NWS FORM E-5	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION	HYDROLOGIC SERVICE AREA (HS	A)	
PRES. by NWS Instruct	tion 10-924) NATIONAL WEATHER SERVICE	Tulsa, Oklahoma	(TSA)	
		REPORT FOR:		
MONTHLY	REPORT OF RIVER AND FLOOD CONDITIONS	MONTH	YEAR	
		August	2024	
		SIGNATURE		
TO:	Hydrometeorological Information Center, W/OH2	Steven F. Piltz		
	NOAA / National Weather Service	(Meteorologist-in-Charge)		
	Silver Spring, MD 20910-3283	DATE		
		September 29, 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.

Two storm systems mid-August 2024 brought excessive rainfall to east central OK and west central AR, while other parts of the area received well below normal rainfall for the month. Normal rainfall for August ranges from 2.6 inches in McIntosh County to 3.8 inches in Ottawa County. In the Ozark region of northwest Arkansas, rainfall averages 3.7 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 August 2024 ranged from a few hundredths of an inch to around 15" across eastern OK and northwest AR, with much of the area receiving 2"-5". These rainfall totals correspond to 2% to 400% of the normal August rainfall (Fig. 1b).



Fig. 1a. Estimated Observed Rainfall for August 2024



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

In Tulsa, OK, August 2024 ranked as the 43rd warmest August (83.2°F, tied 1922; since records began in 1905) and the 44th wettest August (3.79", tied 1957, 1904; since records began in 1888). Fort Smith, AR had the 39th warmest August (83.7°F; since records began in 1882) and the 9th wettest August (7.20"; since records began in 1882). Fayetteville, AR had the 15th warmest (79.5°F) and the 12th wettest (5.99") July since records began in 1949.

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

ound of the larger proop	nation rep	in mones for August 2		ucu.	
Bunch 0.8N, OK (coco)		Cookson, OK (meso)	10.56	Muskogee, OK (ASOS)	9.13
Sallisaw 1.0SE, OK (coco)	8.86	Sallisaw 0.3SE, OK (coco)	8.81	Haskell, OK (meso)	8.61
Terlton 3.7ESE, OK (coco)	8.33	Vian 5.3ENE, OK (coco)	7.74	Jennings 3.5NNE, OK (coco)	7.28
Some of the lowest preci	pitation rep	oorts (in inches) for August	2024 inclu	ided:	
Cloudy, OK (meso)	0.73	Hugo, OK (meso)	0.77	Antlers 6.3SE, OK (coco)	0.86
Nowata, OK (meso)	0.88	Antlers, OK (coop)	1.17	Bartlesville, OK (ASOS)	1.21
Foraker, OK (meso)	1.36	Copan, OK (meso)	1.43	Ochelata 5.6N, OK (coco)	1.64

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

Rank since	Last 30	Summer	Warm Growing	Water Year-to-	Year-to-	Last 60	Last 365
1921	Days	2024	Season	Date	Date	Days	Days
	(Aug 2 –	(Jun 1 –	(Mar 1 –	(Oct 1, 2023 –	(Jan 1 –	(Jul 3 –	(Sep 2, 2023
	31, 2024)	Aug 31)	Aug 31)	Aug 31, 2024)	Aug 31)	Aug 31)	– Aug 31,
							2024)
Northeast	47 th	30 th	46 th	46 th	52 nd	41 st	48 th
OK	wettest	driest	driest	driest	driest	driest	driest
East	5 th	26 th	21 st	32 nd	26 th	19 th	35 th
Central OK	wettest						
Southeast	28 th	37 th	39 th	52 nd	45 th	39 th	43 rd
OK	driest	driest	wettest	wettest	wettest	driest	wettest
Oteterride	46 th	40 th	48 th	50 th	52 nd	48 th	46 th
Statewide	wettest	driest	driest	wettest	wettest	wettest	wettest

Summer (June-July-August) Summary

In Tulsa, OK, Summer 2024 ranked as the 27th warmest Summer (82.5°F, tied 1977; since records began in 1905) and the 68th wettest Summer (10.67"; since records began in 1888). Fort Smith, AR had the 13th warmest Summer (83.0°F, tied 1918; since records began in 1882) and the 19th wettest Summer (15.89"; since records began in 1882). Fayetteville, AR had the 8th warmest (79.0°F) and the 22nd wettest (13.86") Summer since records began in 1950.





Daily Temperature Data - Tulsa Area, OK (ThreadEx)

Accumulated Precipitation - Tulsa Area, OK (ThreadEx)

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



Powered by ACIS



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

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



Accumulated Precipitation - Fort Smith Area, AR (ThreadEx)





Period of Record - 1882-06-01 to 2024-09-03. Normals period: 1991-2020. Click and drag to zoom chart.



Daily Temperature Data - FAYETTEVILLE DRAKE FIELD, AR

Daily Temperature Data - FAYETTEVILLE DRAKE FIELD, AR



Period of Record - 1949-07-14 to 2024-09-03. Normals period: 1991-2020. Click and drag to zoom chart.

Accumulated Precipitation - FAYETTEVILLE DRAKE FIELD, AR

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



Reservoirs



According to the USACE, many of the lakes in the HSA were below 3% of top of their conservation pools as of 9/03/2024: Ft. Gibson Lake 69%, Hugo Lake 72%, Wister Lake 75%, Skiatook Lake 76%, Kaw Lake 84%, Beaver Lake 87%, Eufaula Lake 88%, Hulah Lake 90%, Birch Lake 92%, Oologah Lake 94%, Copan Lake 94%, and Sardis Lake 95%. One lake was above 3% of the top of its conservation pool: Hudson Lake 4%.

Drought

According to the U.S. Drought Monitor (USDM) from August 27, 2024 (Figs. 2, 3), Severe (D2) Drought was present in portions of Choctaw and Pushmataha Counties in eastern Oklahoma. Moderate (D1) drought conditions were occurring across portions of eastern Kay County, Osage, Creek, Okfuskee, Washington, Tulsa, Nowata, Rogers, Craig, Mayes, Pushmataha, and Choctaw Counties in eastern Oklahoma. Abnormally Dry (D0) but not in drought conditions were occurring in parts of Osage, Pawnee, Creek, Okmulgee, Okfuskee, Tulsa, Nowata, Craig, Rogers, Mayes, Wagoner, Ottawa, Delaware, Cherokee, Adair, Pittsburg, and Pushmataha Counties in eastern OK and Benton, Washington, Carroll, and Madison Counties in northwest AR.

U.S. Drought Monitor Oklahoma

Valid 8 a.m. EDT Drought Conditions (Percent Area) None D0-D4 D1-D4 D2-D4 D3-D4 D4 Current 25.64 74.36 47.55 17.52 4.56 0.00 Last Week 27.83 72.17 39.66 10.24 0.00 0.00 08-20-2024 3 Months Ago 29.60 70.40 14.68 6.72 0.00 0.00 05-28-2024 Start of 55.32 44.68 21.64 3.08 0.00 Calendar Year 0.00 Start of Water Year 34 29 65 71 46 76 30.93 12 91 0.00 09-26-2023 One Year Ago 41.73 58.27 35.98 19.70 1.97 0.00 08-29-2023

August 27, 2024 (Released Thursday, Aug. 29, 2024)

D0 Abnormally Dry

D2 Severe Drought 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

Intensity: None



Fig. 2. Drought Monitor for Oklahoma

U.S. Drought Monitor Arkansas



August 27, 2024 (Released Thursday, Aug. 29, 2024)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	21.77	78.23	22.85	3.48	0.00	0.00
Last Week 08-20-2024	35.40	64.60	8.77	0.00	0.00	0.00
3 Month s Ago 05-28-2024	86.14	13.86	4.30	0.00	0.00	0.00
Start of Calend ar Year 01-02-2024	15.06	84.94	44.54	23.39	13.71	0.79
Start of Water Year 09-26-2023	38.45	61.55	25.37	3.70	0.00	0.00
One Year Ago 08-29-2023	80.59	19.41	3.21	0.00	0.00	0.00
Intensity: None D2 Severe Drought D0 Abnormally Dry D3 Extreme Drought D1 Moderate 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



droughtmonitor.unl.edu

Fig. 3. Drought Monitor for Arkansas

Outlooks

The <u>Climate Prediction Center</u> (CPC) outlook for September 2024 (issued August 31, 2024) indicates an enhanced chance for above normal temperatures across northeast OK and an equal chance for above, near, and below normal temperatures elsewhere across eastern OK and northwest AR. This outlook also calls for an equal chance for above, near, and below median precipitation across all of eastern OK and northwest AR. This outlook was based on dynamical and statistical model output along with long-term trends. The Madden-Julian Oscillation (MJO) and ENSO did not influence this month's outlook for eastern OK and northwest AR.

For the 3-month period September-October-November 2024, CPC is forecasting an enhanced chance for below median precipitation and an increased chance of above normal temperatures across eastern OK and northwest AR (outlook issued August 15, 2024). This outlook is based on long-term trends, ENSO state, and incorporates suite of statistical and dynamical forecast tools. According to CPC, "ENSO-neutral is expected to continue for the next several months, with La Niña favored to emerge during September-November (66% chance) and persist into the Northern Hemisphere winter 2024-25 (74% chance during November-January)." CPC continues the La Niña Watch.

<u>Summary of Heavy Precipitation Events</u> Daily quality-controlled rainfall maps can be found at: <u>http://water.weather.gov/precip/index.php?location_type=wfo&location_name=tsa</u>

A little after midnight of the 2nd, thunderstorms moved into eastern Kay, Osage, and Pawnee Counties from the northwest. These storms continued to move to the southeast, becoming less intense and more scattered, through the early morning hours. Most of the locations impacted by this activity received less than 1.5" of rain, though a small portion of Osage and Pawnee Counties received 1.5" to around 2.5" of rain (Fig. 4).



Fig. 4. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/02/2024.

During the early morning hours of the 11th, thunderstorms developed from central OK into northeast OK. This activity continued to expand in coverage while spreading to the southeast into east central OK and west central AR. By sunrise on the 11th, these storms had developed into a mesoscale convective system (MCS) and had produced 1" to 5" of rain between Highway 412 and I-40 in northeast and east central OK (Figs. 5, 7). Rainfall rates during this time were 2"-4"/hour in some areas. A small mesoscale convective vortex (MCV) developed over east central OK, and rainfall rates of 2"-3"/hour continued near the MCV through the morning as the complex continued to move east-southeast. The storms then rapidly dissipated through the afternoon hours as the low-level jet weakened and the overrunning flow across the stationary front near the Red River became less favorable. In total, 1"-8" of rain fell across a large potion of eastern OK and northwest AR south of Highway 412, with the highest totals occurring over Muskogee, southern Cherokee, and southern Adair Counties (Fig. 8). Minor flash flooding was reported throughout the city of Muskogee. Then, just before midnight of the 12th, thunderstorms developed across north central and northeast OK, northwest of I-44, as a short-wave trough moved across the region and the low-level jet again increased the flow over the Red River Valley stationary front. These storms expanded to the south and east through the early morning hours, developing into an MCS. Heavier rain persisted west of Highway 75 in northeast and east central OK due to training thunderstorms and precipitable water (PWAT) values of 2" (Fig. 9). Around sunrise of the 12th, the showers and thunderstorms had encompassed a large portion of eastern OK and northwest AR. The 24-hour rainfall totals through 7 am on the 12th ranged from around 0.25" to 7" across most of eastern OK and northwest AR, with the highest corridor of 24-hour rainfall of 3"-7" from Ponca City to Sapulpa, to Fort Smith (Fig. 6). As the MCS continued to move southeast, the rain ended from northwest to southeast through the morning hours, but training persisted across Pittsburg and Latimer Counties resulting in 1.5"-4" of rain after 7 am (Fig C). Rapid dissipation of the MCS occurred during the early afternoon. An additional 0.1" to 4" of rain fell across eastern OK and northwest AR after 7 am (Fig. C).



Fig. 5. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/11/2024.



Fig. 6. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/12/2024.



6-Hour Rainfall Accumulation (inches)

10:05 AM August 11, 2024 CDT Created 10:11:06 AM August 11, 2024 CDT © Conversite 2024

Fig. 7. OK Mesonet (values) and NWS RFC rainfall estimate (image) 6-hour rainfall ending at 10:05 am CDT 08/11/2024.



Today's Rainfall (inches)

9:00 PM August 11, 2024 CDT Created 9:05:53 PM August 11, 2024 CDT. @ Copyright 2024

Fig. 8. OK Mesonet (values) and NWS RFC rainfall estimate (image) since midnight ending at 9:00 pm CDT 08/11/2024.



12-Hour Rainfall Accumulation (inches)

7:50 AM August 12, 2024 CDT Created 7:57:39 AM August 12, 2024 CDT. © Copyright 2024

Fig. 9. OK Mesonet (values) and NWS RFC rainfall estimate (image) 12-hour rainfall ending at 7:50 am CDT 08/12/2024.



Fig. 10. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/13/2024.

A quasi-stationary surface boundary set up near the OK/KS and MO/AR state line on the 16th. Isolated thunderstorms developed near the front over far northeast OK and far northwest AR during the peak heating of the late afternoon. More numerous thunderstorms developed in the vicinity of the front during the evening, congealing into a MCS across northeast OK and northwest AR. This MCS moved swiftly to the souheast, exiting the area around midnight of the 17th. In its wake, scattered showers and thunderstorms redeveloped over far eastern OK and northwest AR, with several small clusters of storms persisting through sunrise. Training of storms and PWAT values of 2" over the area resulted in heavy rainfall across far eastern OK and northwest AR. At 7 am on the 17th, the rainfall total ranged from around 0.25" to 8", with a large area of 1.5"-4" across far northeast OK, far east central OK, and west central AR (Figs. 11, 12). Flash flooding was reported in Vian (Sequoyah County) and in Adair County. Scattered showers and thunderstorms remained through the morning hours across eastern OK and northwest AR, before finally diminishing through the late morning and early afternoon hours. An additional 0.10" to 2" of rain fell after 7 am on the 17th (Fig. 13).

Convection developed over northwest AR and adjacent areas of northeast OK along a front moving southwest out of MO during the evening hours of the 18th. These storms quickly moved southeast, exiting the area a few hours later. The frontal zone remained active, with new showers and thunderstorms developing near the OK/MO/AR border around midnight of the 19th. While individual storm clusters moved south, impacting northwest AR and far eastern OK, new storms continued to fester in the OK/MO/AR border region through the overnight hours. By sunrise, most of the activity had weakened or moved east of the area, though some showers continued over far northwest AR for the remainder of the morning. Rainfall totals were around 0.25" to 2" along the OK/AR state line and east into western AR (Fig. 14).

A small cluster of showers and thunderstorms moved southeast out of KS and into Osage County during the morning of the 22nd. Some training occurred over Osage County before the storms shifted east and weakened by noon. A narrow swath of around 0.5" to 2" of rain fell from northwest to southeast across the county (Fig. 16).



Fig. 11. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/17/2024.



12-Hour Rainfall Accumulation (inches)

6:30 AM August 17, 2024 CDT Created 6:37:39 AM August 17, 2024 CDT. © Copyright 2024

Fig. 12. OK Mesonet (values) and NWS RFC rainfall estimate (image) 12-hour rainfall ending at 6:30 am CDT 08/17/2024.



Fig. 13. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/18/2024.



Fig. 14. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/19/2024.



4-Day Rainfall Accumulation (inches)

7:45 AM August 19, 2024 CDT Created 7:52:42 AM August 19, 2024 CDT. © Copyright 2024

Fig. 15. OK Mesonet (values) and NWS RFC rainfall estimate (image) 4-day rainfall ending at 7:45 am CDT 08/19/2024.



Fig. 16. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/23/2024.



Fig. 17. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/31/2024.



Fig. 18. 24-hour Estimated Observed Rainfall ending at 7am CDT 9/01/2024.

Widely scattered showers and thunderstorms were around eastern OK and northwest AR during the morning hours of the 30th, but during the afternoon, organized convection developed along the I-44 corridor near a stalled cold front. Additional scattered storms developed south of the front. By late evening, most of the convection had dissipated with the loss of daytime heating; however, isoalted activity lingered through the overnight hours. PWATS around 2" allowed for some localized higher rainfall totals, though the scattered nature of the convection precluded widespread heavy rainfall. Rainfall totals ranged from a few hundredths of an inch to around 2.5" (Fig. 17). New convection developed around noon on the 31st along and south of the weak front, affecting locations in northeast OK and northwest AR along and southeast of I-44 through the afternoon and early evening hours. These storms once again dissipated by midnight with the loss of daytime heating. Similar rainfall totals of a few hundredths to near 3" were observed on the 31st (Fig. 18).

Written by:

Nicole McGavock Service Hydrologist WFO Tulsa

Products issued in August 2024:

- 12 Flash Flood Warnings (FFW)
- 8 Flash Flood Statements (FFS)
- 0 Flash/Areal Flood Watches (FFA) (0 Watch FFA CON/EXT/EXA/EXB/CAN)
- 30 Urban and Small Stream Advisories (FLS)
- 6 Areal Flood Warnings (FLW)
- 6 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: None