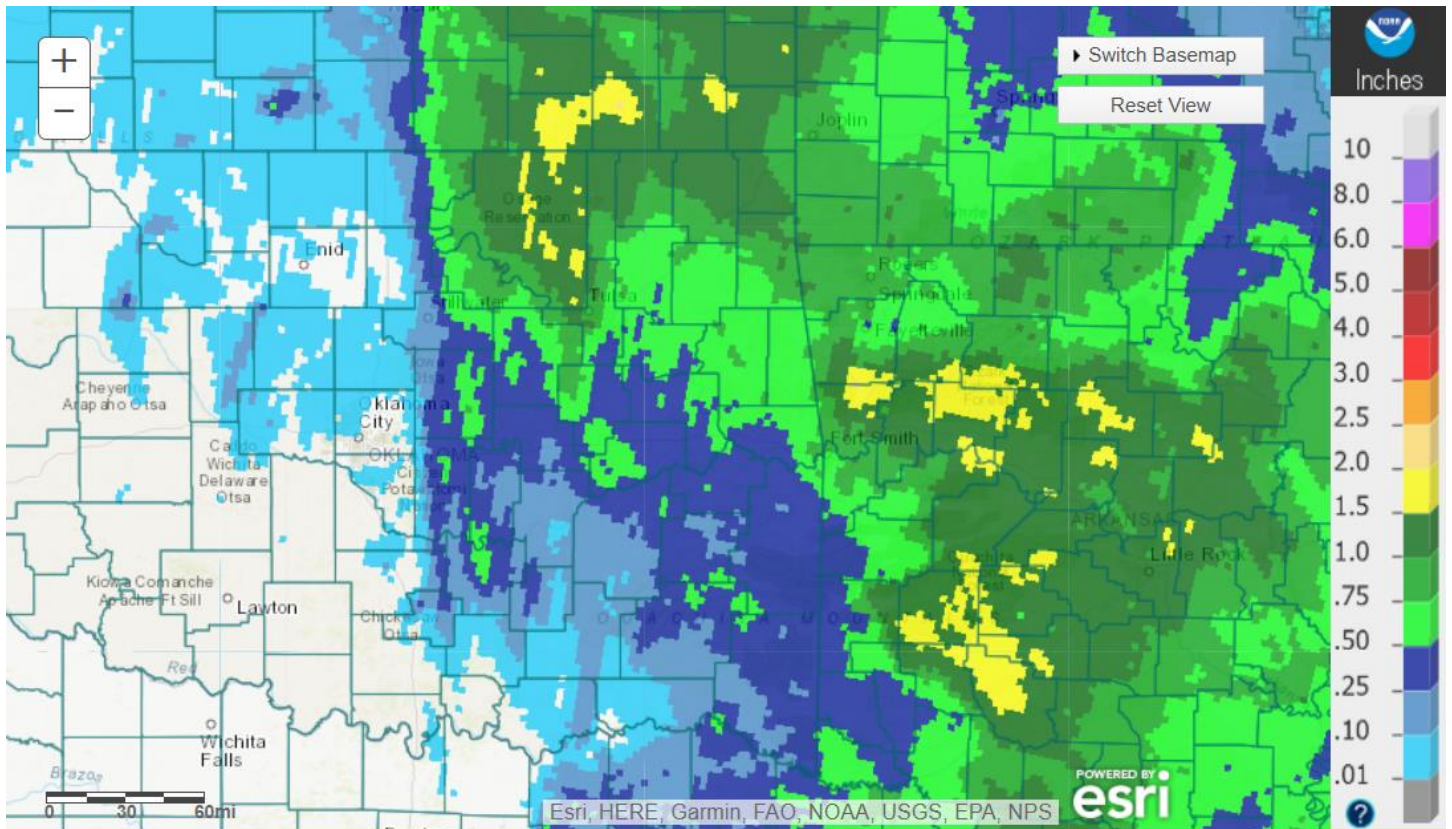
The [Climate Prediction Center](#) (CPC) outlook for March 2024 (issued February 29, 2024) indicates an enhanced chance for above median precipitation along the OK/KS state line and an equal chance for above, near, and below median precipitation elsewhere in eastern OK and northwest AR. This outlook also calls for above normal temperatures across all of eastern OK and northwest AR. This outlook was based on dynamical model output, the Madden-Julian Oscillation (MJO), and ENSO. There is some potential that the expected Sudden Stratospheric Warming at the beginning of the month could result in arctic airmasses later in the month; however, confidence is currently low for this.

For the 3-month period March-April-May 2024, CPC is forecasting an enhanced chance for above median precipitation and an equal chance for above, near, and below normal temperatures across eastern OK and northwest AR (outlook issued February 15, 2024). This outlook is based on long-term trends, ENSO state, and incorporates both statistical and dynamical forecast tools. According to CPC, El Niño conditions are present in the equatorial Pacific Ocean. El Niño will weaken and then transition to ENSO-neutral by the April-June 2024 season (79% chance). There are increasing odds (55% chance) for a return of La Niña conditions this summer. CPC continues the El Niño Advisory and issued a La Niña Watch.

**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](http://water.weather.gov/precip/index.php?location_type=wfo&location_name=tsa)

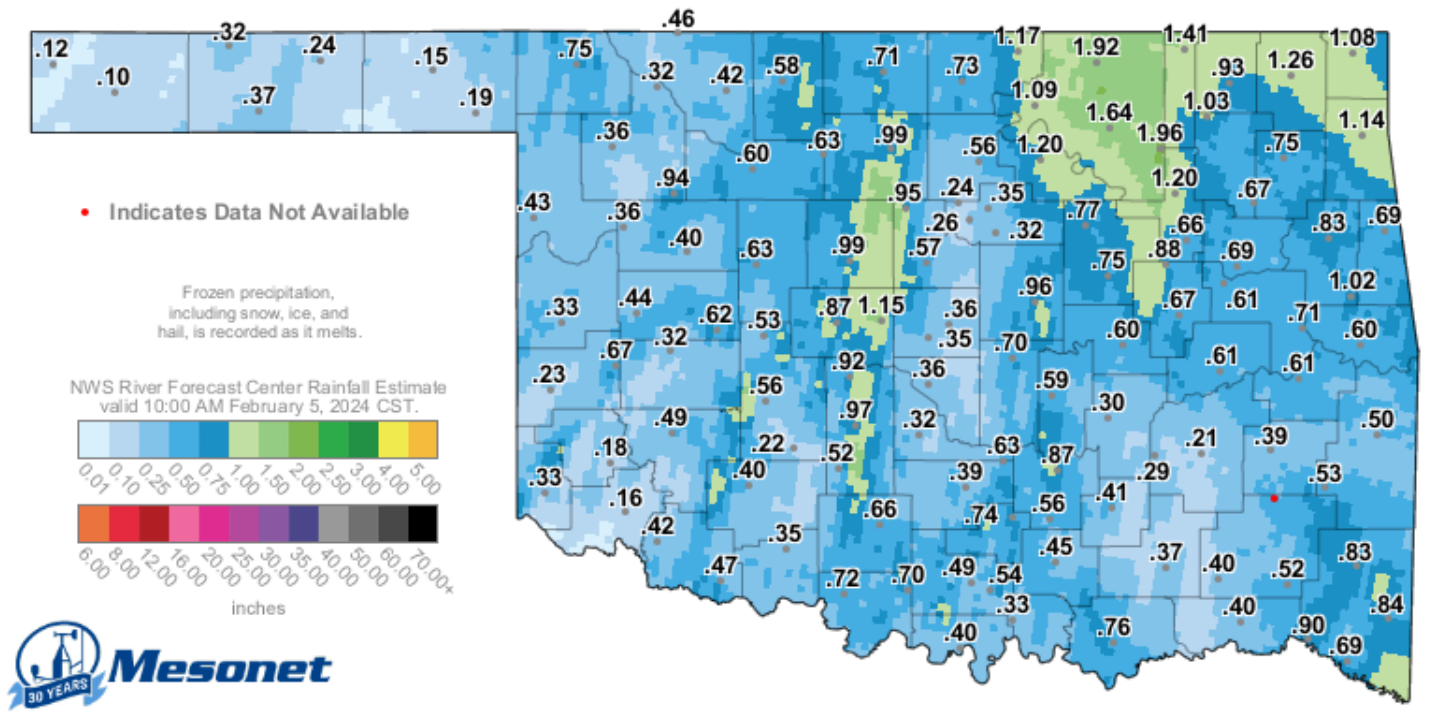
An upper-level low was moving east from northern NM toward the OK/TX Panhandles early on the 3<sup>rd</sup>. At the surface, low pressure was positioned over the Panhandles with a frontal boundary extending southward into central TX. Along and just ahead of this boundary, which combined with a 30-45KT low-level jet and elevated frontogenetic forcing, was a broken line of convection that stretched from KS to southern TX. This activity moved eastward with the movement of the main upper-level low. Convection across OK into TX was along the western periphery of the deeper moisture plume that extended eastward over eastern OK. The broken line of elevated showers and thunderstorms moved east across eastern OK and northwest AR during the morning hours. Showers and isolated thunderstorms redeveloped over eastern OK during the afternoon near an occluded front. By midnight of the 4<sup>th</sup>, widespread showers were affecting northeast and east central OK and northwest AR. This activity continued through the overnight hours before dissipating around sunrise. Rainfall totals ranged from 0.25" to 2" across eastern OK and northwest AR (Figs. 4, 5).

Shortly after sunrise on the 11<sup>th</sup>, showers and isolated thunderstorms moved into southeast OK and expanded northward through the morning within the warm conveyor belt ahead of an upper-level low over southeast NM. Lift from this system increased through the afternoon and evening hours, with a corresponding increase in rain coverage primarily across northeast OK and far northwest AR. After midnight of the 12<sup>th</sup>, the upper-low lifted east-northeast into south-central/southeast OK, and the 850-700mb warm frontogenesis strengthened along the deformation zone on the north side of the low. Thermal profiles supported a change over from rain to snow as the near-surface layer cooled, with some brief instances of sleet in between. The precipitation continued to shift eastward during the overnight and morning hours as the upper-low moved east. Shortly after noon, the precipitation had dissipated. Snowfall totals were highly variable across the area due to the banding of the snow showers combined with temperatures only around or above freezing. Snowfall estimates and measurements ranged from a trace to near 5" (Fig. 7) and the rainfall/liquid equivalent totals were a few hundredths of an inch to around one inch (Fig. 6).



Tulsa, OK: February 04, 2024 1-Day Observed Precipitation  
Valid on: February 04, 2024 12:00 UTC

Fig. 4. 24-hour Estimated Observed Rainfall ending at 6am CST 2/04/2024.

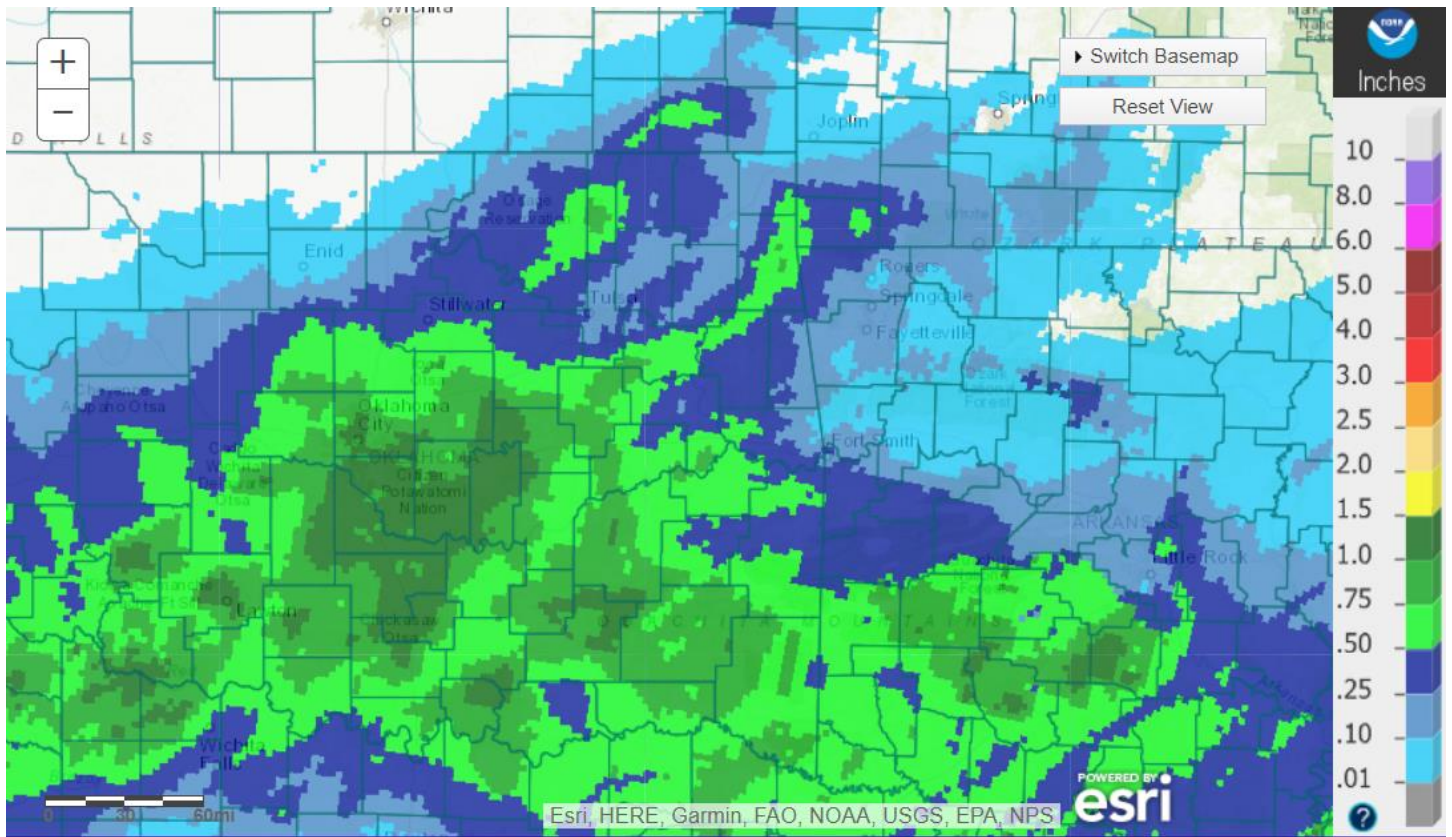


3-Day Rainfall Accumulation (inches)

11:35 AM February 5, 2024 CST

Created 11:40:57 AM February 5, 2024 CST. © Copyright 2024

Fig. 5. OK Mesonet (values) and NWS RFC rainfall estimate (image) 3-day rainfall ending at 11:35 am CST 2/05/2024.



Tulsa, OK: February 12, 2024 1-Day Observed Precipitation  
Valid on: February 12, 2024 12:00 UTC

Fig. 6. 24-hour Estimated Observed Rainfall ending at 6am CST 2/12/2024.

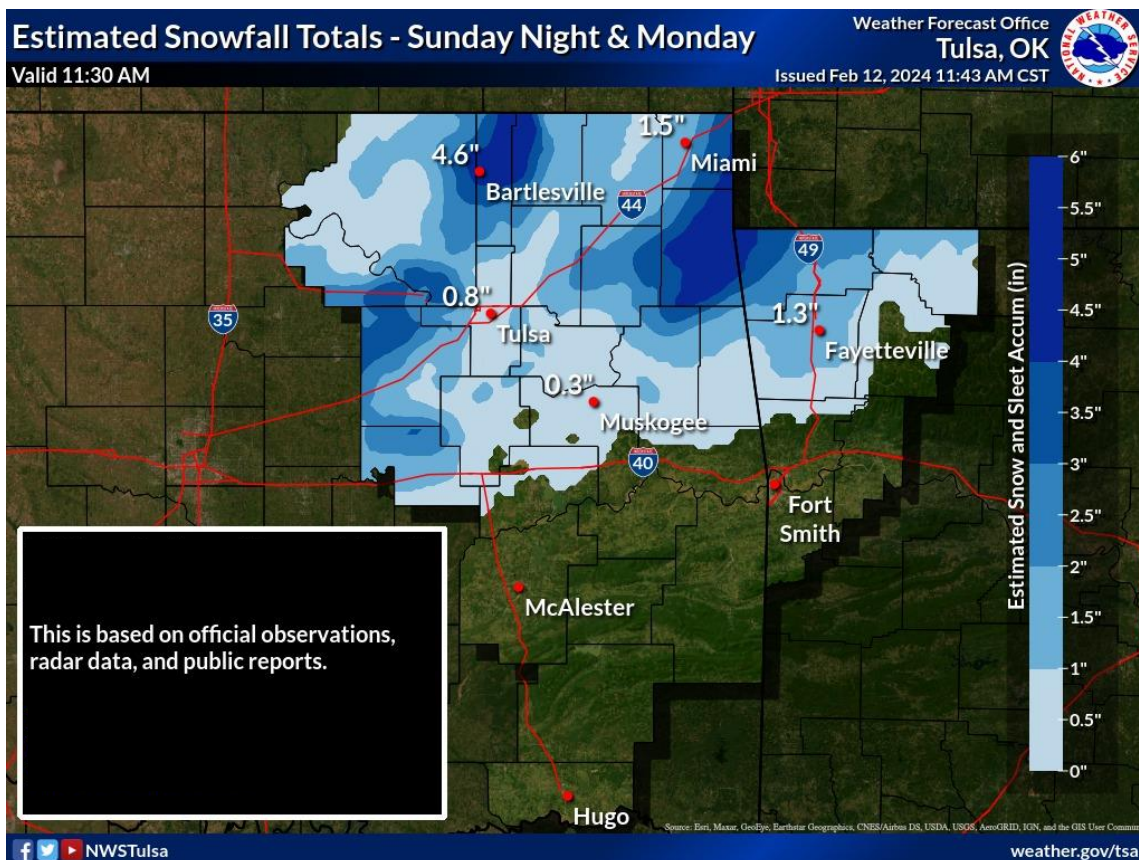


Fig. 7. Estimate of snowfall totals through 11:30 am CST 2/12/2024.

Written by:

Nicole McGavock  
Service Hydrologist  
WFO Tulsa

**Products issued in February 2024:**

- 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