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 **March** YEAR **2024**
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 **April 15, 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)

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

Minor river flooding occurred this month after not having river flooding at any of the NWS Tulsa river forecast points since March 2023. Temperatures averaged 4°-6°F above normal for March across eastern Oklahoma and northwest Arkansas. Normal precipitation for March ranges from 3.1 inches in Pawnee County to 4.3 inches in Le Flore County. In the Ozark region of northwest Arkansas, the normal precipitation for the month is 4.4 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 March 2024 ranged from around 0.50" to around 8" across eastern OK and northwest AR. These rainfall totals correspond to 90% to 200% of the normal March rainfall from southeast OK into west central AR, and 10% to around 90% of the normal March rainfall elsewhere across eastern OK and northwest AR (Fig. 1b).

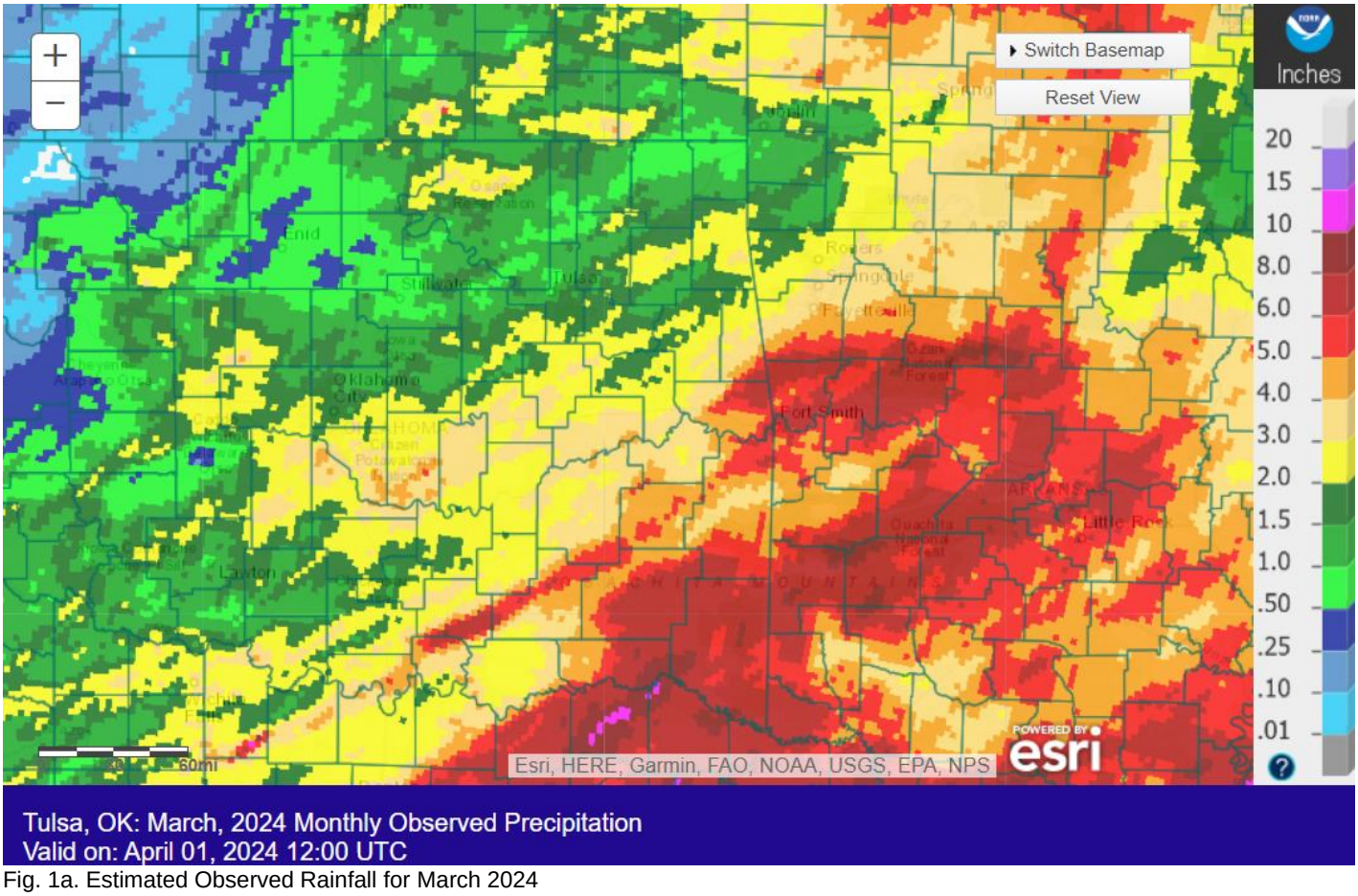


Fig. 1a. Estimated Observed Rainfall for March 2024

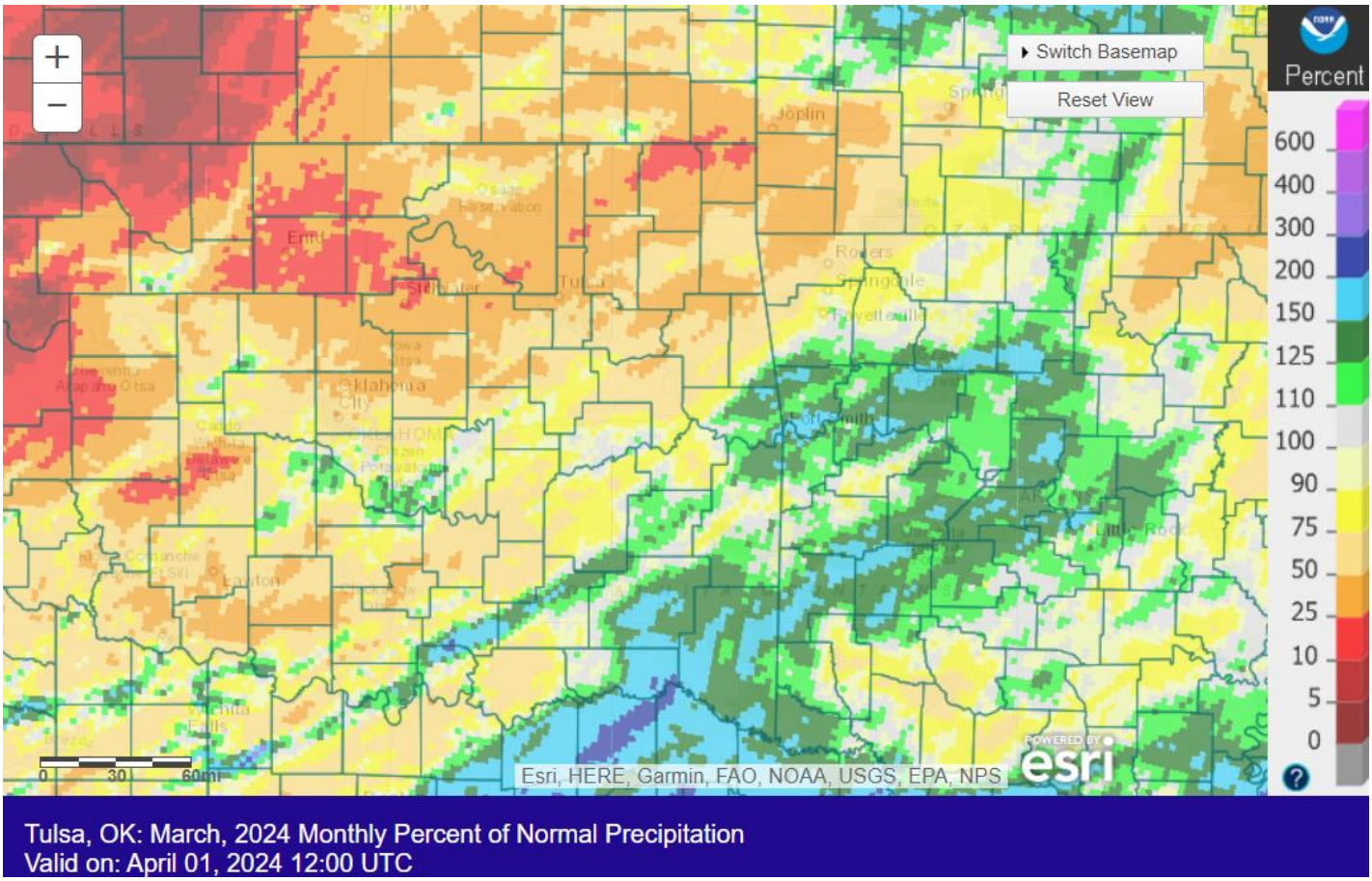


Fig. 1b. Estimated % of Normal Rainfall for March 2024

In Tulsa, OK, March 2024 ranked as the 15th warmest March (56.3°F; since records began in 1905) and the 27th driest March (1.07"; since records began in 1888). Fort Smith, AR had the 13th warmest March (57.9°F; since records began in 1883) and the 16th wettest March (6.04"; since records began in 1883). Fayetteville, AR had the 5th warmest (54.5°F) and the 36th wettest (3.73") March since records began in 1950.

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

Hugo 1.9ENE, OK (coco)	7.72	Cloudy, OK (meso)	6.86	Riverdale 4.2E, AR (coco)	6.44
Mountainburg 2NE, AR (coop)	6.24	Rye Hill 1.1E, AR (coco)	6.16	Ozark, AR (coop)	6.10
Hugo, OK (meso)	6.09	Antlers 6.3SE, OK (coco)	6.04	Fort Smith, AR (ASOS)	6.04

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

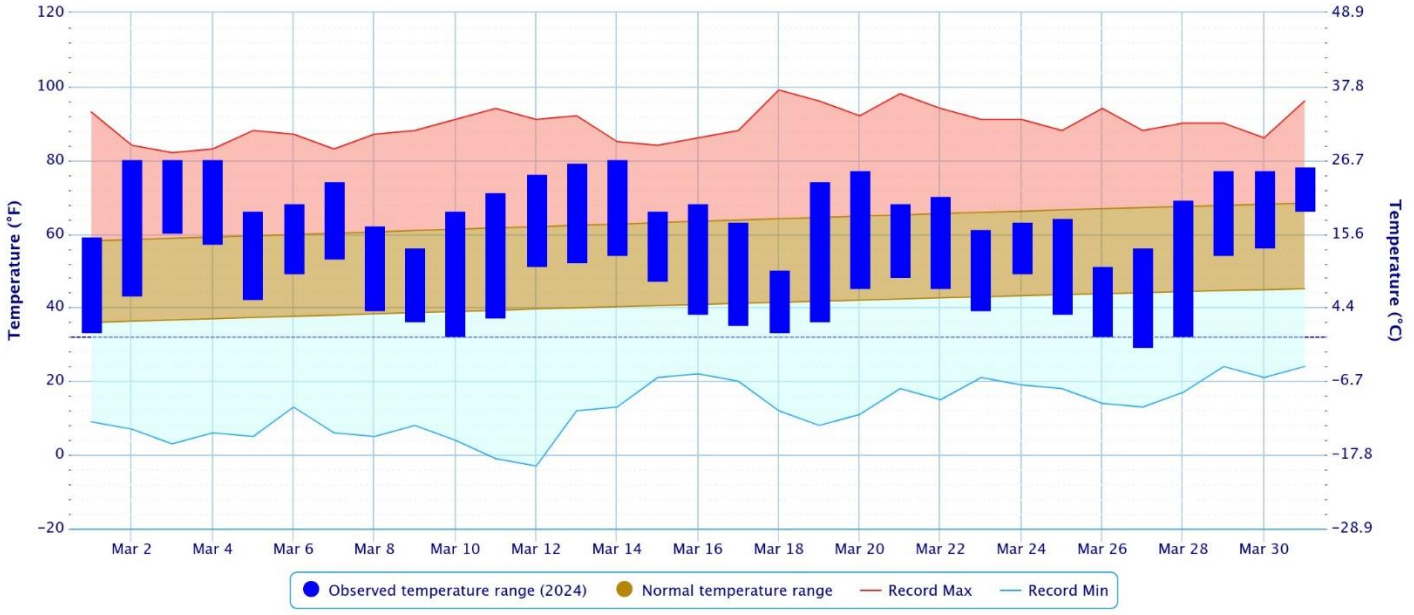
Miami 3.7ENE, OK (coco)	0.81	Miami, OK (meso)	0.85	Terlton 3.7ESE, OK (coco)	0.88
Oilton, OK (meso)	0.93	Talala, OK (meso)	0.97	Skiatook, OK (meso)	0.97
Vinita, OK (meso)	1.02	Tulsa, OK (meso)	1.03	Ralston, OK (coop)	1.05

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

Rank since 1921	March 2024	Last 60 Days (Feb 1 – Mar 31)	Water Year-to-Date (Oct 1, 2023 – Mar 31, 2024)	Year-to-Date (Jan 1 – Mar 31)	Last 120 Days (Dec 3 – Mar 31)	Last 365 Days (Apr 2, 2023 – Mar 31, 2024)
Northeast OK	23rd driest	29th driest	36th driest	39th driest	52nd wettest	28th driest
East Central OK	51st driest	35th driest	50th driest	45th driest	52nd wettest	34th driest
Southeast OK	22nd wettest	50th wettest	48th wettest	38th wettest	50th driest	37th driest
Statewide	33rd driest	30th driest	43rd wettest	48th driest	39th wettest	45th wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

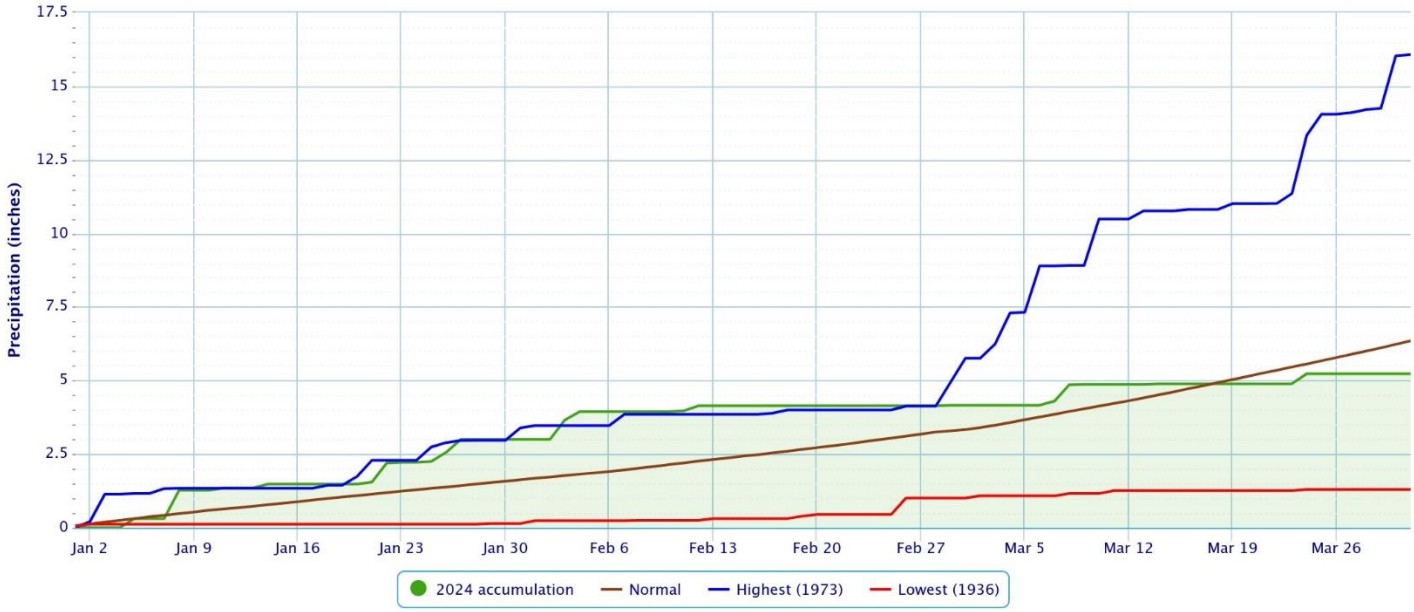
Period of Record – 1905-01-06 to 2024-04-08. Normals period: 1991-2020. Click and drag to zoom chart.



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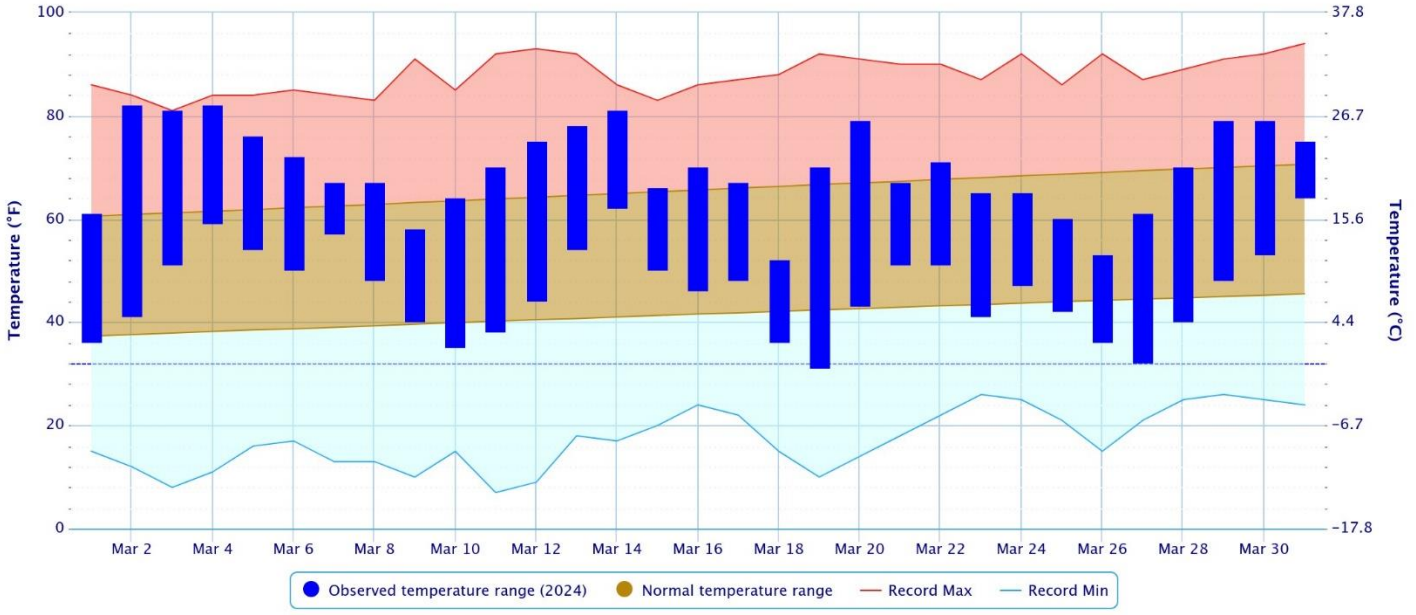
Daily Temperature Data – Fort Smith Area, AR (ThreadEx)

Period of Record – 1882-06-01 to 2024-04-08. Normals period: 1991-2020. Click and drag to zoom chart.



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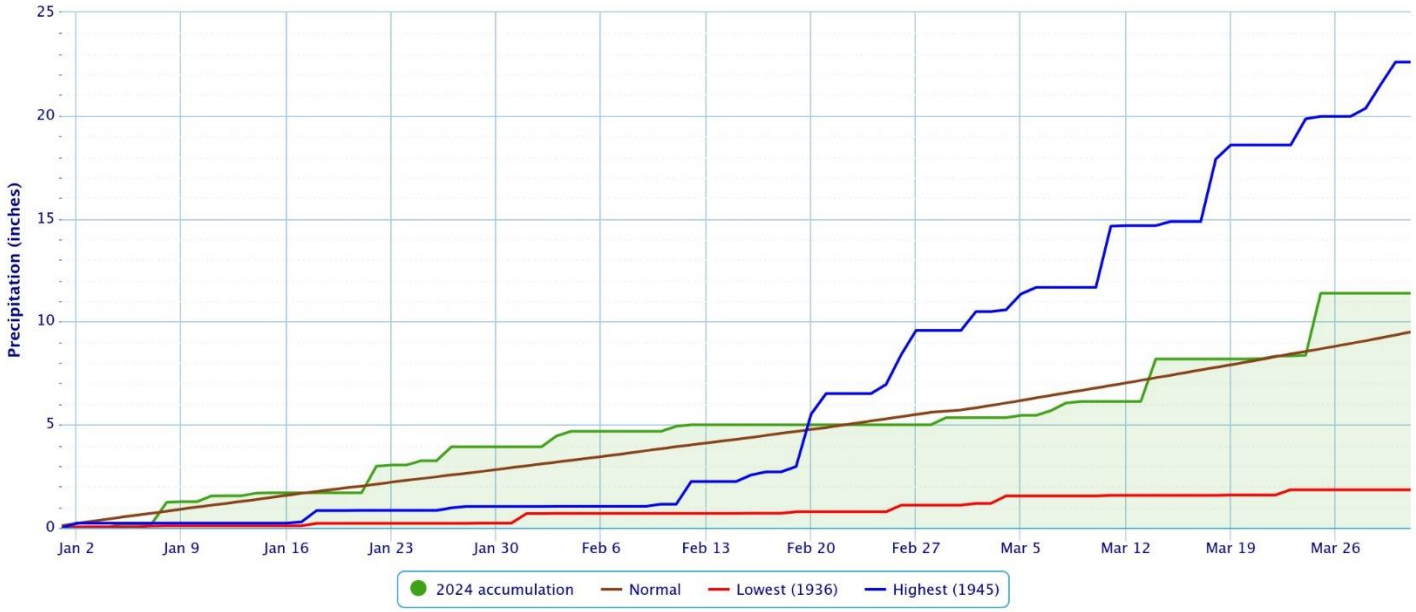
Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

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



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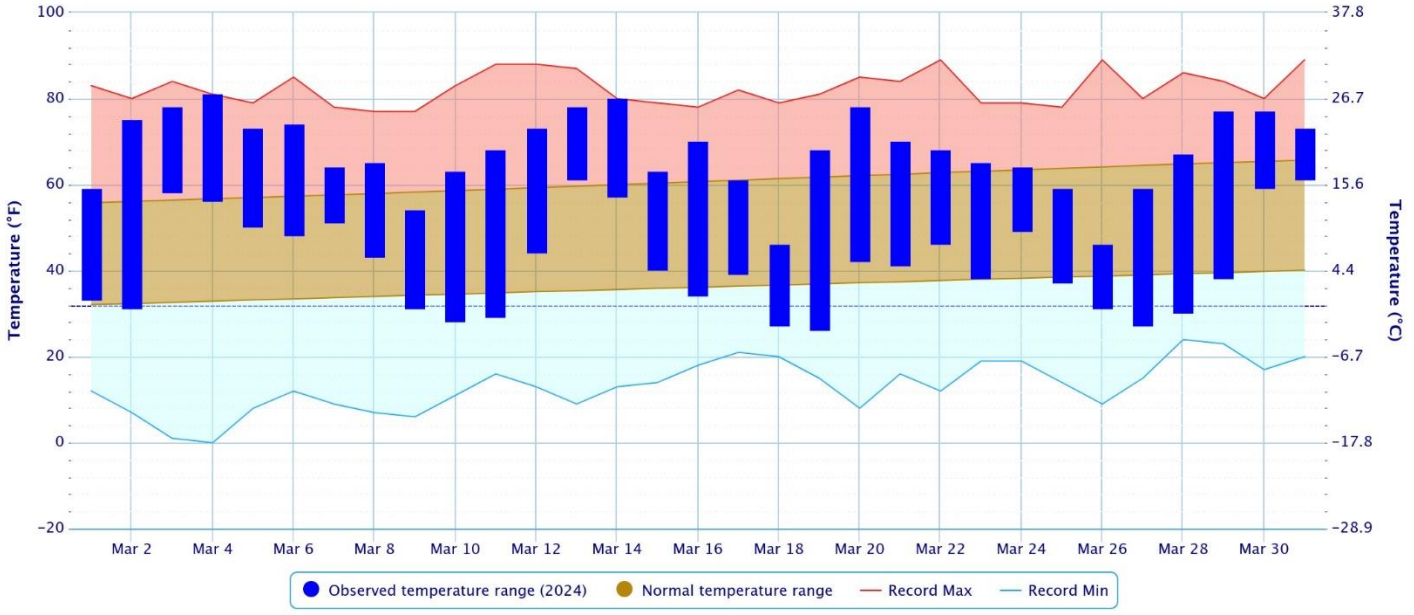
Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

Period of Record – 1949-07-14 to 2024-04-08. Normals period: 1991-2020. Click and drag to zoom chart.



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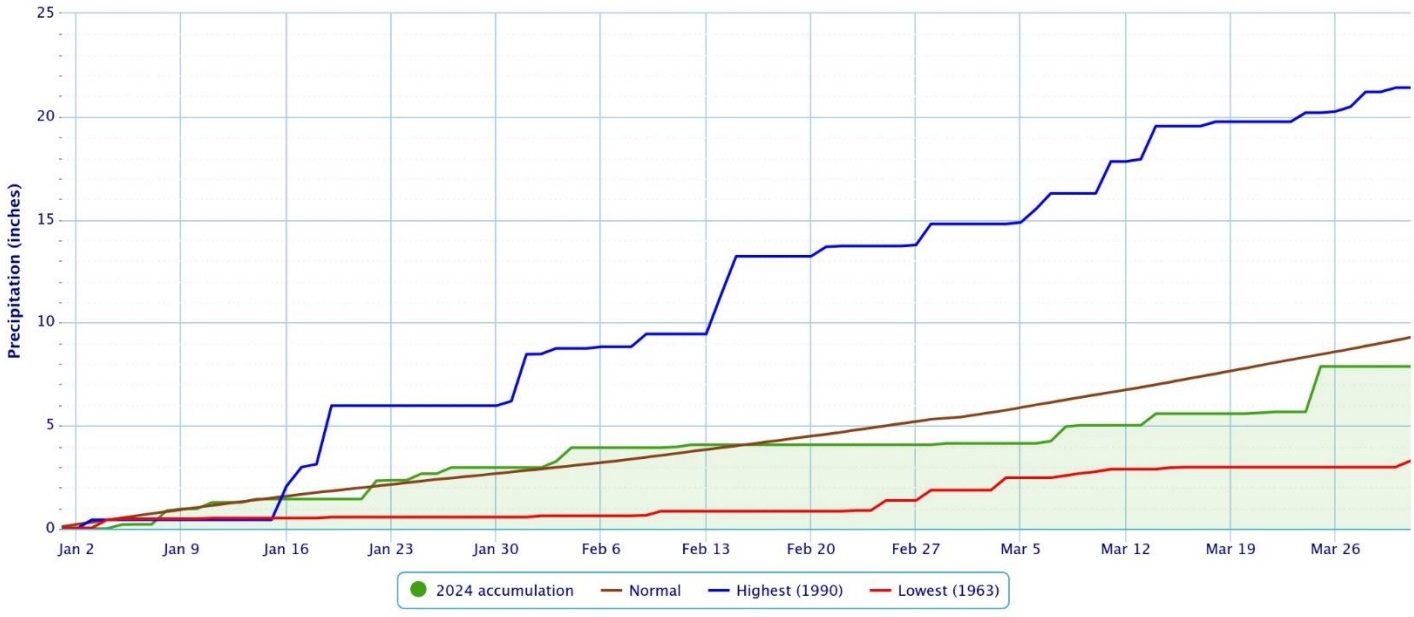
Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

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



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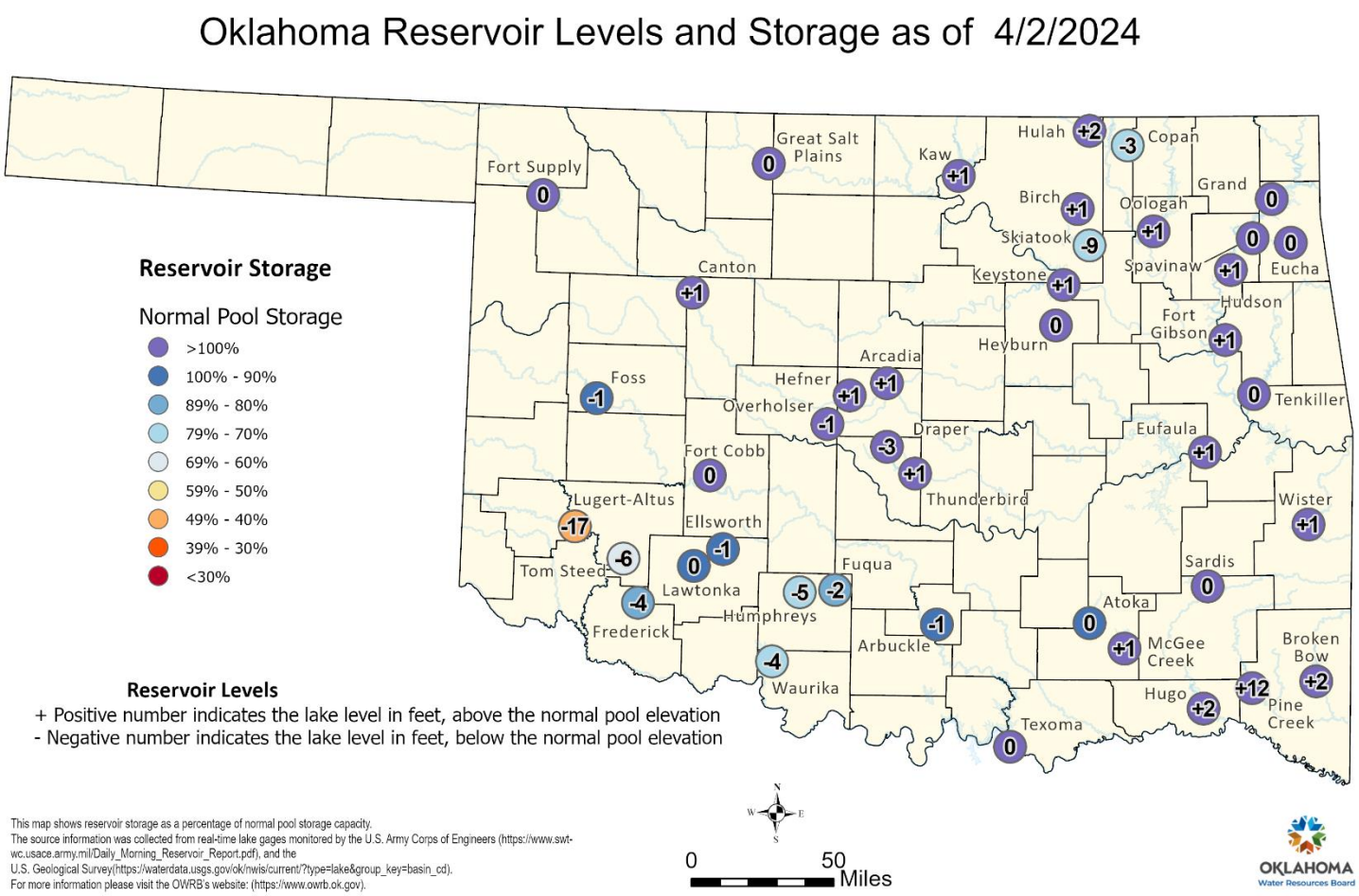
Reservoirs



According to the USACE, a few of the lakes in the HSA were below 3% of top of their conservation pools as of 4/01/2024: Copan Lake 66%, Skiatook Lake 74%, and Beaver Lake 95%. Several lakes were above 3% of the top of their conservation pools: Wister Lake 5%, Sardis Lake 5%, Hugo Lake 5%, Hudson Lake 4%, and Eufaula Lake 4%.

Drought

According to the U.S. Drought Monitor (USDM) from March 26, 2024 (Figs. 2, 3), 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, and Osage Counties in eastern Oklahoma. Abnormally Dry (D0) but not in drought conditions were occurring in Ottawa, Craig, Nowata, Washington, Osage, eastern Kay, Muskogee, Wagoner, Cherokee, Adair, Delaware, Pushmataha, and Choctaw Counties in eastern OK, and Benton and Washington Counties in northwest AR.

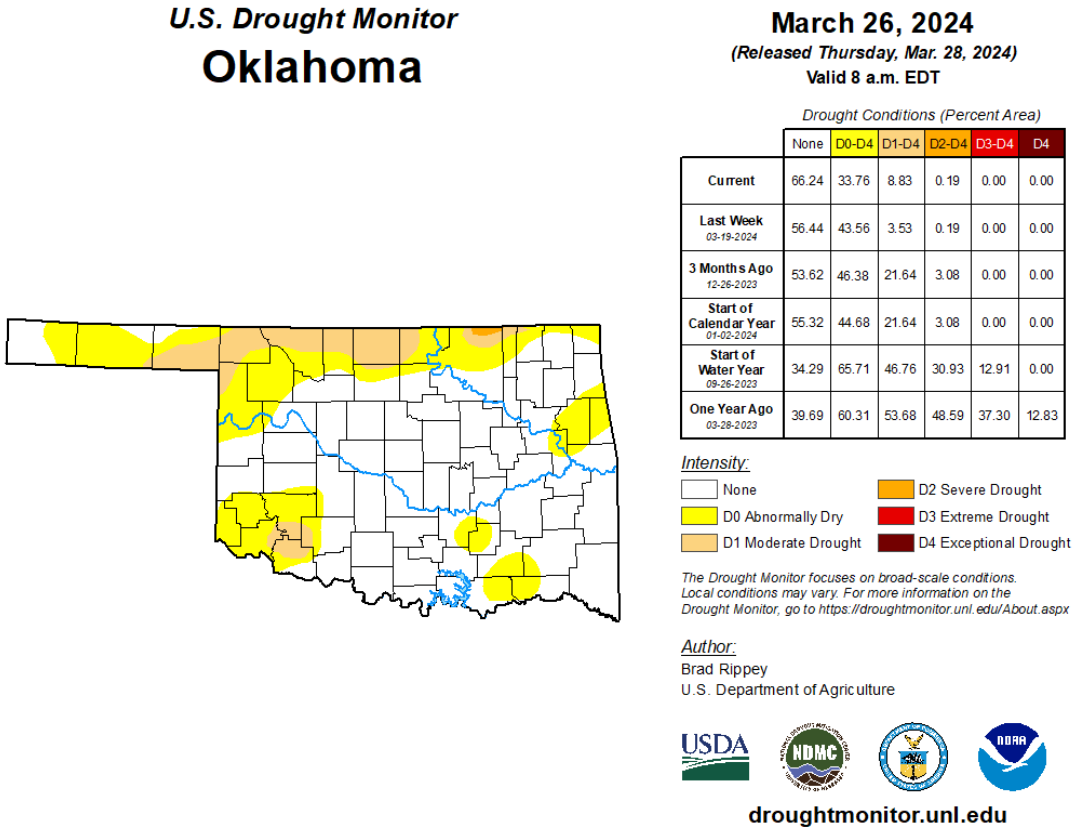


Fig. 2. Drought Monitor for Oklahoma

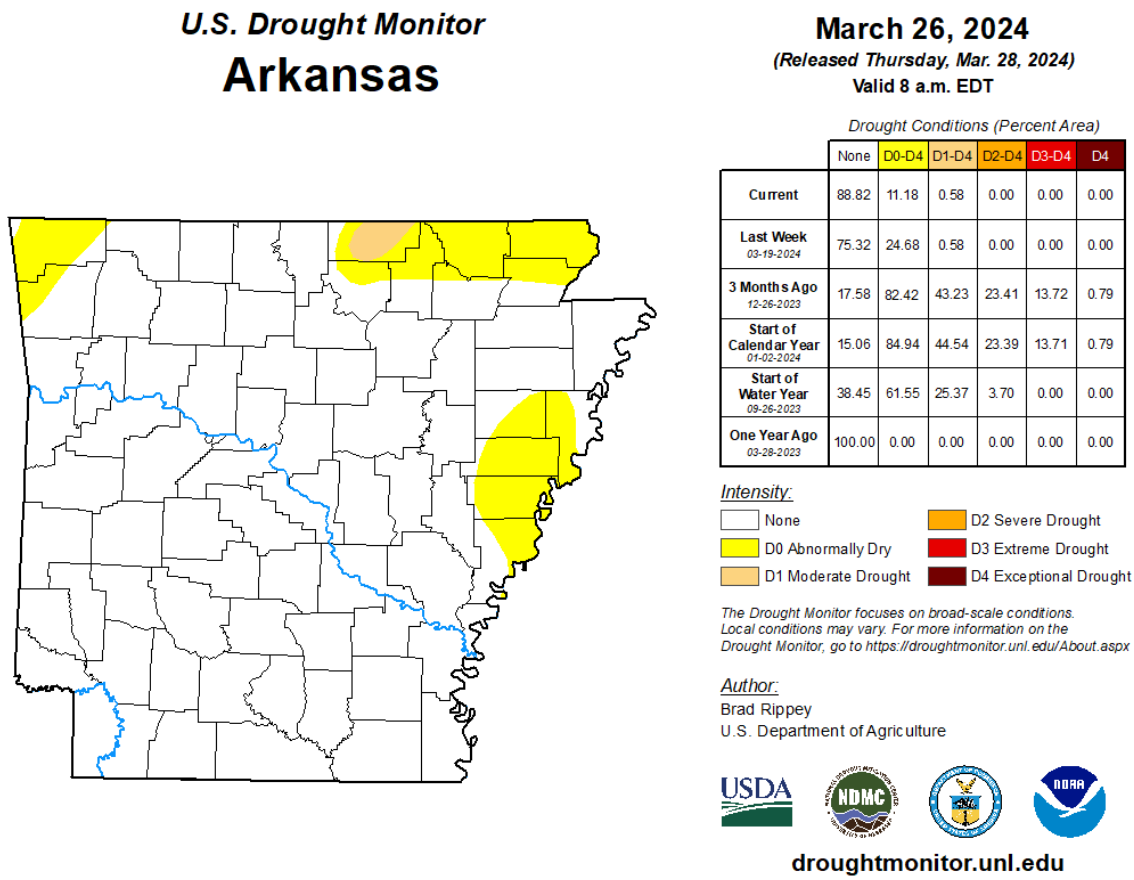


Fig. 3. Drought Monitor for Arkansas

Outlooks

The Climate Prediction Center (CPC) outlook for April 2024 (issued March 31, 2024) 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 April-May-June 2024, CPC is forecasting an enhanced chance for above median precipitation and above below normal temperatures across eastern OK and northwest AR (outlook issued March 21, 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, but rapidly weakening, in the equatorial Pacific Ocean. El Niño will weaken and then transition to ENSO-neutral by the April-June 2024 season (83% chance). There are increasing odds (62% chance) for a return of La Niña conditions this summer. CPC continues the El Niño Advisory and 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

Widespread showers and thunderstorms moved northeast across eastern OK and northwest AR during the morning hours of the 7th as a mid-level wave tracked across the region. After a break from the rain in the afternoon, showers and thunderstorms redeveloped in two different areas during the early evening. To the north, a line of thunderstorms developed near a cold front from central OK into southeast KS. These storms shifted eastward through the evening, affecting northeast OK primarily northwest of I-44, before dissipating by midnight. The second area of storms developed within the low-level jet axis across southern OK and northern TX. This activity continued to spread northward during the evening and overnight hours, bringing rain to eastern OK and northwest AR south of I-44. These storms shifted east of the area by sunrise on the 8th. Rainfall totals ranged from around 0.10" to around 2" across eastern OK and northwest AR (Figs. 4, 5).

Just before noon on the 14th, a line of thunderstorms began to develop over central OK in the vicinity of a dry line and cold front. Additional storms rapidly developed just southeast of I-44 in eastern OK over the next couple of hours, which then moved to the northeast impacting eastern OK and northwest AR. One of these storms produced an EF0 tornado in McIntosh County OK (see https://arcg.is/0eHLf0 for details). By early evening, isolated thunderstorms developed across east central and southeast OK ahead of the cold front. These storms then transitioned into a line of storms during the evening, stretching from south central OK into northwest AR. Flash flooding was reported in Sebastian County AR. This activity moved eastward and exited the region around midnight of the 15th. Severe weather occurred with the various rounds of storms, including 2"-4" diameter hail. Rainfall totals ranged from 0.25" to near 4" southeast of I-44 (Figs. 6, 7).

Scattered showers and thunderstorms developed across eastern OK on the evening of the 21st as an upper-level low moved out of New Mexico and across northern TX, resulting in increased moisture over the area. While much of the activity dissipated around midnight, an area of showers and isolated thunderstorms continued across east central and southeast OK and west central AR through the night until midday on the 22nd. Rainfall totals ranged from a few hundredths of an inch to 2.5" across the affected locations (Fig. 8).

Scattered showers impacted eastern OK during the day on the 24th. Then, during the late evening hours, thunderstorms that had developed to the west moved into eastern OK as a line of storms. This line of showers and thunderstorms continued eastward, entering western AR shortly after midnight of the 25th. The line then slowed considerably, remaining across western AR and southeast OK from the overnight hours through late afternoon of the 25th an upper-level jet moved over the region. Precipitable water (PWAT) values were two standard deviations above normal for this time of year, resulting in heavy rainfall across this area. A narrow band of showers developed across southeast OK into northwest AR near a cold front during the evening hours, but these moved quickly to the southeast and did not produce much rain. Rainfall totals ranged from around 0.10" to near 2.5" (Figs. 9-11). The widespread 1.5"-3" of rain over the Poteau River basin resulted in minor flooding along the lower Poteau River near Panama (see E3 and the preliminary hydrograph at the end of this report).

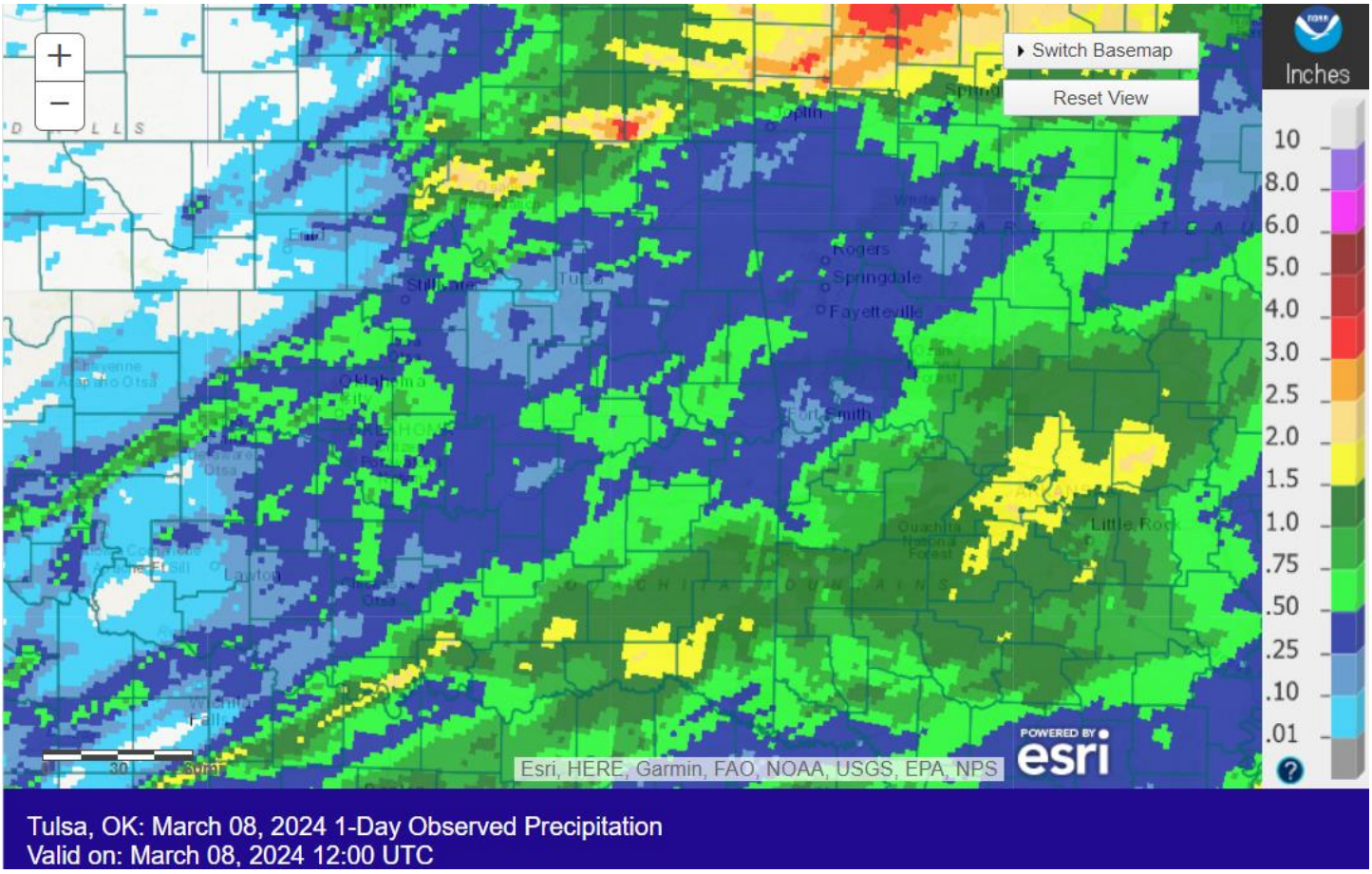


Fig. 4. 24-hour Estimated Observed Rainfall ending at 6am CST 03/08/2024.

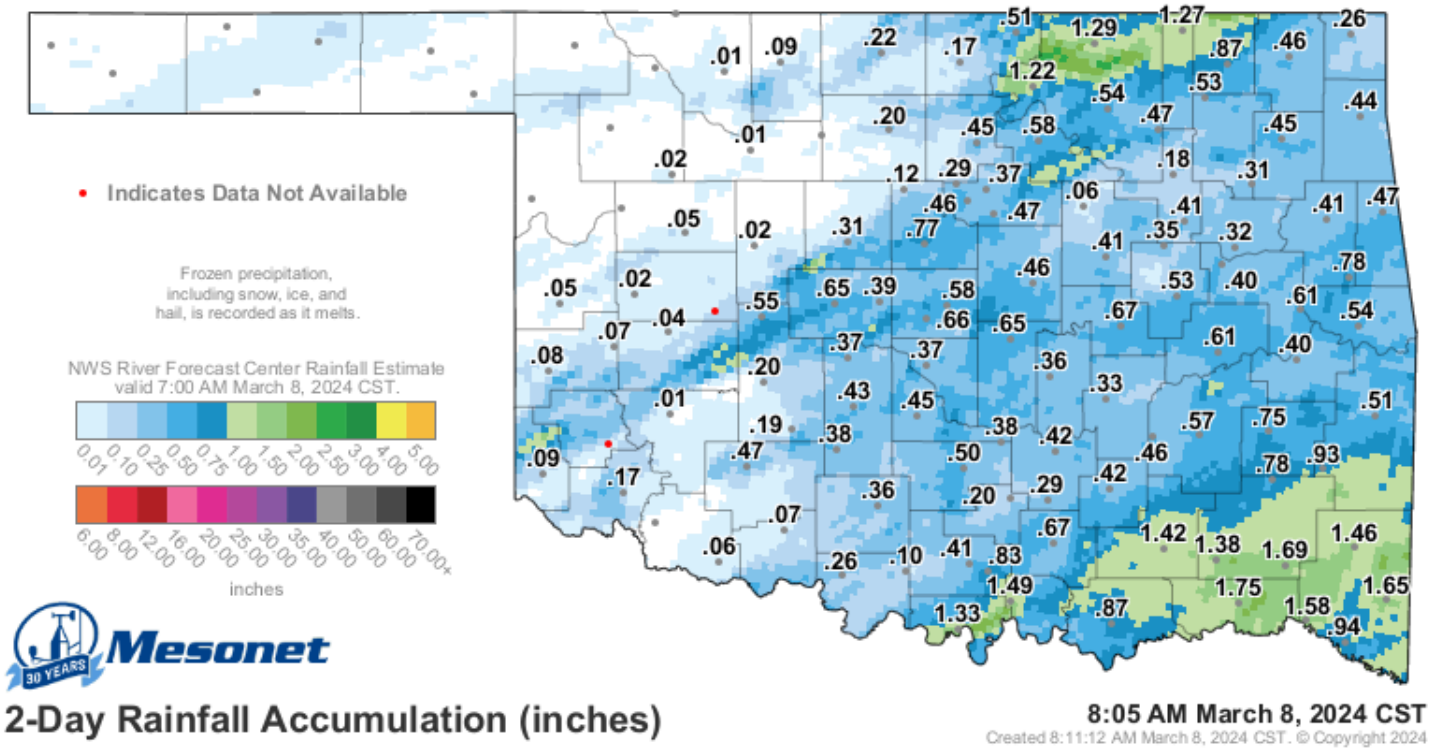


Fig. 5. OK Mesonet (values) and NWS RFC rainfall estimate (image) 48-hour rainfall ending at 8:05 am CST 03/08/2024.

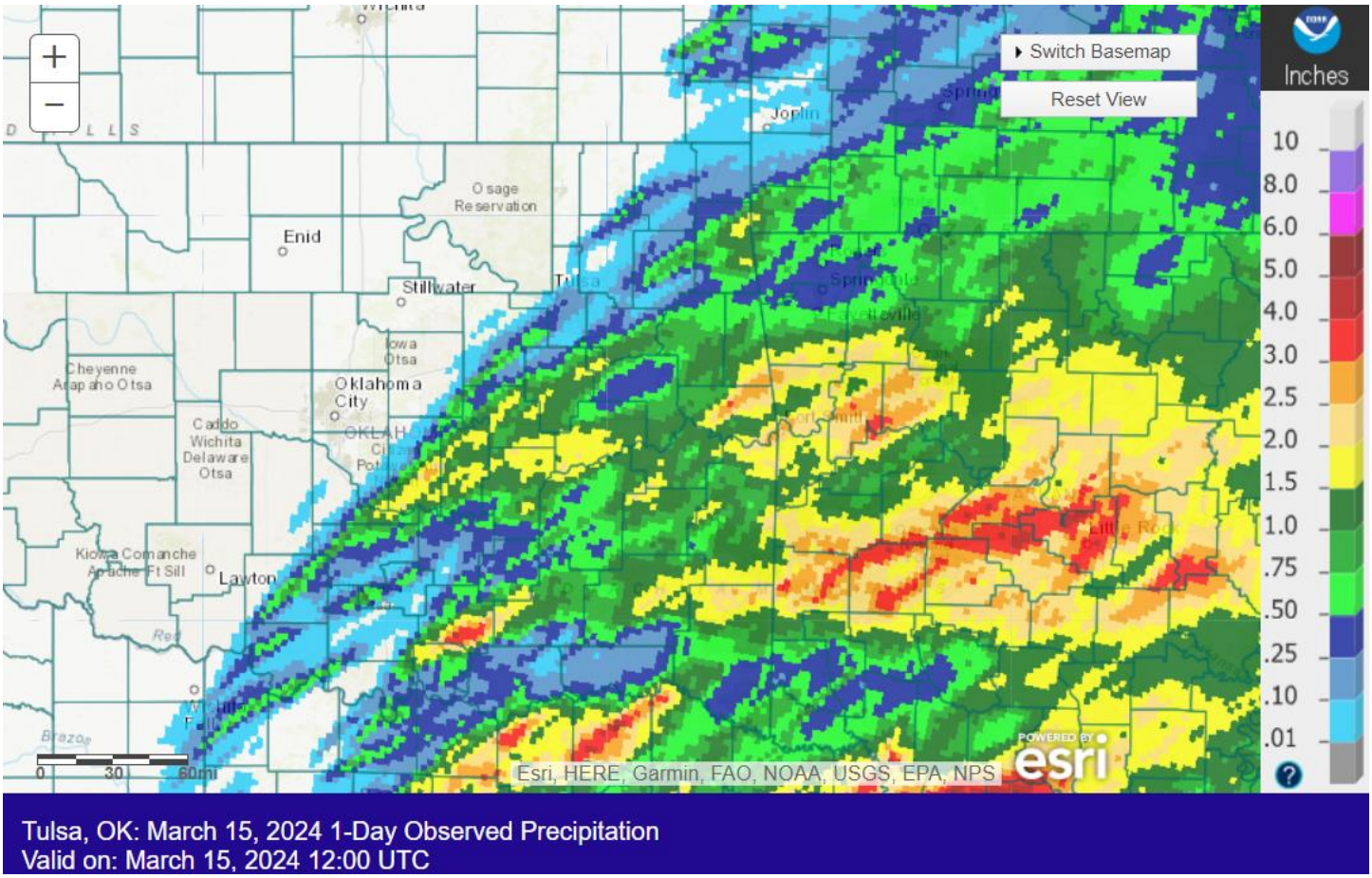


Fig. 6. 24-hour Estimated Observed Rainfall ending at 7am CDT 03/15/2024.

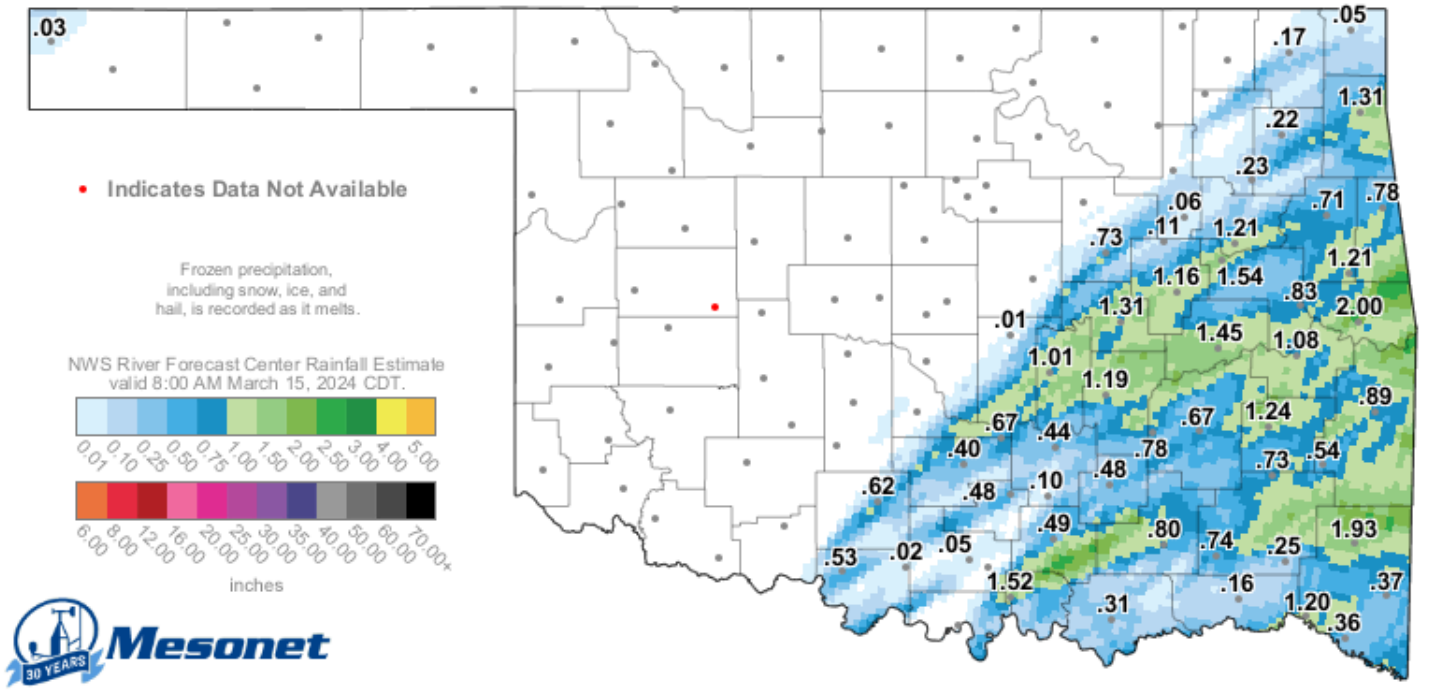


Fig. 7. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 9:00 am CDT 03/15/2024.

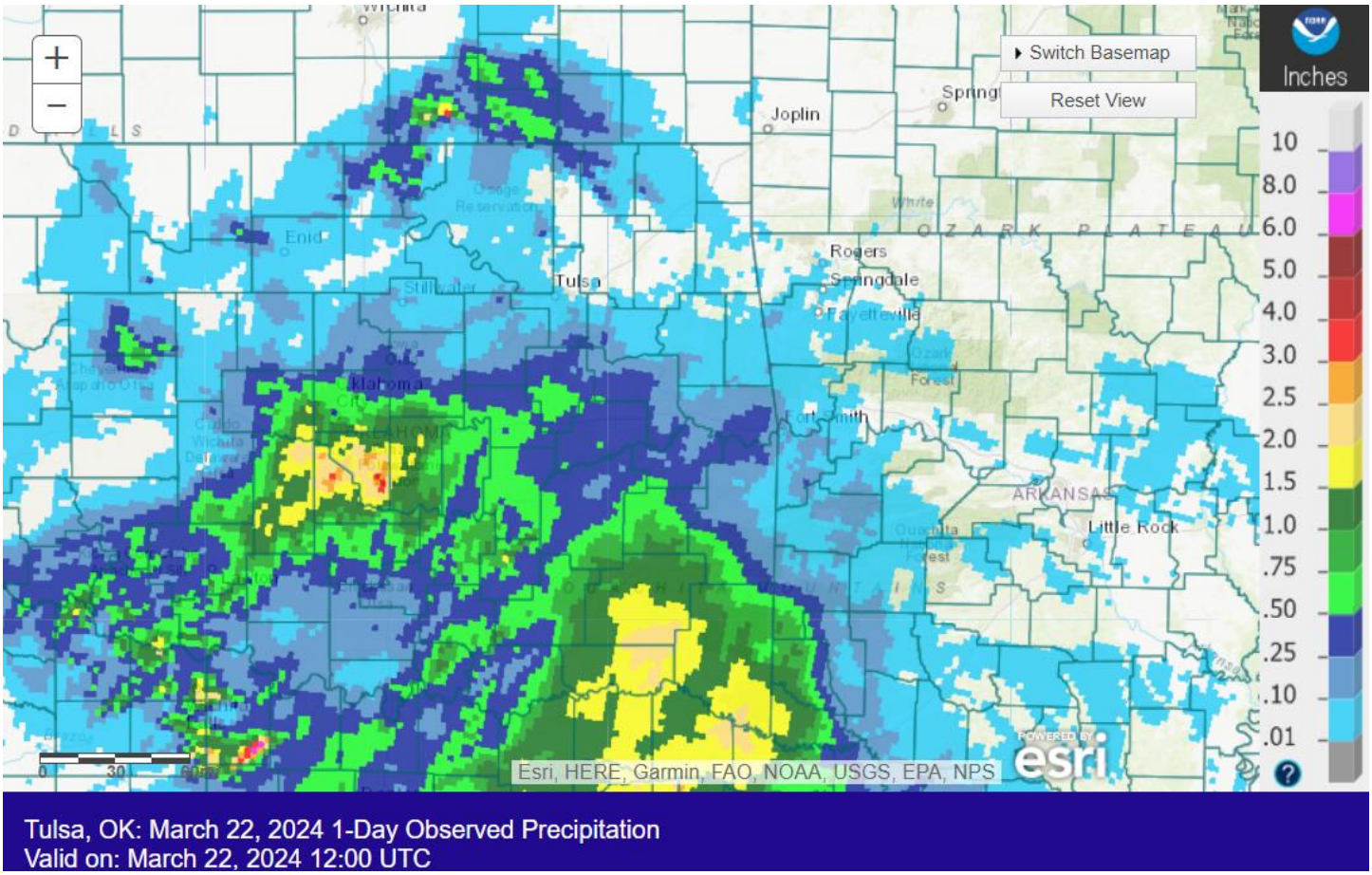


Fig. 8. 24-hour Estimated Observed Rainfall ending at 7am CDT 03/22/2024.

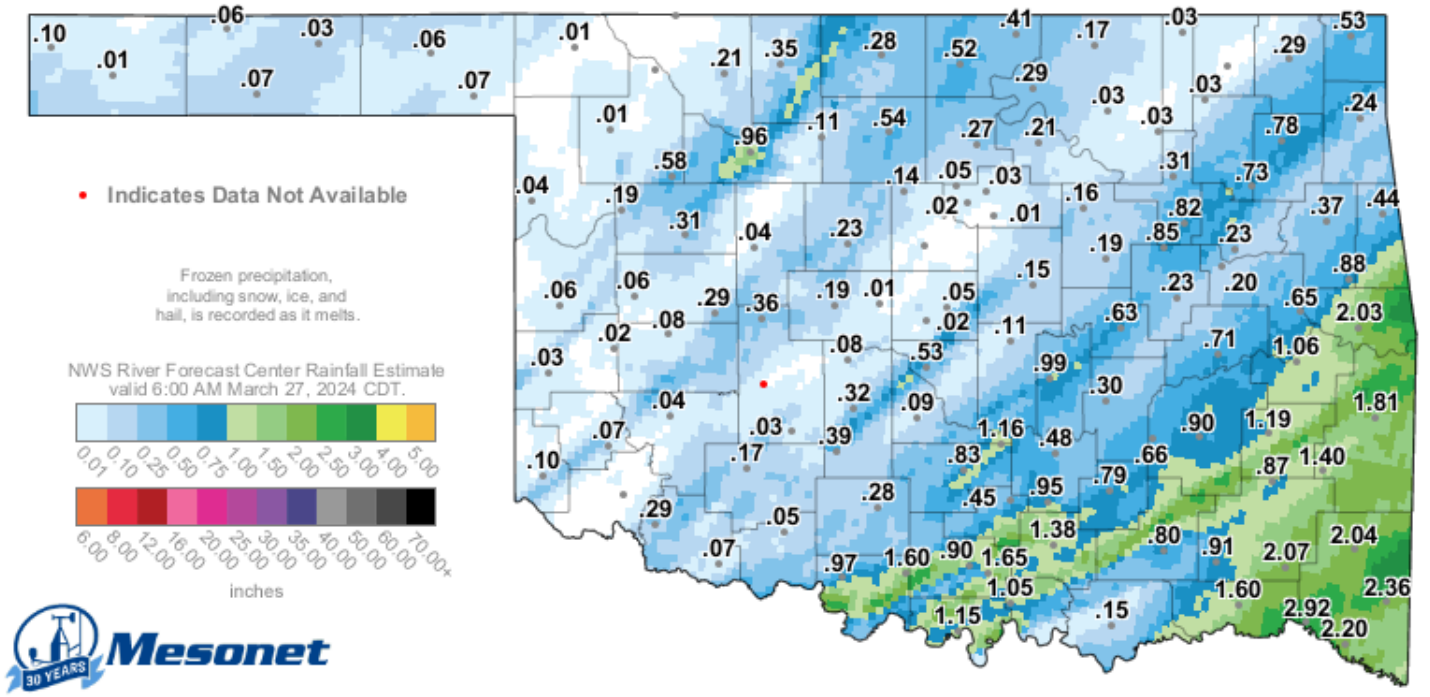


Fig. 9. OK Mesonet (values) and NWS RFC rainfall estimate (image) 3-Day rainfall ending at 7:00 am CDT 03/27/2024.

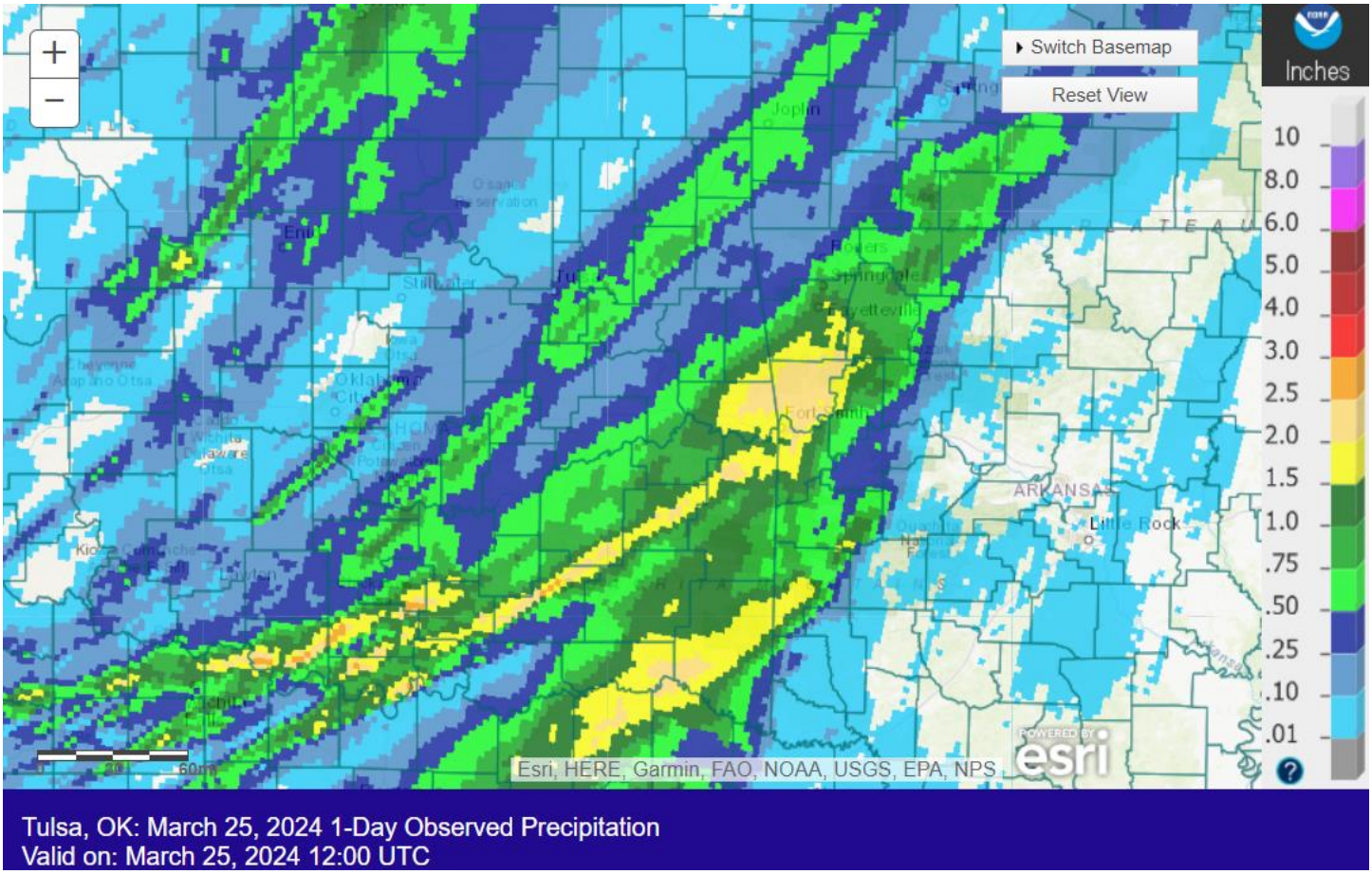


Fig. 10. 24-hour Estimated Observed Rainfall ending at 7am CDT 03/25/2024.

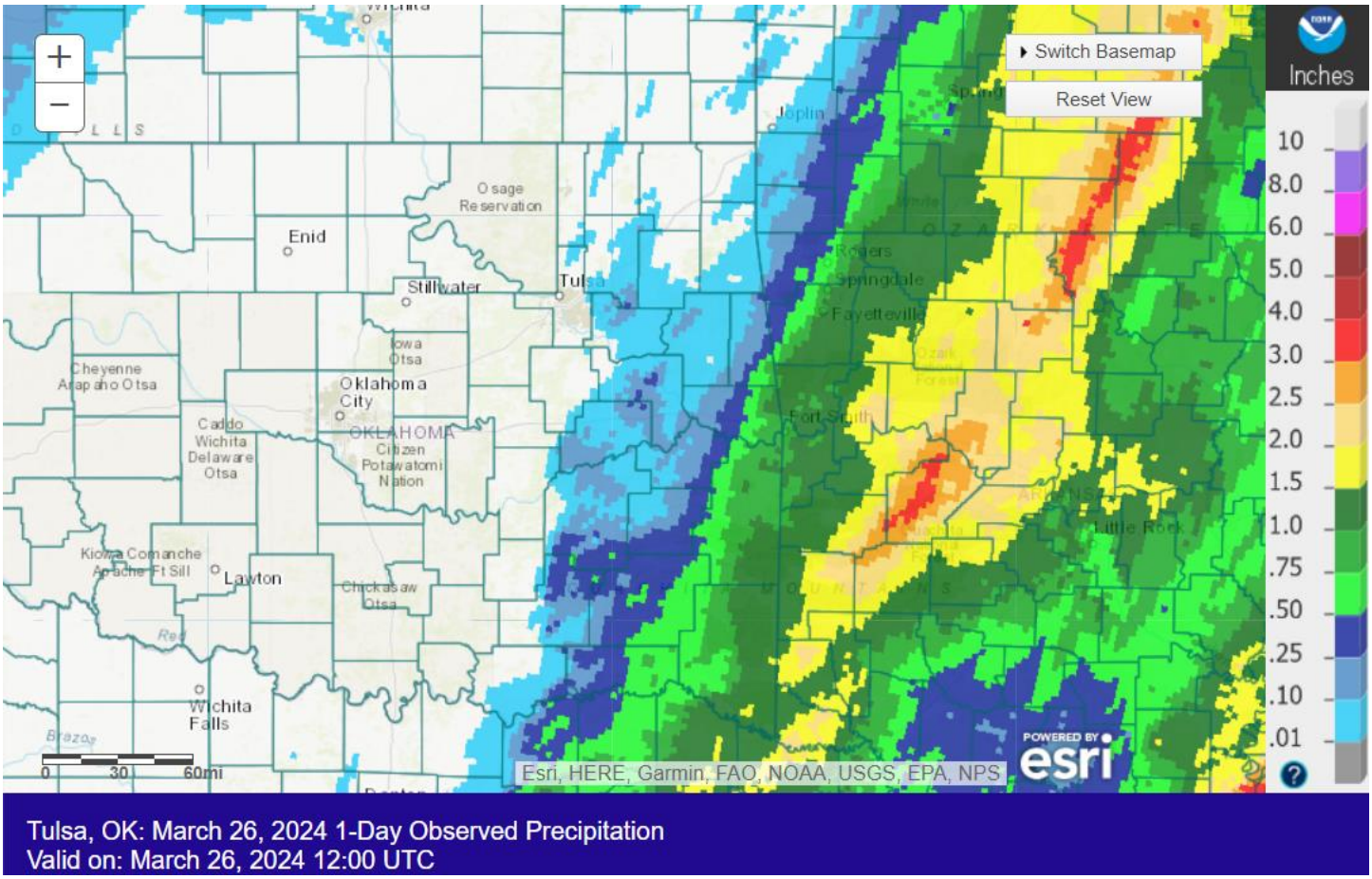


Fig. 11. 24-hour Estimated Observed Rainfall ending at 7am CDT 03/26/2024.

Written by:
Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in March 2024:

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