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 **December** 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 **January 12, 2024**

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.

December 2023 was a very warm month, with the average monthly temperatures 4°-6°F above normal. The majority of eastern OK and northwest AR received below normal precipitation this month. Normal precipitation for December ranges from 1.5 inches in Pawnee County to 3.2 inches in Haskell County. Normal precipitation for the Ozark region of northwest Arkansas averages 3.2 inches for the month. 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 December 2023 ranged from around 0.50" to 5" across eastern OK and northwest AR, with much of the area receiving 2"-3". These rainfall totals correspond to 25% to around 250% of the normal December rainfall (Fig. 1b).

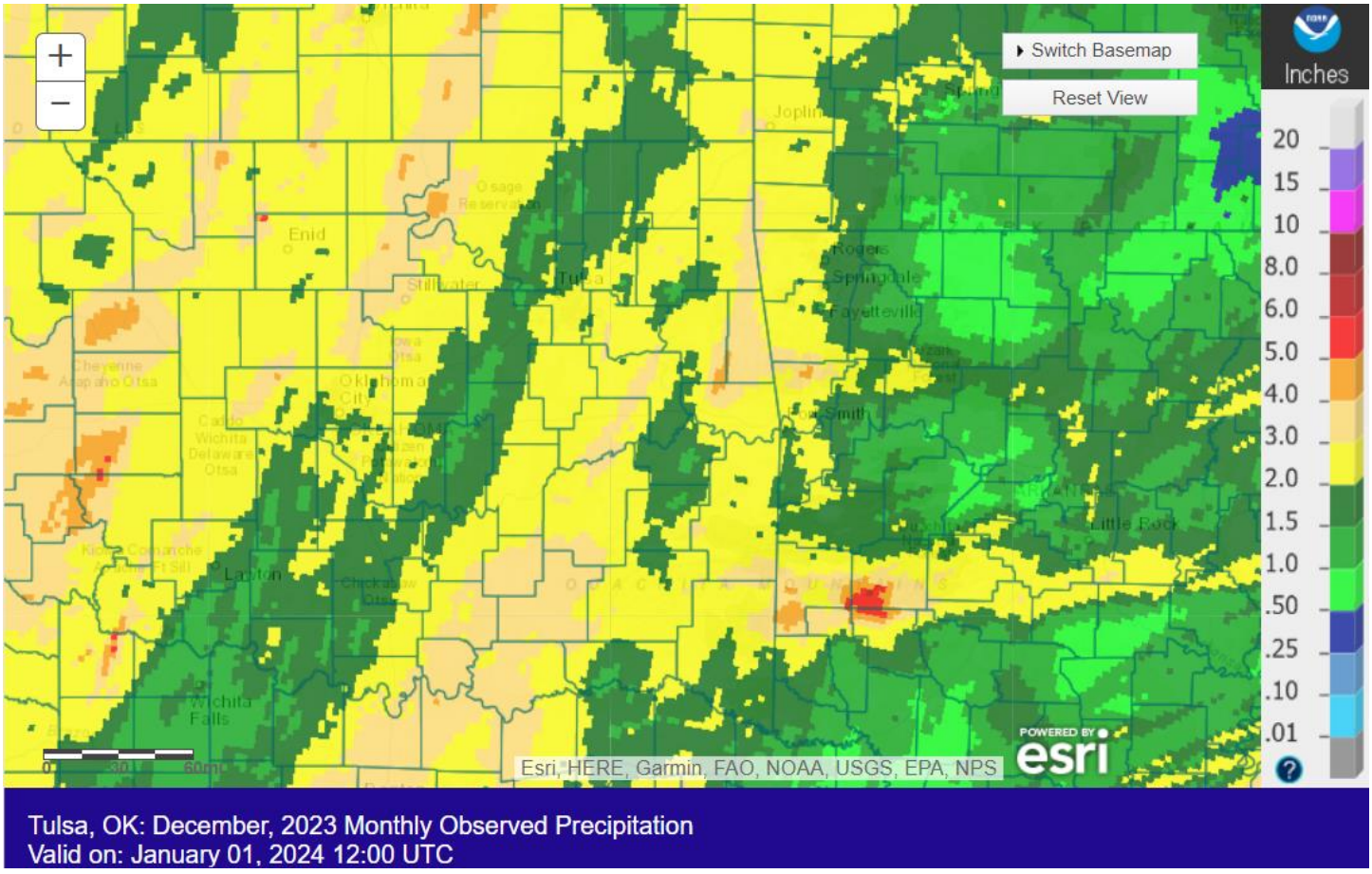


Fig. 1a. Estimated Observed Rainfall for December 2023

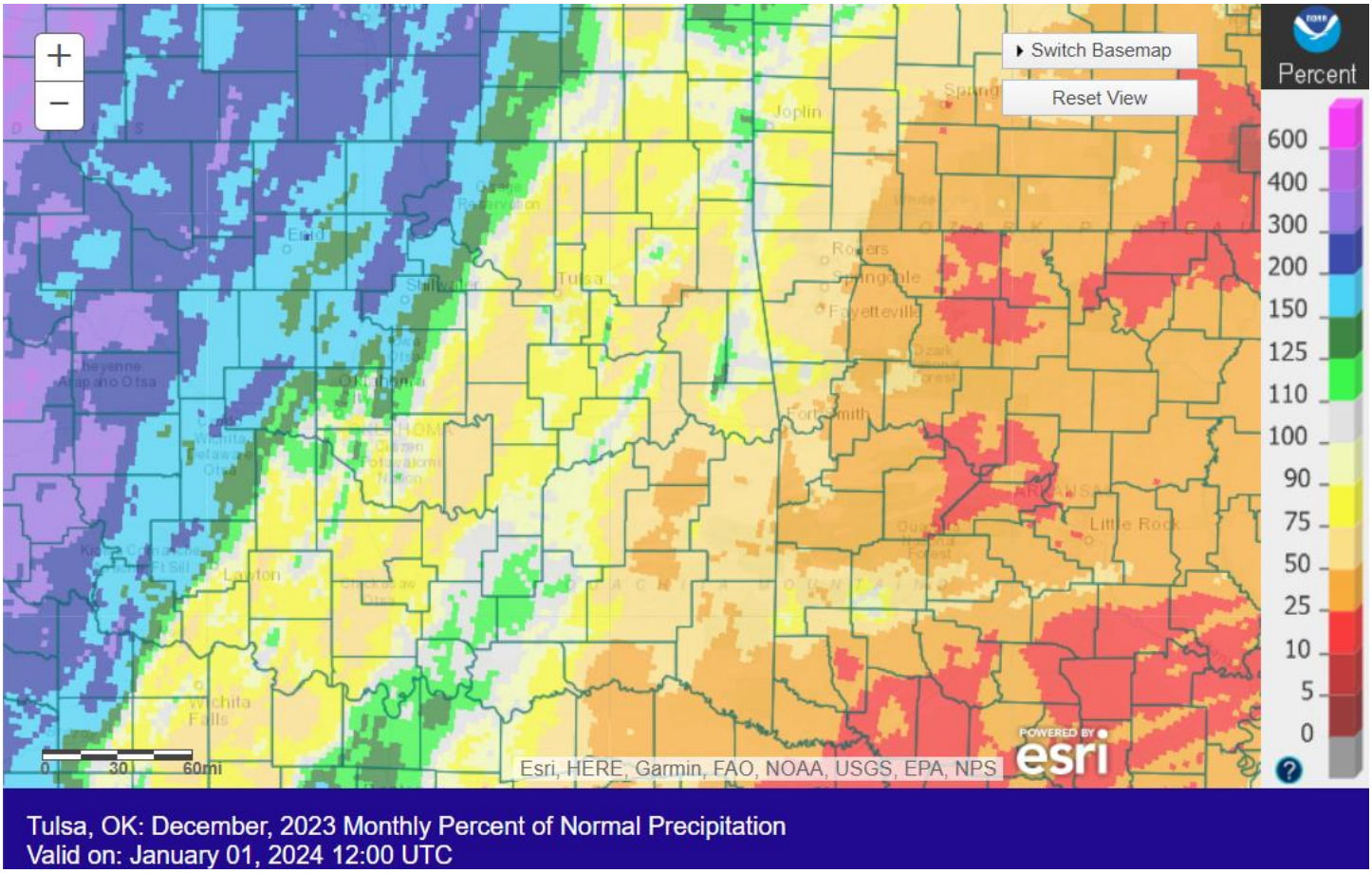


Fig. 1b. Estimated % of Normal Rainfall for December 2023

In Tulsa, OK, December 2023 ranked as the 7th warmest December (45.5°F; since records began in 1905), the 56th wettest December (1.83"; since records began in 1888), and the 29th snowiest December (Trace, tied 28 other years; since records began in 1900). Fort Smith, AR had the 10th warmest December (46.9°F; since records began in 1882) and the 50th driest December (1.95"; since records began in 1882). Fayetteville, AR had the 4th warmest (44.6°F), the 30th driest (2.09"), and the 16th snowiest (Trace, tied with 22 other years) December since records began in 1949.

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

Cookson, OK (meso)	4.99	Mountainburg 2NE, AR (coop)	4.78	Vian 5.3ENE, OK (coco)	4.60
Burbank, OK (meso)	4.40	Watts 7.2WSW, OK (coco)	4.39	Ralston, OK (coop)	4.35
Jay 3.3NNE, OK (coco)	4.22	Hulbert 3.9N, OK (coco)	4.17	Siloam Springs 1.8N, AR (coco)	4.16

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

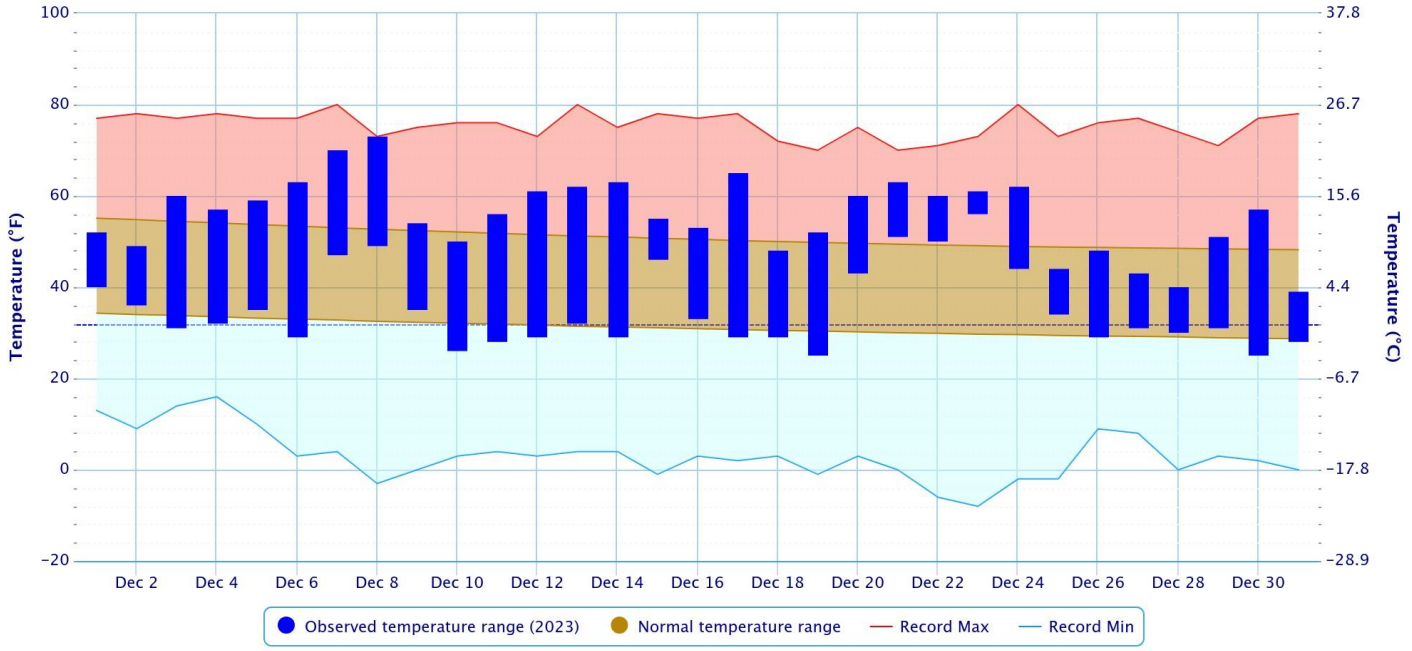
Bartlesville, OK (ASOS)	1.55	Bristow, OK (meso)	1.58	Clayton, OK (meso)	1.65
Nowata, OK (meso)	1.66	Talala, OK (meso)	1.69	Tulsa, OK (meso)	1.75
Hugo, OK (meso)	1.79	Stigler, OK (meso)	1.83	Tulsa, OK (ASOS)	1.83

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

Rank since 1921	Last 30 Days (Dec 6 – Jan 4)	Cool Growing Season (Sep 1 – Jan 4)	Water Year-to-Date (Oct 1, 2023 – Jan 4, 2024)	Last 60 Days (Nov 6 – Jan 4)	Last 180 Days (Jul 9 – Jan 4)	Last 365 Days (Jan 5, 2023 – Jan 4, 2024)
Northeast OK	32nd wettest	41st driest	37th driest	49th driest	49th wettest	41st driest
East Central OK	39th wettest	52nd wettest	51st wettest	50th driest	42nd wettest	50th wettest
Southeast OK	27th driest	42nd wettest	47th driest	48th driest	48th driest	33rd wettest
Statewide	17th wettest	48th wettest	40th wettest	34th wettest	44th wettest	44th wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

Period of Record – 1905-01-06 to 2024-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



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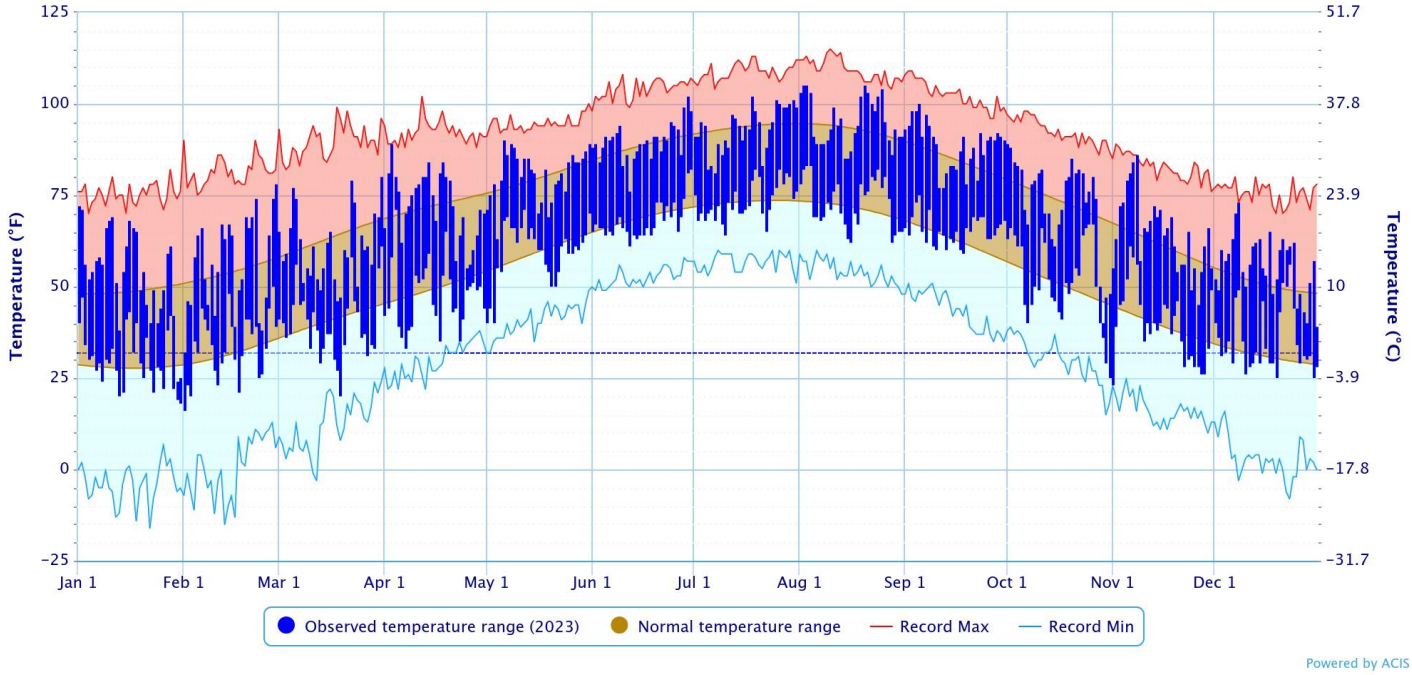

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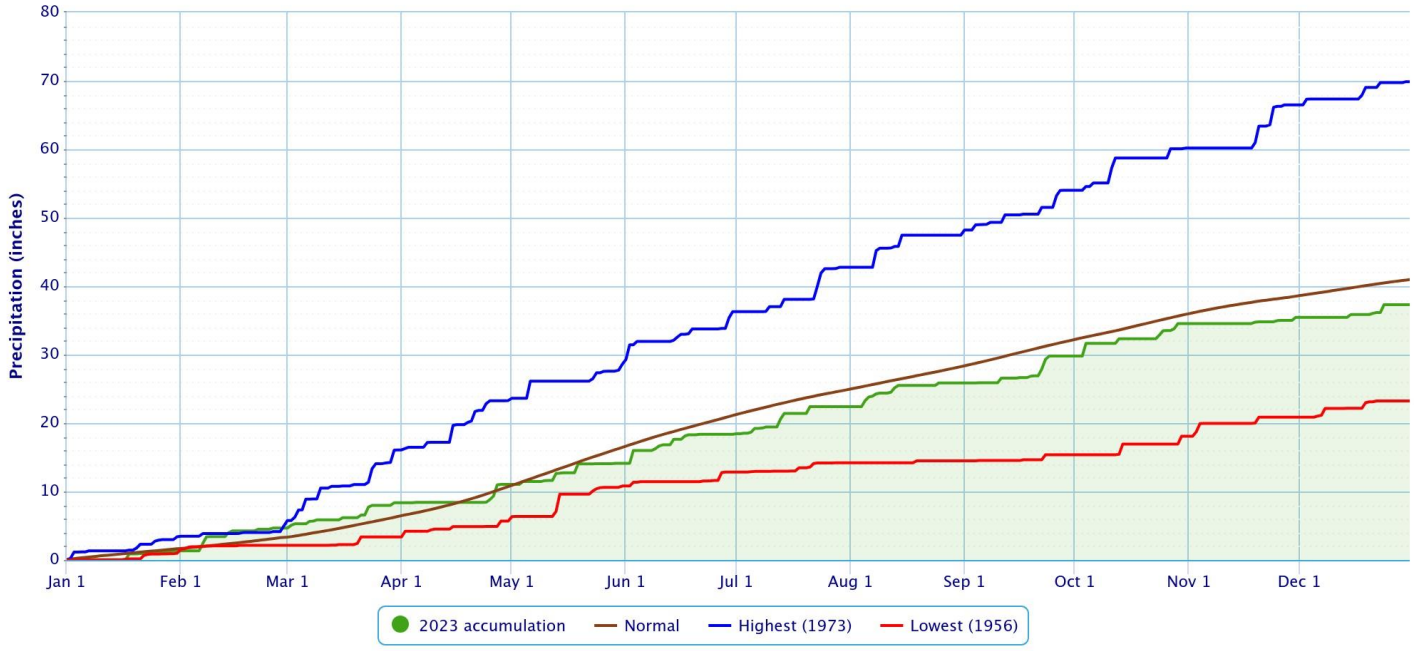
Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

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



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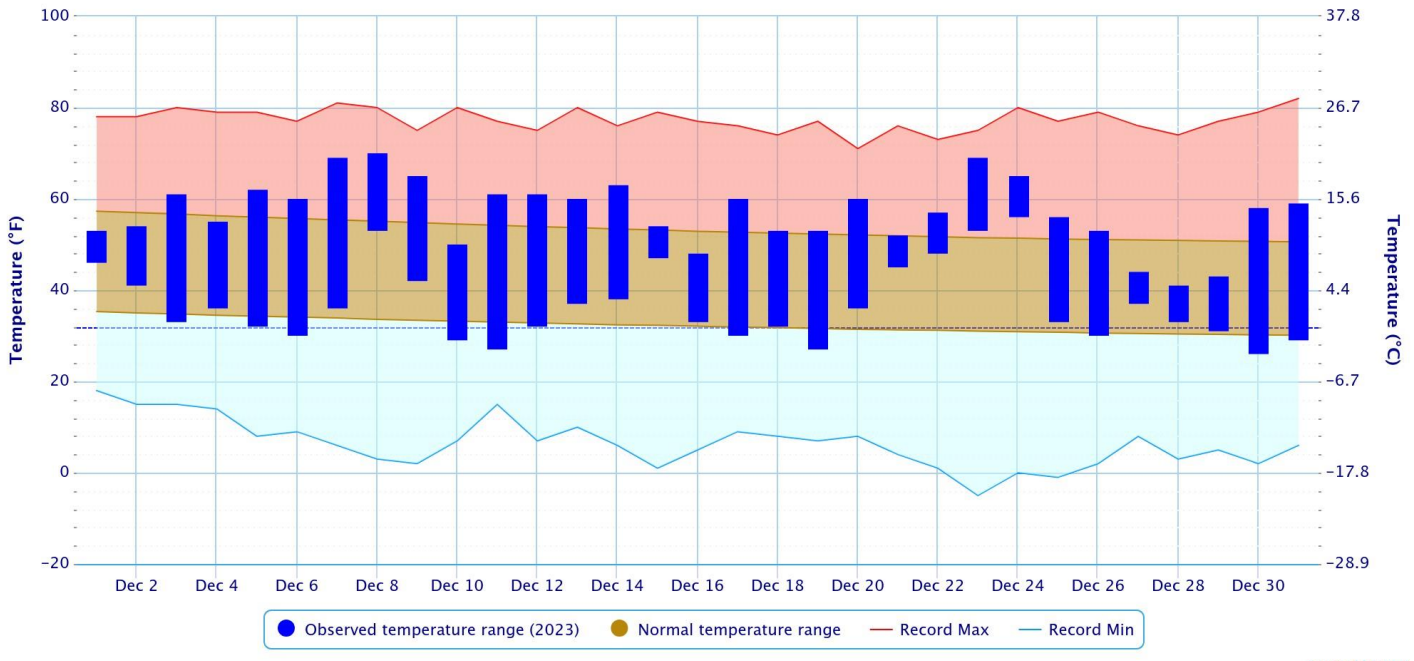
Daily Temperature Data – Fort Smith Area, AR (ThreadEx)

Period of Record – 1882-06-01 to 2024-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



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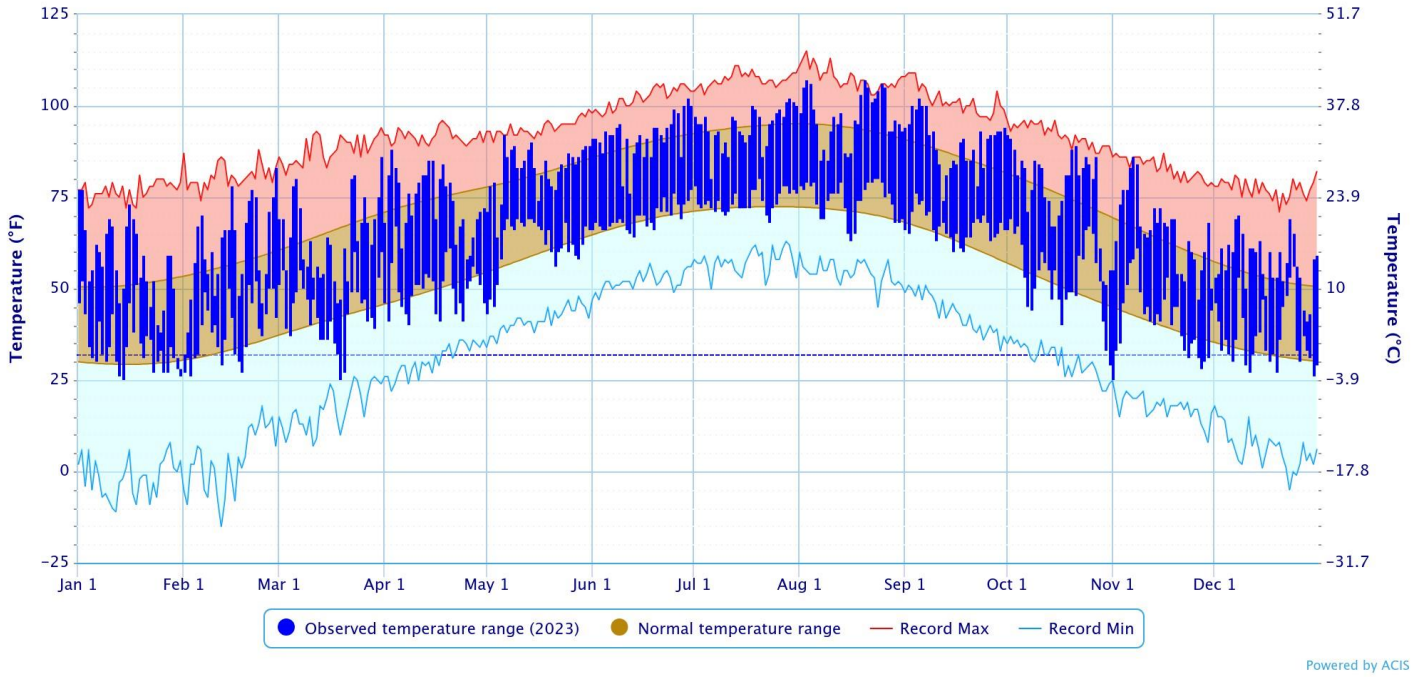
Daily Temperature Data – Fort Smith Area, AR (ThreadEx)

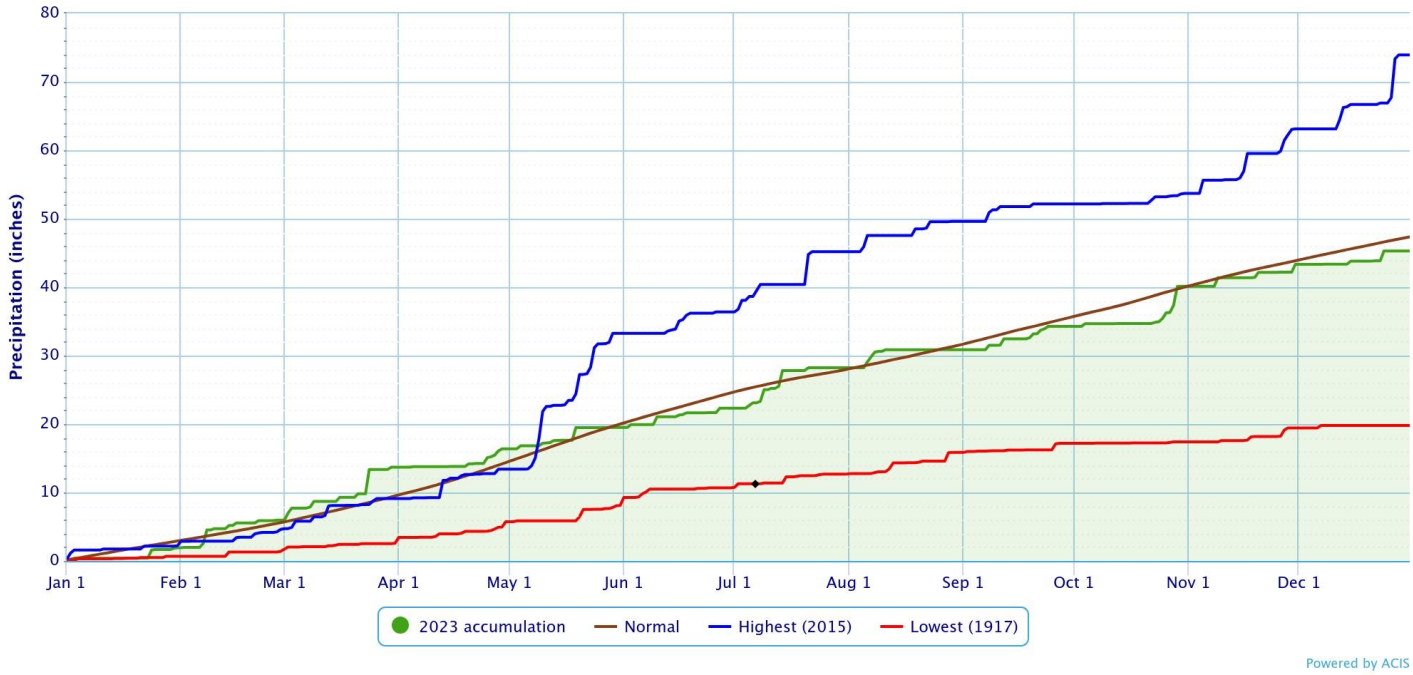
Period of Record – 1882-06-01 to 2024-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



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



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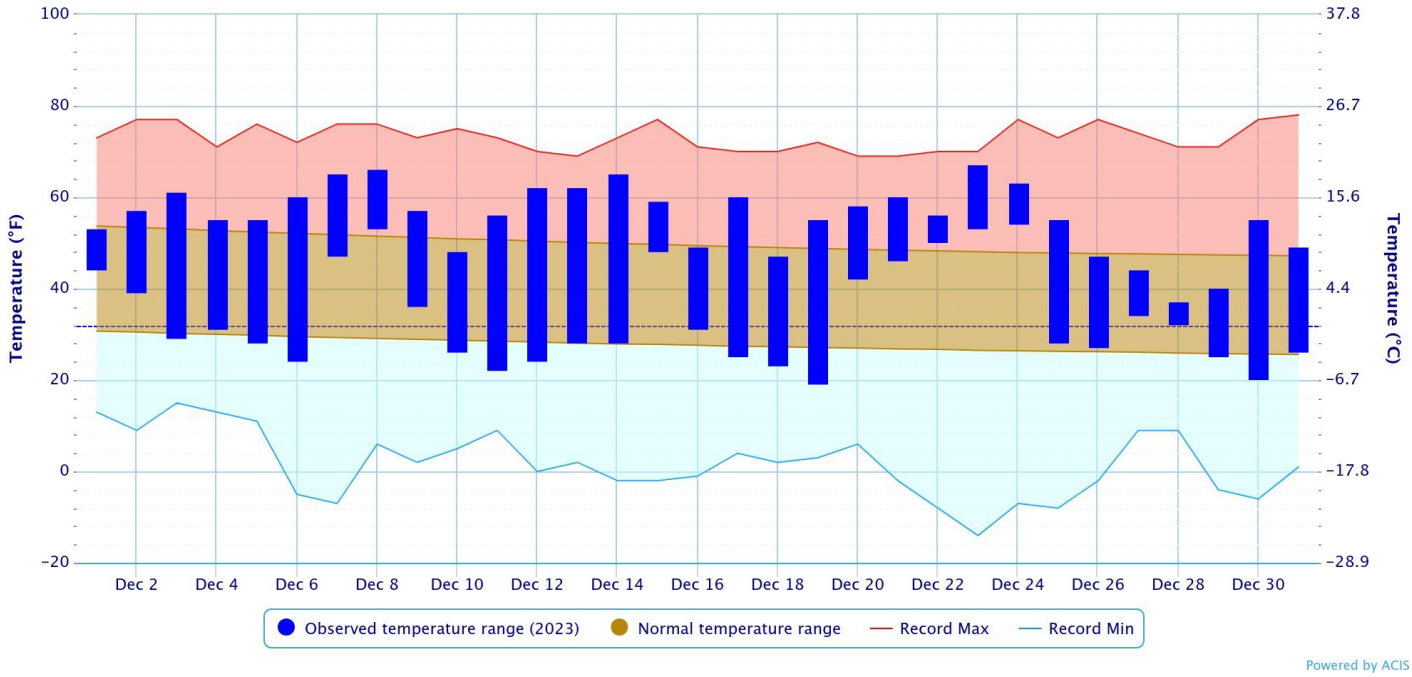
Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

Period of Record – 1949-07-14 to 2024-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



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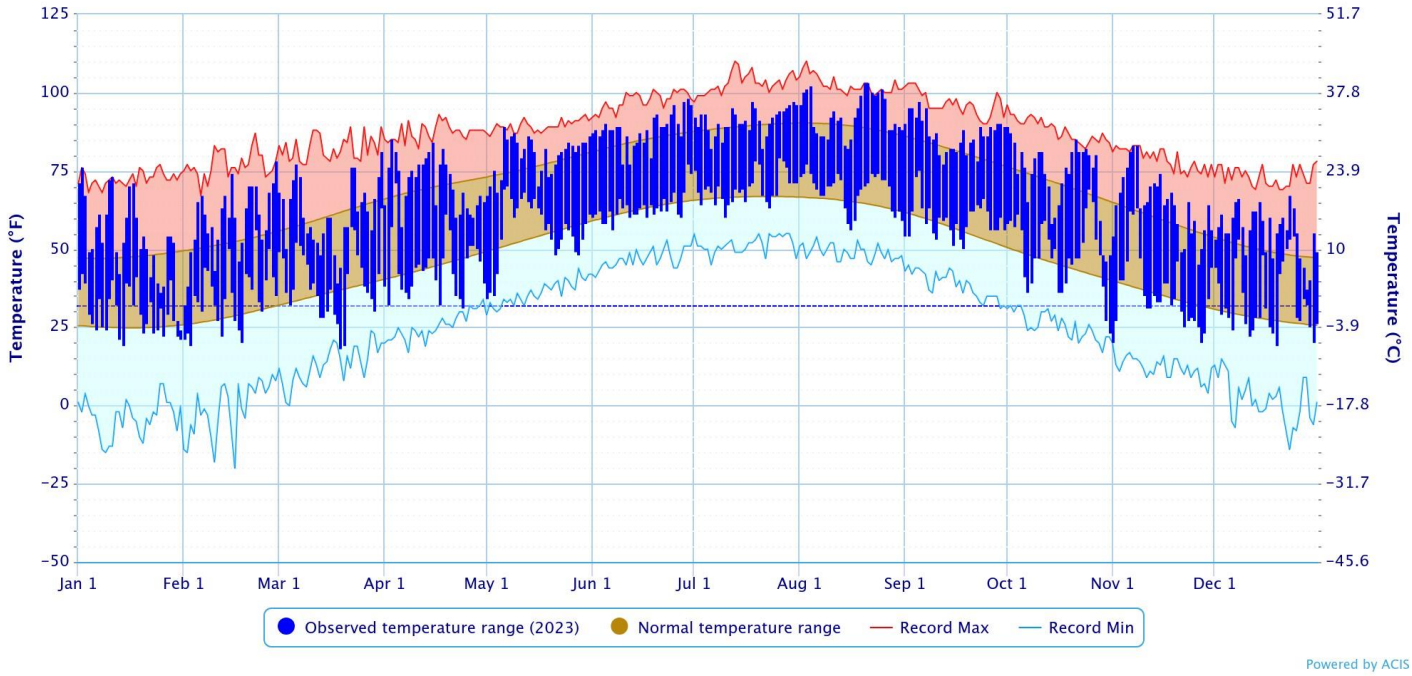
Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

Period of Record – 1949-07-14 to 2024-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



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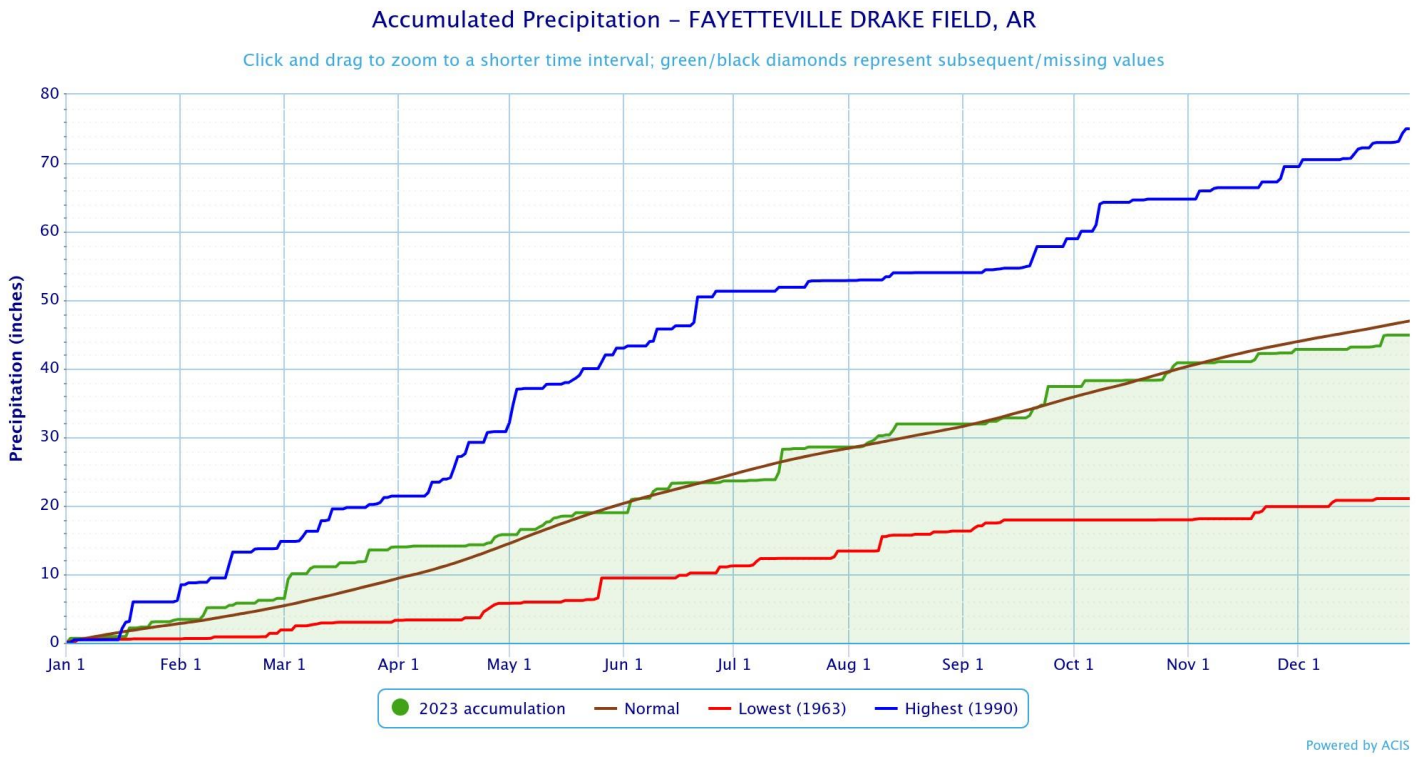
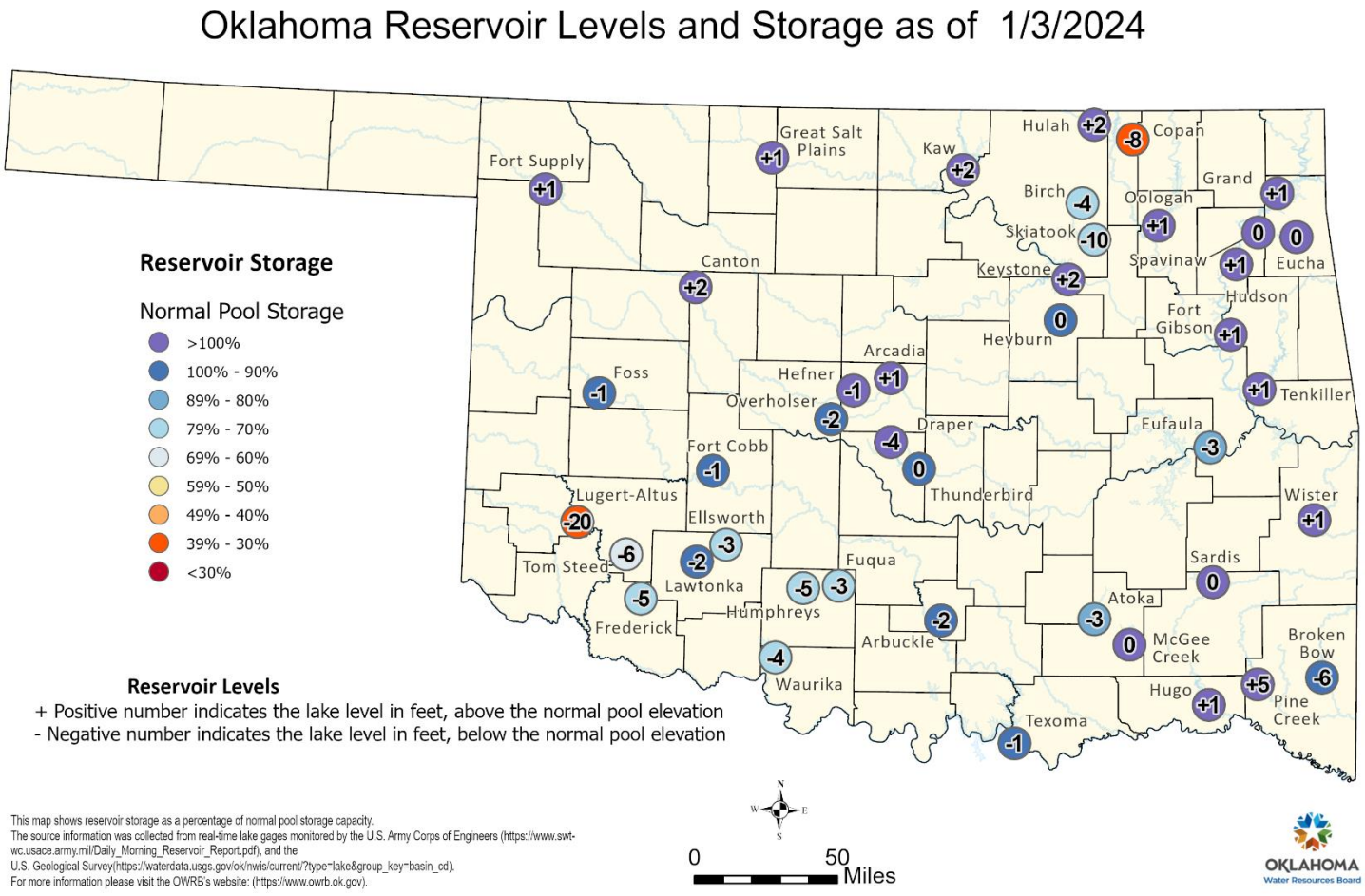

Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values
Precipitation (inches)
0
10
20
30
40
50
60
70
80
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
Oct 1
Nov 1
Dec 1
2023 accumulation
Normal
Lowest (1963)
Highest (1990)
Powered by ACIS

Reservoirs


Oklahoma Reservoir Levels and Storage as of 1/3/2024
Reservoir Storage
Normal Pool Storage
>100%
100% - 90%
89% - 80%
79% - 70%
69% - 60%
59% - 50%
49% - 40%
39% - 30%
<30%
Reservoir Levels
+ Positive number indicates the lake level in feet, above the normal pool elevation
- Negative number indicates the lake level in feet, below the normal pool elevation
Fort Supply +1
Great Salt Plains +1
Kaw +2
Hulah +2
Copan -8
Grand +1
Birch -4
Oologah +1
Skiatook -10
Spavinaw +1
0
0
Eucha
Canton +2
Keystone +2
Hudson
Fort Gibson +1
0
Heyburn
Arcadia
Foss -1
Hefner -1
+1
Overholser -2
Draper -4
Eufaula -3
+1
Tenkiller
Fort Cobb -1
0
Thunderbird
Wister +1
Lugert-Altus -20
Ellsworth -3
-6
Tom Steed -2
Fuqua -3
-5
Sardis 0
Lawtonka -5
Humphreys
Atoka -3
Frederick -5
Arbuckle -2
0
McGee Creek
Broken Bow -6
Waurika -4
Hugo +1
+5
Pine Creek
Texoma -1
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).
N
W
E
S
0
50
Miles
OKLAHOMA
Water Resources Board

According to the USACE, several of the lakes in the HSA were below 3% of top of their conservation pools as of 1/05/2024: Copan Lake 33%, Skiatook Lake 69%, Birch Lake 71%, Beaver Lake 76%, Eufaula Lake 83%. Three lakes were above 3% of the top of their conservation pools: Hudson Lake 5%, Pensacola Lake 4%, and Kaw Lake 4%.

Year 2023

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 2a), rainfall totals for 2023 ranged from around 25" to 70" across eastern OK and northwest AR, with much of the area receiving 40"-50". These rainfall totals correspond to around 50% to 150% of the normal annual rainfall (Fig. 2b).

In Tulsa, OK, 2023 ranked as the 16th warmest Year (62.5°F, tied 1998; since records began in 1905), the 68th wettest Year (37.28"; since records began in 1888), and the 5th least snowy Year (0.5", tied 1907, 1976; since records began in 1900). Fort Smith, AR had the 2nd warmest Year (64.9°F; since records began in 1883), the 50th wettest Year (45.29"; since records began in 1883), and the 68th least snowy Year (4.0", tied 1963; since records began in 1884). Fayetteville, AR had the Record warmest (60.8°F, previous record was 60.5°F in 2012), the 35th driest (44.89"), and the 29th snowiest (9.0", tied 1959) Year since records began in 1950.

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

Bella Vista 2.2E, AR (coco)	60.21	Jay 3.3NNE, OK (coco)	59.70	Wister 3.0NNE, OK (coco)	59.60
Clayton, OK (meso)	56.46	Talihina, OK (meso)	56.14	Wister, OK (meso)	55.71
Pryor 6.9ESE, OK (coco)	55.45	Jay, OK (meso)	54.60	Berryville 0.9E, AR (coco)	54.23

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

Foraker, OK (meso)	29.40	Copan, OK (meso)	29.85	Nowata, OK (meso)	31.27
Burbank, OK (meso)	31.66	Vinita, OK (meso)	32.18	Wynona, OK (meso)	32.82
Pawnee, OK (meso)	34.64	Jenks Riverside Arpt, OK (ASOS)	36.55	Talala, OK (meso)	36.58

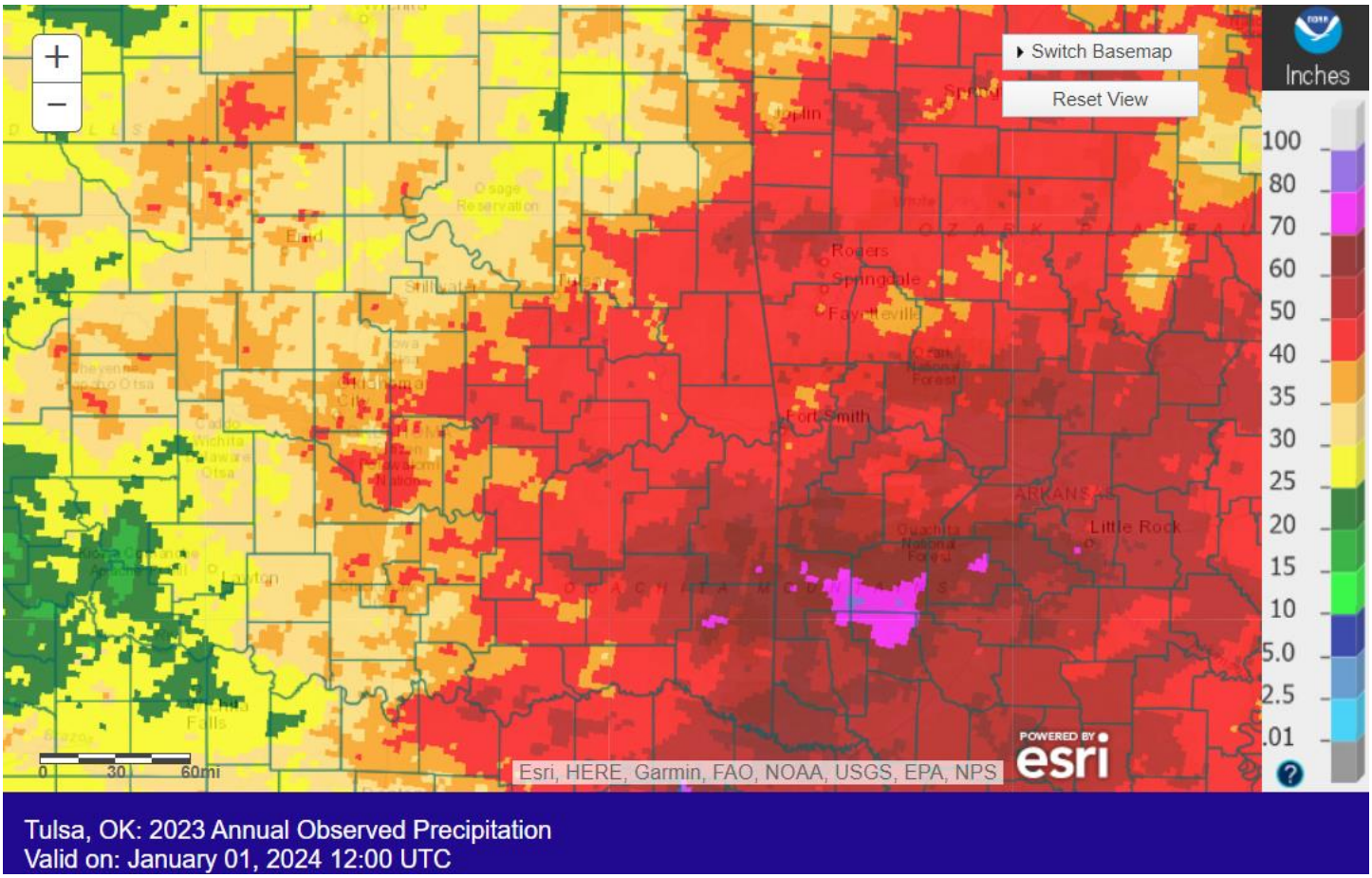


Fig. 2a. Estimated Observed Rainfall for 2023

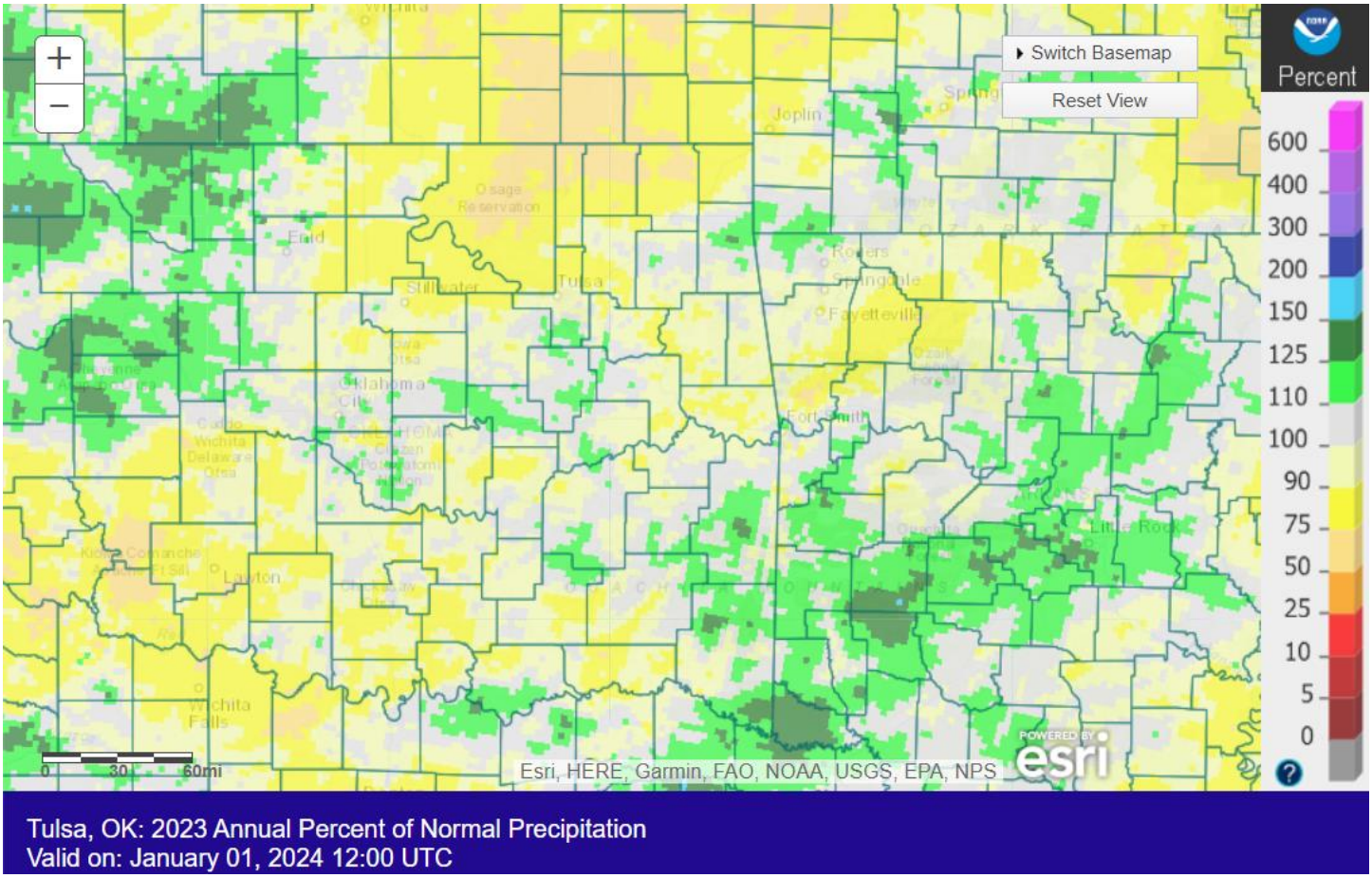


Fig. 2b. Estimated % of Normal Rainfall for 2023

Drought

According to the U.S. Drought Monitor (USDM) from January 2, 2024 (Figs. 3, 4), Severe (D2) Drought conditions exist in portions of Osage, Choctaw, and Pushmataha Counties 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, Rogers, Mayes, Wagoner, Cherokee, Osage, Pawnee, eastern Kay, Pittsburg, Pushmataha, and Choctaw Counties in eastern OK, and Benton, Carroll, Washington, Madison, and Franklin Counties in northwest AR.

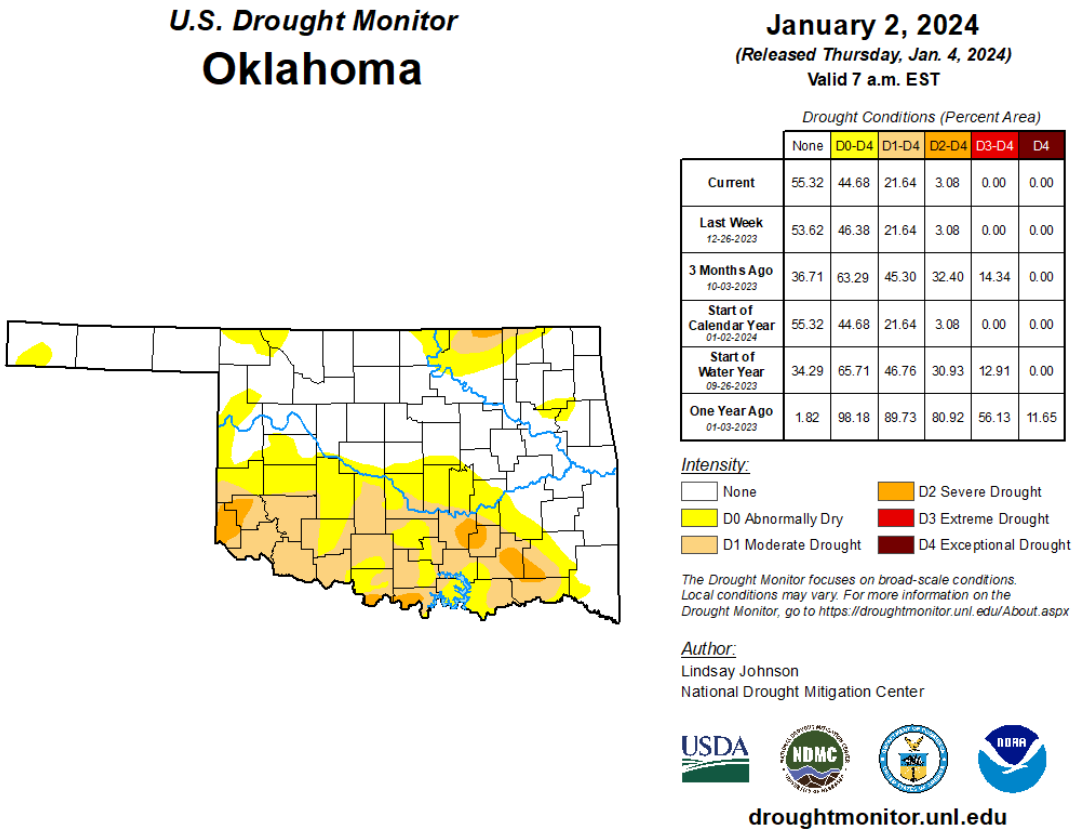


Fig. 3. Drought Monitor for Oklahoma

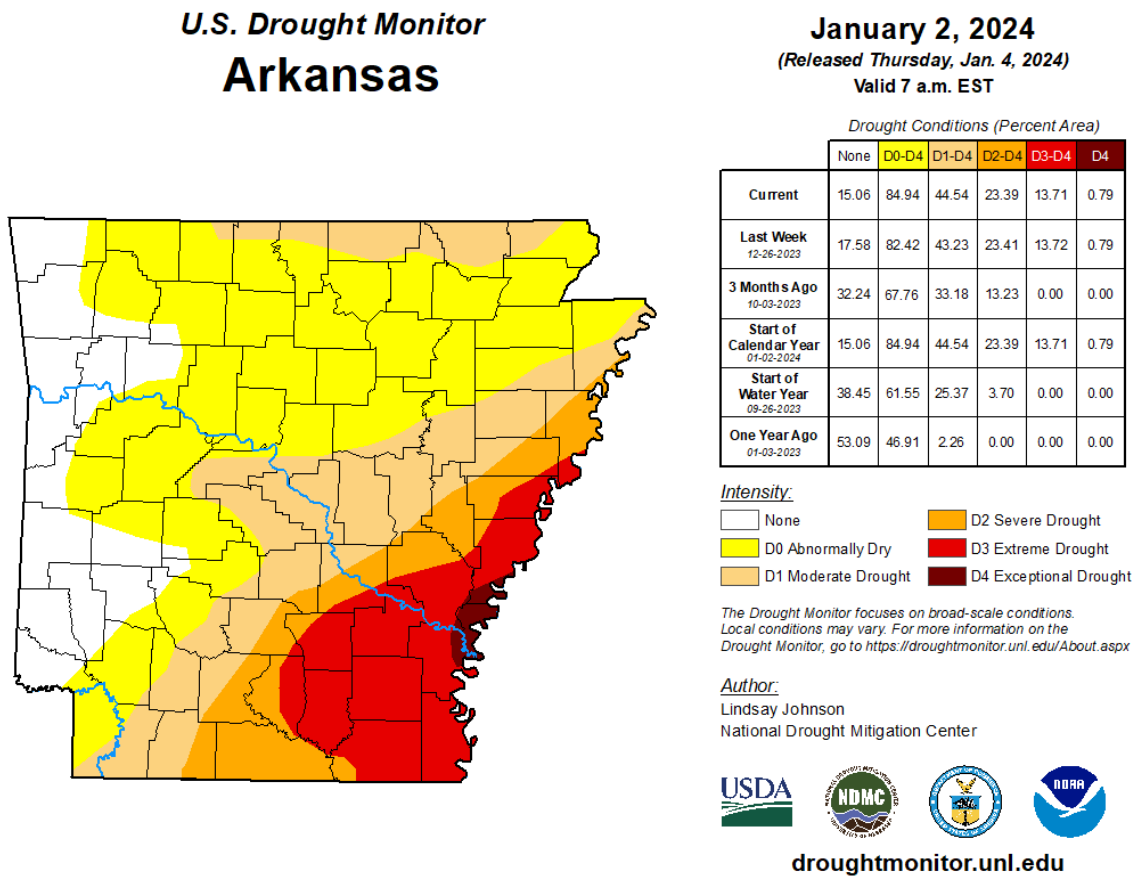


Fig. 4. Drought Monitor for Arkansas

Outlooks

The Climate Prediction Center (CPC) outlook for January 2024 (issued December 31, 2023) indicates an enhanced chance for below normal temperatures northwest of I-44 and an equal chance for above, near, and below normal temperatures elsewhere in eastern OK and northwest AR. This outlook also calls for above median precipitation across all of eastern OK and northwest AR. This outlook was based on dynamical model output, the Madden-Julian Oscillation (MJO), Artic Oscillation (AO), and ENSO. The AO in particular could result in below normal temperatures mid-month.

For the 3-month period January-February-March 2024, CPC is forecasting an enhanced chance for near normal temperatures and an equal chance for above, near, and below median precipitation across eastern OK and northwest AR (outlook issued December 21, 2023). This outlook is based on long-term trends, ENSO state, and incorporates both statistical and dynamical forecast tools. 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 73% chance for a transition to ENSO neutral by late 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

During the afternoon of the 21st, showers moved northeast out of TX and into southeast and east central OK as unseasonable deep moisture was being drawn northward ahead of a passing wave. These showers continued to spread to the northeast across northeast OK and northwest AR through the evening hours. Most of this activity then shift northeast out of the area by mid-morning of the 22nd. Rainfall totals ranged from a few hundredths to around 1.5" (Fig. 5).

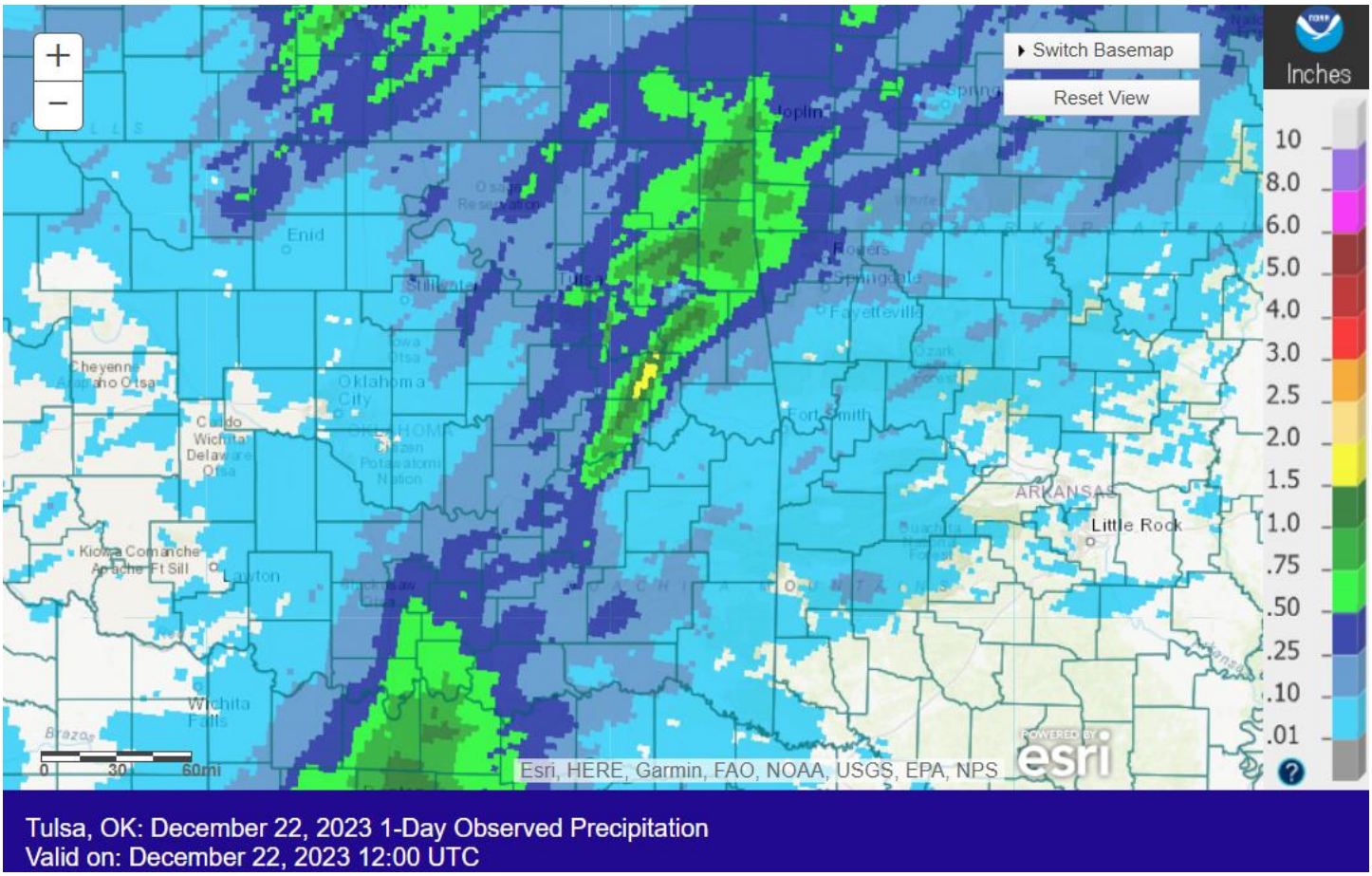


Fig. 5. 24-hour Estimated Observed Rainfall ending at 6am CST 12/22/2023.

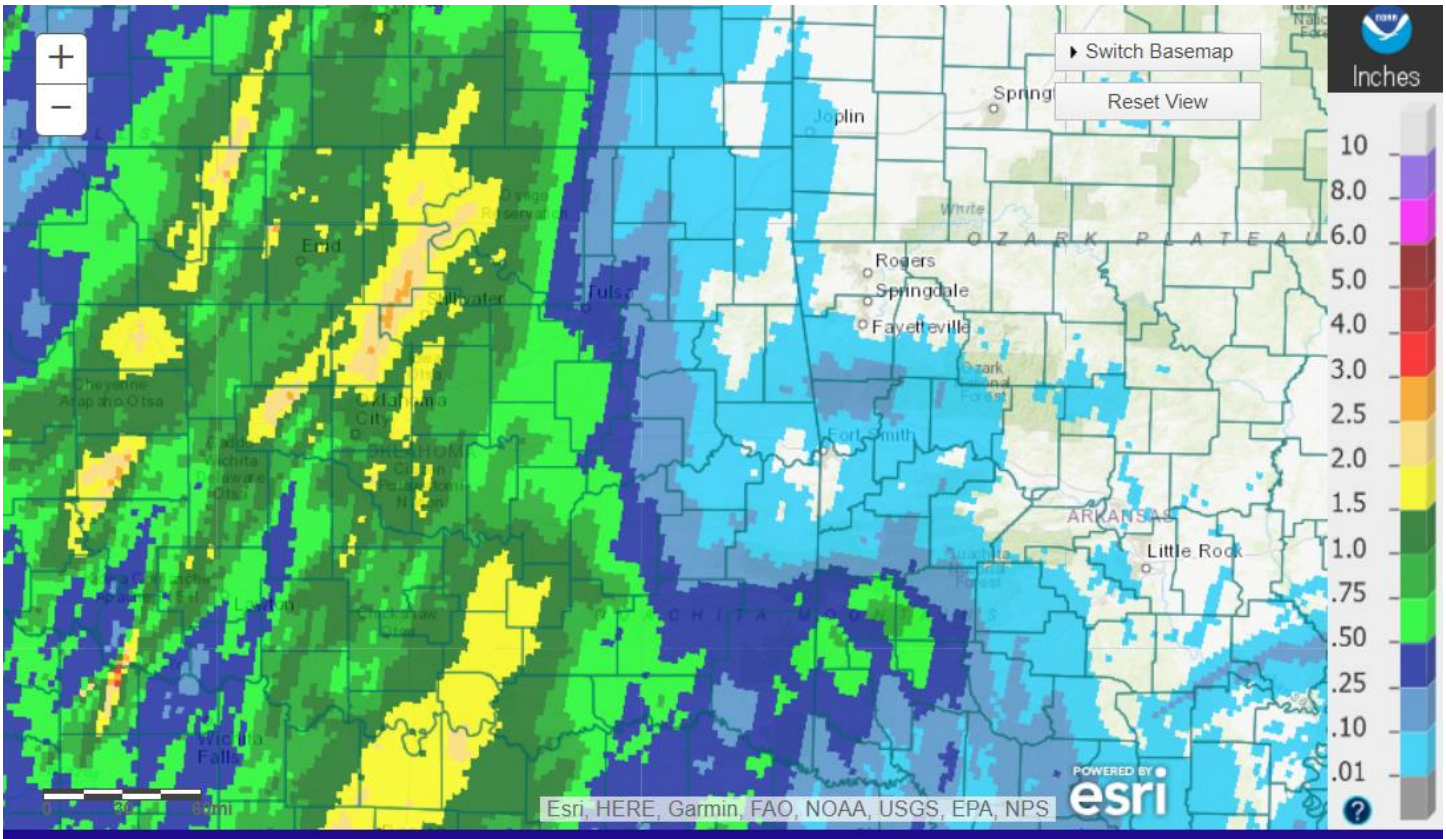


Fig. 6. 24-hour Estimated Observed Rainfall ending at 6am CST 12/24/2023.

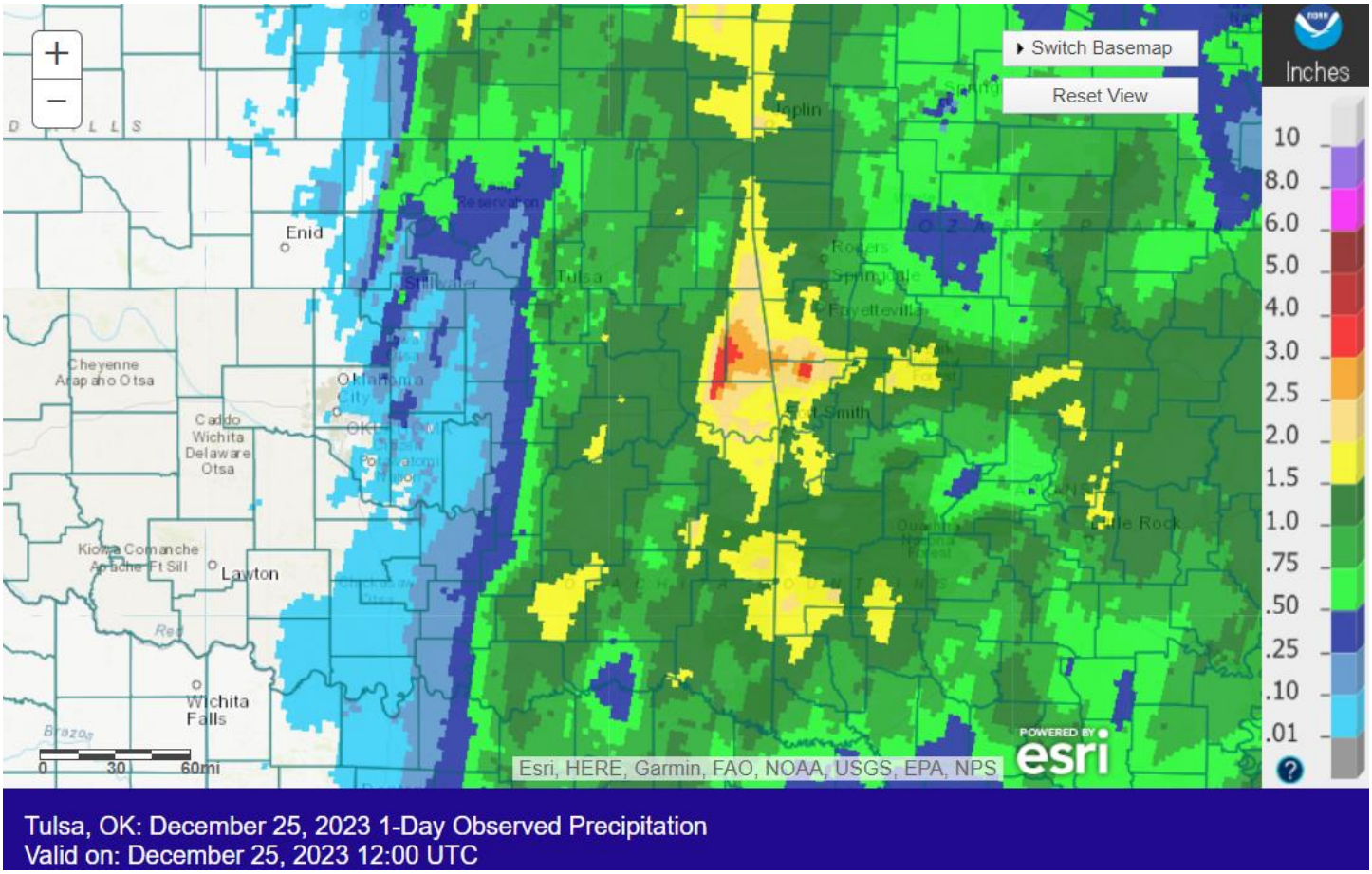


Fig. 7. 24-hour Estimated Observed Rainfall ending at 6am CST 12/25/2023.

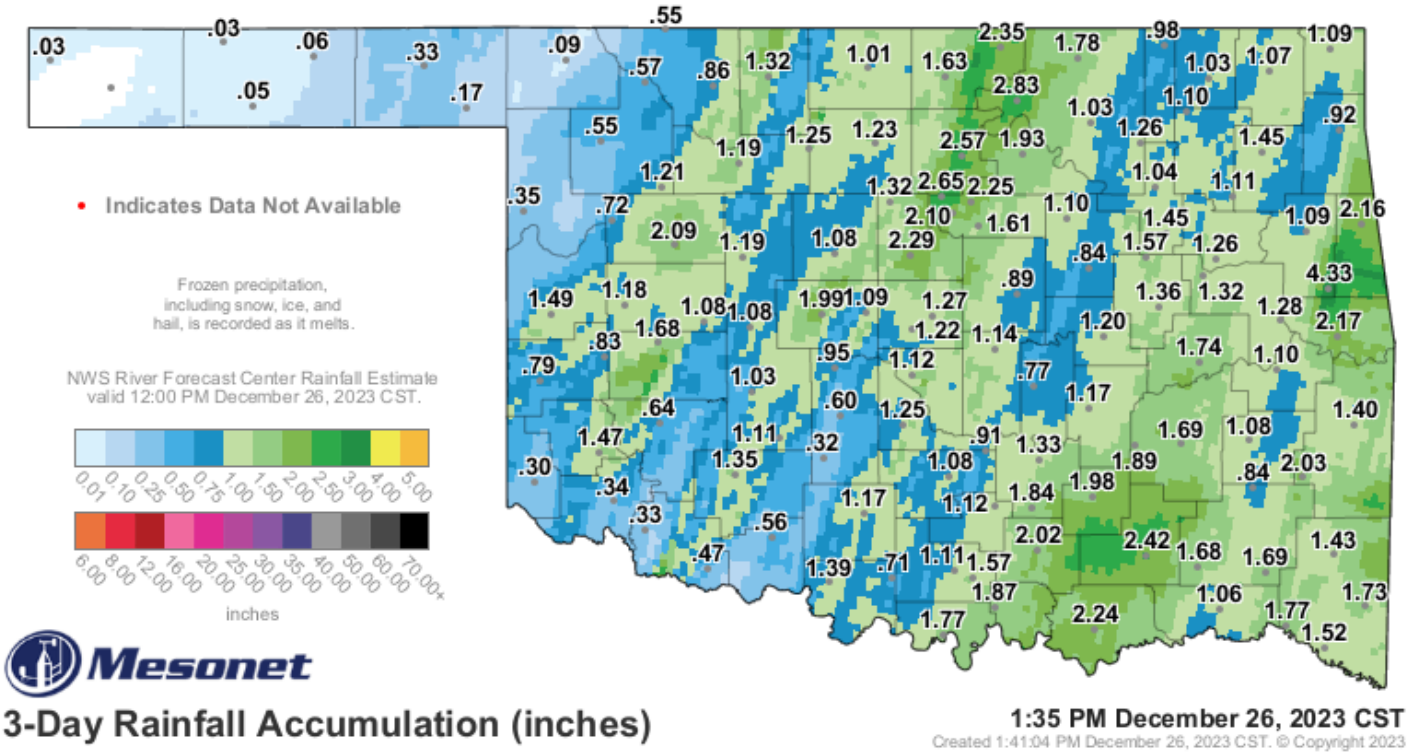


Fig. 8. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 1:35 pm CST 12/26/2023.

An unseasonably moist atmosphere remained in place over the Southern Plains as a strong upper-level trough began to eject out of the desert southwest. Showers and isolated thunderstorms began to move into eastern OK from the west around midnight on the 24th. Widespread precipitation continued to spread eastward through the overnight hours, and continued to impact eastern OK and northwest AR for most of the day. The rain finally began to come to an end from west to east during the late evening hours of the 24th, and exited the region entirely shortly after midnight of the 25th. Rainfall totals ranged from 0.50" to around 4" (Figs. 6-8), with a large portion of the area receiving 1"-2". Far western Osage County, as well as far east central OK and northwest AR, received 2"-4" of rain during this event. However, no river flooding occurred.

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in December 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)
1 Drought Information Statements (DGT)

Preliminary Hydrographs:

None