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 **February** 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 **March 10, 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.**

For the first time since June 2022, there was river flooding in the NWS Tulsa HSA in February 2023. Both temperatures and precipitation were above normal for most of the area, though the affects of longer-term drought persisted. Normal precipitation across the HSA in February ranges from 1.8 inches in Osage County to 3.2 inches in Choctaw County. In the Ozark region of northwest AR, 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.

Monthly Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for February 2023 ranged from 0.5" to 8" across eastern OK and northwest AR, with much of the area receiving 2"-5". These rainfall totals correspond to around 50% to 300% of the normal February rainfall (Fig. 1b). Most of the area was near or above normal this month, though much of Osage, Pawnee, eastern Kay, and Madison Counties received below normal precipitation.

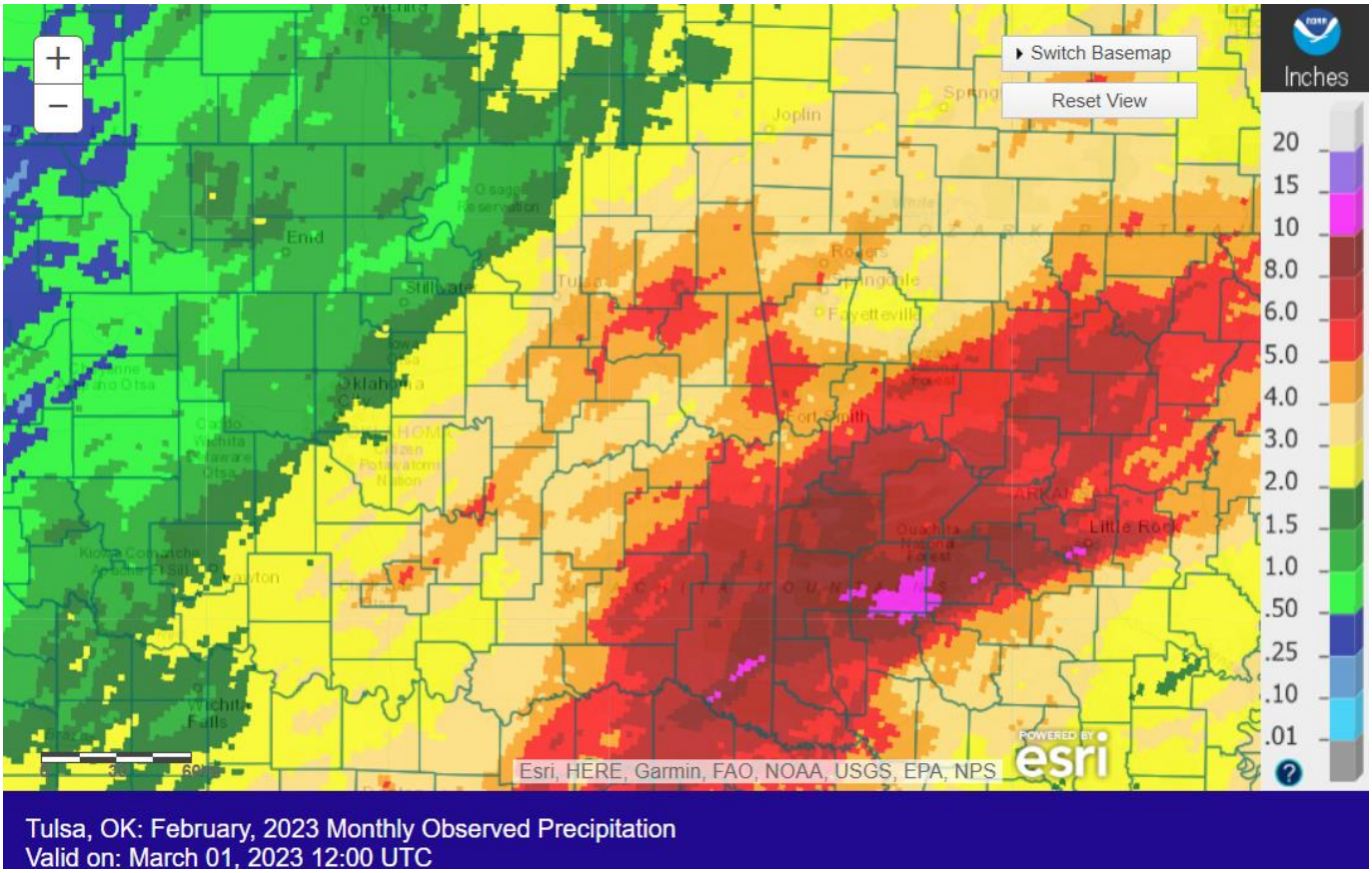


Fig. 1a. Estimated Observed Rainfall for February 2023

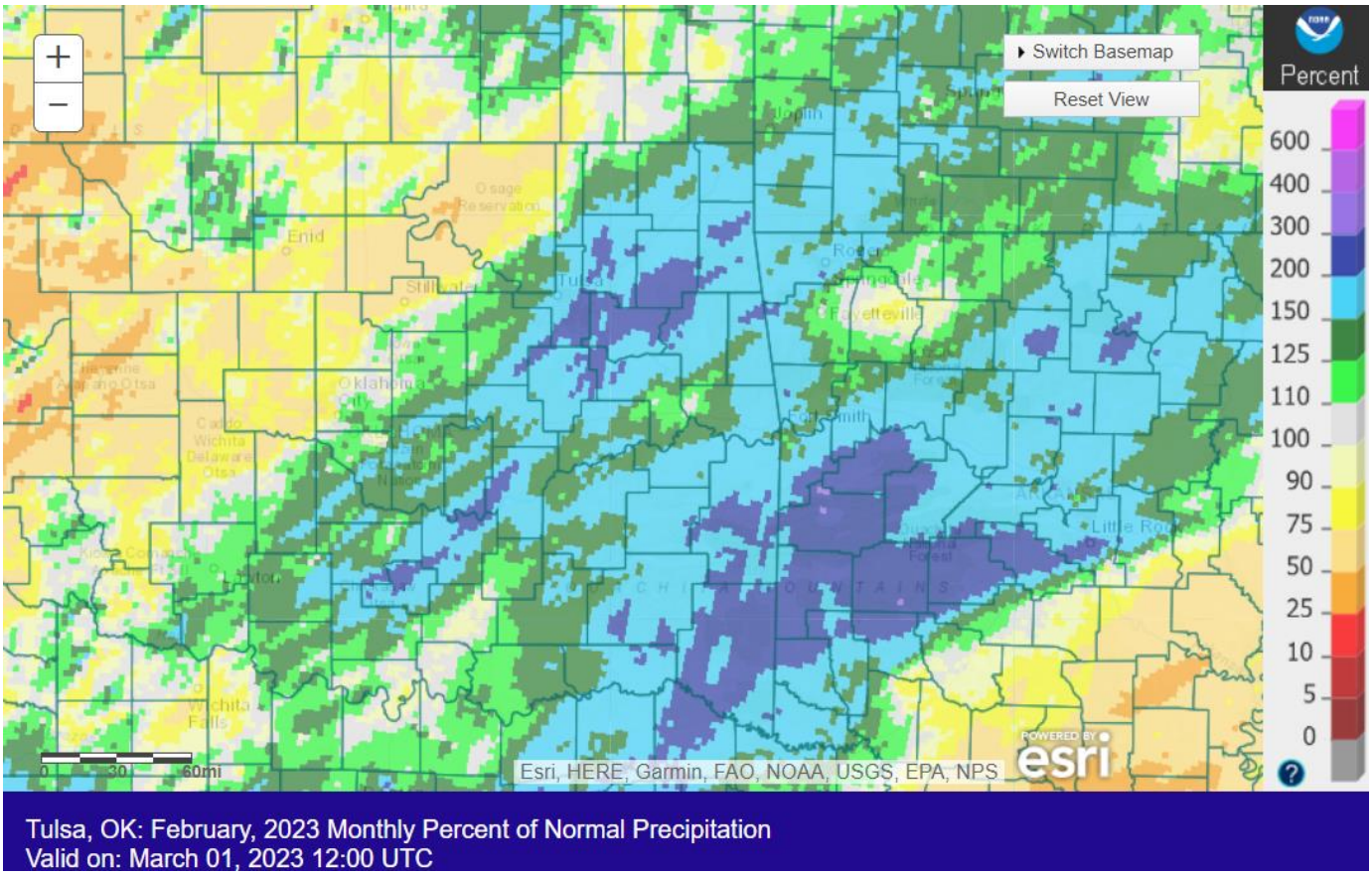


Fig. 1b. Estimated % of Normal Rainfall for February 2023

In Tulsa, OK, February 2023 ranked as the 30th warmest February (45.0°F; since records began in 1905), the 12th wettest February (3.32"; since records began in 1888), and the 20th least snowy February (Trace, tied 19 other years; since records began in 1900). Fort Smith, AR had the 11th warmest February (49.8°F; since records began in 1883), the 30th wettest February (4.03", tied 1900; since records began in 1883), and the 37th least snowy February (Trace, tied 24 other years; since records began in 1884). Fayetteville, AR had the 3rd warmest (46.8°F), the 29th wettest (3.08"), and the 10th least snowy (Trace, tied 15 other years) February since records began in 1950.

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

Cloudy, OK (meso)	7.28	Wister 3.0NNE, OK (coco)	6.70	Talihina, OK (meso)	6.40
Westville, OK (meso)	6.22	Wister, OK (meso)	6.20	Hugo, OK (meso)	6.19
Clayton, OK (meso)	6.10	Hulbert 3.9N, OK (coco)	5.94	Pryor 6.9ESE, OK (coco)	5.92

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

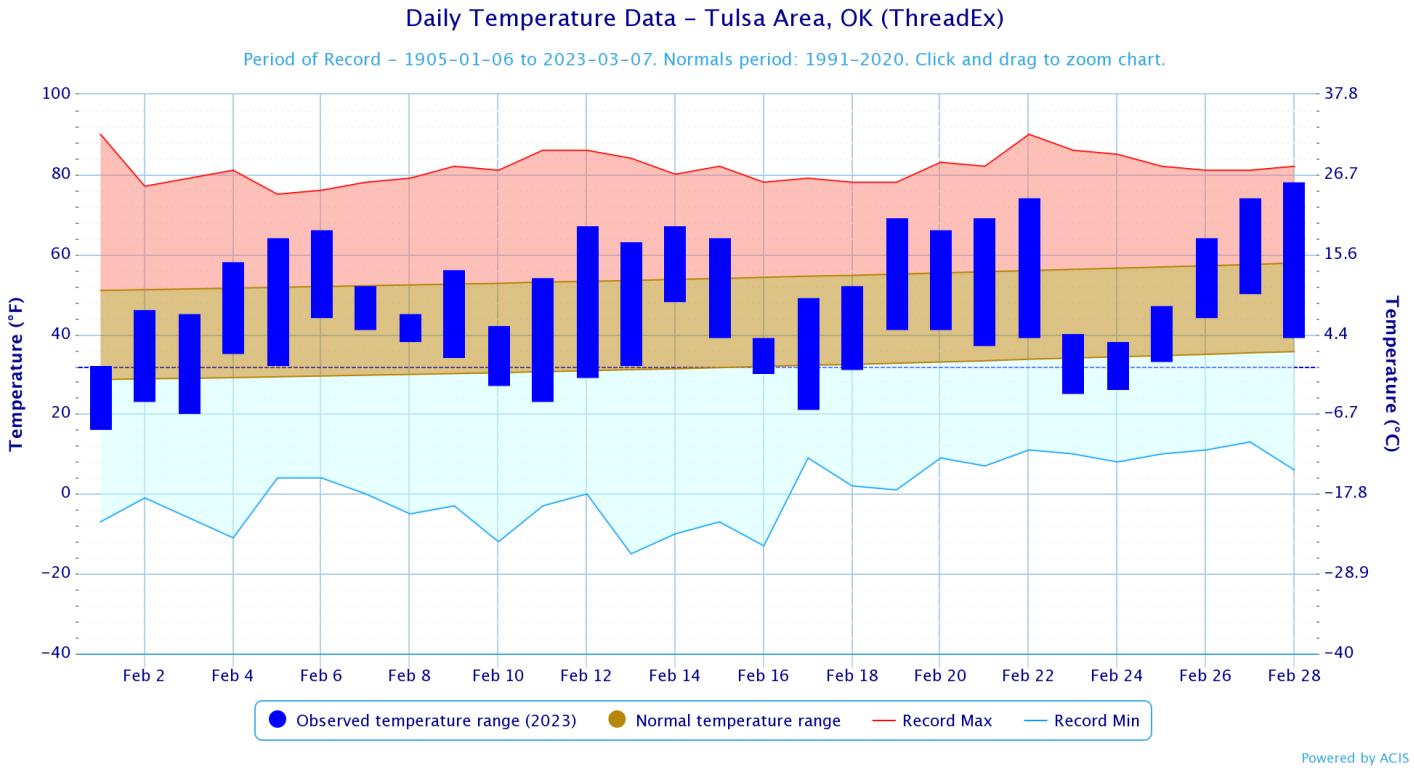
Burbank, OK (meso)	0.84	Pawnee, OK (meso)	1.15	Foraker, OK (meso)	1.18
Bartlesville, OK (ASOS)	1.58	Wynona, OK (meso)	1.71	Copan, OK (meso)	2.11
Ochelata 5.6N, OK (coco)	2.35	Nowata, OK (meso)	2.54	Oilton, OK (meso)	2.55

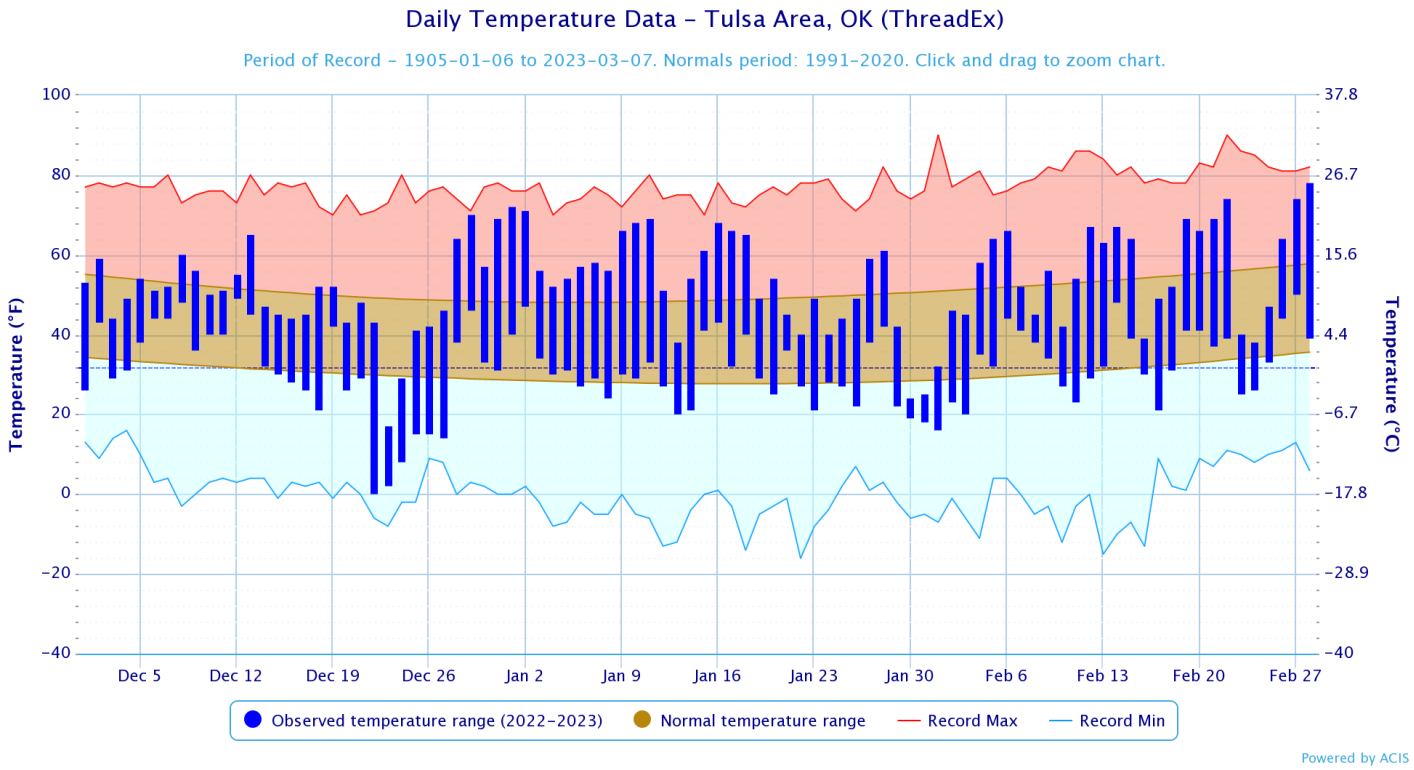
According to statistics from the Oklahoma Climatological Survey (OCS) Mesonet:

Rank since 1921	Last 30 Days (Jan 30 – Feb 28)	Winter 2022-23 (Dec 1 – Feb 28)	Cool Growing Season (Sep 1 – Feb 28)	Last 120 Days (Nov 1 – Feb 28)	Year-to-Date (Jan 1 – Feb 28)	Water Year-to-Date (Oct 1 – Feb 28)	Last 365 Days (Mar 1, 2022 – Feb 28, 2023)
Northeast OK	14th wettest	25th wettest	32nd driest	25th wettest	25th wettest	41st wettest	32nd driest
East Central OK	13th wettest	20th wettest	45th wettest	20th wettest	20th wettest	22nd wettest	28th wettest
Southeast OK	**6th wettest**	26th wettest	41st wettest	26th wettest	15th wettest	22nd wettest	44th driest
Statewide	24th wettest	37th wettest	35th driest	30th wettest	31st wettest	38th wettest	28th driest

Winter (December-January-February) 2022-23

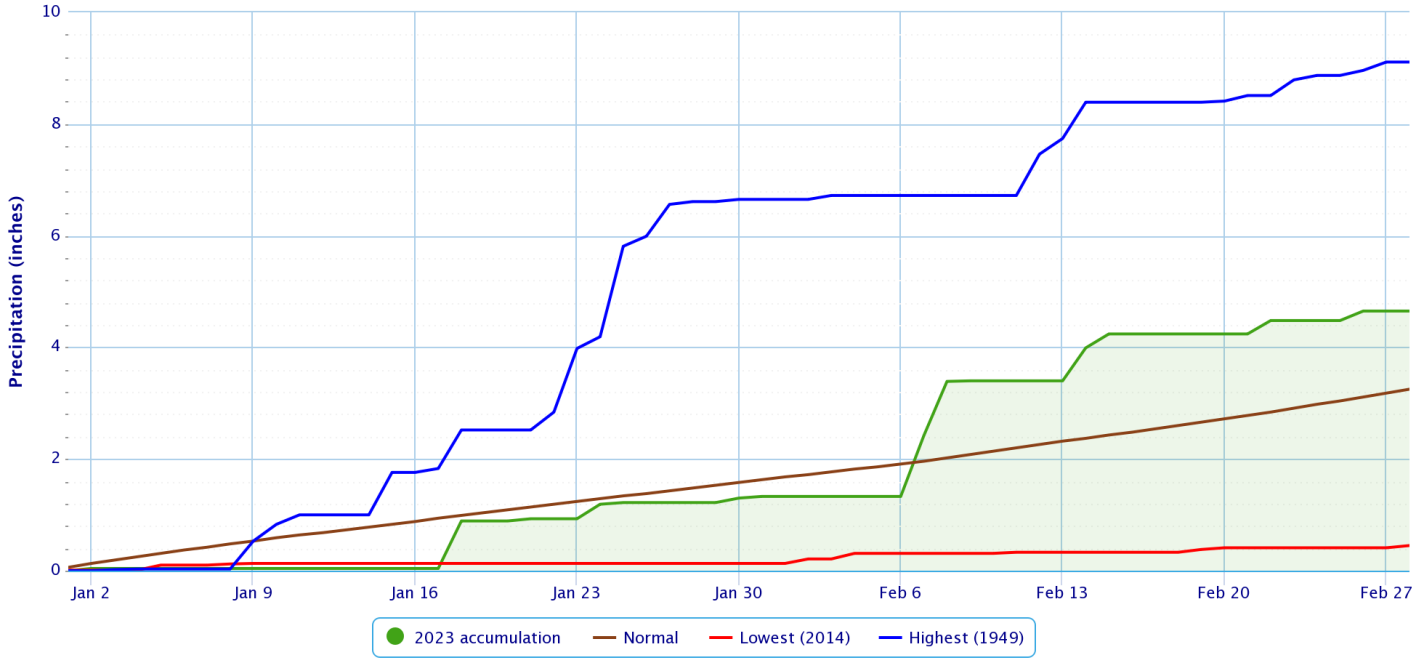
In Tulsa, OK, Winter 2022-23 ranked as the 21st warmest Winter (42.3°F; since records began in 1905-06) and the 29th wettest Winter (7.20"; since records began in 1888-89). Fort Smith, AR had the 5th warmest Winter (46.1°F, tied 2011-12; since records began in 1882-83) and the 43rd wettest Winter (9.92"; since records began in 1882-83). Fayetteville, AR had the Record warmest (43.2°F; previous record 43.0°F in 1991-92) and the 20th wettest (9.92") Winter since records began in 1949-50.





Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

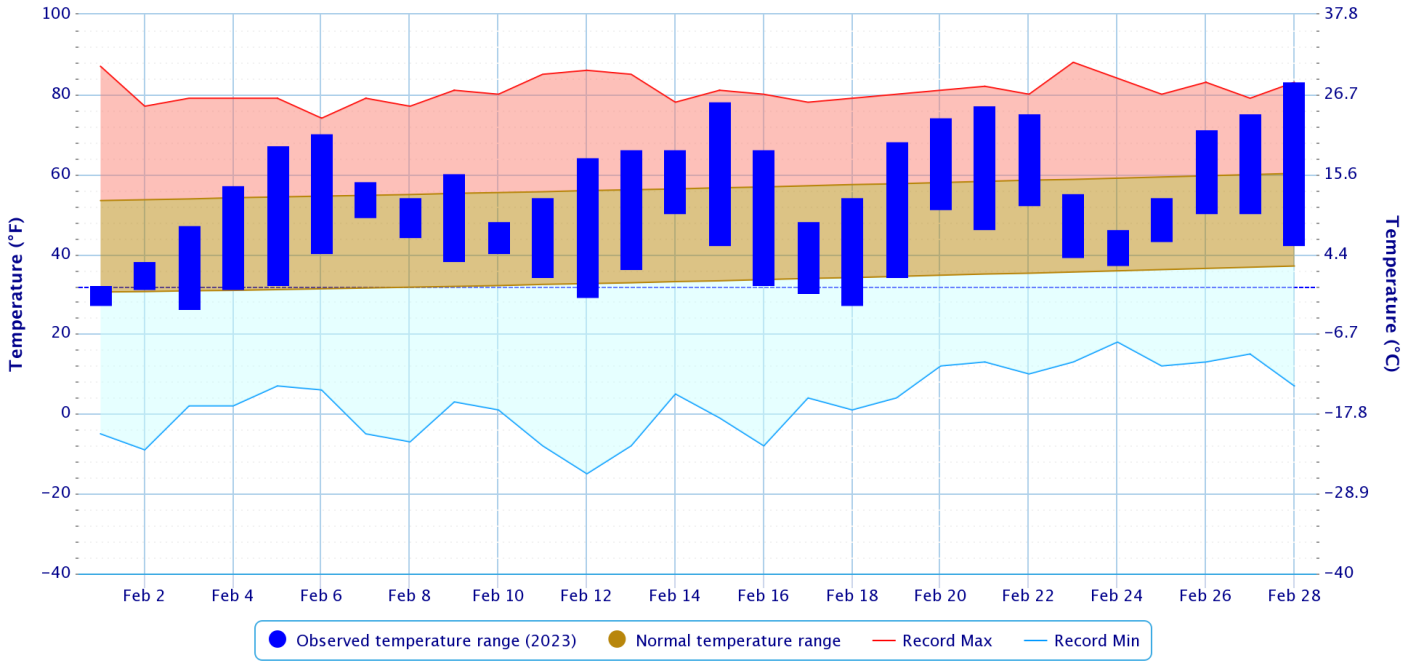
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

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

Period of Record – 1882-06-01 to 2023-03-07. Normals period: 1991-2020. Click and drag to zoom chart.



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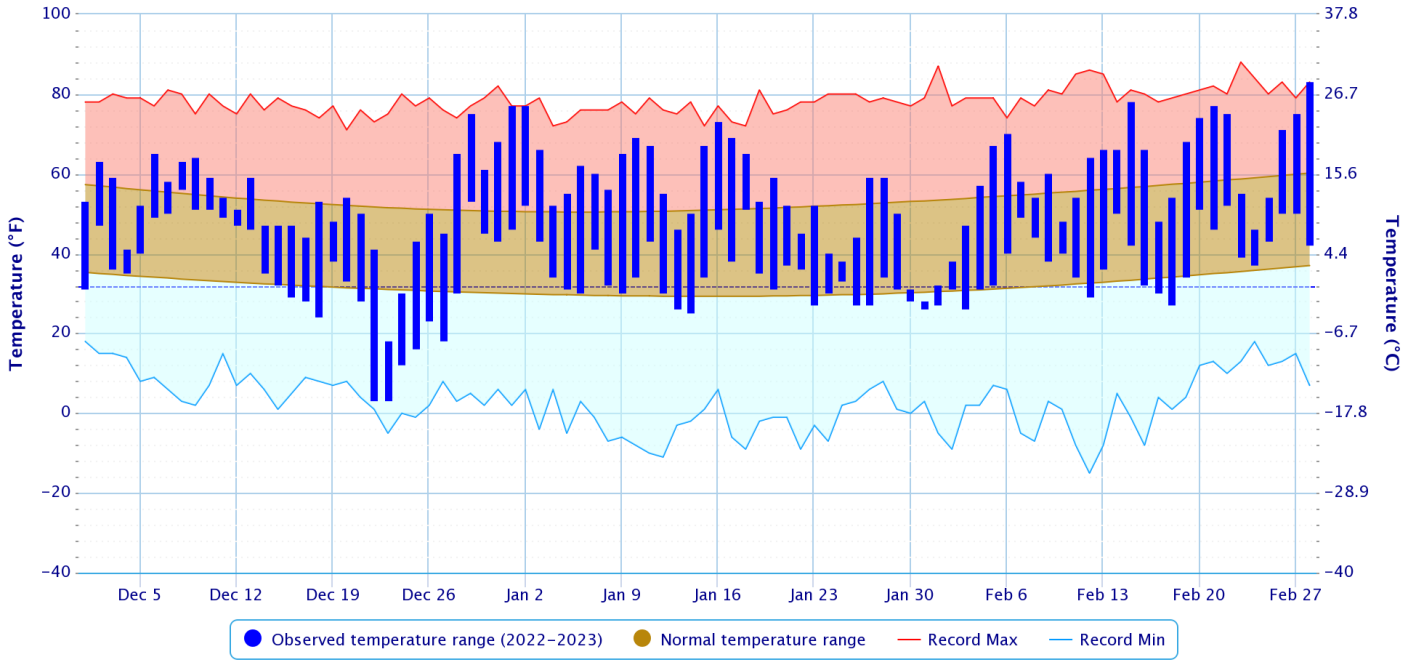
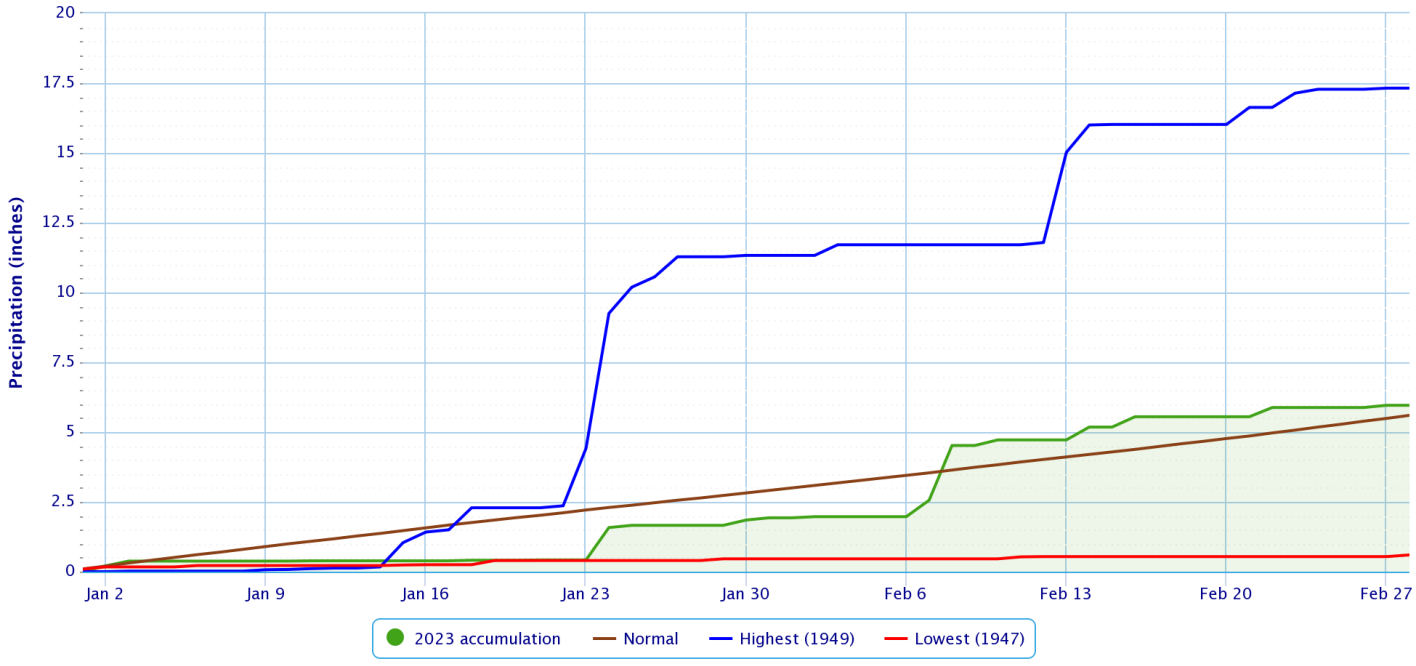


Powered by ACIS

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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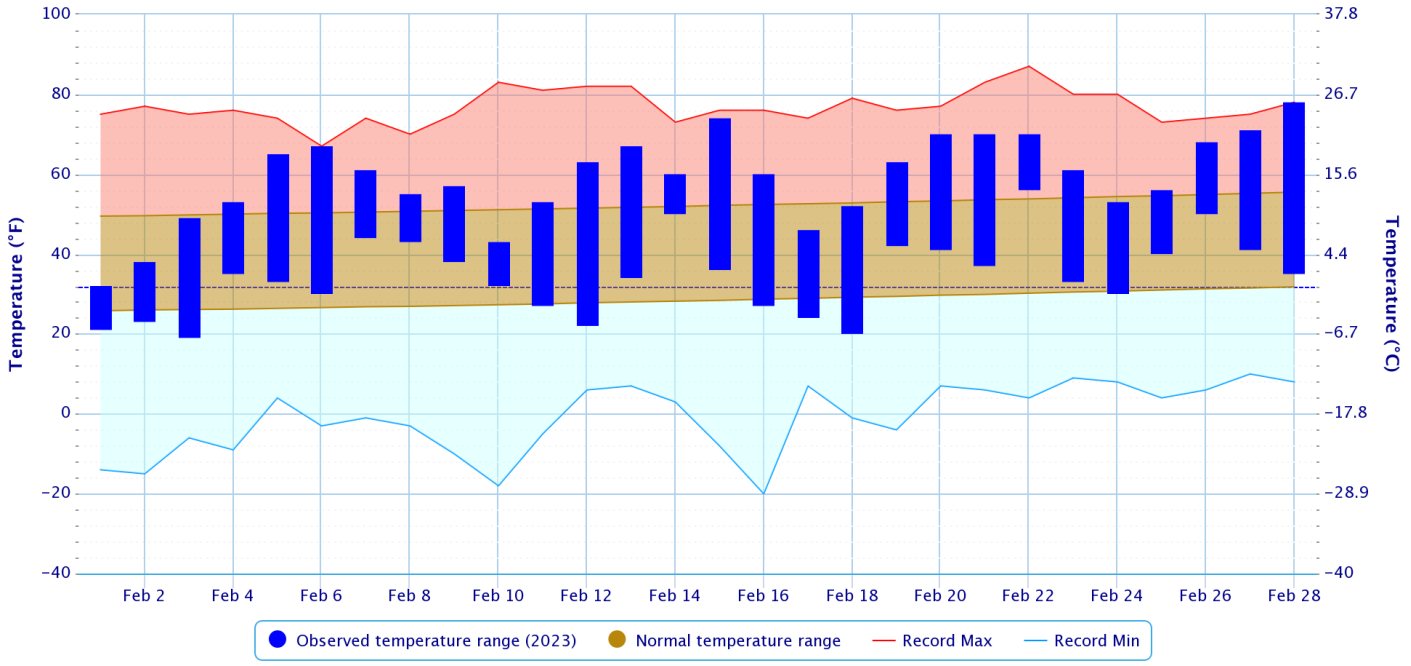
Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

Period of Record – 1949-07-14 to 2023-03-07. Normals period: 1991-2020. Click and drag to zoom chart.



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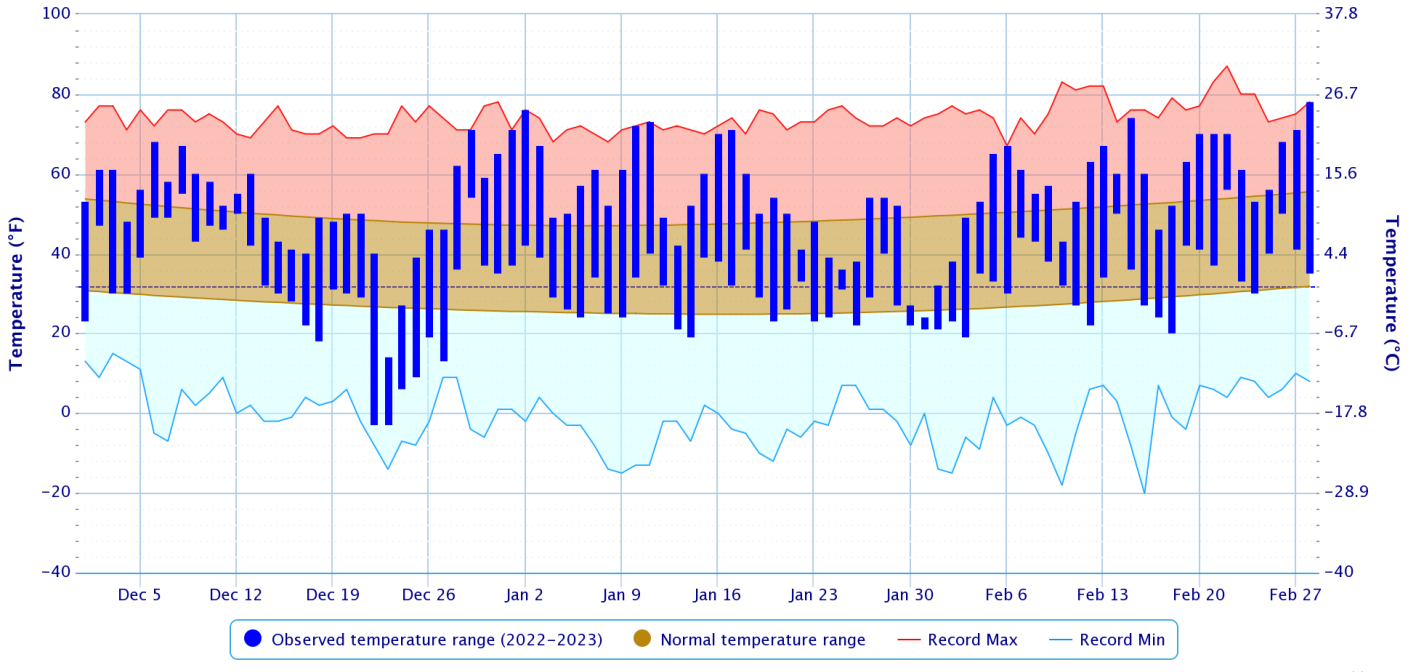
Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

Period of Record – 1949-07-14 to 2023-03-07. Normals period: 1991-2020. Click and drag to zoom chart.



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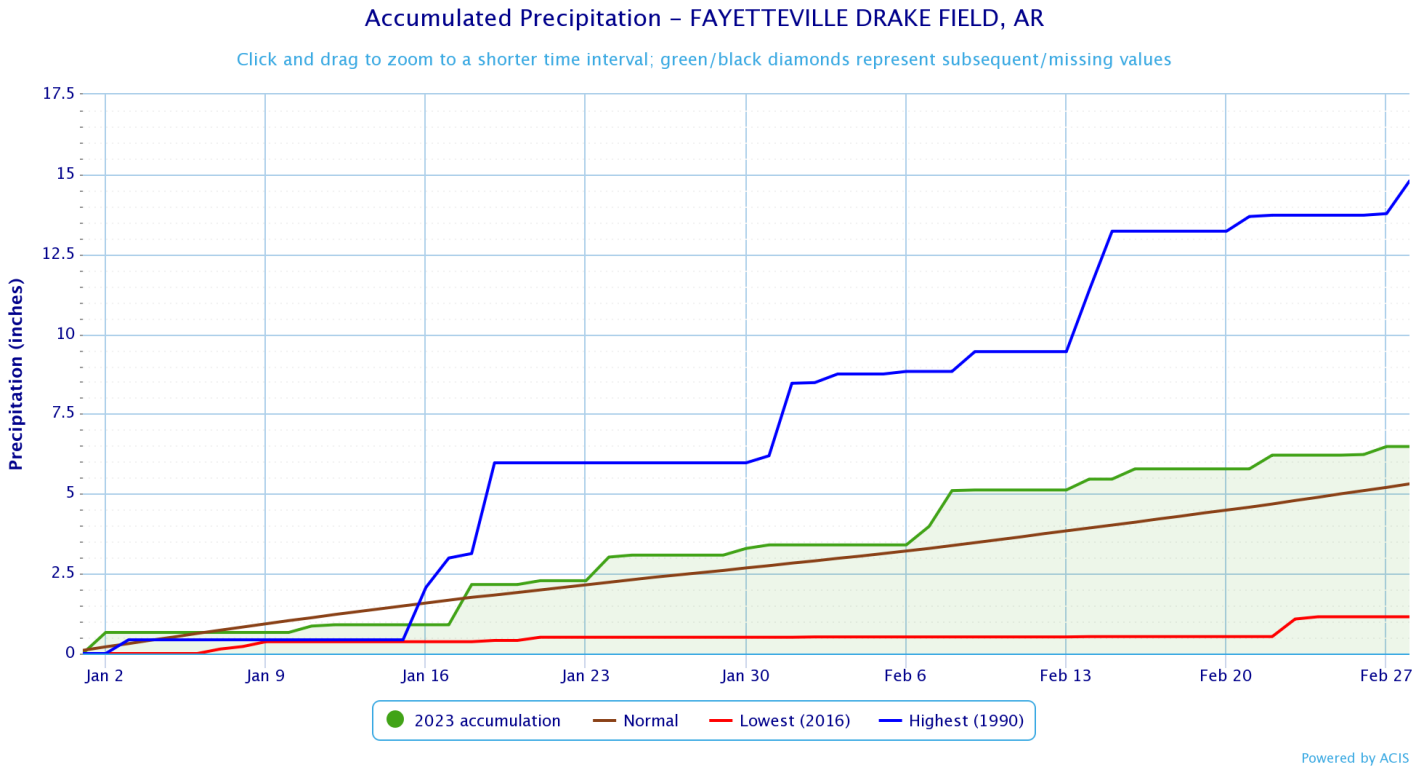
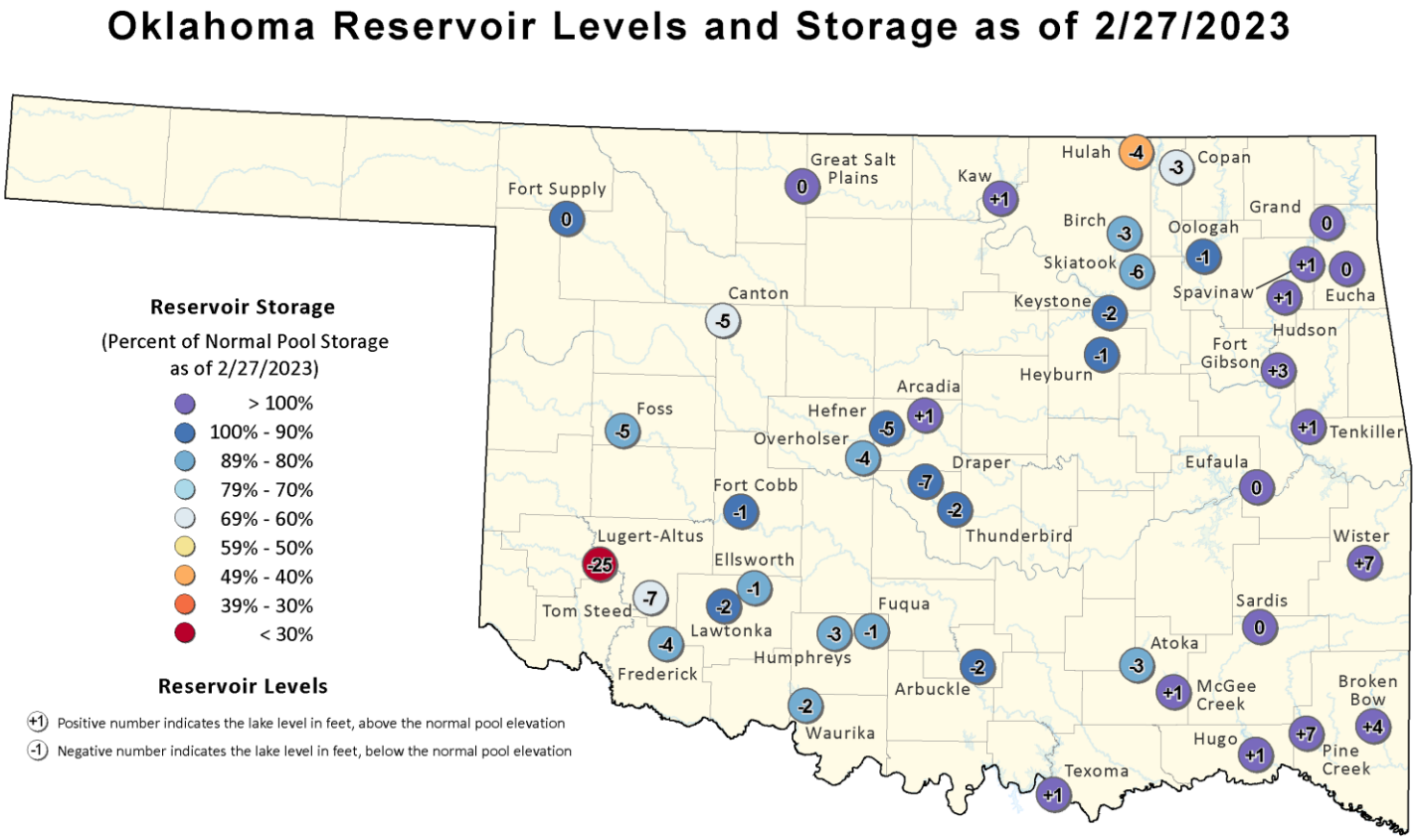

Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values
Precipitation (inches)
17.5
15
12.5
10
7.5
5
2.5
0
Jan 2
Jan 9
Jan 16
Jan 23
Jan 30
Feb 6
Feb 13
Feb 20
Feb 27
2023 accumulation
Normal
Lowest (2016)
Highest (1990)
Powered by ACIS

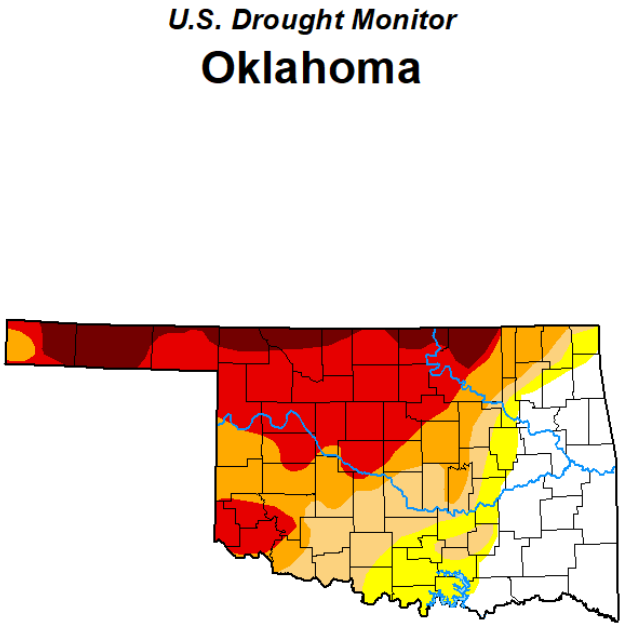
Reservoirs


Oklahoma Reservoir Levels and Storage as of 2/27/2023
Reservoir Storage
(Percent of Normal Pool Storage as of 2/27/2023)
> 100%
100% - 90%
89% - 80%
79% - 70%
69% - 60%
59% - 50%
49% - 40%
39% - 30%
< 30%
Reservoir Levels
(+1) Positive number indicates the lake level in feet, above the normal pool elevation
(-1) Negative number indicates the lake level in feet, below the normal pool elevation
Fort Supply 0
Great Salt Plains 0
Kaw +1
Hulah -4
Copan -3
Grand 0
Oologah -1
Birch -3
Skiatook -6
Spavinaw +1
Eucha 0
Canton -5
Keystone -2
Hudson
Fort Gibson +3
Heyburn -1
Arcadia +1
Foss -5
Hefner -5
Overholser -4
Draper -7
Tenkiller +1
Eufaula 0
Fort Cobb -1
Thunderbird -2
Lugert-Altus -25
Ellsworth -1
Wister +7
Tom Steed -7
Lawtonka -2
Fuqua -1
Sardis 0
Frederick -4
Humphreys -3
Arbuckle -2
Atoka -3
McGee Creek +1
Broken Bow +4
Waurika -2
Hugo +1
Pine Creek +7
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).
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 02/28/2023: Hulah Lake 48%, Copan Lake 64%, Skiatook Lake 81%, Birch Lake 83%, Keystone Lake 91% and Oologah Lake 96%. A few lakes were above 3% of the top of their conservation pools: Wister Lake 15%, Ft. Gibson Lake 8%, Hudson Lake 4%, and Beaver Lake 4%.

Drought

According to the U.S. Drought Monitor (USDM) from February 28, 2023 (Figs. 2, 3), Exceptional (D4) Drought conditions persisted across portions of eastern Kay and Osage Counties in eastern OK. Extreme (D3) Drought conditions were occurring in portions of eastern Kay, Osage, and Pawnee Counties in eastern Oklahoma. Severe (D2) Drought conditions exist in portions of Craig, Nowata, Rogers, Washington, Tulsa, Osage, Pawnee, Creek, and Okfuskee Counties in eastern Oklahoma. Moderate (D1) Drought conditions were present in portions of Ottawa, Craig, Rogers, Tulsa, Creek, and Okfuskee Counties in eastern OK. Abnormally Dry (D0) but not in drought conditions were occurring in Ottawa, Delaware, Craig, Mayes, Rogers, Tulsa, Okmulgee, and Okfuskee Counties in eastern OK. No drought conditions were present in northwest AR.



U.S. Drought Monitor

Oklahoma

February 28, 2023

(Released Thursday, Mar. 2, 2023)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	22.85	77.15	66.88	53.52	36.64	8.86
Last Week 02-21-2023	19.22	80.78	74.65	56.47	36.64	8.86
3 Months Ago 11-29-2022	0.03	99.97	91.21	85.98	64.01	19.77
Start of Calendar Year 01-03-2023	1.82	98.18	89.73	80.92	56.13	11.65
Start of Water Year 09-27-2022	0.00	100.00	99.88	94.44	64.44	17.25
One Year Ago 03-01-2022	7.72	92.28	86.65	74.04	52.05	3.05

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

Fig. 2. Drought Monitor for Oklahoma

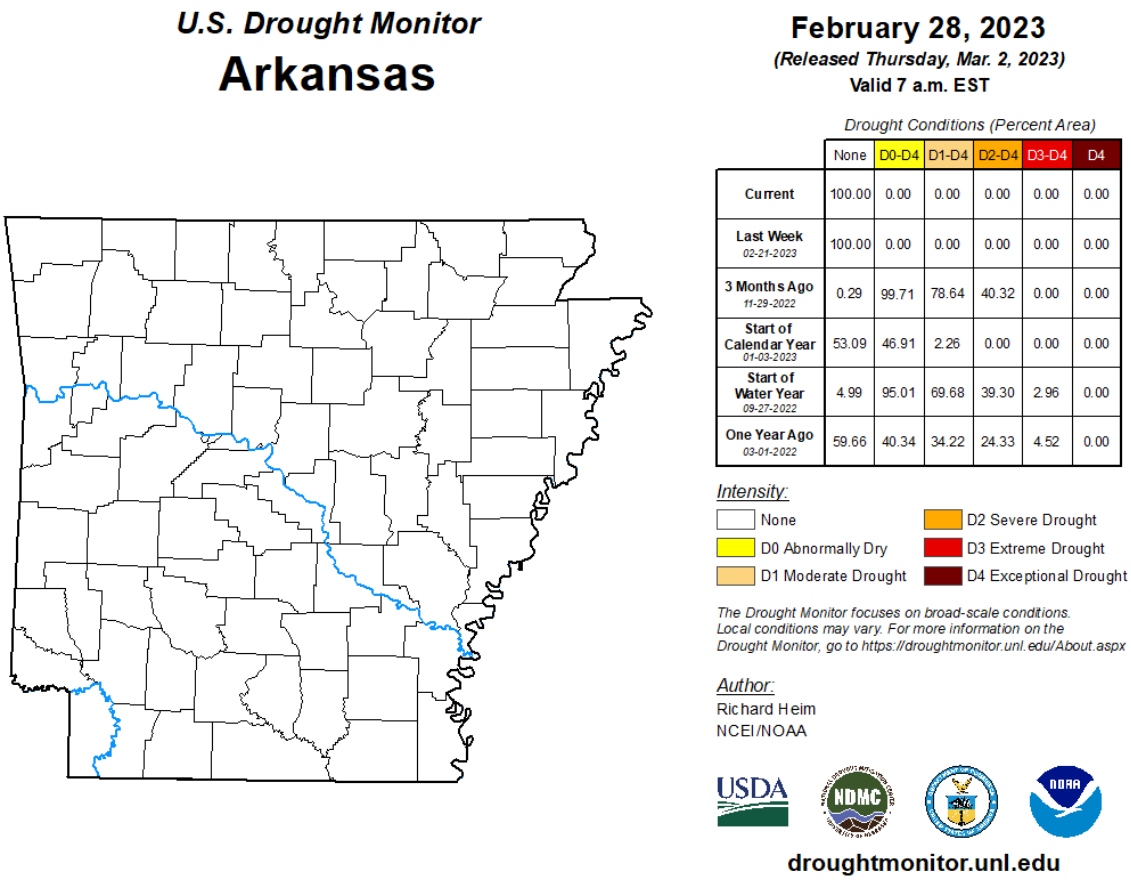


Fig. 3. Drought Monitor for Arkansas

Outlooks

The Climate Prediction Center (CPC) outlook for March 2023 (issued February 28, 2023) indicates an equal chance for above, near, and below normal temperatures and an enhanced chance for above median precipitation across eastern OK and northwest AR. This outlook was largely based on dynamical model output as well as La Niña and Madden-Julian Oscillation (MJO) influences. The robost MJO will likely lead to below normal temperatures across the country for the middle two weeks of March, but above normal temperatures appear to be more likely for the first and last weeks of March for eastern OK and northwest AR, resulting in equal chances for the month as a whole. A stratospheric warming event may weaken the polar vortex, which would also result in colder air further south in the U.S.

For the 3-month period March-April-May 2023, CPC is forecasting an enhanced chance for above normal temperatures eastern OK and northwest AR. This outlook also indicates a slightly enhanced chance for above median precipitation for northwest AR, and equal chances for above, near, and below median rainfall across eastern OK and west central AR (outlook issued February 16, 2023). This outlook is based on long-term trends, La Niña impacts, and incorporates both statistical and dynamical forecast tools. The potential for cold air outbreaks in the central plains remains for March. According to CPC, the combined effect of the ocean-atmosphere system remains consistent with La Niña conditions. La Niña conditions are expected to rapidly transition to ENSO-neutral, with a 90% chance of ENSO-neutral by the mid-spring. CPC continues the La Niña 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

A cold front moved into northeast OK early on the 7th and continued to move southeast before stalling across far southeast OK. Scattered showers and isolated thunderstorms became more widespread across northeast OK and far northwest AR by early afternoon along and north of the front. This activity shifted slightly further south, in proximity to a stalled 850mb front, during the evening, with widespread showers and isolated thunderstorms over eastern OK and northwest AR primarily from the I-44 corridor to I-40. Southerly flow was transporting moisture into this frontogenetic zone, and precipitable water (PWAT) values ranged from 0.8 to 1.5 inches, which is anomalously high for February. The rain expanded over southeast OK by late evening, and much of the area continued to receive precipitation through the overnight hours as the main upper-level low lifted northeast over the region. By sunrise on the 8th, most of the rain had shifted east of the area. Rainfall totals ranged from 0.25" to 4" from northwest to southeast across a large portion of eastern OK and northwest AR (Figs. 4-7). However, this was not the end of the event. After a brief lull in the rain, convection renewed as the upper low continued its approach. Widespread showers and isolated thunderstorms spread from southwest to northeast through mid-morning on the 8th, with much of the area impacted through noon. The rain then ended from southwest to northeast through the afternoon hours. As the upper-level low moved over the area during the evening, scattered wrap around showers continued. The low and associated rain lifted northeast out of the area shortly after midnight. An additional 0.25" to 2.5" of rain fell across eastern OK and northwest AR (Fig. 8). The storm total across the region ranged from 0.5" to around 5" (Figs. 9, 10), which resulted in rises on several rivers. Minor flooding occurred along the lower Illinois River, and minor to moderate flooding occurred along the Poteau River (see E3 and preliminary hydrographs at the end of this report).

Thunderstorms developed near a dry line in south central OK during the evening of the 15th in response to a developing surface low over central OK as an upper-level trough approached the area. These storms increased in coverage and intensity through the late evening hours, impacting eastern OK and northwest AR along and southeast of I-44. These storms quickly translated east, exiting the area around 2 am CST on the 16th. Rainfall totals ranged from around 0.10" to around 1.5" (Fig. 11).

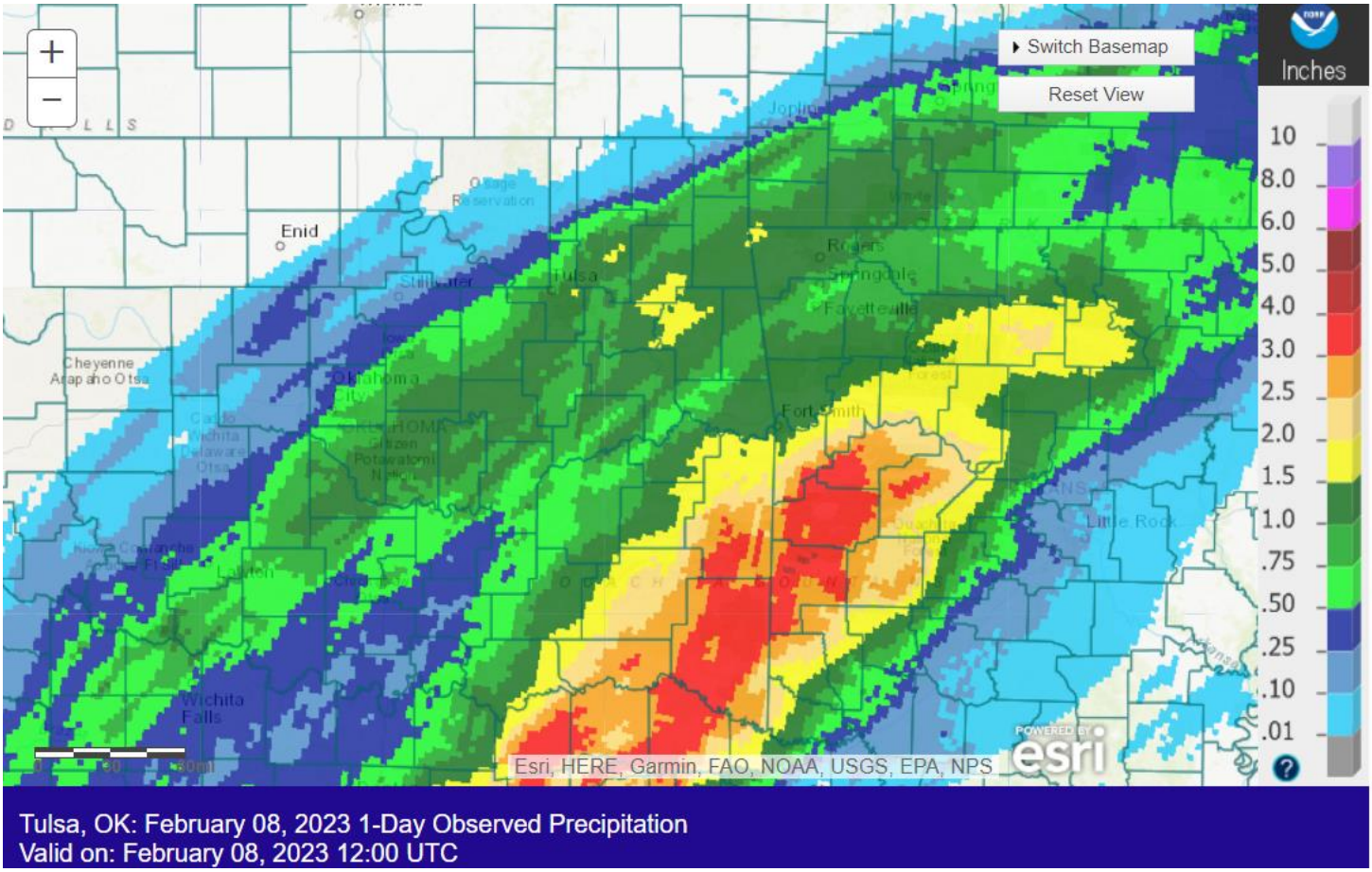


Fig. 4. 24-hour Estimated Observed Rainfall ending at 6am CST 2/08/2023.

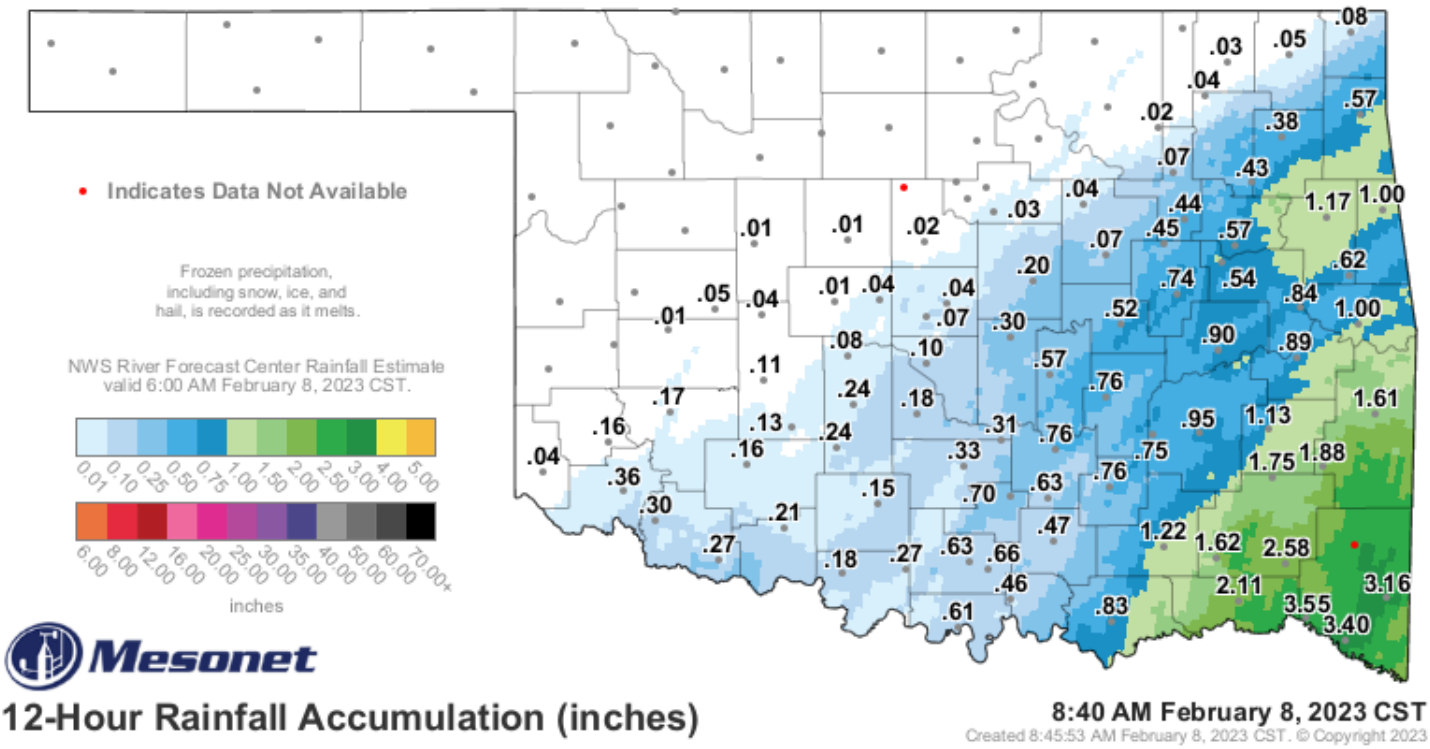


Fig. 5. OK Mesonet (values) and NWS RFC rainfall estimate (image) 12-hour rainfall ending at 8:40 am CST 2/08/2023.

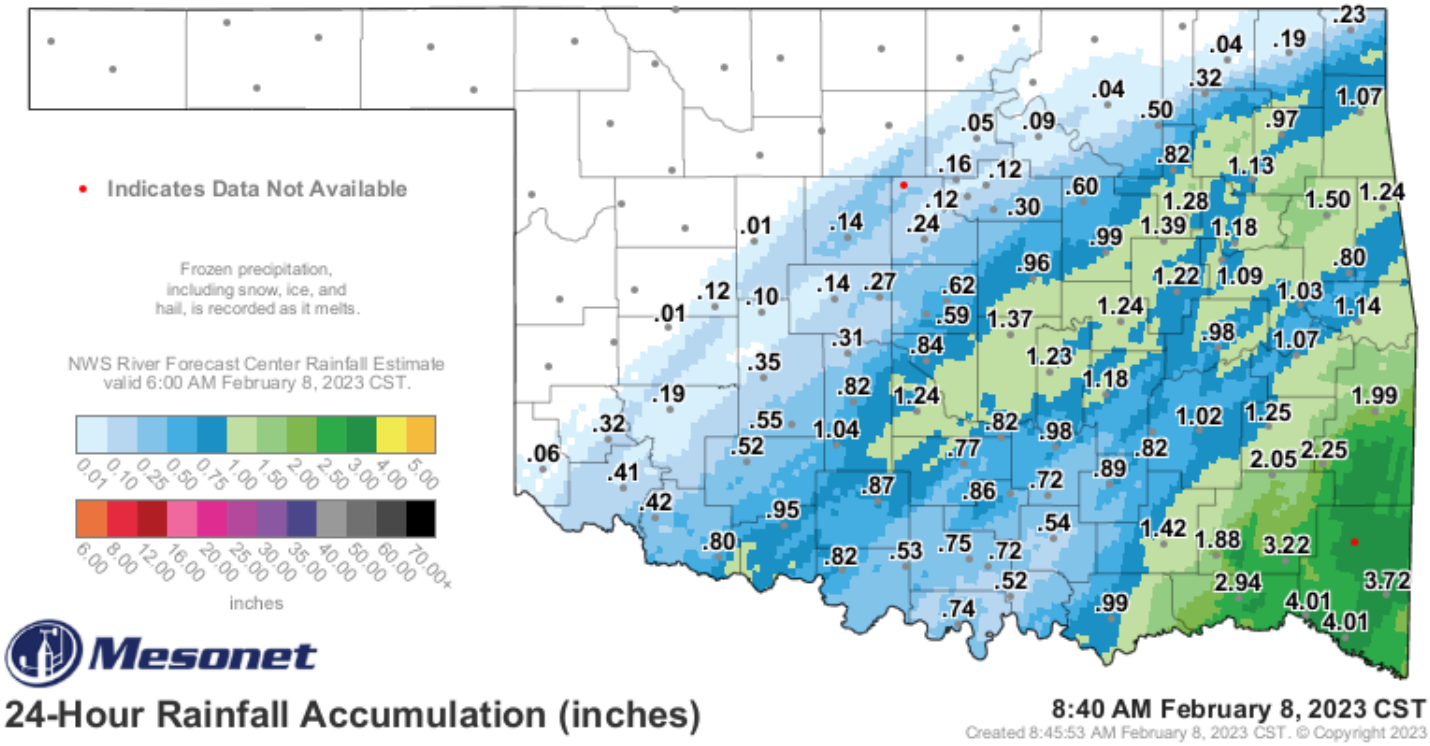


Fig. 6. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 8:40 am CST 2/08/2023.

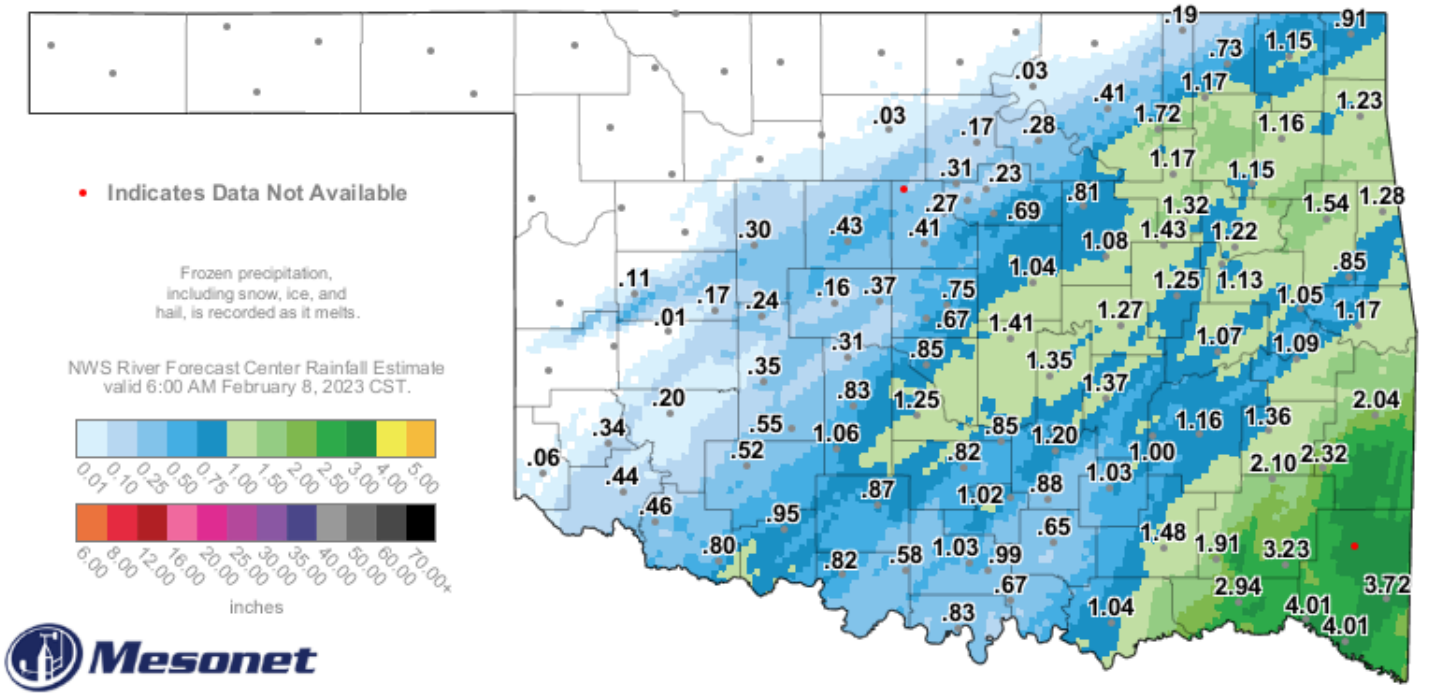


Fig. 7. OK Mesonet (values) and NWS RFC rainfall estimate (image) 48-hour rainfall ending at 8:40 am CST 2/08/2023.

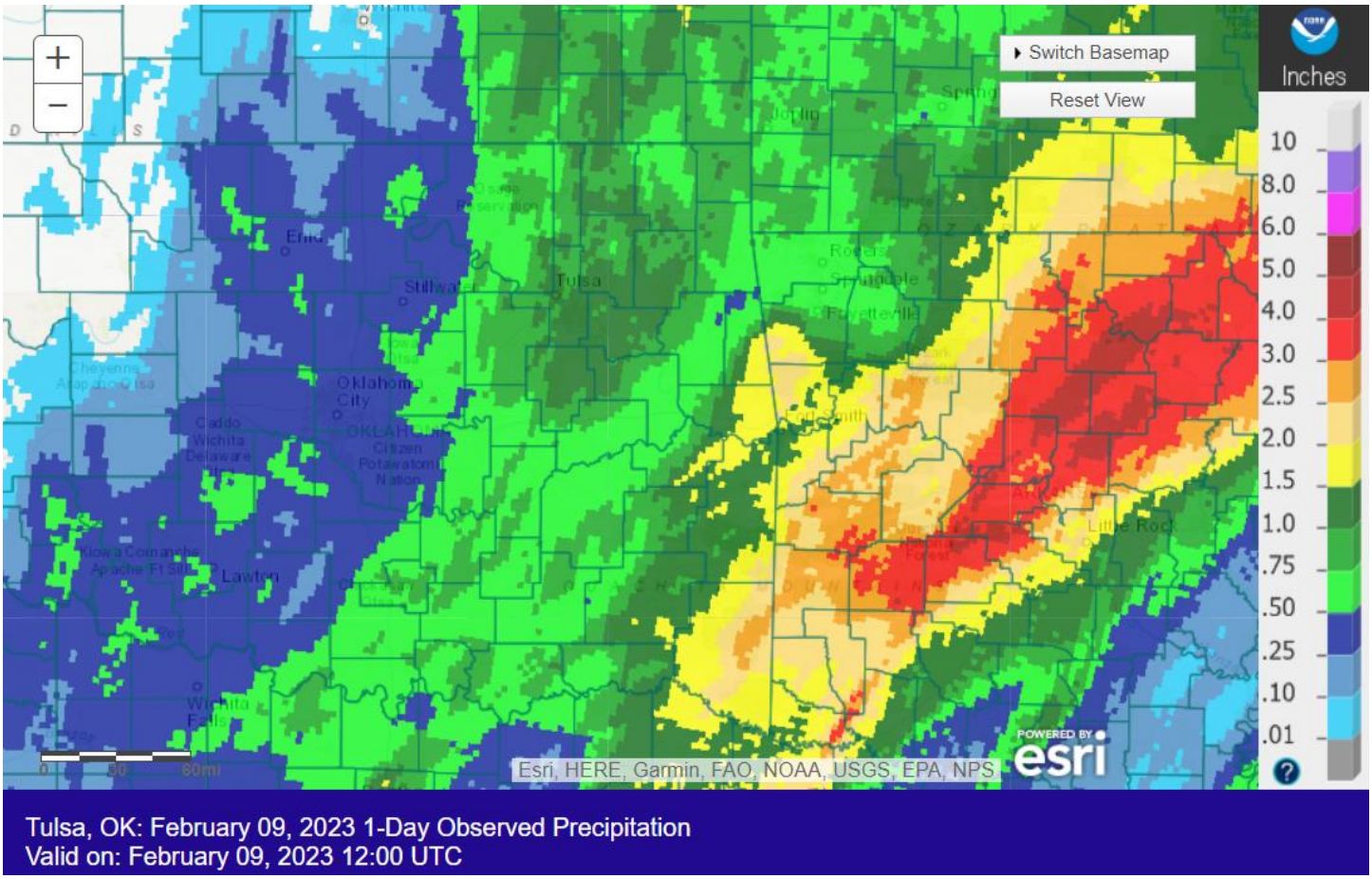


Fig. 8. 24-hour Estimated Observed Rainfall ending at 6am CST 2/09/2023.

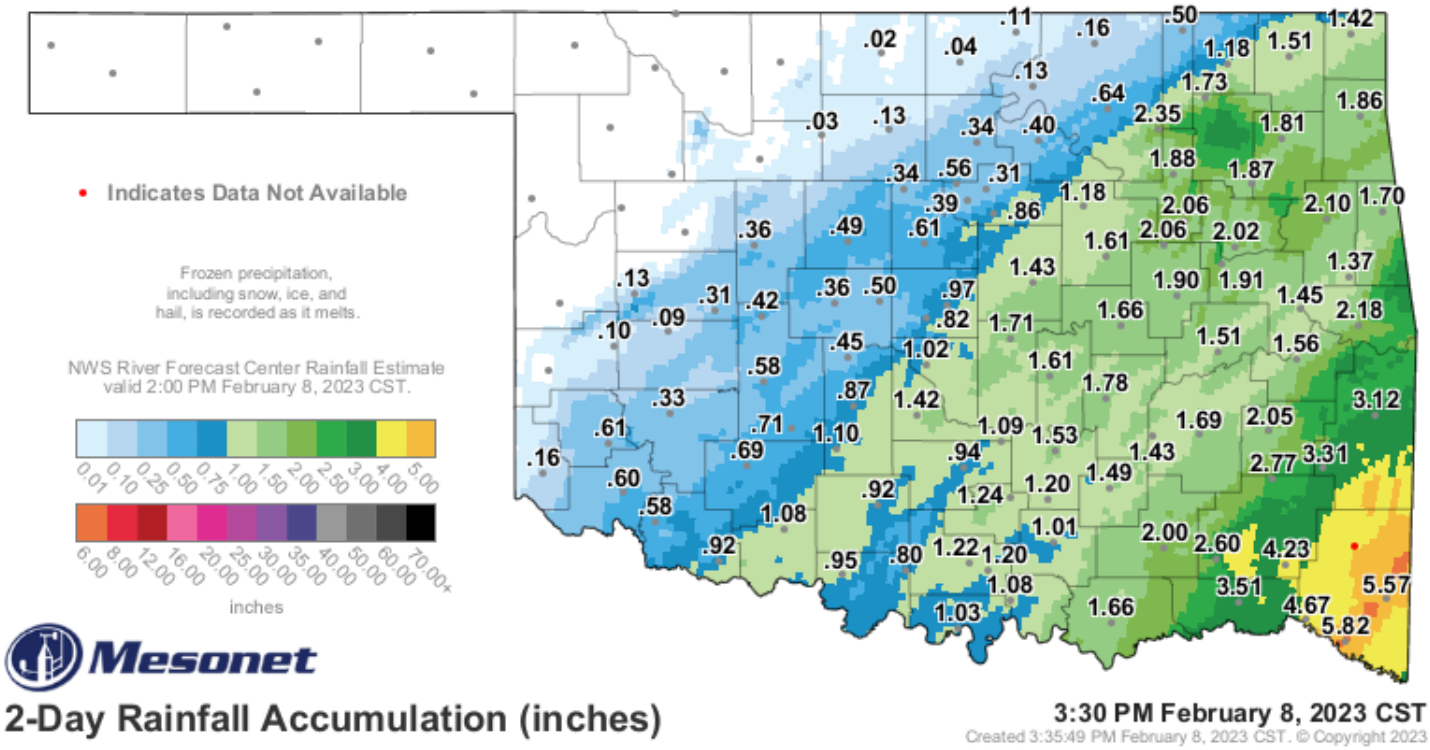


Fig. 9. OK Mesonet (values) and NWS RFC rainfall estimate (image) 48-hour rainfall ending at 3:30 pm CST 2/08/2023, mid-event.

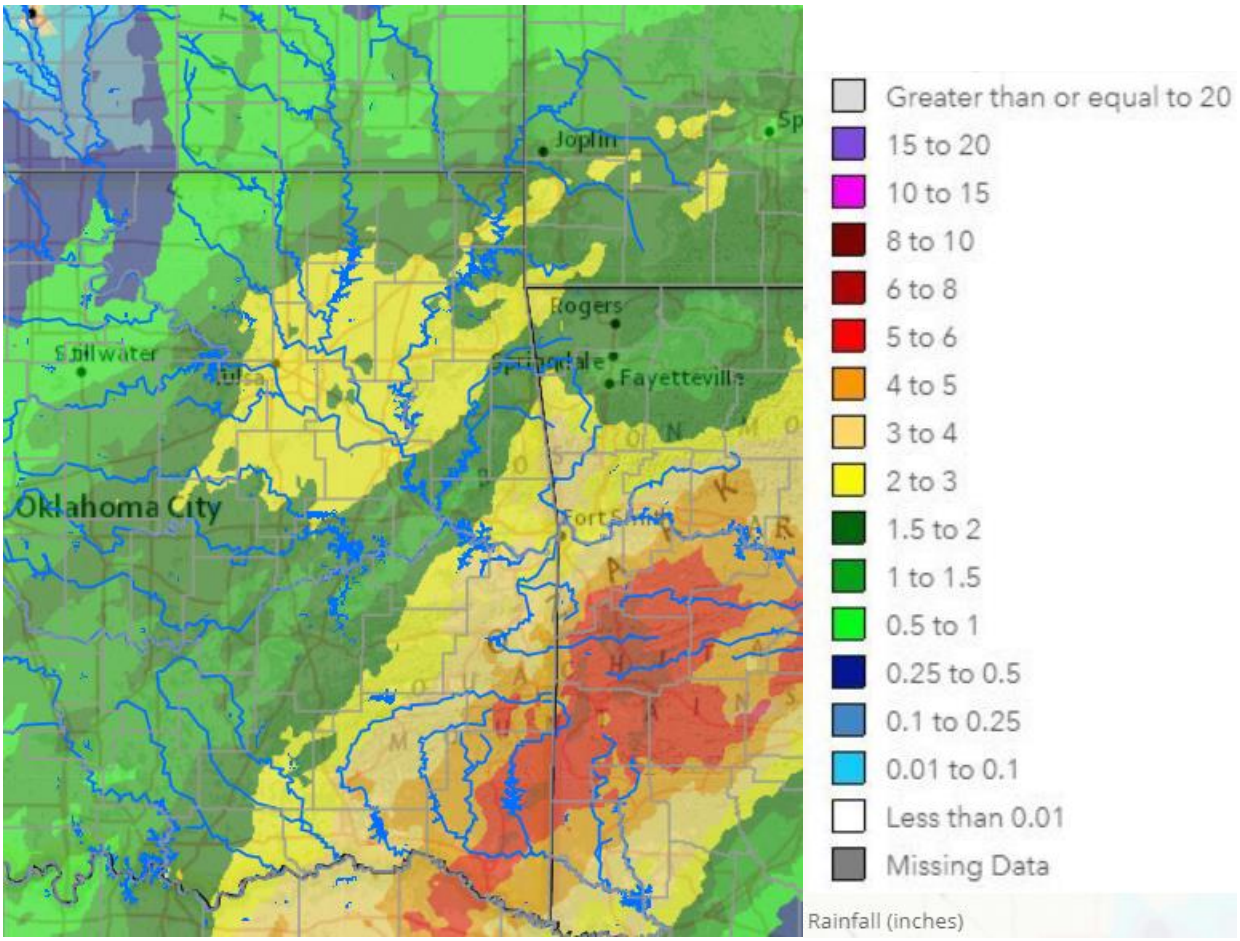


Fig. 10. 3-Day Estimated Observed Rainfall ending at 6am CST 2/09/2023 with rivers shown in blue.

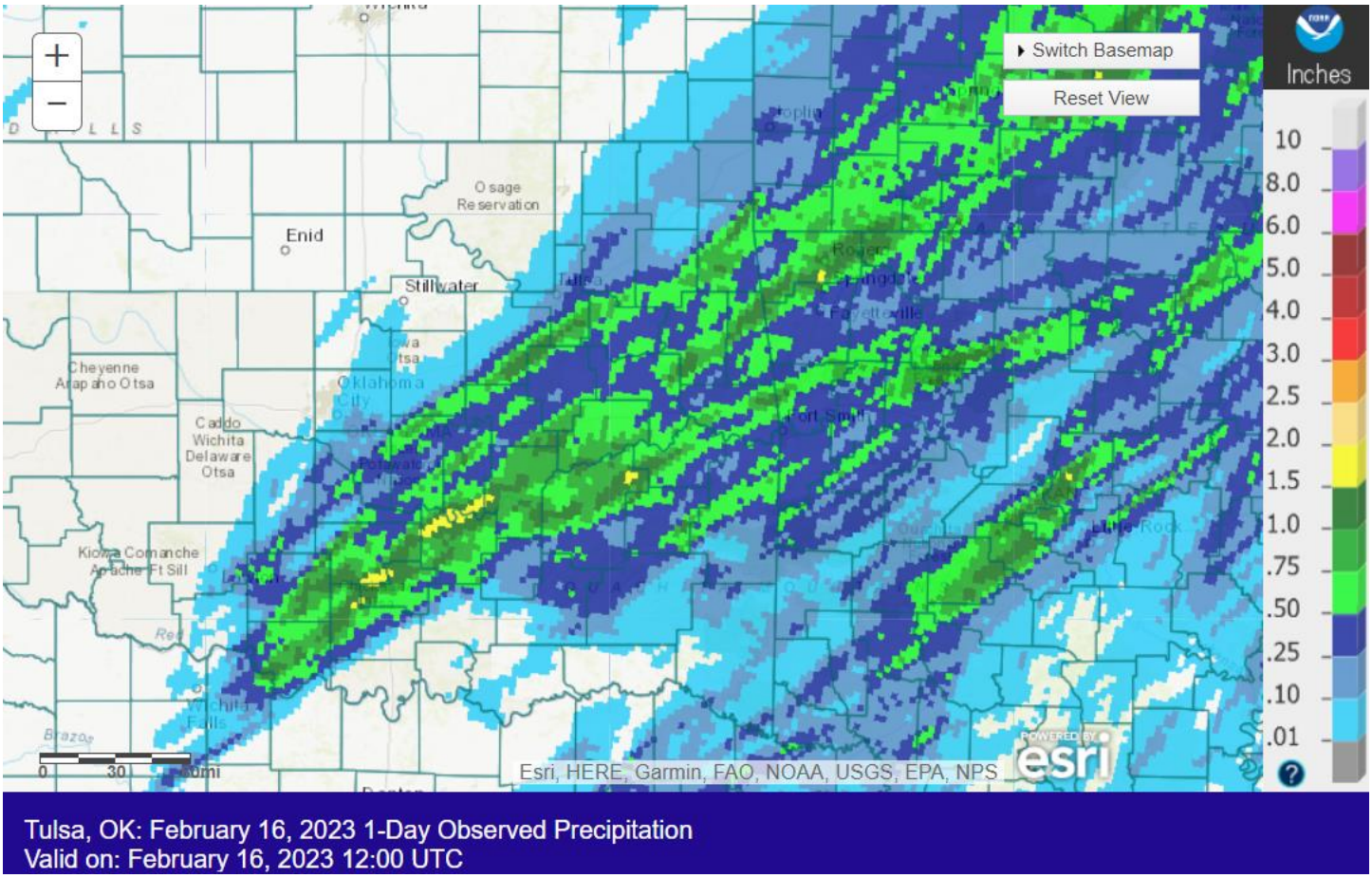


Fig. 11. 24-hour Estimated Observed Rainfall ending at 6am CST 2/16/2023.

Written by:

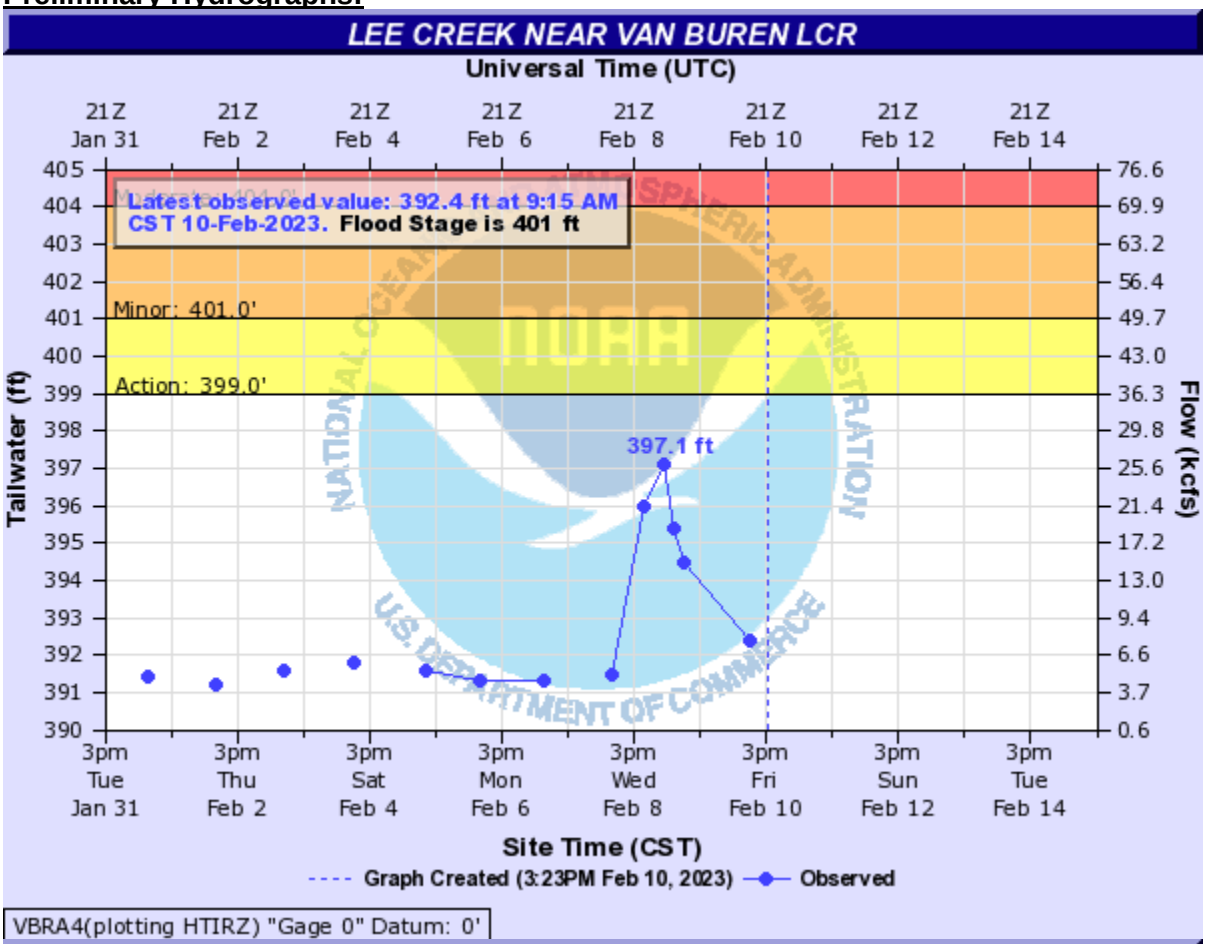
Nicole McGavock
Service Hydrologist
WFO Tulsa

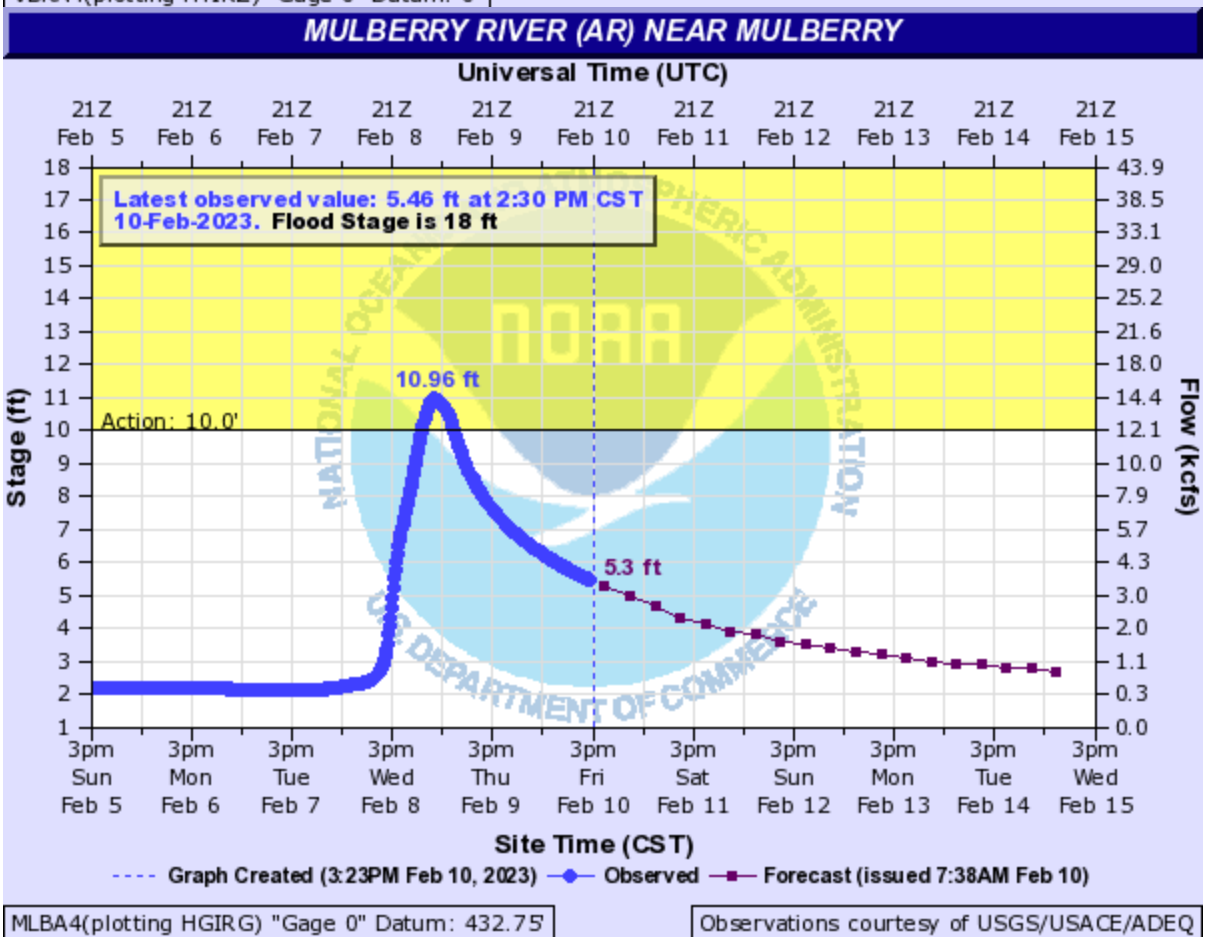
Products issued in February 2023:

*CWYO2 became a daily river forecast point September 7, 2016
*MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014
*Mixed case River Flood products began July 31, 2013

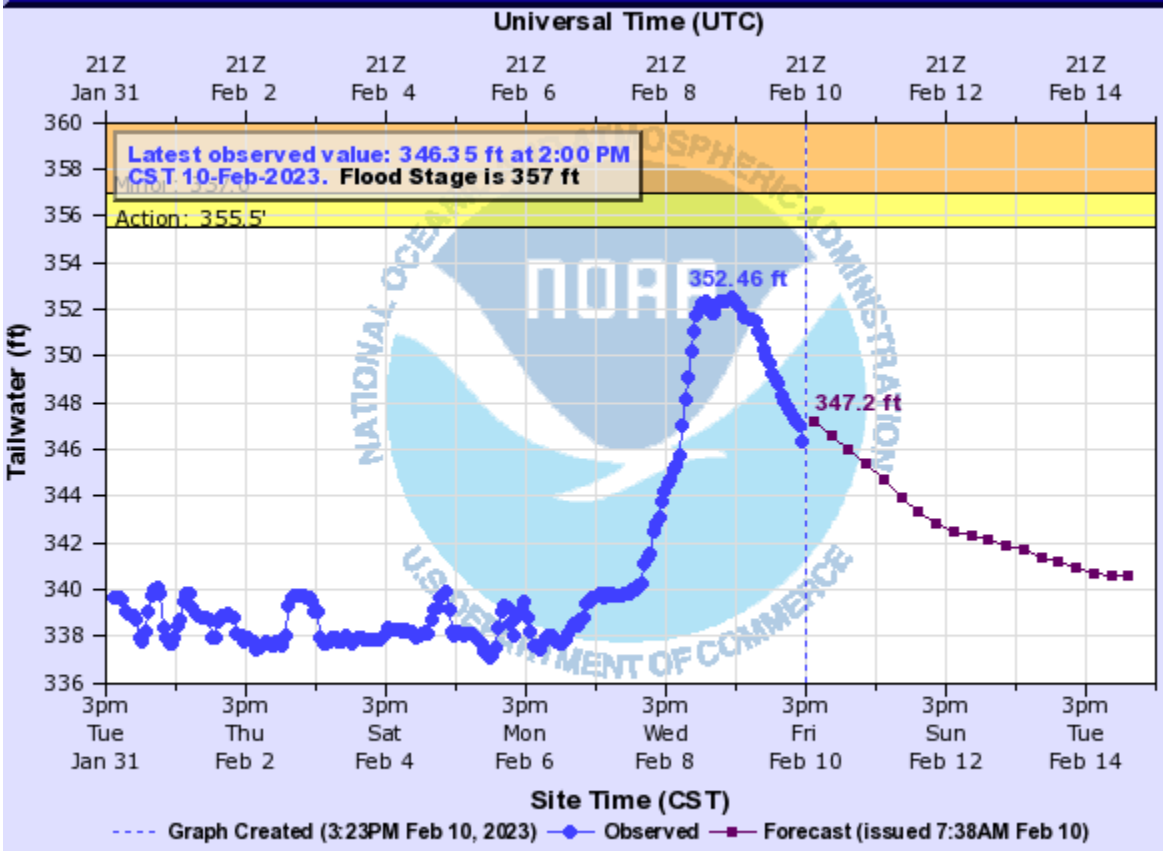
0 Flash Flood Warnings (FFW)
0 Flash Flood Statements (FFS)
1 Flash/Areal Flood Watches (FFA) (3 Watch FFA CON/EXT/EXA/EXB/CAN)
3 Urban and Small Stream Advisories (FLS)
7 Areal Flood Warnings (FLW)
2 Areal Flood Statements (FLS)
5 River Flood Warnings (FLW) (includes category increases)
35 River Flood Statements (FLS)
5 River Flood Advisories (FLS) (23 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:





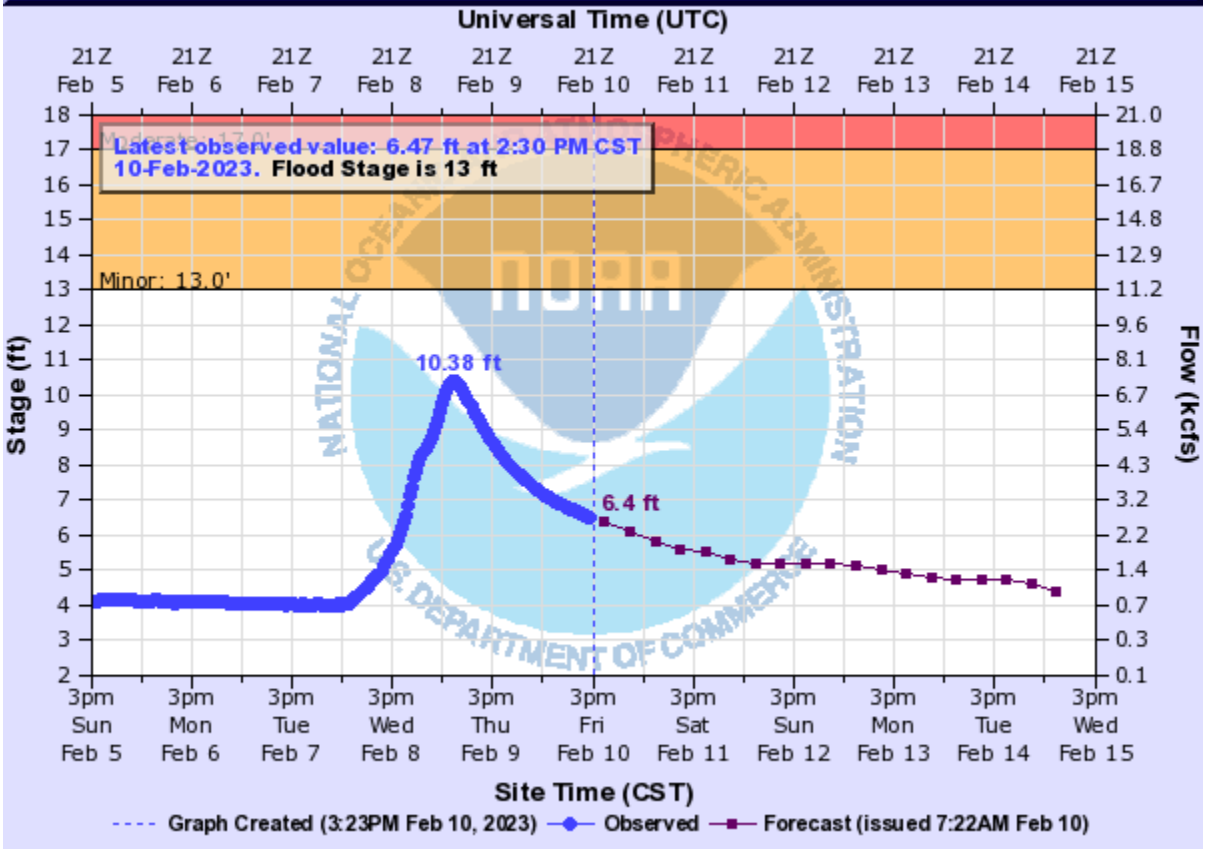
ARKANSAS RIVER AT OZARK L/D TAILWATER



OZGA4(plotting HTIRG) "Gage 0" Datum: 0'

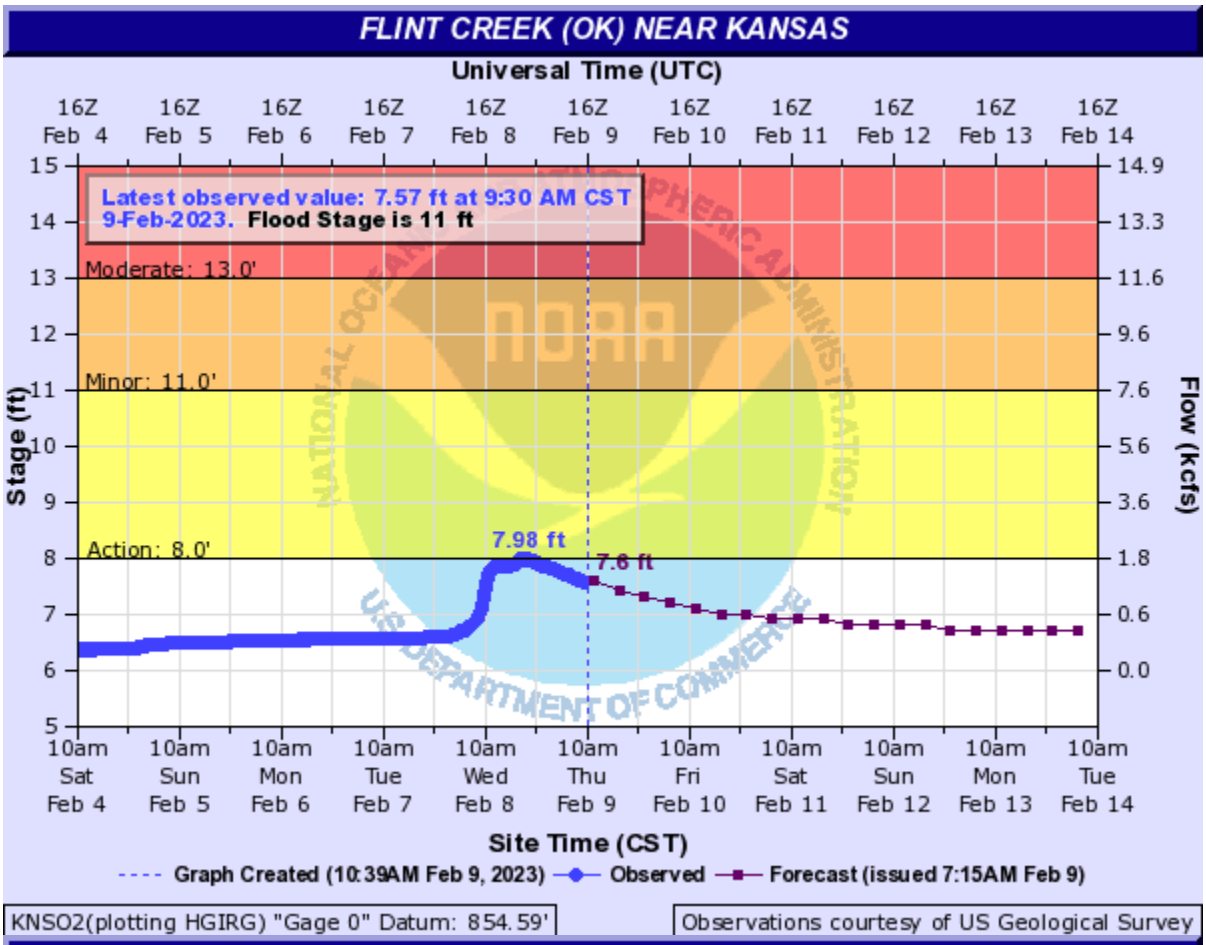
Observations courtesy of US Army Corps of Engineers - LRD

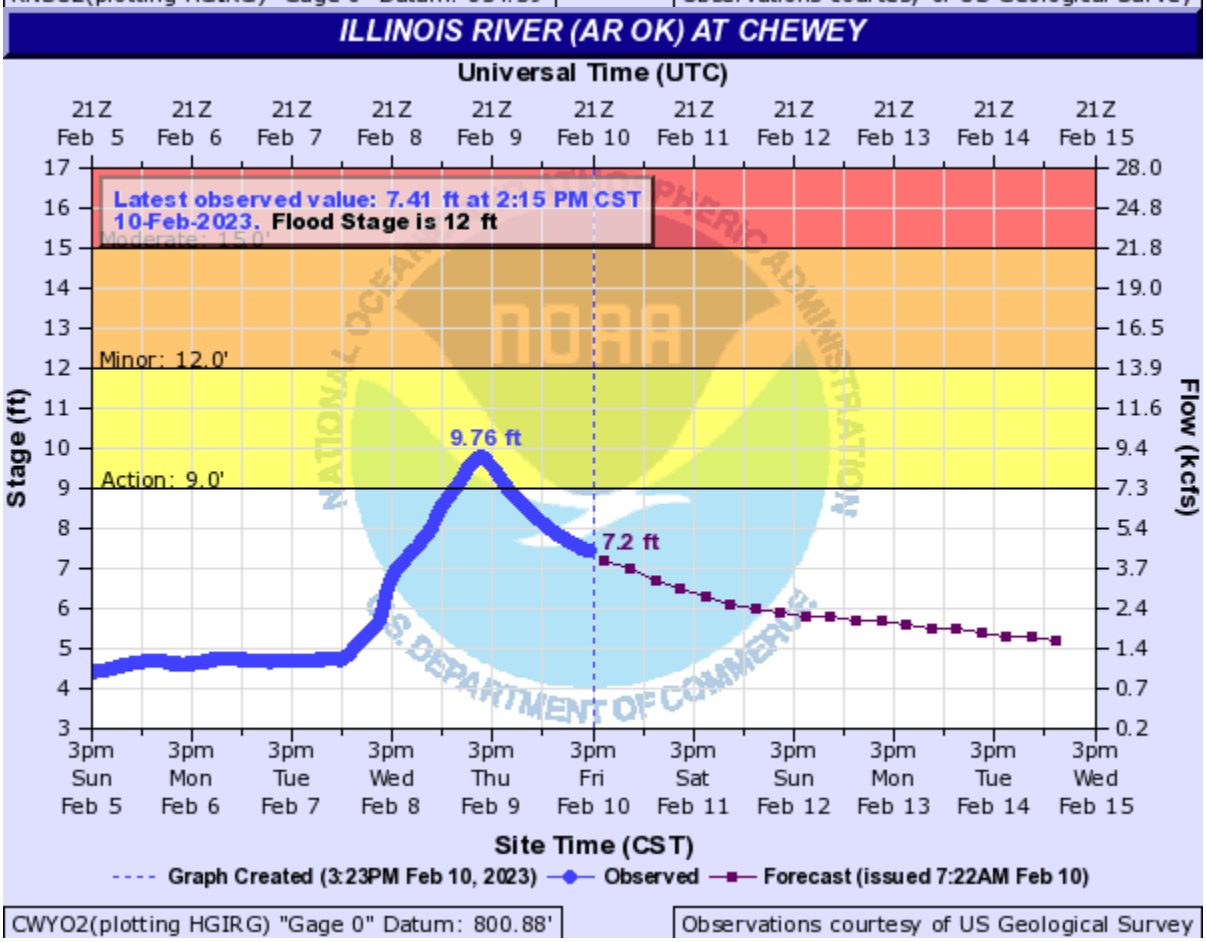
ILLINOIS RIVER (AR OK) NEAR WATTS



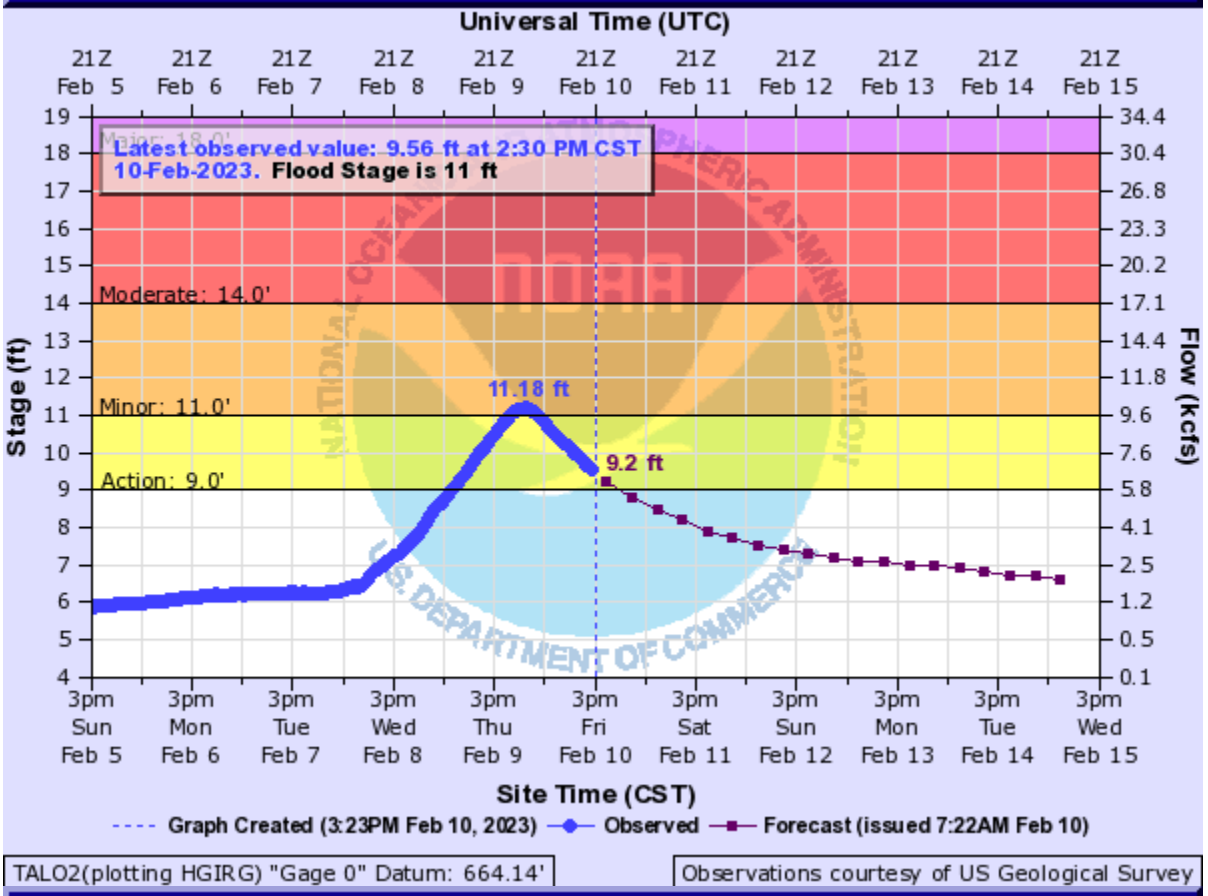
WTTO2(plotting HGIRG) "Gage 0" Datum: 893.78'

Observations courtesy of US Geological Survey


FLINT CREEK (OK) NEAR KANSAS
Universal Time (UTC)
16Z Feb 4
16Z Feb 5
16Z Feb 6
16Z Feb 7
16Z Feb 8
16Z Feb 9
16Z Feb 10
16Z Feb 11
16Z Feb 12
16Z Feb 13
16Z Feb 14
Latest observed value: 7.57 ft at 9:30 AM CST 9-Feb-2023. Flood Stage is 11 ft
Moderate: 13.0'
Minor: 11.0'
Action: 8.0'
7.98 ft
7.6 ft
Stage (ft)
Flow (kcfs)
15
14
13
12
11
10
9
8
7
6
5
14.9
13.3
11.6
9.6
7.6
5.6
3.6
1.8
0.6
0.0
10am Sat Feb 4
10am Sun Feb 5
10am Mon Feb 6
10am Tue Feb 7
10am Wed Feb 8
10am Thu Feb 9
10am Fri Feb 10
10am Sat Feb 11
10am Sun Feb 12
10am Mon Feb 13
10am Tue Feb 14
Site Time (CST)
Graph Created (10:39AM Feb 9, 2023)
Observed
Forecast (issued 7:15AM Feb 9)
KNSO2(plotting HGIRG) "Gage 0" Datum: 854.59'
Observations courtesy of US Geological Survey


ILLINOIS RIVER (AR OK) AT CHEWEY
Universal Time (UTC)
21Z Feb 5
21Z Feb 6
21Z Feb 7
21Z Feb 8
21Z Feb 9
21Z Feb 10
21Z Feb 11
21Z Feb 12
21Z Feb 13
21Z Feb 14
21Z Feb 15
Latest observed value: 7.41 ft at 2:15 PM CST 10-Feb-2023. Flood Stage is 12 ft
Moderate: 15.0'
Minor: 12.0'
Action: 9.0'
9.76 ft
7.2 ft
Stage (ft)
Flow (kcfs)
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
28.0
24.8
21.8
19.0
16.5
13.9
11.6
9.4
7.3
5.4
3.7
2.4
1.4
0.7
0.2
3pm Sun Feb 5
3pm Mon Feb 6
3pm Tue Feb 7
3pm Wed Feb 8
3pm Thu Feb 9
3pm Fri Feb 10
3pm Sat Feb 11
3pm Sun Feb 12
3pm Mon Feb 13
3pm Tue Feb 14
3pm Wed Feb 15
Site Time (CST)
Graph Created (3:23PM Feb 10, 2023)
Observed
Forecast (issued 7:22AM Feb 10)
CWYO2(plotting HGIRG) "Gage 0" Datum: 800.88'
Observations courtesy of US Geological Survey

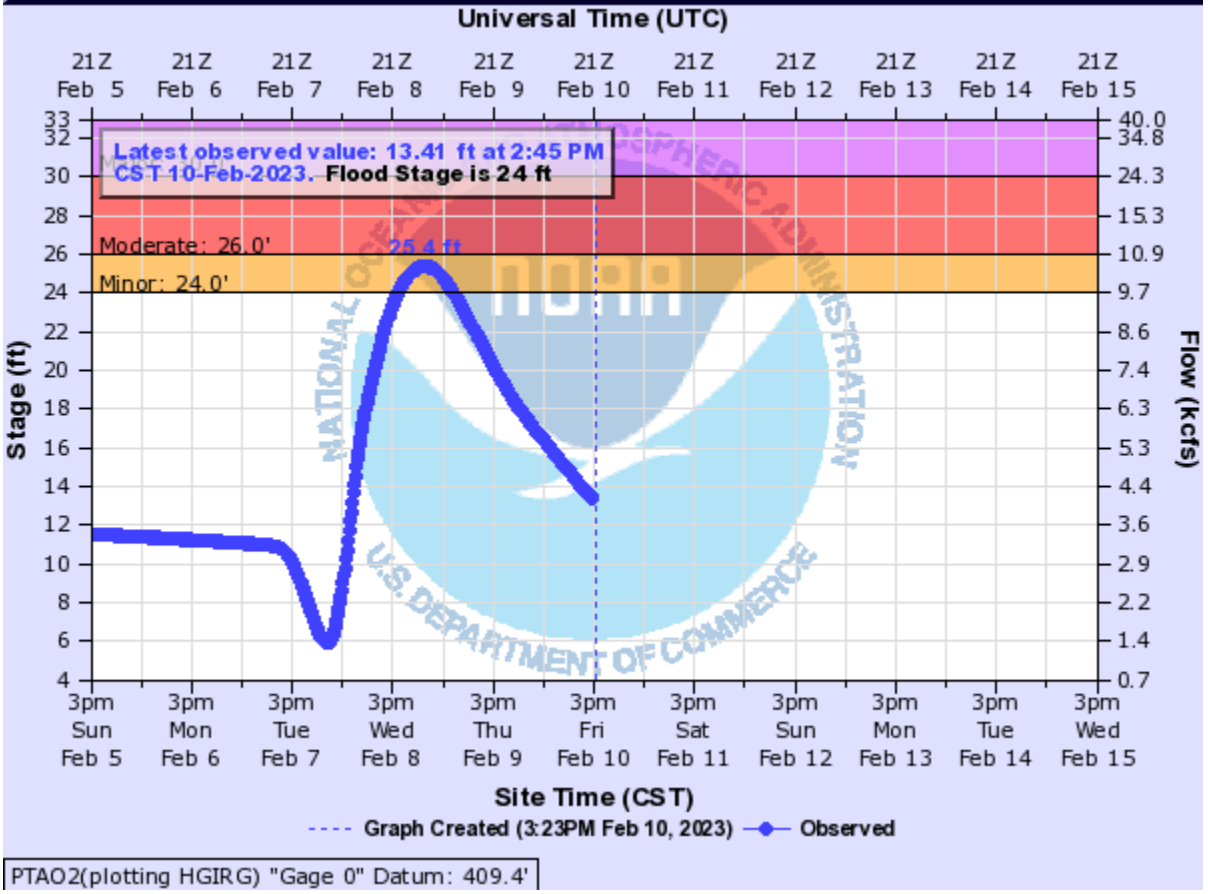
ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH



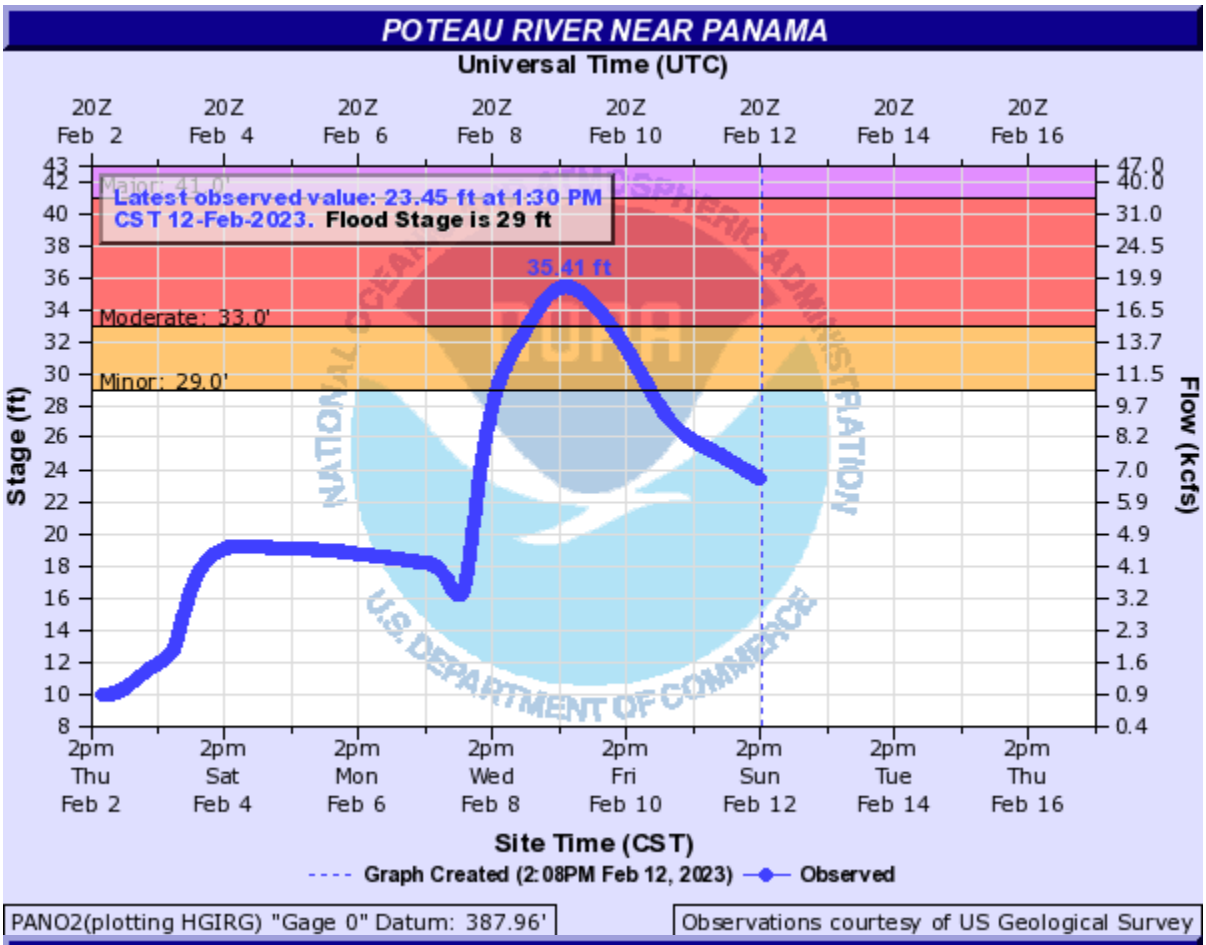
TALO2(plotting HGIRG) "Gage 0" Datum: 664.14'

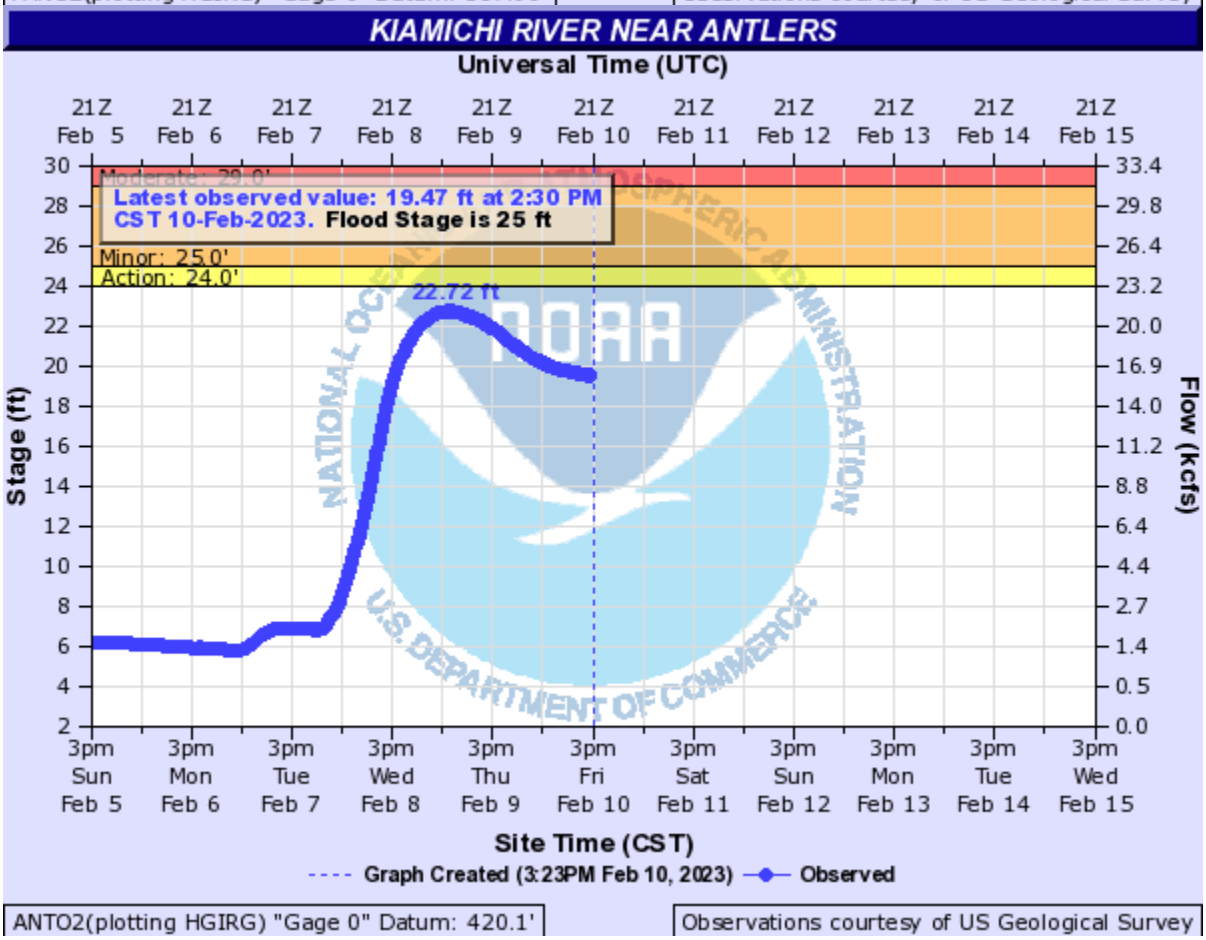
Observations courtesy of US Geological Survey

POTEAU RIVER NEAR POTEAU



PTAO2(plotting HGIRG) "Gage 0" Datum: 409.4'


POTEAU RIVER NEAR PANAMA
Universal Time (UTC)
20Z Feb 2
20Z Feb 4
20Z Feb 6
20Z Feb 8
20Z Feb 10
20Z Feb 12
20Z Feb 14
20Z Feb 16
Latest observed value: 23.45 ft at 1:30 PM CST 12-Feb-2023. Flood Stage is 29 ft
35.41 ft
Moderate: 33.0'
Minor: 29.0'
Stage (ft)
Flow (kcfs)
2pm Thu Feb 2
2pm Sat Feb 4
2pm Mon Feb 6
2pm Wed Feb 8
2pm Fri Feb 10
2pm Sun Feb 12
2pm Tue Feb 14
2pm Thu Feb 16
Site Time (CST)
Graph Created (2:08PM Feb 12, 2023)
Observed
PANO2(plotting HGIRG) "Gage 0" Datum: 387.96'
Observations courtesy of US Geological Survey


KIAMICHI RIVER NEAR ANTLERS
Universal Time (UTC)
21Z Feb 5
21Z Feb 6
21Z Feb 7
21Z Feb 8
21Z Feb 9
21Z Feb 10
21Z Feb 11
21Z Feb 12
21Z Feb 13
21Z Feb 14
21Z Feb 15
Latest observed value: 19.47 ft at 2:30 PM CST 10-Feb-2023. Flood Stage is 25 ft
Minor: 25.0'
Action: 24.0'
22.72 ft
Stage (ft)
Flow (kcfs)
3pm Sun Feb 5
3pm Mon Feb 6
3pm Tue Feb 7
3pm Wed Feb 8
3pm Thu Feb 9
3pm Fri Feb 10
3pm Sat Feb 11
3pm Sun Feb 12
3pm Mon Feb 13
3pm Tue Feb 14
3pm Wed Feb 15
Site Time (CST)
Graph Created (3:23PM Feb 10, 2023)
Observed
ANTO2(plotting HGIRG) "Gage 0" Datum: 420.1'
Observations courtesy of US Geological Survey