

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	HYDROLOGIC SERVICE AREA (HSA)	
		Tulsa, Oklahoma (TSA)	
MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS		REPORT FOR:	
		MONTH December	YEAR 2021
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 7, 2022	

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.

Rainfall in December 2021 primarily occurred during two heavy rain events, and minor to moderate flooding occurred along the Illinois River basin. The December 2021 mean temperature was 10-13°F above normal across eastern OK and northwest AR and was the warmest December on record for Tulsa, OK (since 1905) and Fayetteville, AR (since 1949). 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 <http://www.weather.gov/tsa/hydro-monthly-summary>.

Monthly Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for December 2021 ranged from 0.25" to 8" across eastern OK and northwest AR, with much of the area receiving 1"-4". These rainfall totals correspond to 10% to around 200% of the normal December rainfall (Fig. 1b).

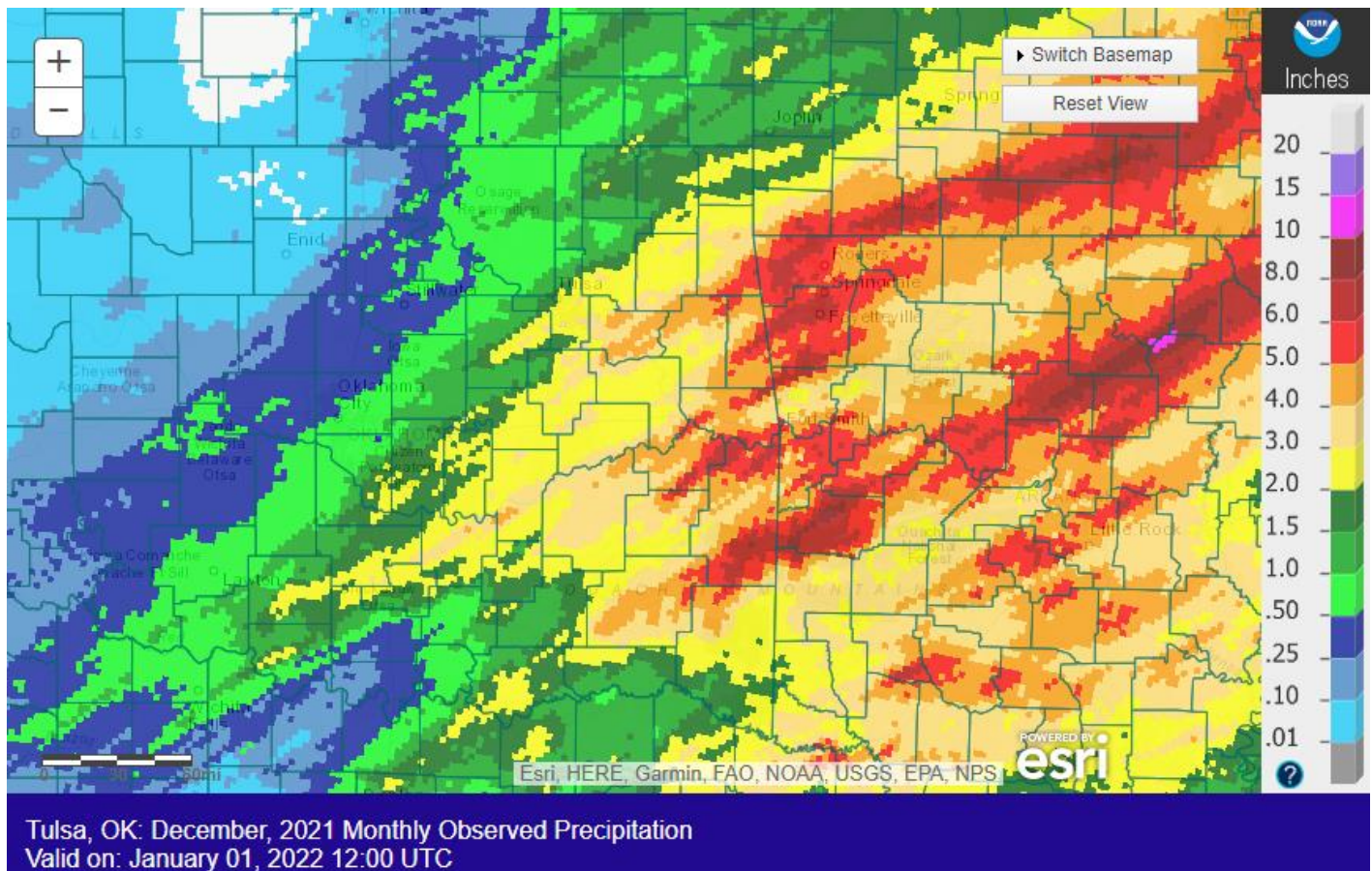


Fig. 1a. Estimated Observed Rainfall for December 2021

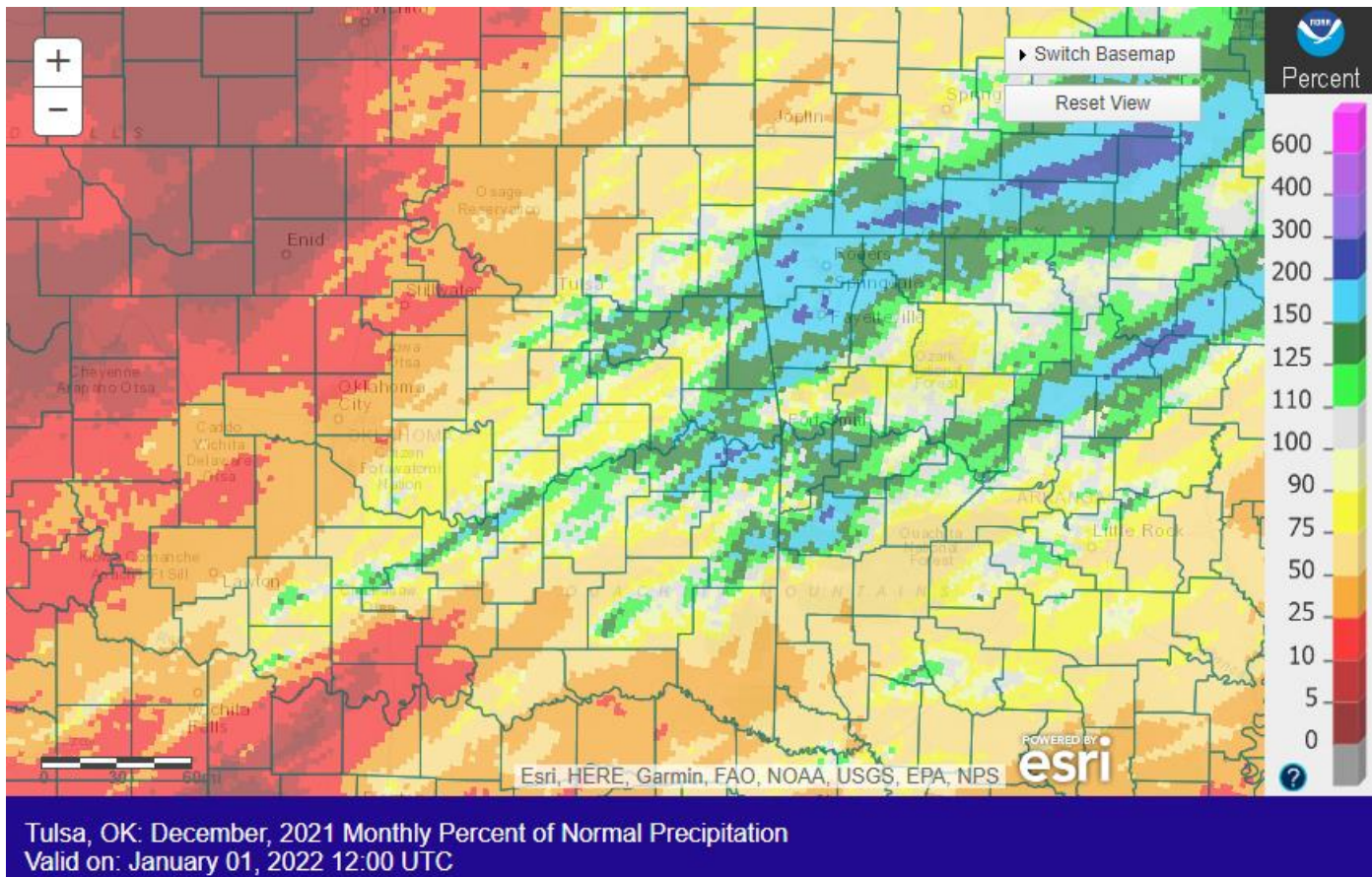


Fig. 1b. Estimated % of Normal Rainfall for December 2021

In Tulsa, OK, December 2021 ranked as the Record warmest December (52.2°F, previous record was 47.3°F in 1931; since records began in 1905), the 62nd wettest December (1.68"; since records began in 1888), and tied with 27 other years with no December snow. Fort Smith, AR had the 2nd warmest December (54.3°F; since records began in 1882), the 27th wettest December (4.44", tied 1924; since records began in 1882), and tied with 59 other years with no December snow. Fayetteville, AR had the Record warmest (51.5°F, previous record was 45.8°F in 1984), the 9th wettest (5.36") December, and tied with 14 other years with no December snow since records began in 1949.

Some of the larger precipitation reports (in inches) for December 2021 included:

Decatur 2.6ESE, AR (coco)	6.48	Bella Vista 2.2E, AR (coco)	5.96	Winslow 7NE, AR (coop)	5.54
Rogers 2.4SSW, AR (coco)	5.52	Fayetteville 3.9W, AR (coco)	5.51	Centerton 1.0E, AR (coco)	5.44
Fayetteville Drake Field, AR (ASOS)	5.36	NW AR Regional Airport (ASOS)	5.19	Bentonville Airport, AR (AFOS)	5.01

Some of the lowest precipitation reports (in inches) for December 2021 included:

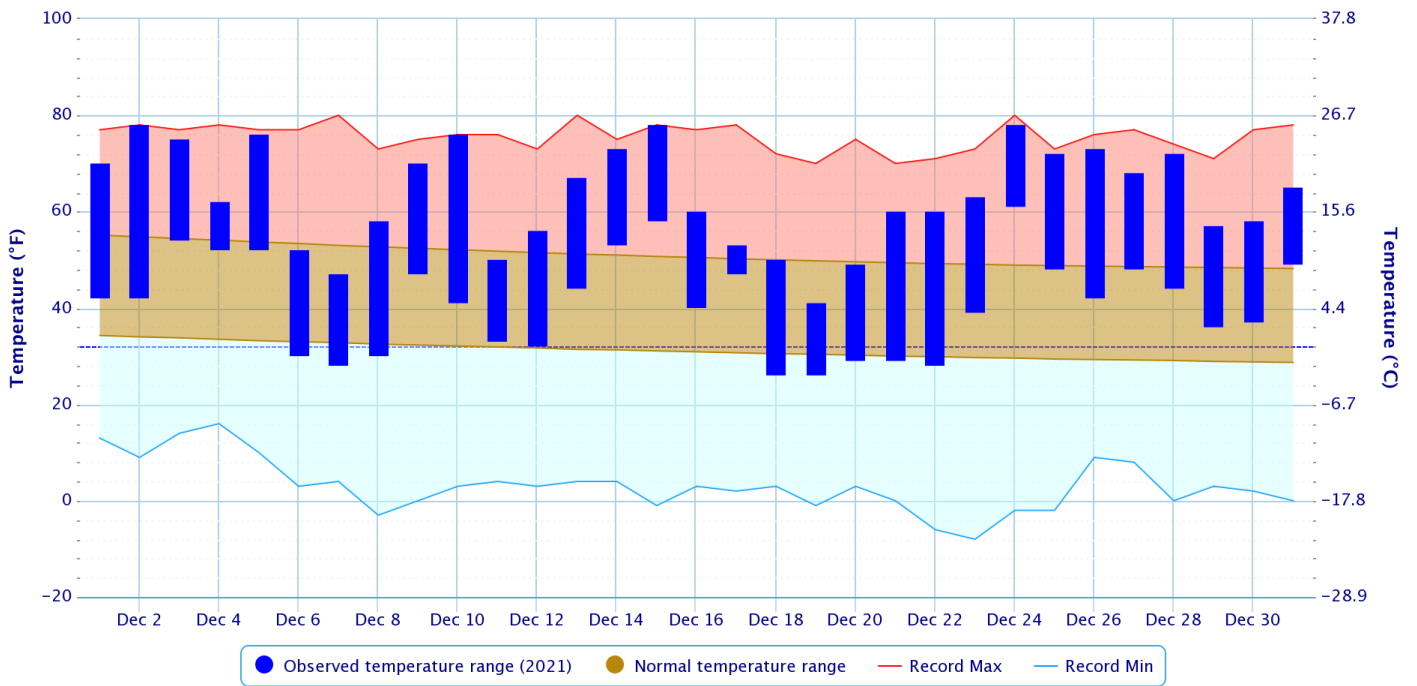
Terlton 3.7ESE, OK (coco)	0.28	Oilton, OK (meso)	0.35	Burbank, OK (meso)	0.52
Skiatook, OK (meso)	0.55	Pawnee, OK (meso)	0.55	Wynona, OK (meso)	0.73
Talala, OK (meso)	0.80	Foraker, OK (meso)	0.83	Copan, OK (meso)	0.85

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

Rank since 1921	December 2021	Year 2021	Last 60 Days (Nov 2 – Dec 31)	Water Year-to-Date (Oct 1, 2021 – Dec 31, 2021)	Cool Growing Season (Sep 1 – Dec 31)	Last 180 Days (Jul 5 – Dec 31)
Northeast OK	48 th driest	39 th wettest	25 th driest	48 th wettest	29 th driest	25 th driest
East Central OK	33 rd wettest	49 th driest	43 rd driest	36 th wettest	48 th driest	34 th driest
Southeast OK	34 th driest	50 th driest	14 th driest	27 th driest	16 th driest	27 th driest
Statewide	22 nd driest	38 th driest	12 th driest	32 nd driest	15 th driest	15 th driest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

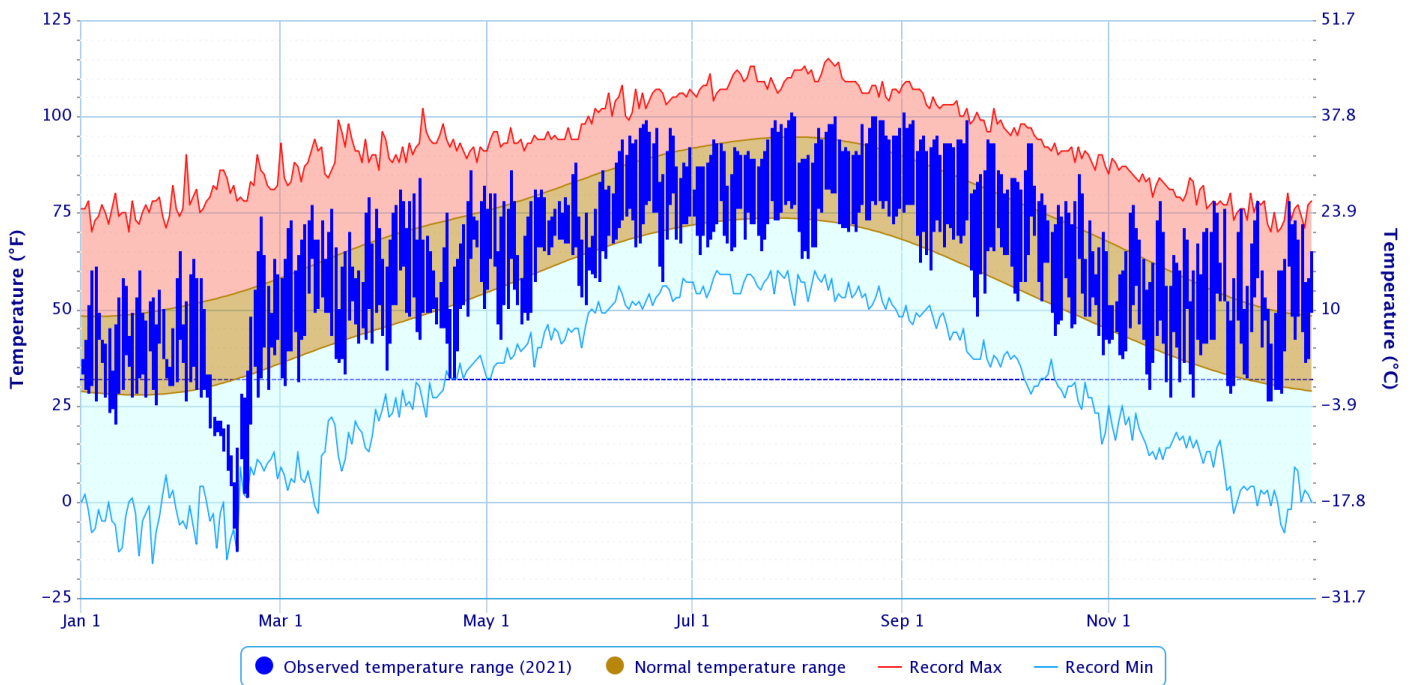
Period of Record – 1905-01-06 to 2022-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



Powered by ACIS

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

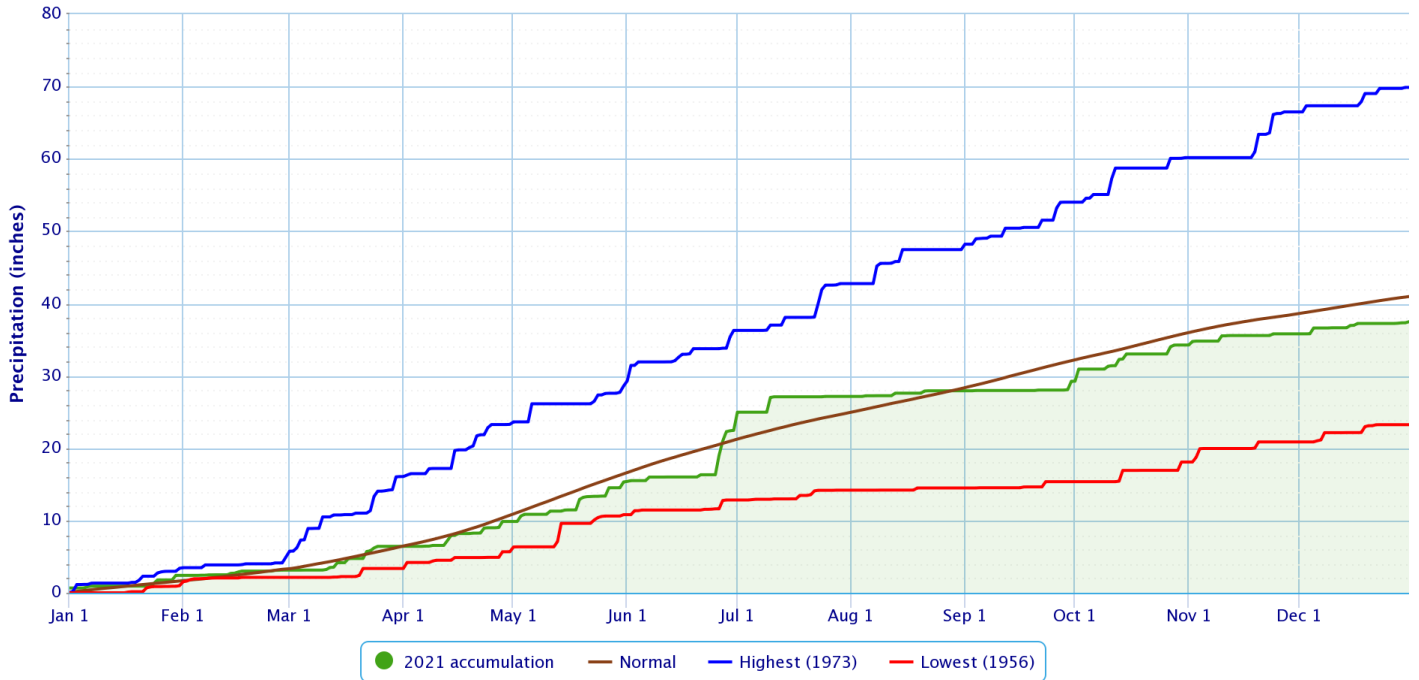
Period of Record – 1905-01-06 to 2022-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

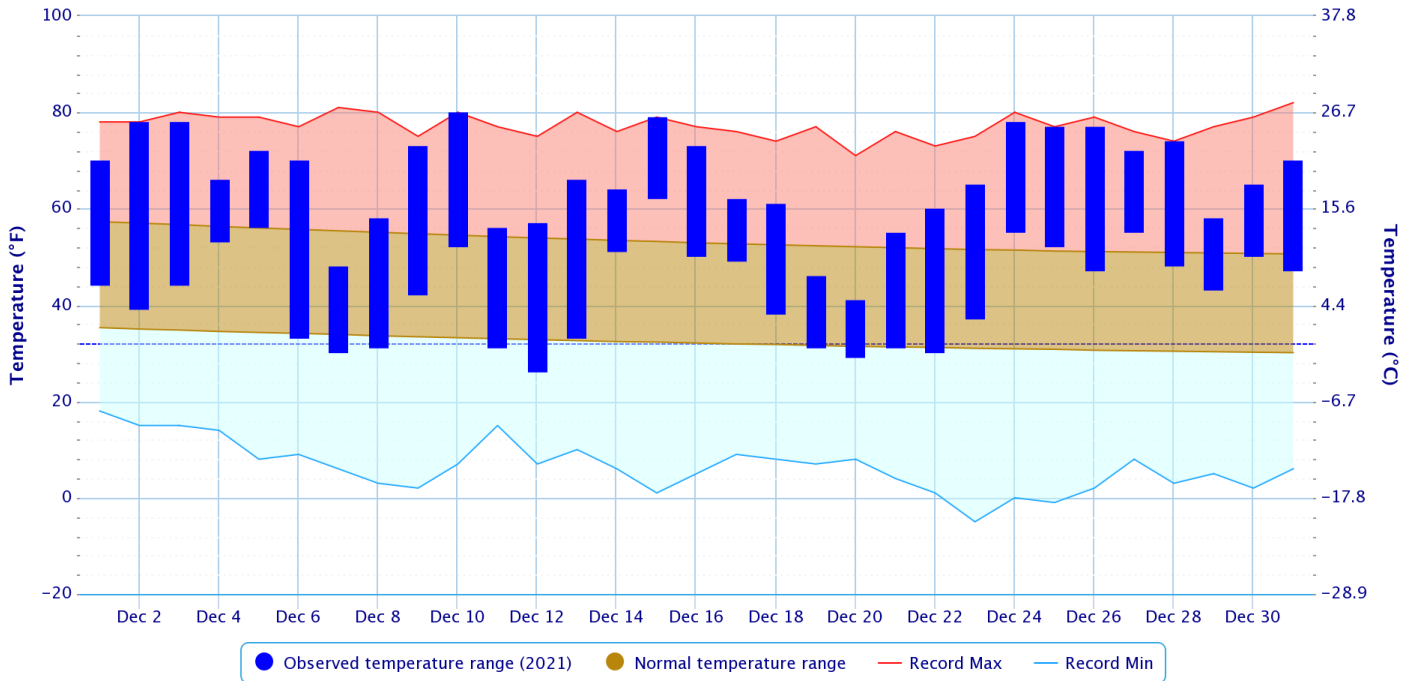
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

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

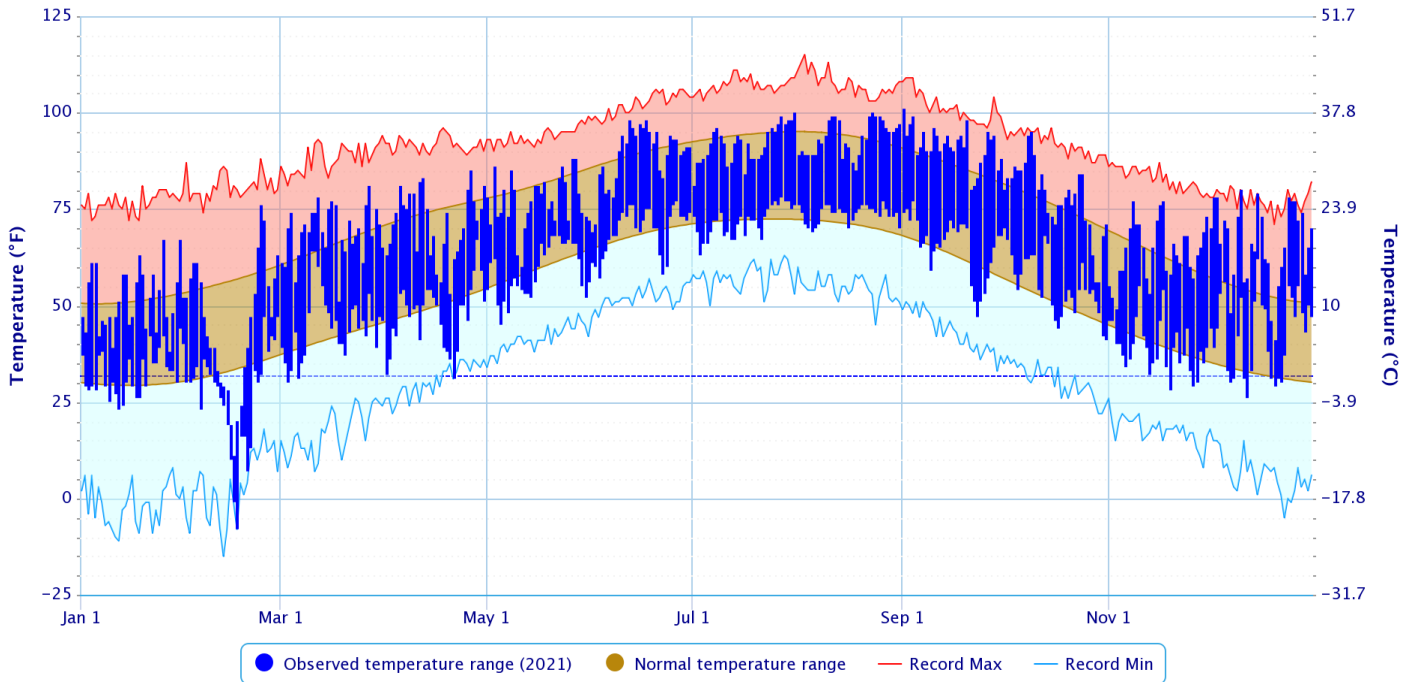
Period of Record – 1882-06-01 to 2022-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



Powered by ACIS

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

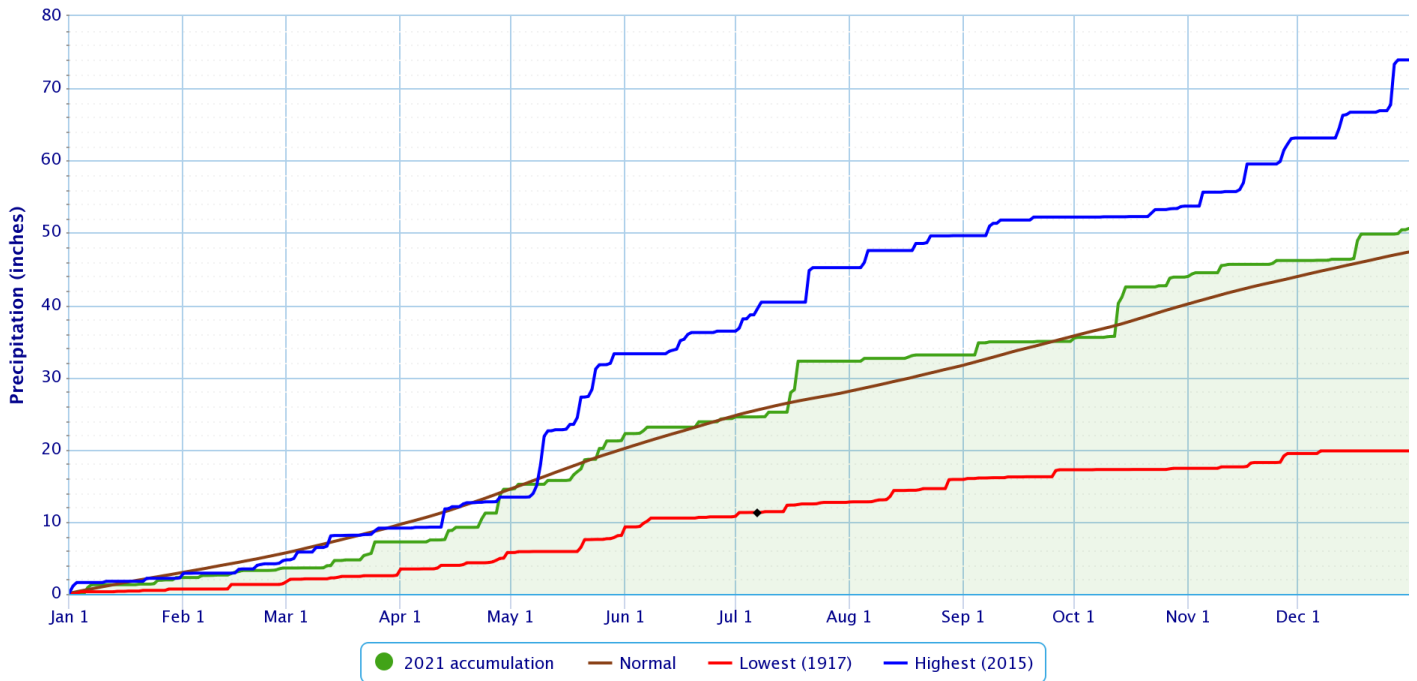
Period of Record – 1882-06-01 to 2022-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



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Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

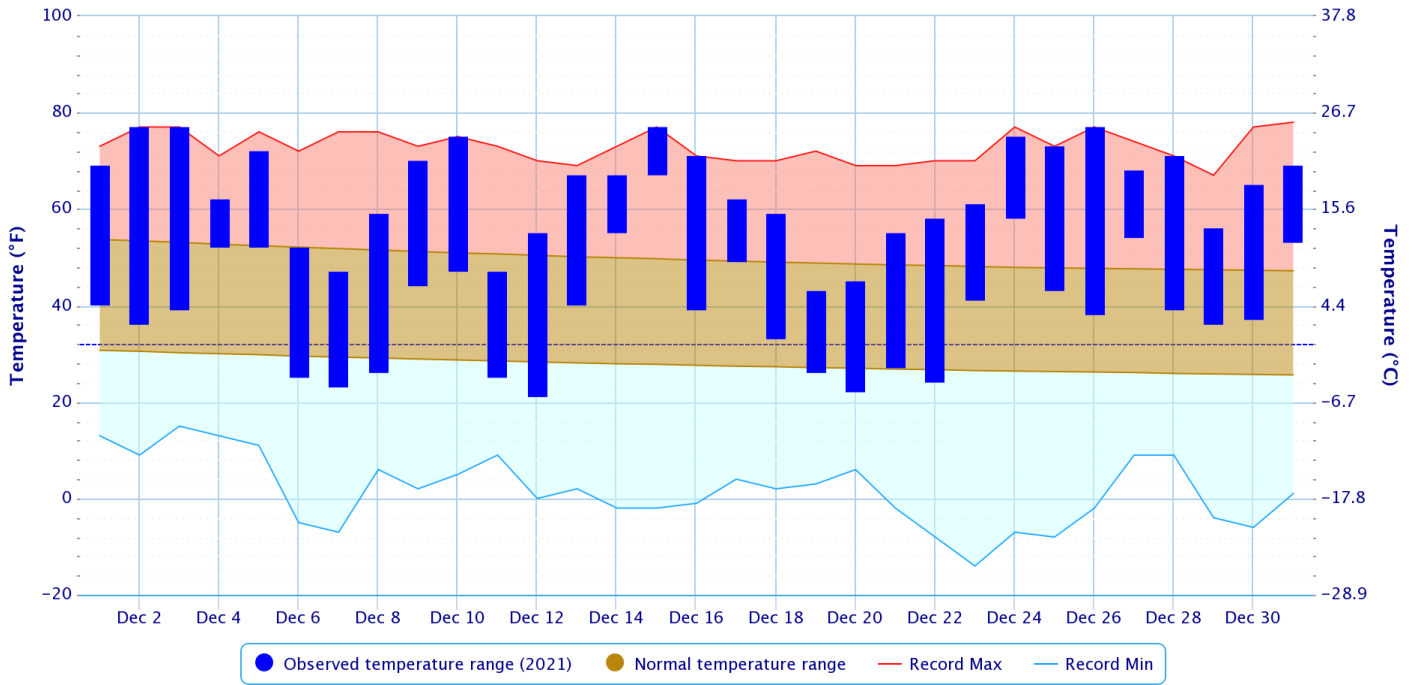
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

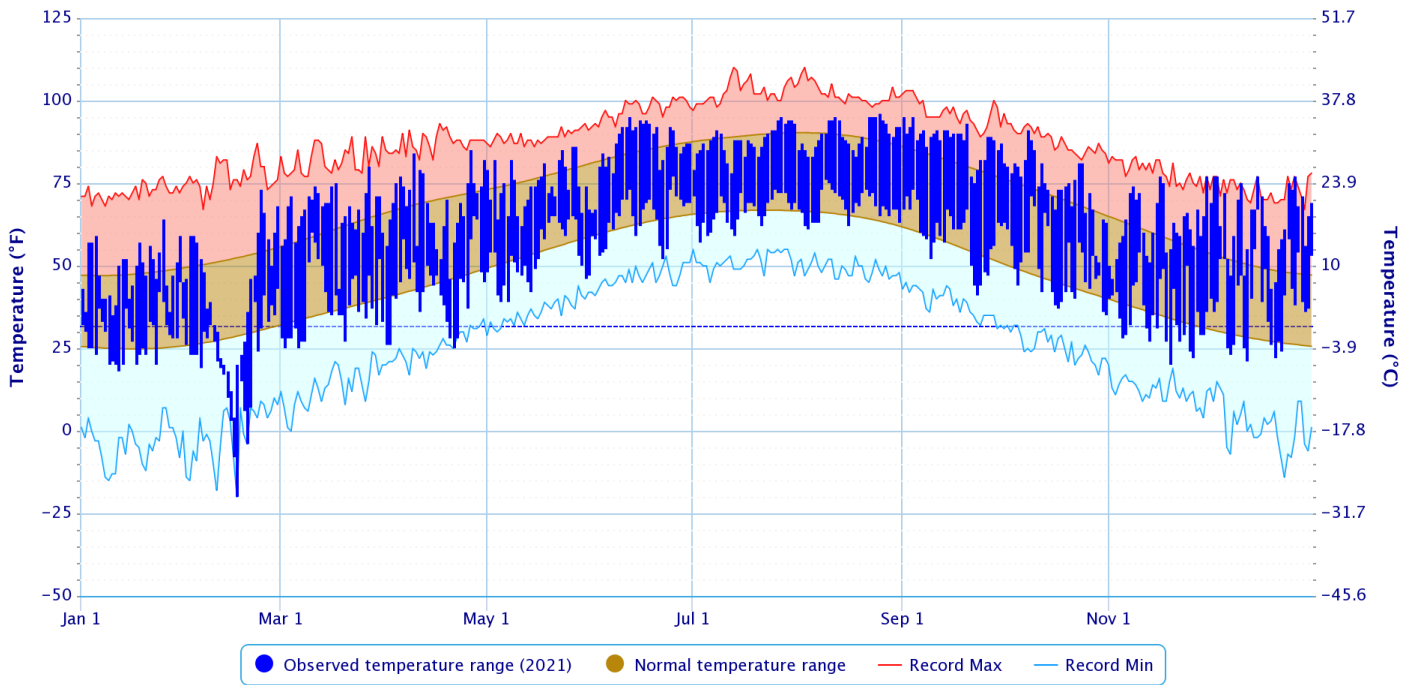
Period of Record – 1949-07-14 to 2022-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



Powered by ACIS

Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

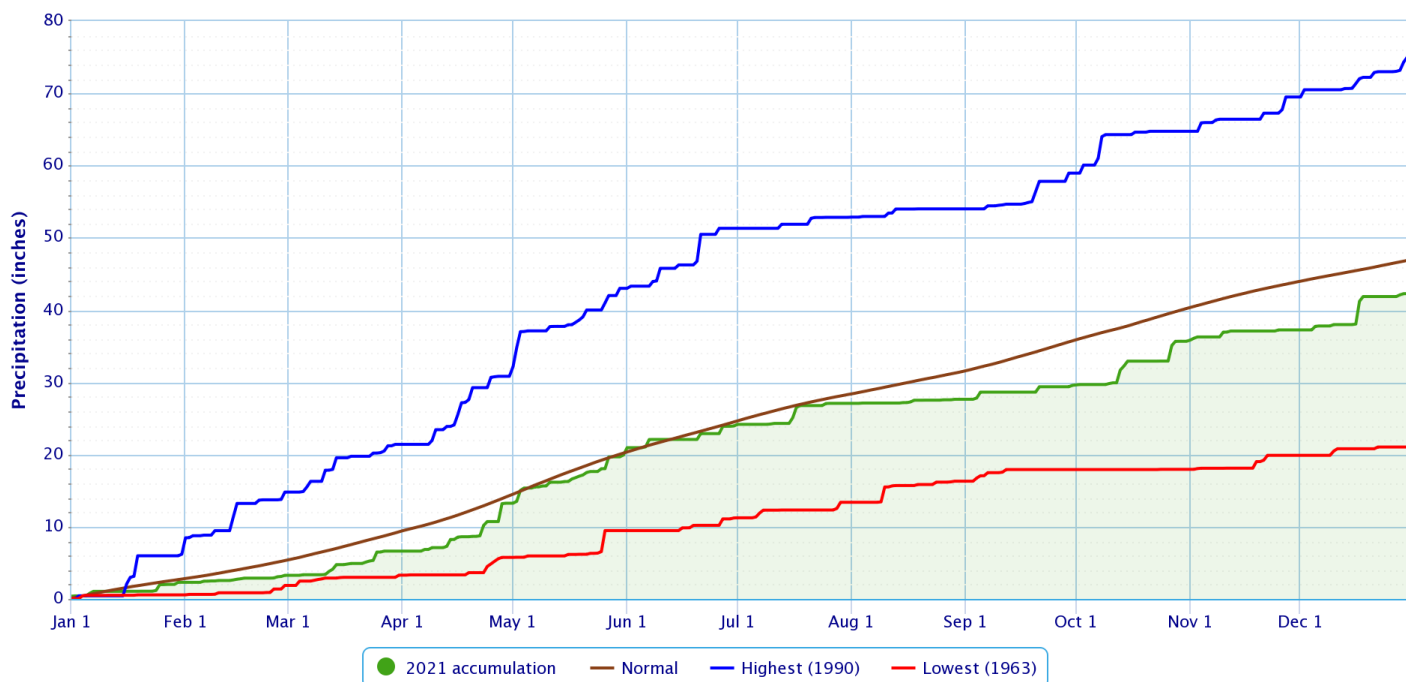
Period of Record – 1949-07-14 to 2022-01-04. Normals period: 1991-2020. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

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



Powered by ACIS

Year 2021

In Tulsa, OK, 2021 ranked as the 21st warmest Year (62.2°F, tied 1939; since records began in 1905), the 66th wettest Year (37.48"; since records began in 1888), and the 44th snowiest Year (10.1", tied 1985; since records began in 1900). Fort Smith, AR had the 16th warmest Year (63.2°F, tied 2005, 1999, 1896; since records began in 1883), the 23rd wettest Year (50.60"; since records began in 1882), and the 51st snowiest Year (6.0", tied 2012, 1935, 1915; since records began in 1884). Fayetteville, AR had the 8th warmest (59.0°F), the 26th driest (42.60"), and the 35th snowiest (7.9", tied 2015, 1969) Year since records began in 1950.

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 2a), rainfall totals for 2021 ranged from 25" to around 60" west to east across eastern OK and northwest AR, with much of the area receiving 35"-50". These rainfall totals correspond to 75% to 110% of the normal annual rainfall for the majority of the area (Fig. 2b). A few isolated spots had 110% to 150% of the normal annual rainfall.

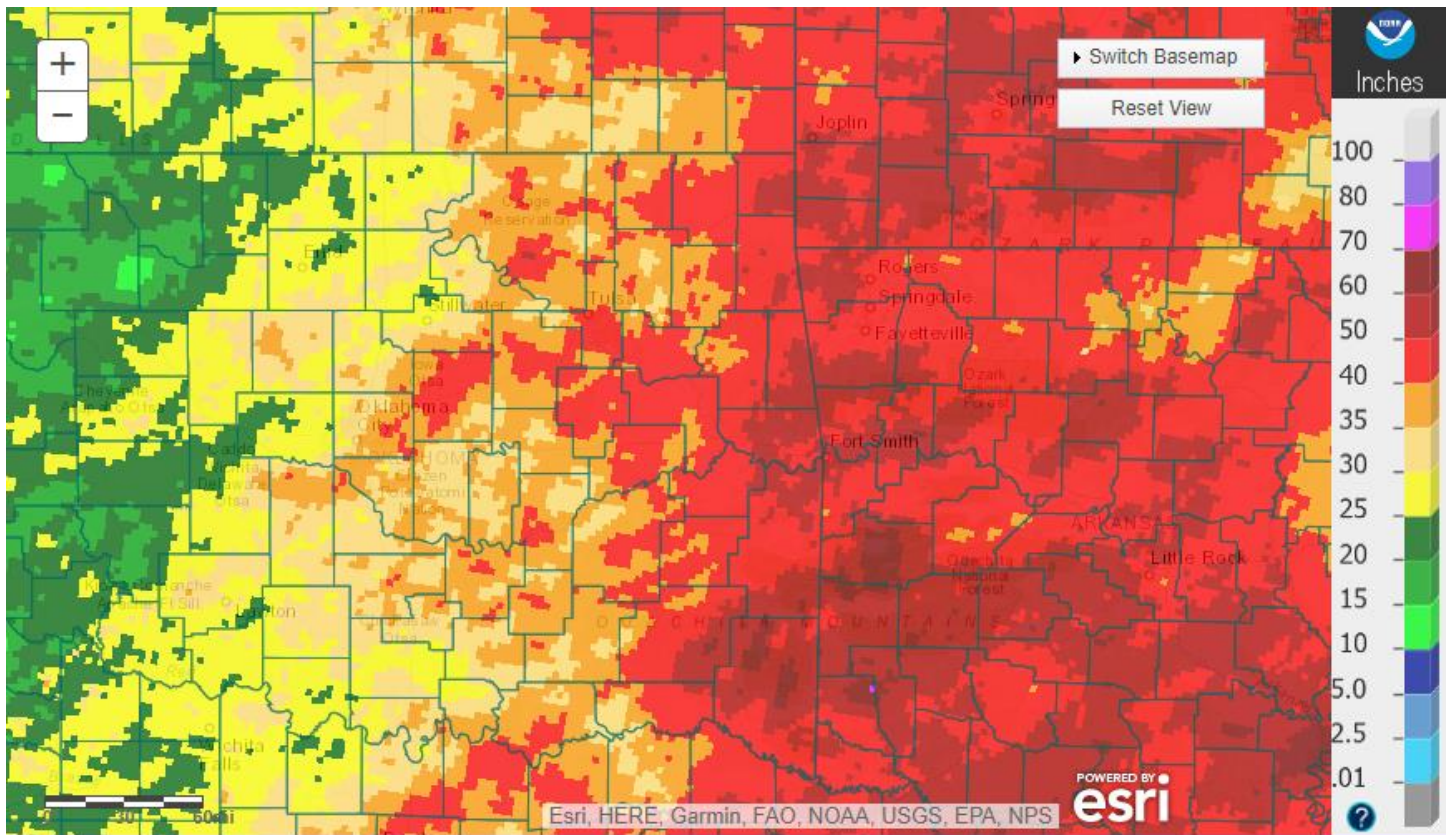
Some of the larger precipitation reports (in inches) for 2021 included:

Uniontown 2.1ESE, AR (coco)	59.07	Ozark, AR (coop)	58.25	Cloudy, OK (meso)	58.16
Winslow 7NE, AR (coop)	58.10	Van Buren 2.1NNW, AR (coco)	57.87	Rogers 2.4SSW, AR (coco)	57.45
Bella Vista 2.5SSE, AR	56.65	Westville 3.0SSW, OK (coco)	56.19	Sallisaw 1.0SE, OK (coco)	55.97

Some of the lowest precipitation reports (in inches) for 2021 included:

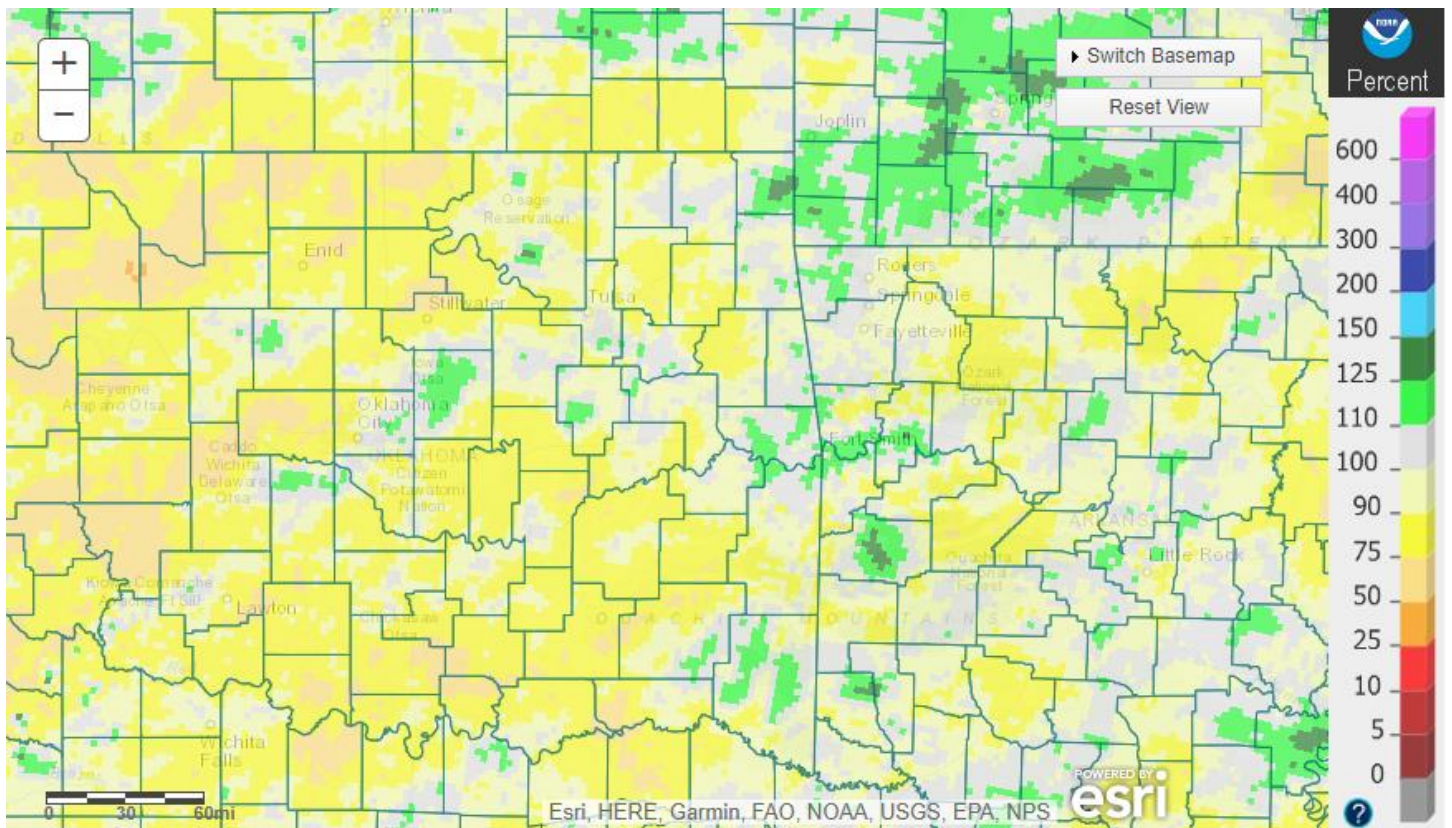
Pawnee, OK (meso)	32.05	Okemah, OK (meso)	36.46	Stuart, OK (meso)	36.67
Tulsa, OK (ASOS)	37.48	Oilton, OK (meso)	37.72	Burbank, OK (meso)	38.20
Talala, OK (meso)	38.84	Hectorville, OK (meso)	39.08	Tulsa 3.4ENE, OK (coco)	39.30

There were 22 tornadoes that occurred in eastern OK and northwest AR in 2021: 4 EF-0, 11 EF-1, and 7 EF-unknown tornadoes.



Tulsa, OK: 2021 Annual Observed Precipitation
Valid on: January 01, 2022 12:00 UTC

Fig. 2a. Estimated Observed Rainfall for 2021



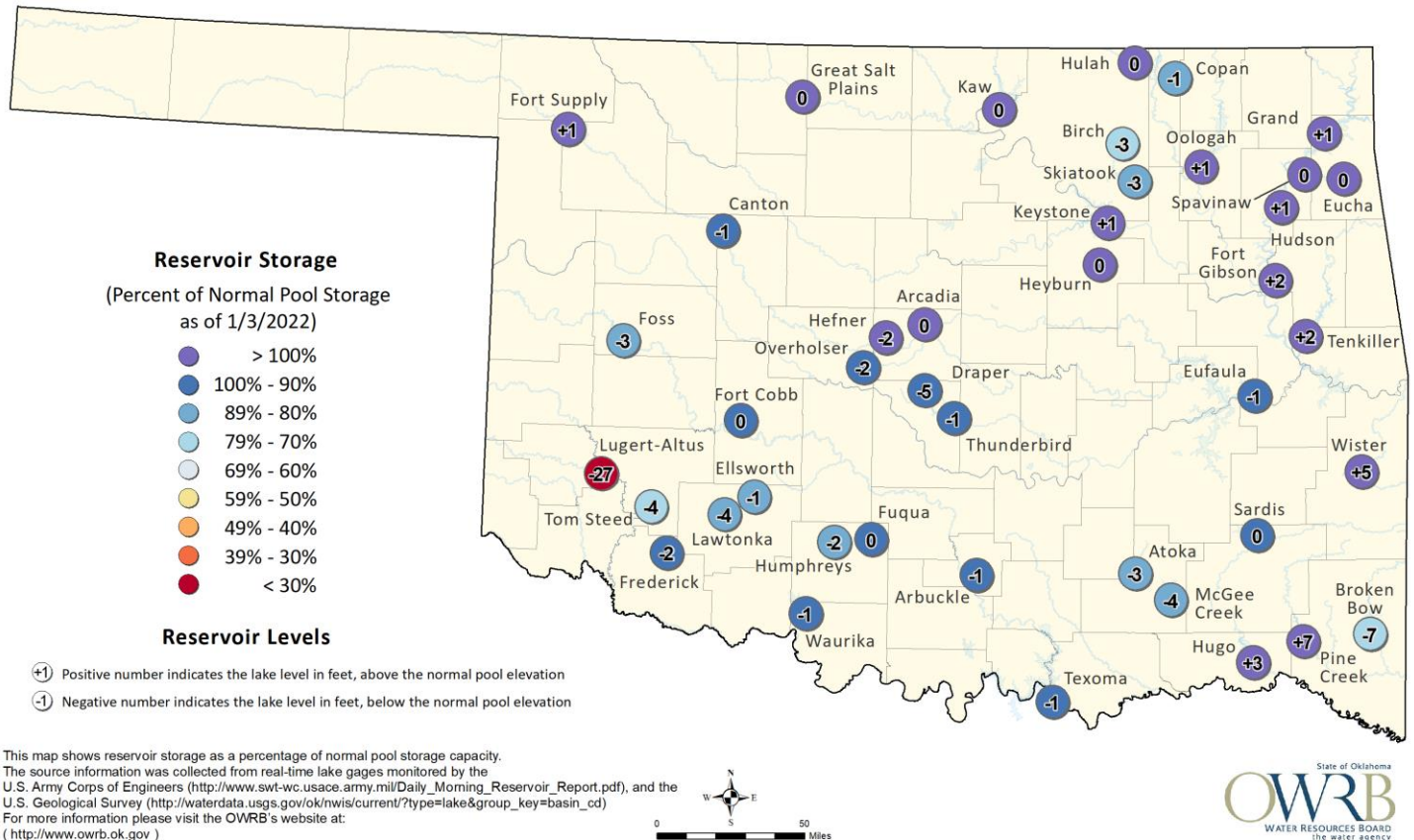
Tulsa, OK: 2021 Annual Percent of Normal Precipitation
Valid on: January 01, 2022 12:00 UTC

Fig. 2b. Estimated % of Normal Rainfall for 2021

Reservoirs

Oklahoma Surface Water Resources

Reservoir Levels and Storage as of 1/3/2022



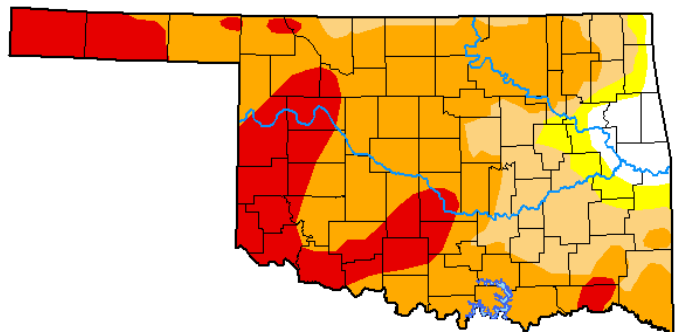
According to the USACE, a few lakes in the HSA were below 3% of top of their conservation pools as of 1/01/2022: Birch Lake 77%, Copan Lake 88%, Skiatook Lake 89%, and Lake Eufaula 91%. A few lakes were more than 3% above the top of their conservation pools: Grand Lake 8%, Tenkiller Lake 6%, and Hudson Lake 5%.

Drought

According to the [U.S. Drought Monitor](#) (USDM) from December 28, 2021 (Figs. 3, 4), drought conditions were present across a large portion of eastern OK and northwest AR. Extreme (D3) Drought conditions developed across portions of Choctaw and Pushmataha Counties in eastern OK. Severe (D2) Drought conditions were present over parts of Osage, Pawnee, Tulsa, Creek, Washington, Nowata, Craig, Rogers, Mayes, Wagoner, Pushmataha, Choctaw, and Le Flore Counties in eastern OK. Moderate (D1) Drought conditions were occurring across portions of Osage, Creek, Rogers, Tulsa, Nowata, Craig, Ottawa, Delaware, Mayes, Wagoner, Okfuskee, Okmulgee, McIntosh, Pittsburg, Latimer, Pushmataha, and Le Flore Counties in eastern OK. Abnormally Dry (but not in drought) (D0) conditions were occurring over portions of Tulsa, Ottawa, Delaware, Cherokee, Wagoner, Rogers, Mayes, Muskogee, Okmulgee, McIntosh, Pittsburg, Latimer, Haskell, and Le Flore Counties in eastern OK, and Sebastian, Franklin, and Madison Counties in northwest AR.

U.S. Drought Monitor Oklahoma

December 28, 2021
(Released Thursday, Dec. 30, 2021)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	4.92	95.08	90.17	72.51	22.62	0.00
Last Week 12-21-2021	9.90	90.10	79.18	43.68	8.83	0.00
3 Months Ago 09-28-2021	6.45	93.55	73.23	23.72	2.65	0.00
Start of Calendar Year 12-29-2020	56.83	43.17	25.21	7.75	1.45	0.00
Start of Water Year 09-28-2021	6.45	93.55	73.23	23.72	2.65	0.00
One Year Ago 12-29-2020	56.83	43.17	25.21	7.75	1.45	0.00

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:

Brad Pugh
CPC/NOAA

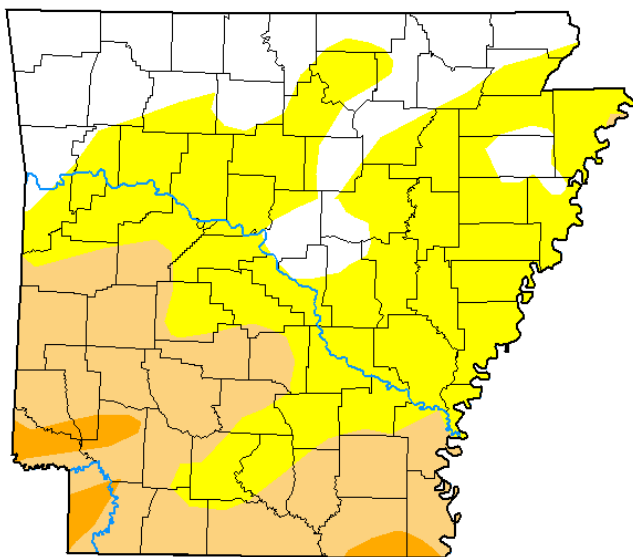


droughtmonitor.unl.edu

Fig. 3. Drought Monitor for Oklahoma

U.S. Drought Monitor Arkansas

December 28, 2021
(Released Thursday, Dec. 30, 2021)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	23.76	76.24	29.83	2.67	0.00	0.00
Last Week 12-21-2021	25.18	74.82	21.99	1.26	0.00	0.00
3 Months Ago 09-28-2021	51.41	48.59	5.17	0.00	0.00	0.00
Start of Calendar Year 12-29-2020	16.45	83.55	6.87	0.00	0.00	0.00
Start of Water Year 09-28-2021	51.41	48.59	5.17	0.00	0.00	0.00
One Year Ago 12-29-2020	16.45	83.55	6.87	0.00	0.00	0.00

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:

Brad Pugh
CPC/NOAA



droughtmonitor.unl.edu

Fig. 4. Drought Monitor for Arkansas

Outlooks

The [Climate Prediction Center](#) (CPC) outlook for January 2022 (issued December 31, 2021) indicates equal chances for above, near, and below normal temperatures and precipitation across all of eastern OK and northwest AR. This outlook was largely based on dynamical model output and La Niña impacts. However, changes in the Pacific-North American Oscillation (PNA) and Madden-Julian Oscillation (MJO) during January may cancel out La Niña impacts at times, resulting in a more uncertain outlook this month.

For the 3-month period January-February-March 2022, CPC is forecasting an enhanced chance for above normal temperatures and an equal chance for above, near, and below median precipitation across all of eastern OK and northwest AR (outlook issued December 16, 2021). This outlook is based on long-term trends, La Niña impacts, MJO impacts, and incorporates both statistical and dynamical forecast tools. According to CPC, the combined effect of the ocean-atmosphere system remains consistent with La Niña conditions. There is a 95% chance that La Niña conditions will continue through winter 2021-22 and a 60% chance for ENSO-neutral conditions in Spring 2022. 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

Warm air advection over a surface front located just south of the Red River resulted in the development of showers and thunderstorms north of the front across southeast and east central OK and northwest AR during the early morning hours of the 17th. This activity continued during the day as the warm front continued to move northward before stalling near I-40 in the afternoon. Training of storms then continued along and north of the front through the afternoon and evening hours (Fig. 5). The unseasonably warm and moist air mass had precipitable water values (PWATs) of 1.4", which is near the record value for this time of year. Just before midnight, the front began to move south again as a cold front. Showers and thunderstorms continued along and north of the front, but this activity had finally begun to shift south as well. By sunrise on the 18th, the precipitation had shifted south of the region. Rainfall totals ranged from around 0.25" to near 5" south of I-44 in eastern OK and northwest AR, with the corridor of heaviest rain from east central OK into northwest and west central AR (Figs. 6, 7). Despite dry antecedent conditions, the heavy rain and dormant vegetation allowed for significant runoff from the efficient storms. A large portion of the Illinois River basin received 2.5"-5" of rainfall, resulting in minor to moderate flooding along the Illinois River (see preliminary hydrographs at the end of this report and the E3 Report for details).

Rain moved into southeast OK and west central AR from the southwest during the afternoon of the 31st and continued to spread across much of eastern OK and northwest AR through the evening hours. As the low-level moisture increased from the south (PWATs were once again near historic levels for this time of year), a new warm front took shape from southeast OK into west central AR, where thunderstorms then developed by late evening and overrunning precipitation continued north of the front. Rain continued over much of eastern OK and northwest AR through the overnight hours. A strong cold front moved out of KS and into northeast OK during the early morning hours of the new year and continued southward through the day, finally moving east of the area by noon on the 1st. Rainfall totals ranged from 0.25" to near 4", with the highest rainfall axis of 1.5"-4" located from northwest Choctaw County, OK into Scott County, AR (Figs. 8-10). The heavy rainfall over the southern portion of Le Flore County caused a large rise of the Poteau River; however, the river remained below flood stage (see preliminary hydrographs at the end of this report).

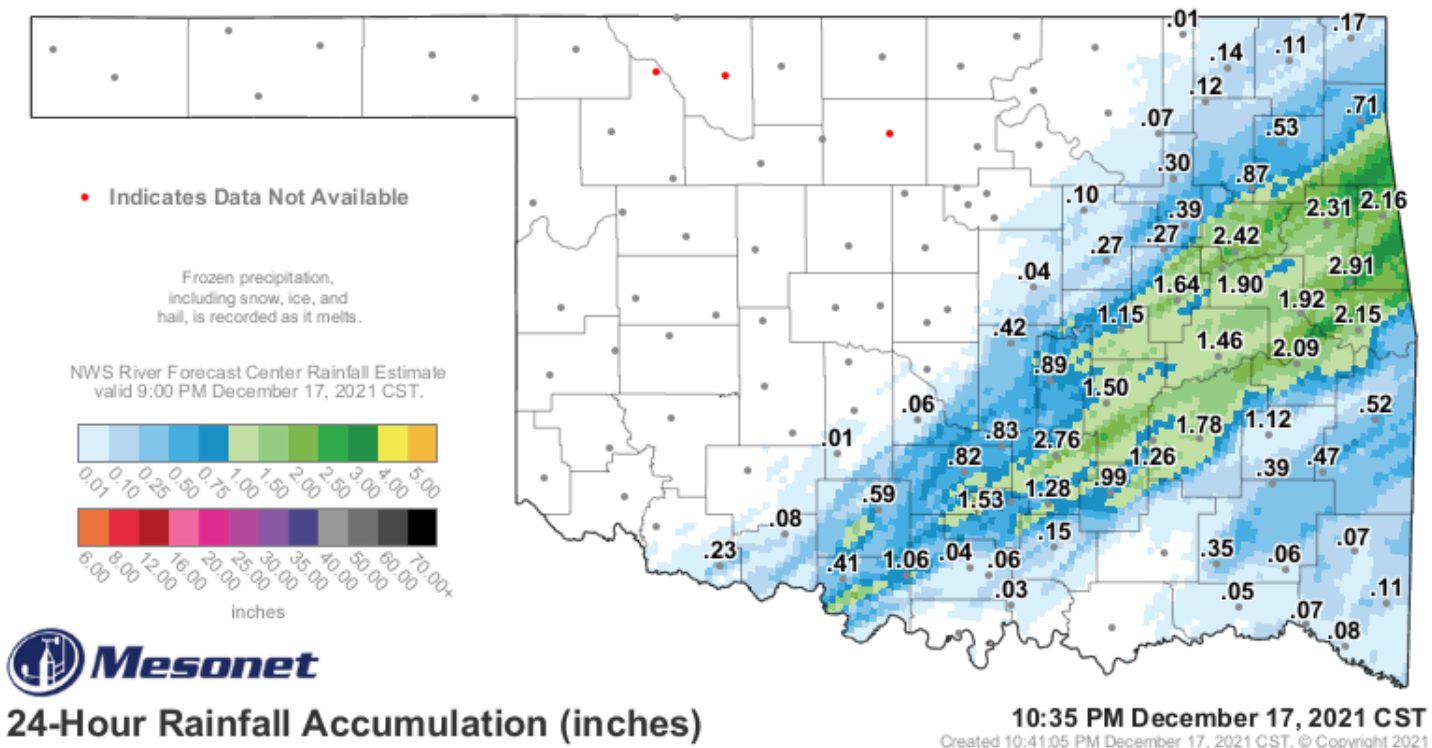


Fig. 5. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 10:35 pm CST 12/17/2021.

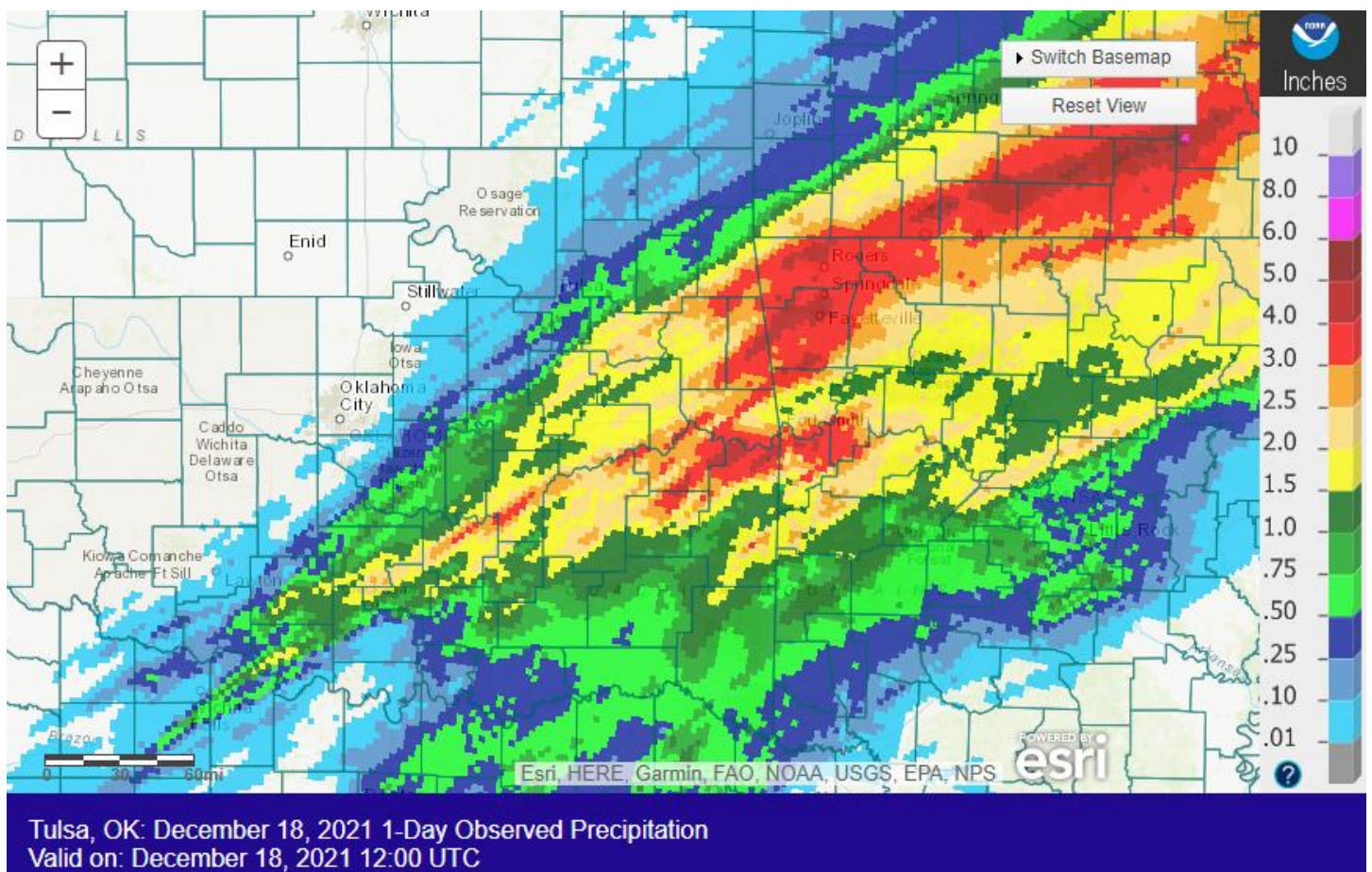


Fig. 6. 24-hour Estimated Observed Rainfall ending at 6am CST 12/18/2021.

Radar Precipitation Estimates Map 12/17-18/21

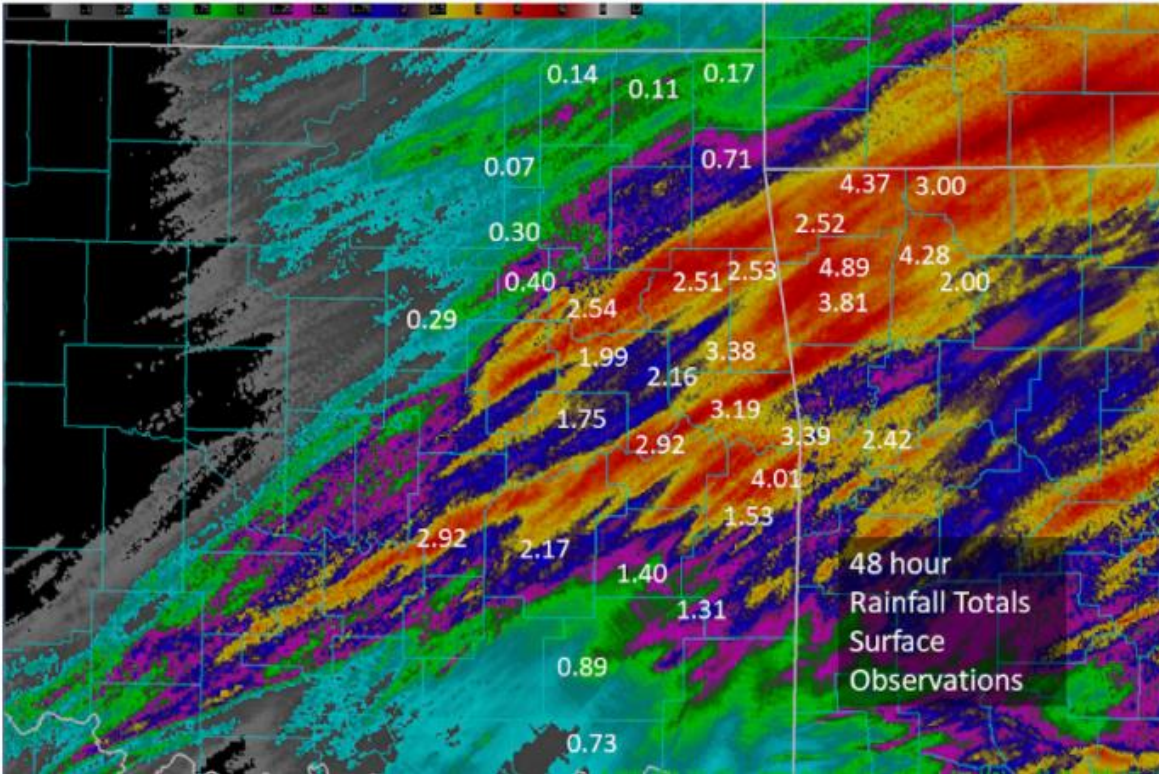


Fig. 7. 48-hour radar estimated precipitation (image) and surface observations (numbers; inches) for December 17-18, 2021.

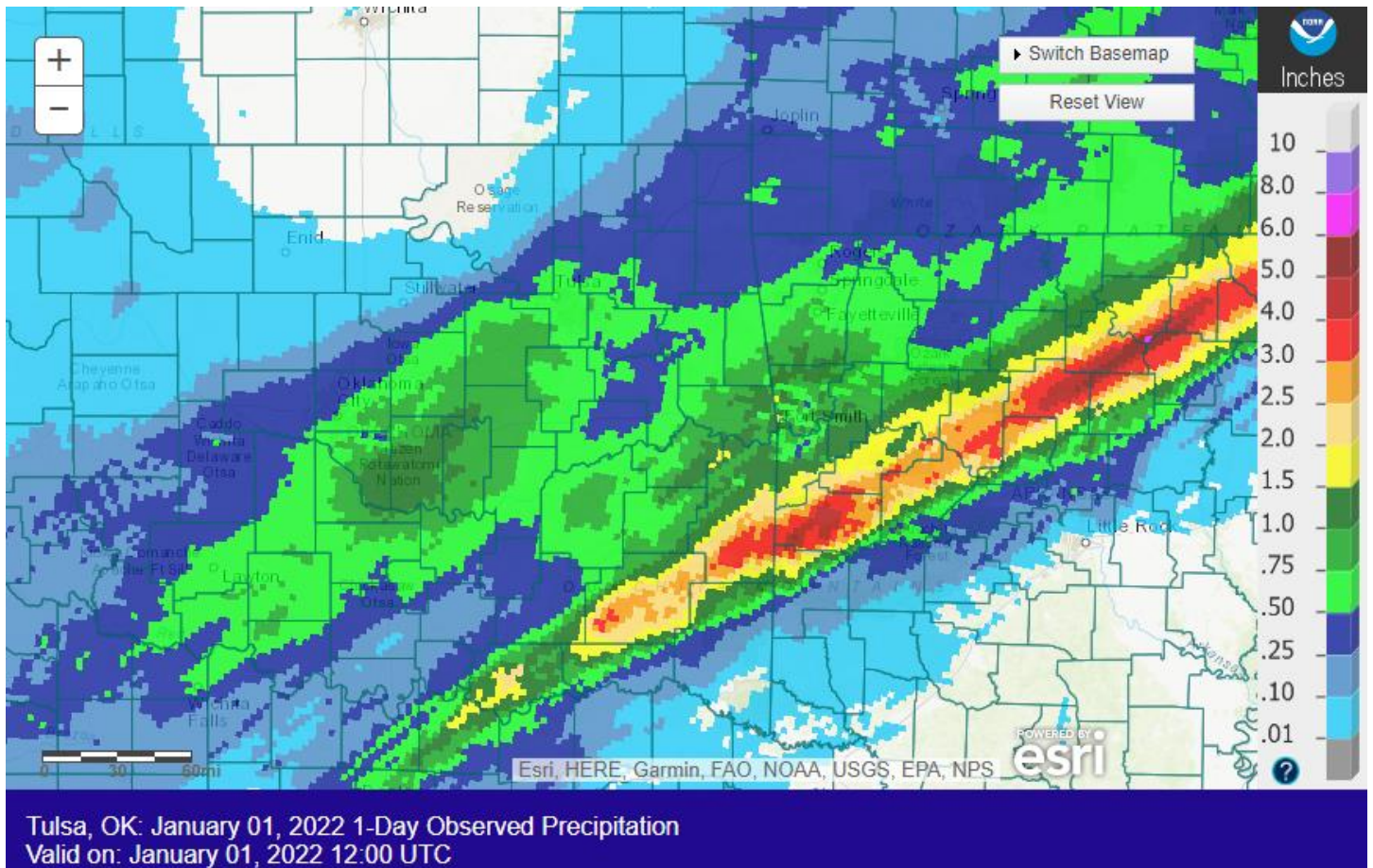
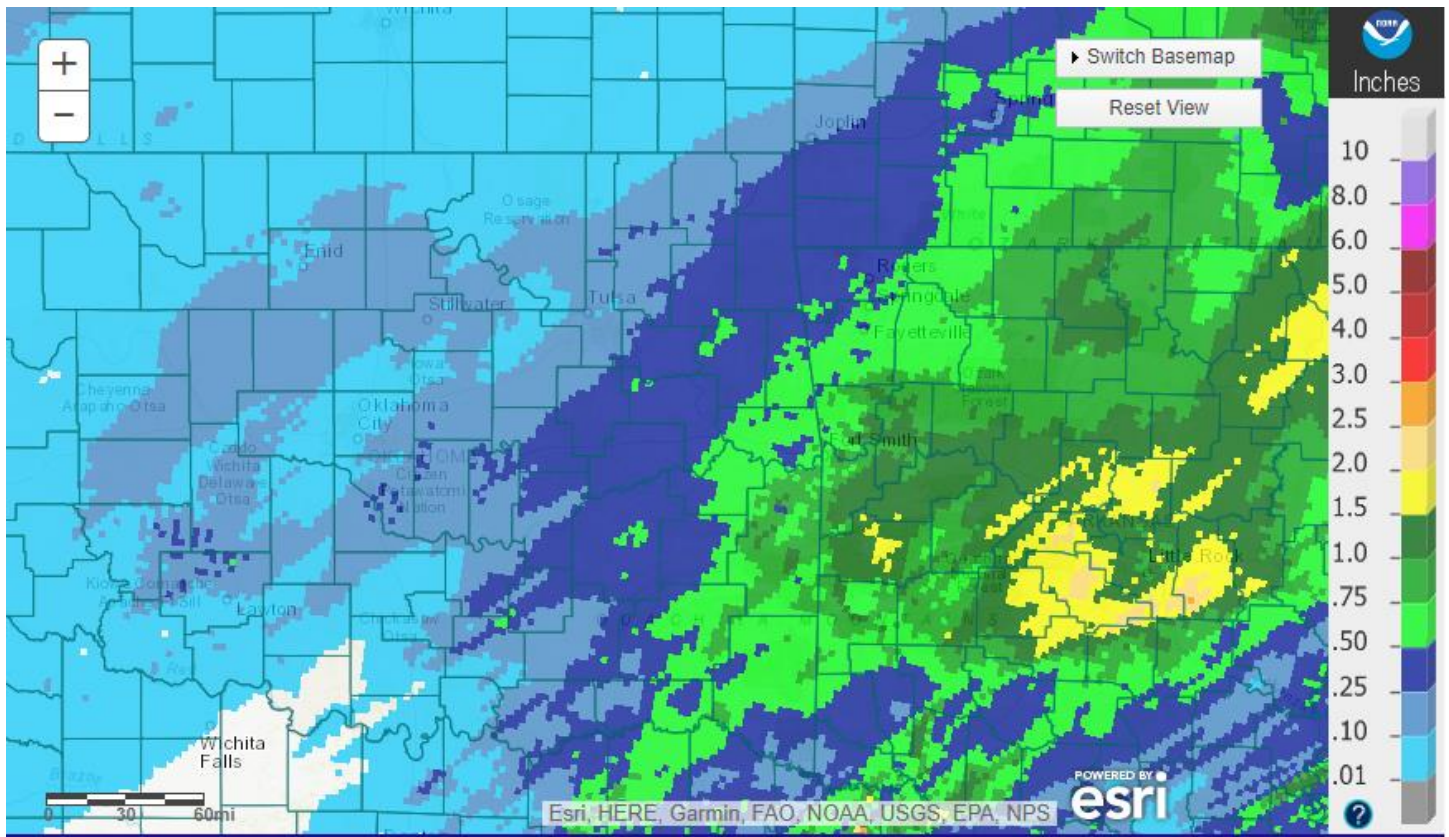
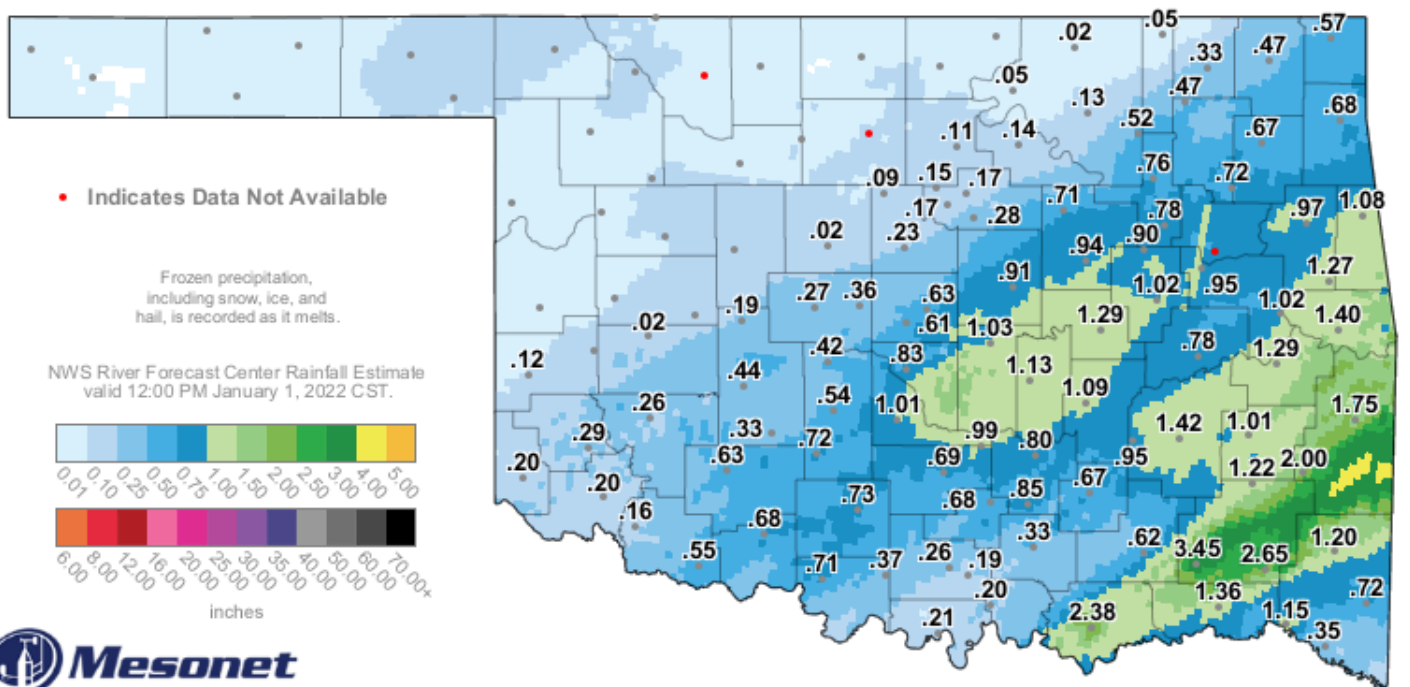


Fig. 8. 24-hour Estimated Observed Rainfall ending at 6am CST 1/01/2022.



Tulsa, OK: January 02, 2022 1-Day Observed Precipitation
Valid on: January 02, 2022 12:00 UTC

Fig. 9. 24-hour Estimated Observed Rainfall ending at 6am CST 1/02/2022.



24-Hour Rainfall Accumulation (inches)

1:25 PM January 1, 2022 CST

Created 1:30:57 PM January 1, 2022 CST. © Copyright 2022

Fig. 10. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 01:25 pm CST 1/01/2022.

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in December 2021:

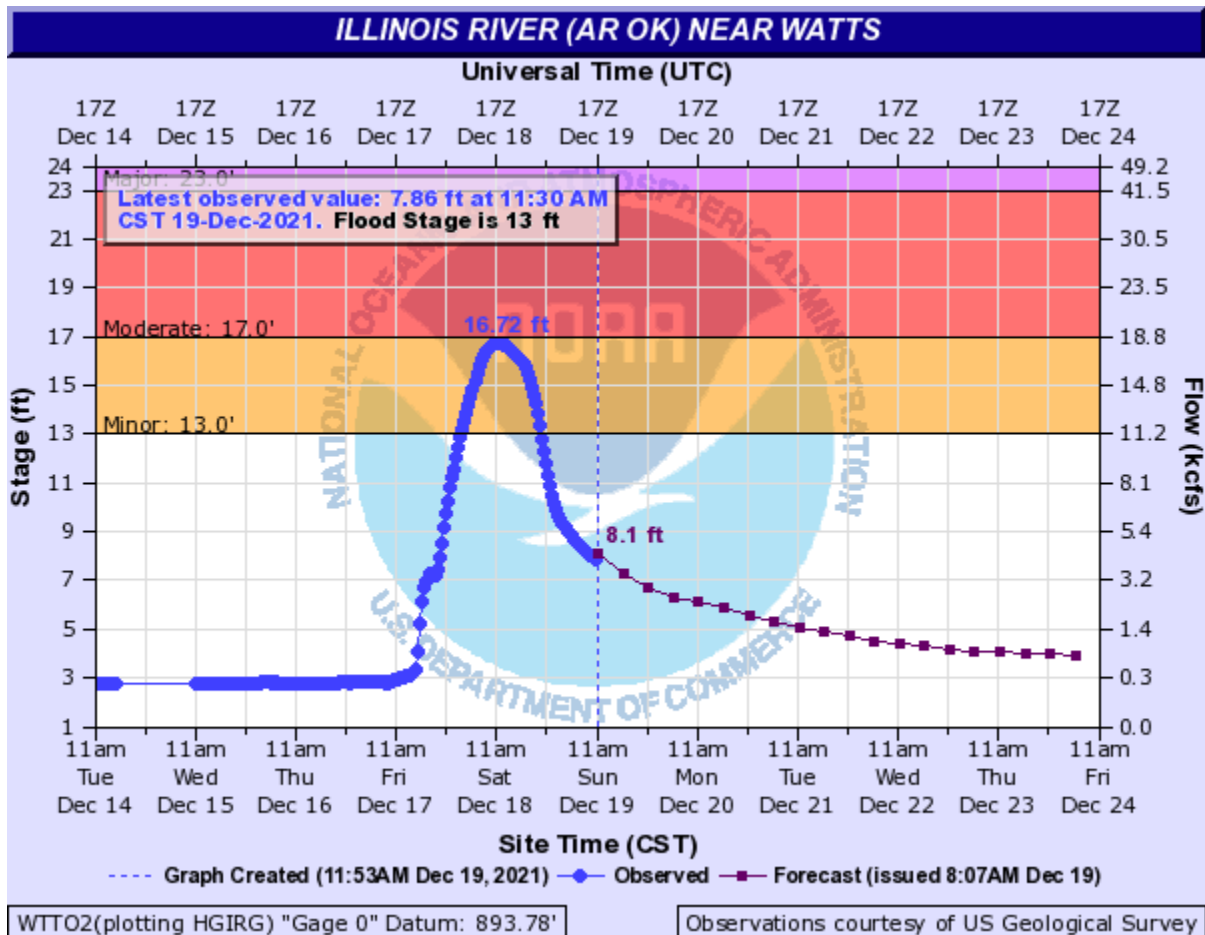
*CWYO2 became a daily river forecast point September 7, 2016

*MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014

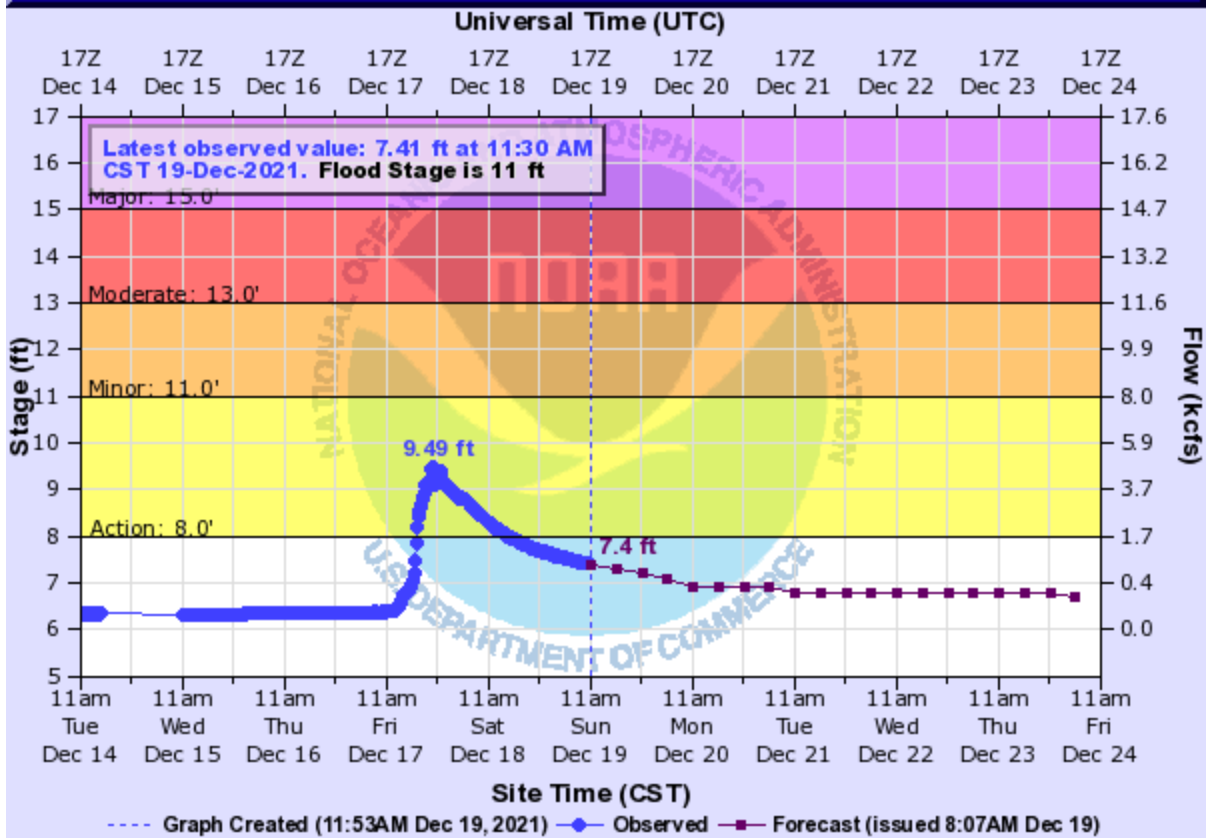
*Mixed case River Flood products began July 31, 2013

- 4 Flash Flood Warnings (FFW)
- 2 Flash Flood Statements (FFS)
- 2 Flash/Areal Flood Watches (FFA) (8 Watch FFA CON/EXT/EXA/EXB/CAN)
- 8 Urban and Small Stream Advisories (FLS)
- 0 Areal Flood Warnings (FLW)
- 0 Areal Flood Statements (FLS)
- 4 River Flood Warnings (FLW) (includes category increases)
- 20 River Flood Statements (FLS)
- 3 River Flood Advisories (FLS) (7 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:



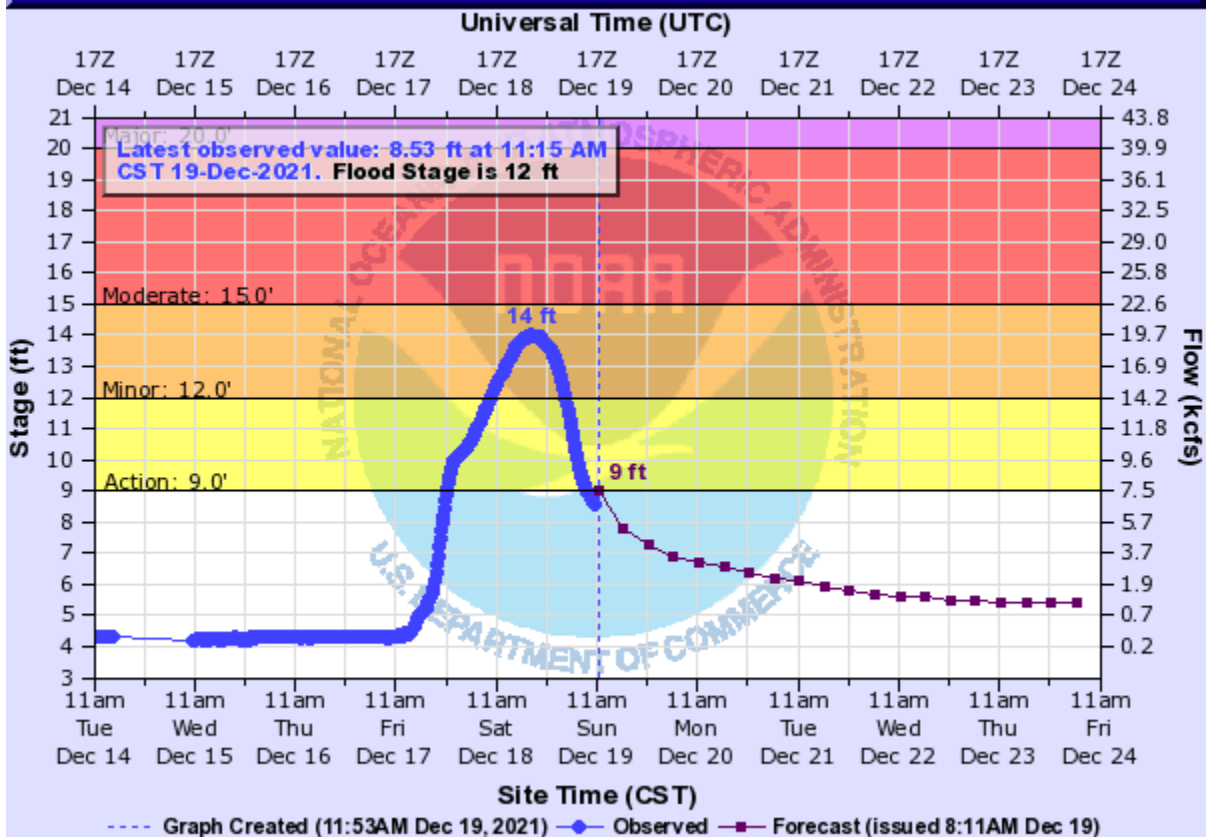
FLINT CREEK (OK) NEAR KANSAS



KNSO2(plotting HGIRG) "Gage 0" Datum: 854.59'

Observations courtesy of US Geological Survey

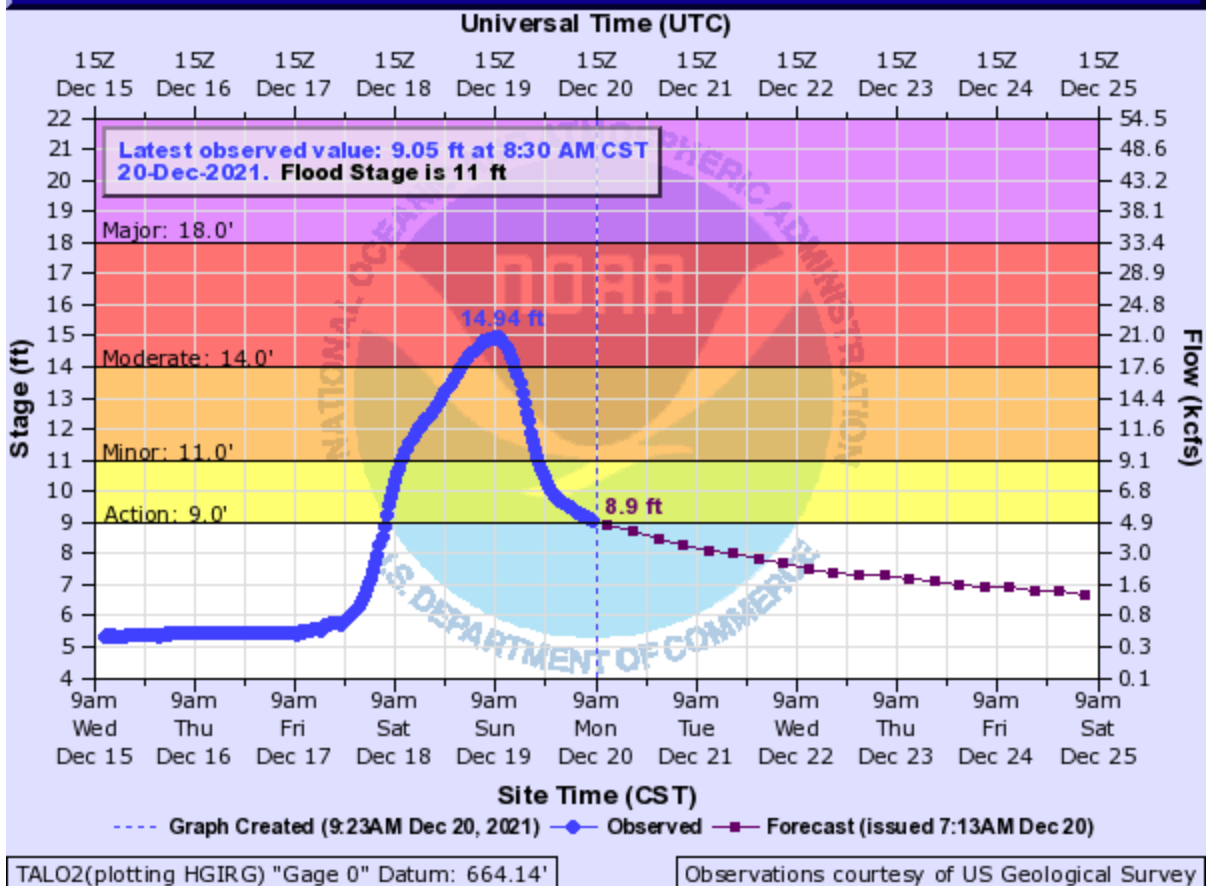
ILLINOIS RIVER (AR OK) AT CHEWEY



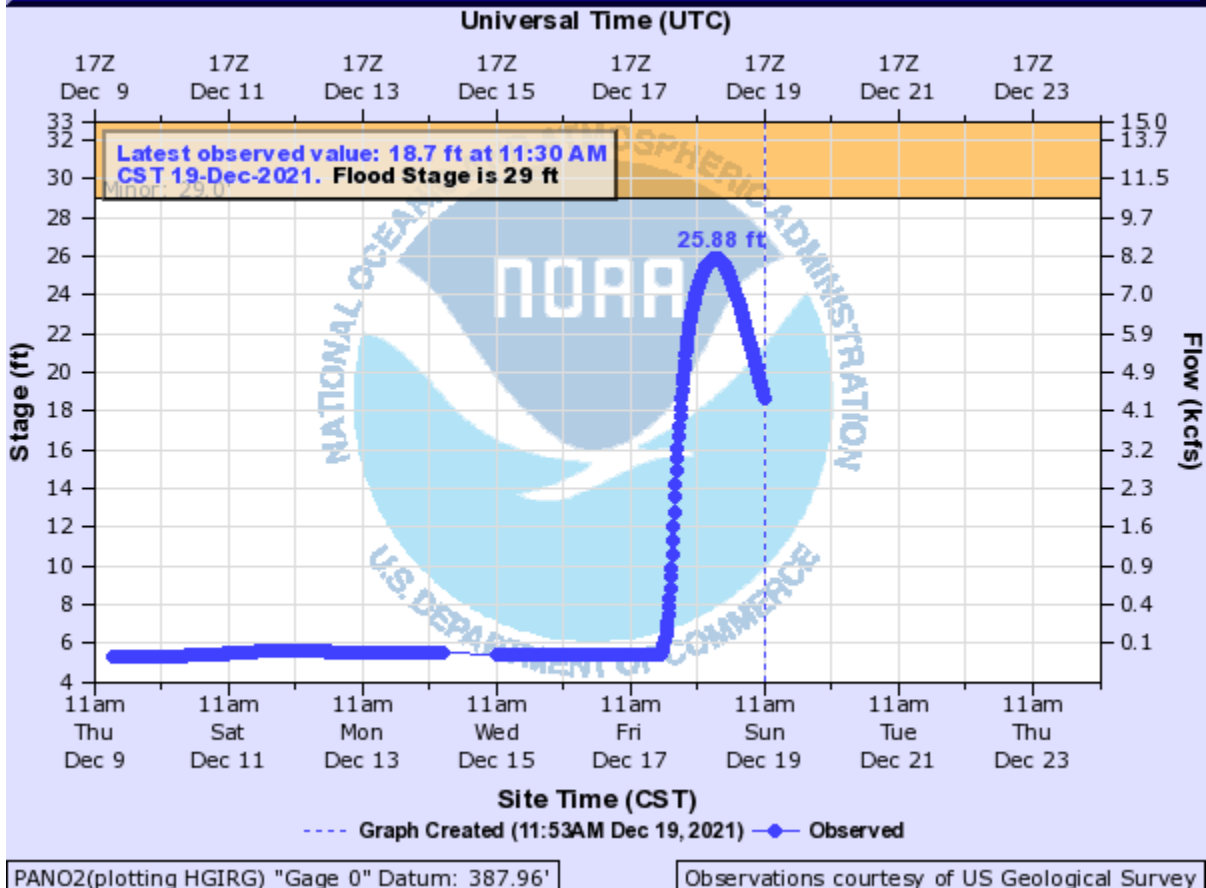
CWYO2(plotting HGIRG) "Gage 0" Datum: 800.88'

Observations courtesy of US Geological Survey

ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH

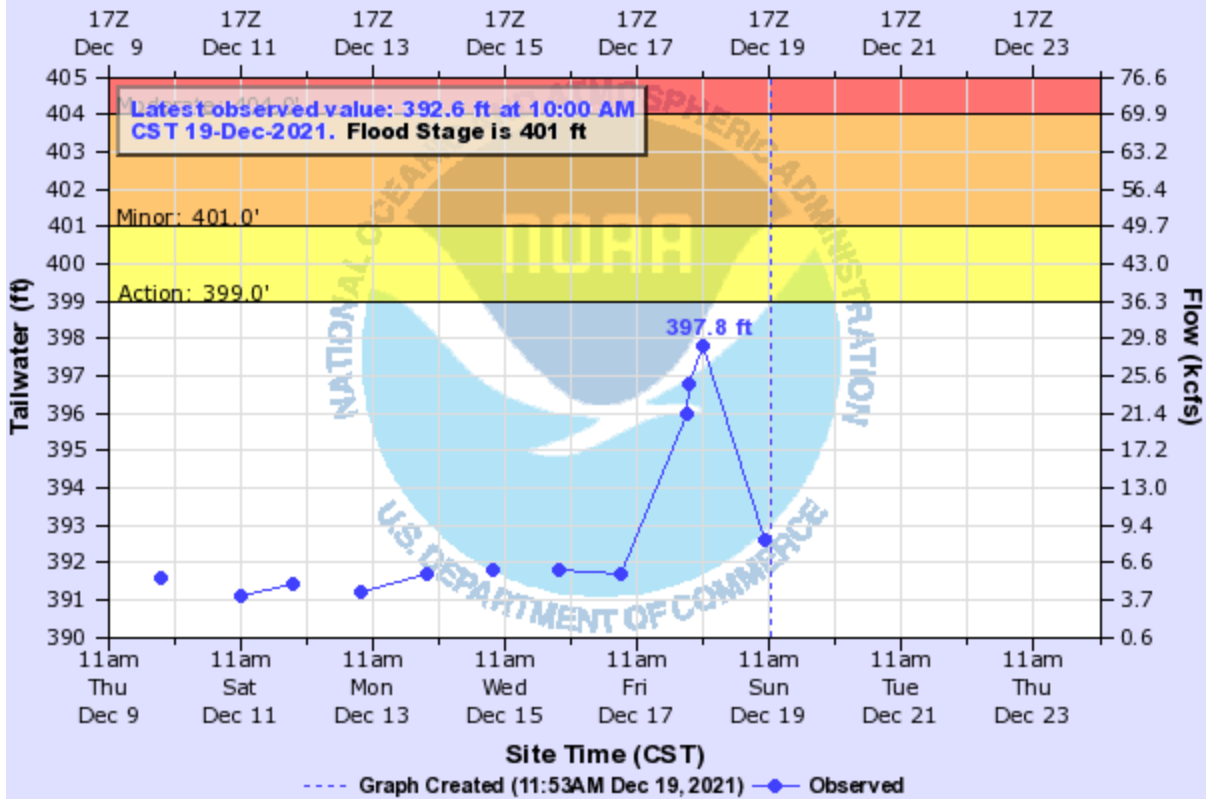


POTEAU RIVER NEAR PANAMA



LEE CREEK NEAR VAN BUREN LCR

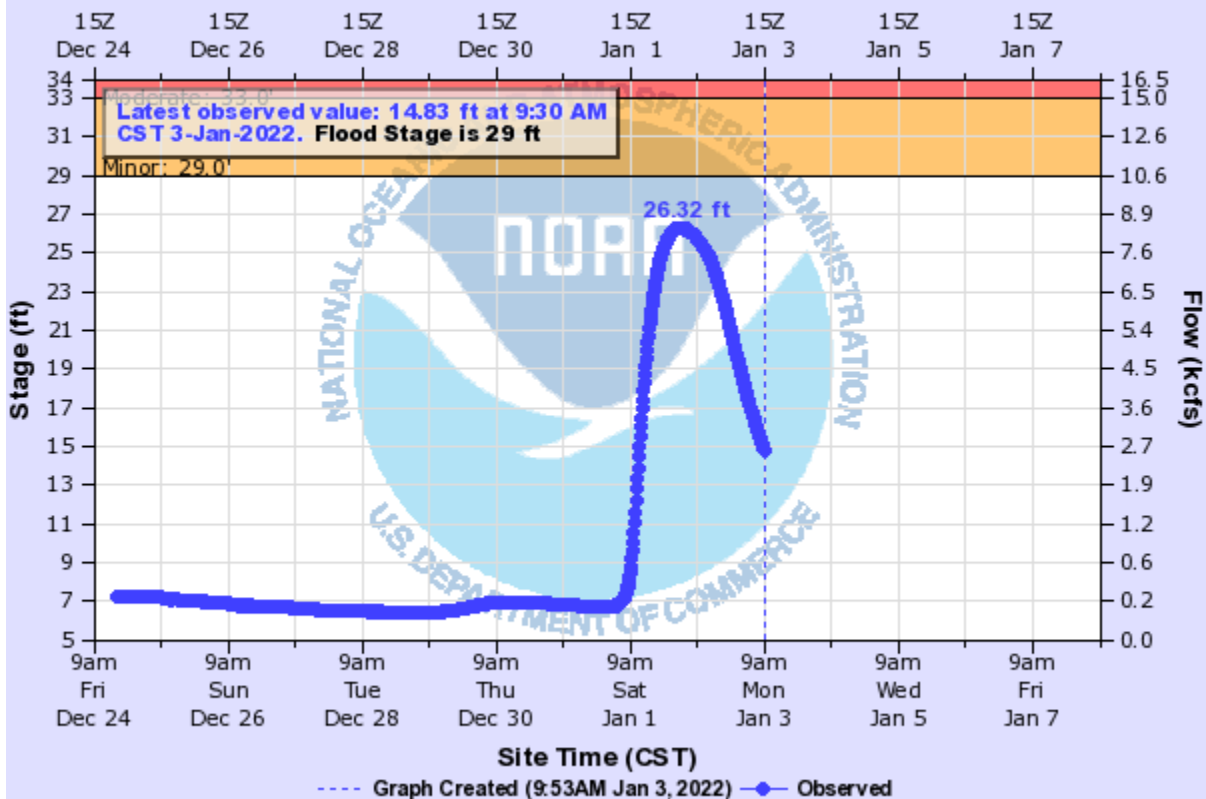
Universal Time (UTC)



VBRA4(plotting HTIRZ) "Gage 0" Datum: 0'

POTEAU RIVER NEAR PANAMA

Universal Time (UTC)



PANO2(plotting HGIRG) "Gage 0" Datum: 387.96'

Observations courtesy of US Geological Survey