

<b>NWS FORM E-5</b> (11-88) (PRES. by NWS Instruction 10-924)	<b>U.S. DEPARTMENT OF COMMERCE</b> NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE	HYDROLOGIC SERVICE AREA (HSA)	
		<b>Tulsa, Oklahoma (TSA)</b>	
<b>MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS</b>		REPORT FOR:	
		MONTH <b>December</b>	YEAR <b>2019</b>
TO: Hydrometeorological Information Center, W/OH2 NOAA / National Weather Service 1325 East West Highway, Room 7230 Silver Spring, MD 20910-3283		SIGNATURE <b>Steven F. Piltz</b> (Meteorologist-in-Charge)	
		DATE <b>January 8, 2020</b>	

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.

December 2019 was warm and dry across eastern OK and northwest AR, with well below normal precipitation. However, there was a weak tornado this month and rainfall at the end of November resulted in minor flooding on the Illinois River at the start of the 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. For 2019, the annual average temperature was near normal and rainfall was near to well above normal for all but far southeast OK. Northeast OK recorded its wettest year on record. Major and Record flooding impacted a large portion of eastern OK and northwest AR in 2019. 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 2019 ranged from around 0.50" to 2.5" across eastern OK and northwest AR. These rainfall totals correspond to 10%-75% of the normal December rainfall across the area, with most of eastern OK and northwest Arkansas receiving 25-50% of normal (Fig. 1b).

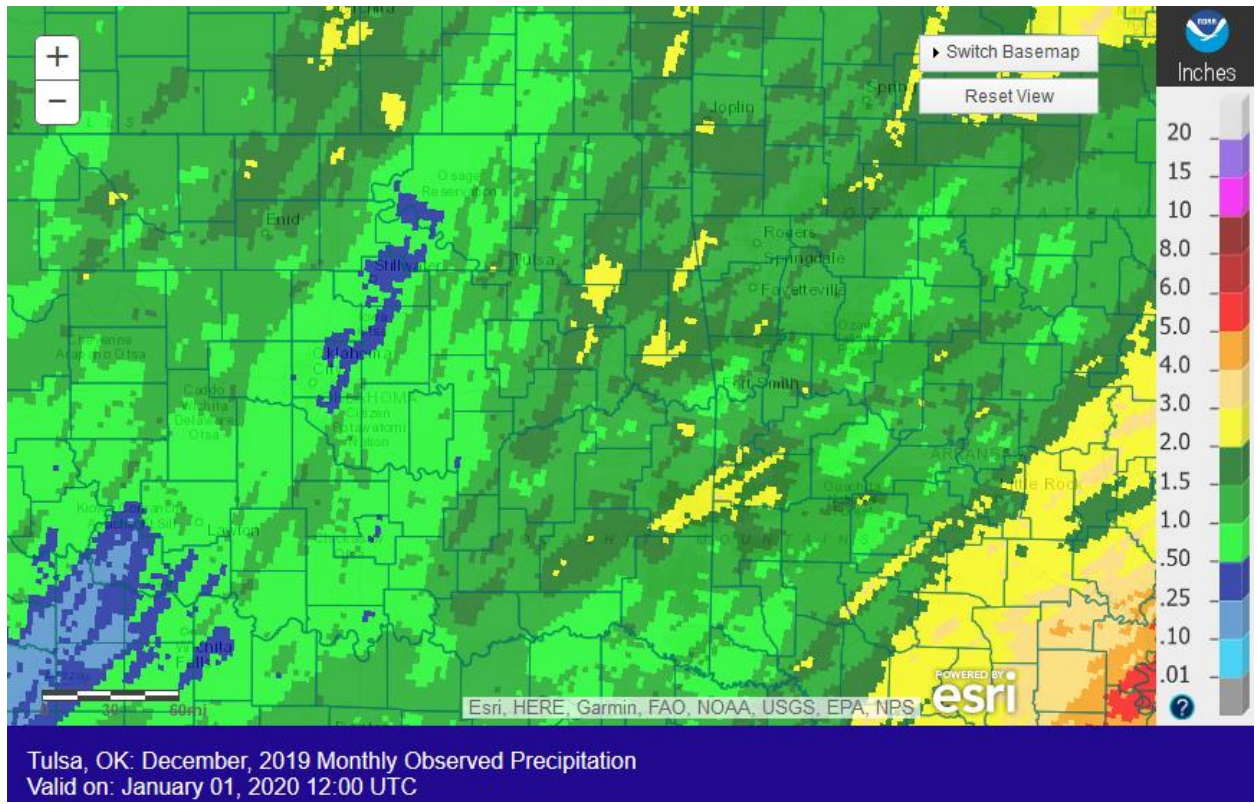


Fig. 1a. Estimated Observed Rainfall for December 2019

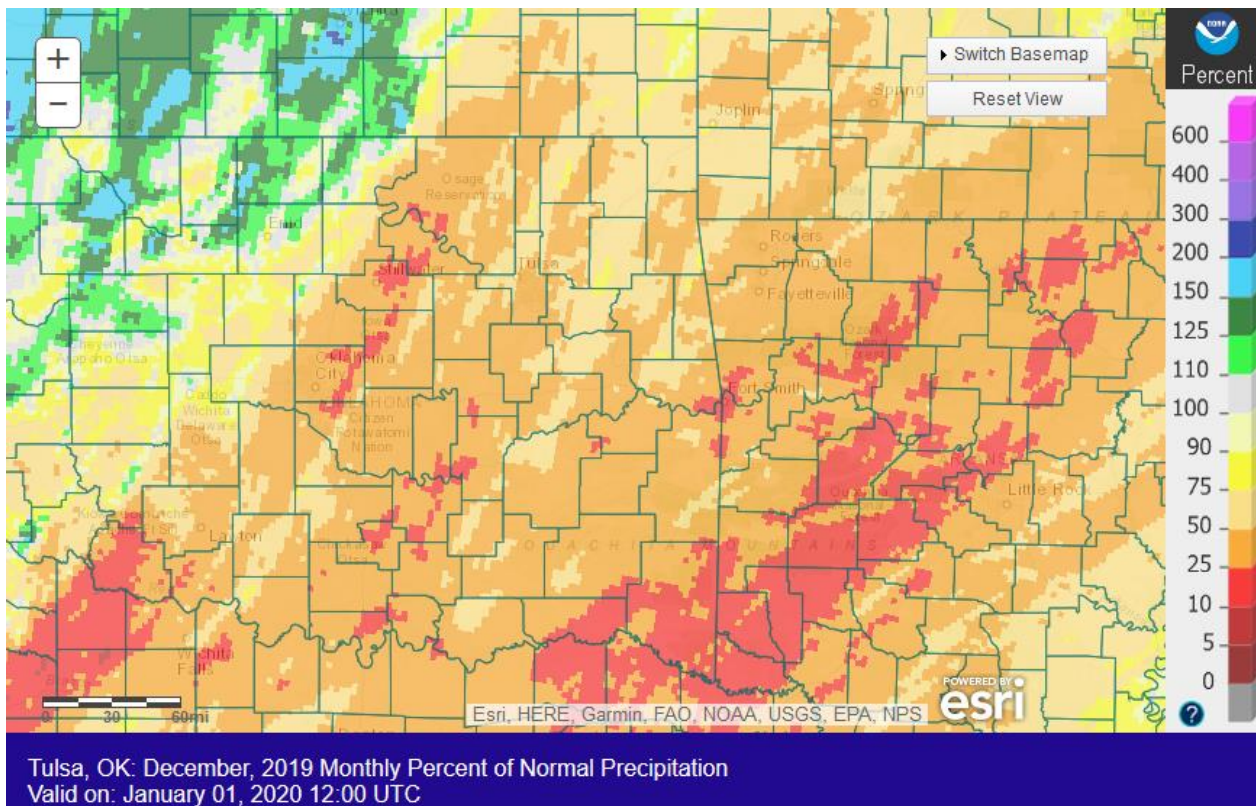


Fig. 1b. Estimated % of Normal Rainfall for December 2019

In Tulsa, OK, December 2019 ranked as the 9<sup>th</sup> warmest December (44.9°F, tied 1959; since records began in 1905) and the 36<sup>th</sup> driest December (0.96"; since records began in 1888). A trace of snow fell in December. Fort Smith, AR had the 21<sup>st</sup> warmest December (45.8°F, tied 1900; since records began in 1882) and the 18<sup>th</sup> driest December (0.87"; since records began in 1882). No snow fell in December. Fayetteville, AR had the 10<sup>th</sup> warmest (43.0°F) and the 15<sup>th</sup> driest (1.33", tied 1996) December since records began in 1949. A trace of snow fell in December.

Some of the larger precipitation reports (in inches) for December 2019 included:

Cookson, OK (meso)	2.36	Greenwood 1.9WNW, AR (coco)	2.27	Winslow 7NE, AR (coop)	2.26
Greenwood 1.4W, AR (coco)	2.21	Antlers, OK (meso)	2.12	West Fork 0.1SSW, AR (coco)	2.08
Porter, OK (meso)	2.07	Elkins 10.6SSE, AR (coco)	2.02	Bella Vista 0.6WSW, AR (coco)	2.00

Some of the lowest precipitation reports (in inches) for December 2019 included:

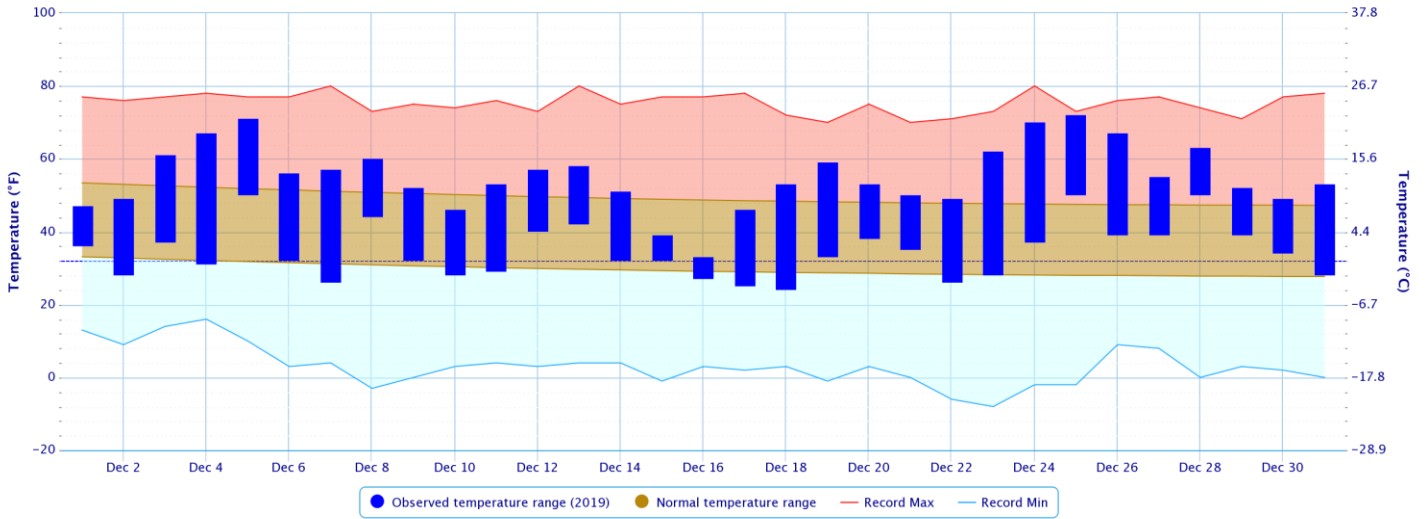
Pawnee, OK (meso)	0.54	Burbank, OK (meso)	0.59	Foraker, OK (meso)	0.72
Bixby, OK (meso)	0.74	Copan, OK (meso)	0.83	Broken Arrow 1.5WSW, OK (coco)	0.84
Broken Arrow 2.7SSW, OK (coco)	0.85	Fort Smith, AR (ASOS)	0.87	Okemah, OK (meso)	0.90

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

Rank since 1921	December 2019	Last 60 Days (Nov 2 – Dec 31)	Water Year-to-Date (Oct 1 – Dec 31)	Cool Growing Season (Sep 1 – Dec 31)	Last 180 Days (Jul 5 – Dec 31)	Year 2019
Northeast OK	36 <sup>th</sup> driest	39 <sup>th</sup> wettest	17 <sup>th</sup> wettest	19 <sup>th</sup> wettest	7 <sup>th</sup> wettest	1 <sup>st</sup> wettest
East Central OK	29 <sup>th</sup> driest	39 <sup>th</sup> wettest	8 <sup>th</sup> wettest	18 <sup>th</sup> wettest	7 <sup>th</sup> wettest	5 <sup>th</sup> wettest
Southeast OK	8 <sup>th</sup> driest	44 <sup>th</sup> driest	22 <sup>nd</sup> wettest	20 <sup>th</sup> wettest	19 <sup>th</sup> wettest	12 <sup>th</sup> wettest
Statewide	33 <sup>rd</sup> driest	48 <sup>th</sup> driest	34 <sup>th</sup> wettest	34 <sup>th</sup> wettest	24 <sup>th</sup> wettest	5 <sup>th</sup> wettest

### Daily Temperature Data – Tulsa Area, OK (ThreadEx)

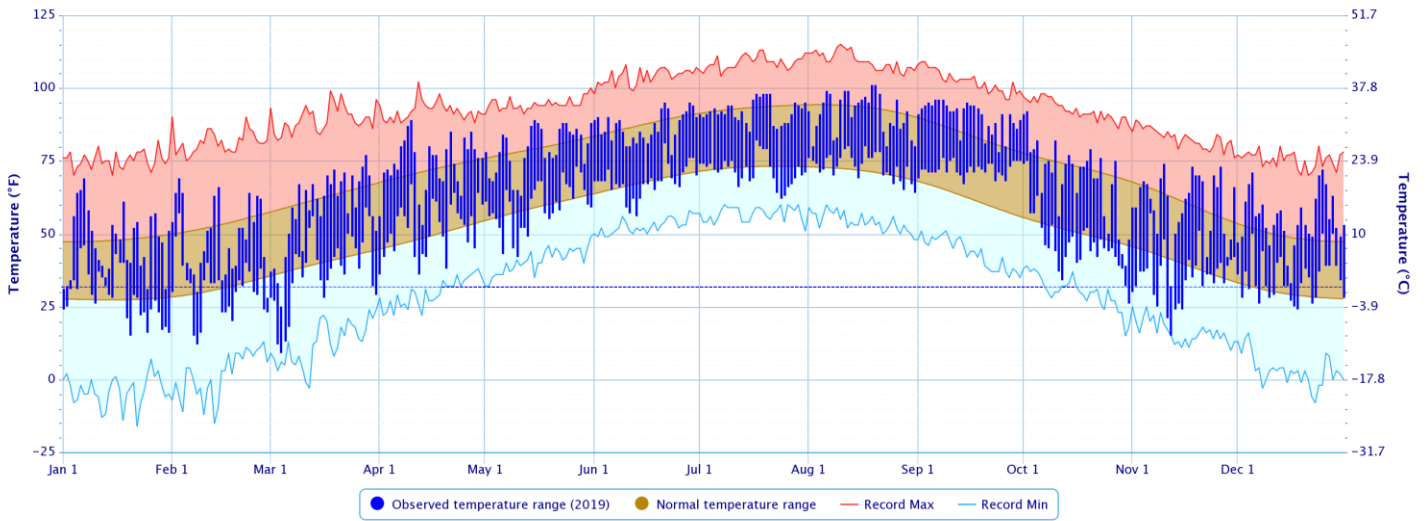
Period of Record – 1905-01-06 to 2020-01-02. Normals period: 1981-2010. Click and drag to zoom chart.



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### Daily Temperature Data – Tulsa Area, OK (ThreadEx)

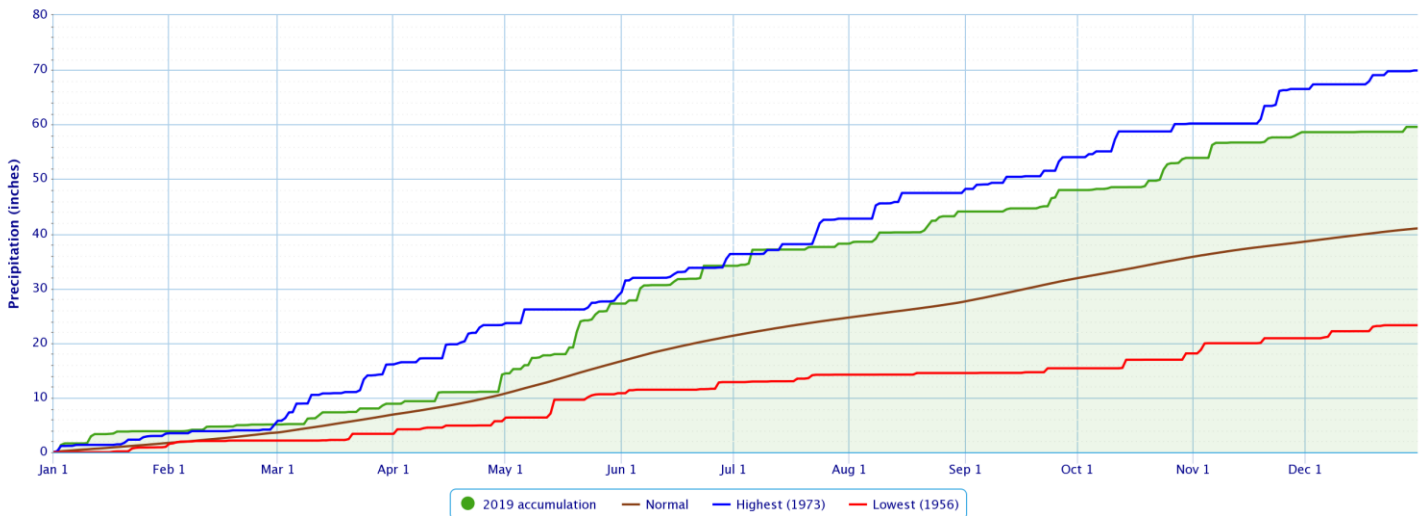
Period of Record – 1905-01-06 to 2020-01-02. Normals period: 1981-2010. Click and drag to zoom chart.



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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

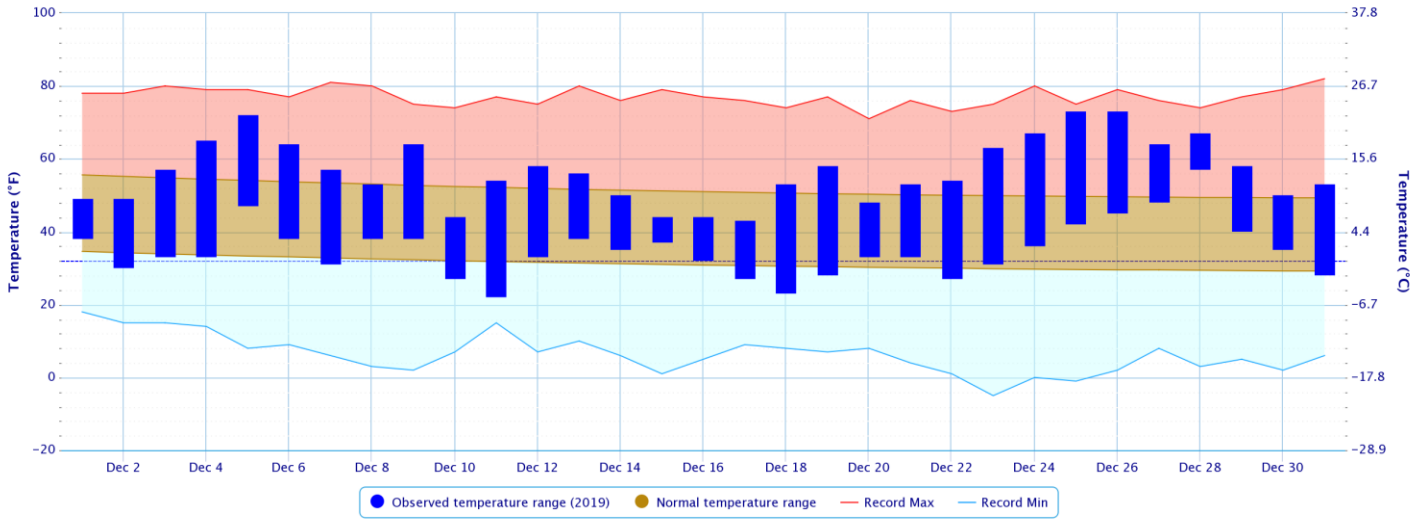


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### Daily Temperature Data – Fort Smith Area, AR (ThreadEx)

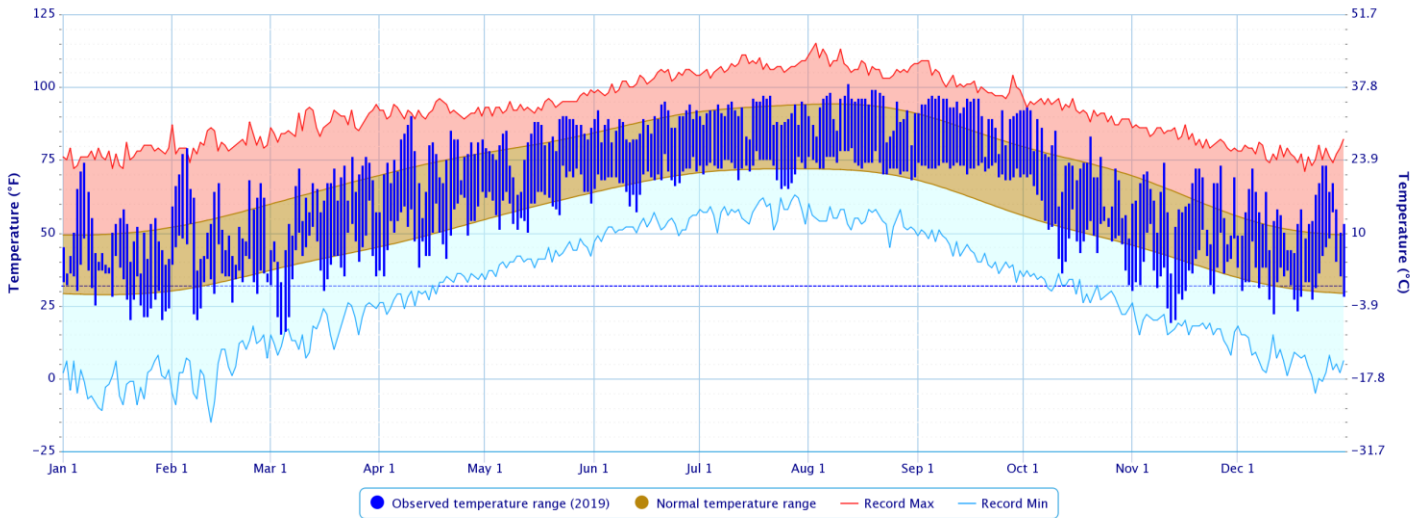
Period of Record – 1882-06-01 to 2020-01-02. Normals period: 1981-2010. Click and drag to zoom chart.



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

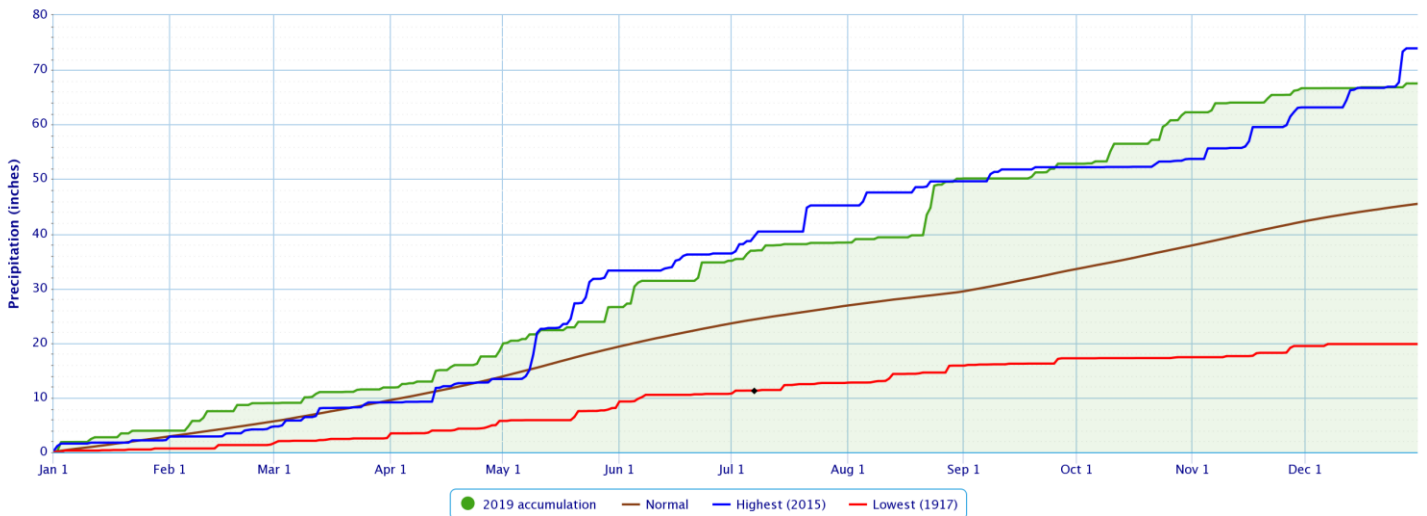
Period of Record – 1882-06-01 to 2020-01-02. Normals period: 1981-2010. Click and drag to zoom chart.



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### Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

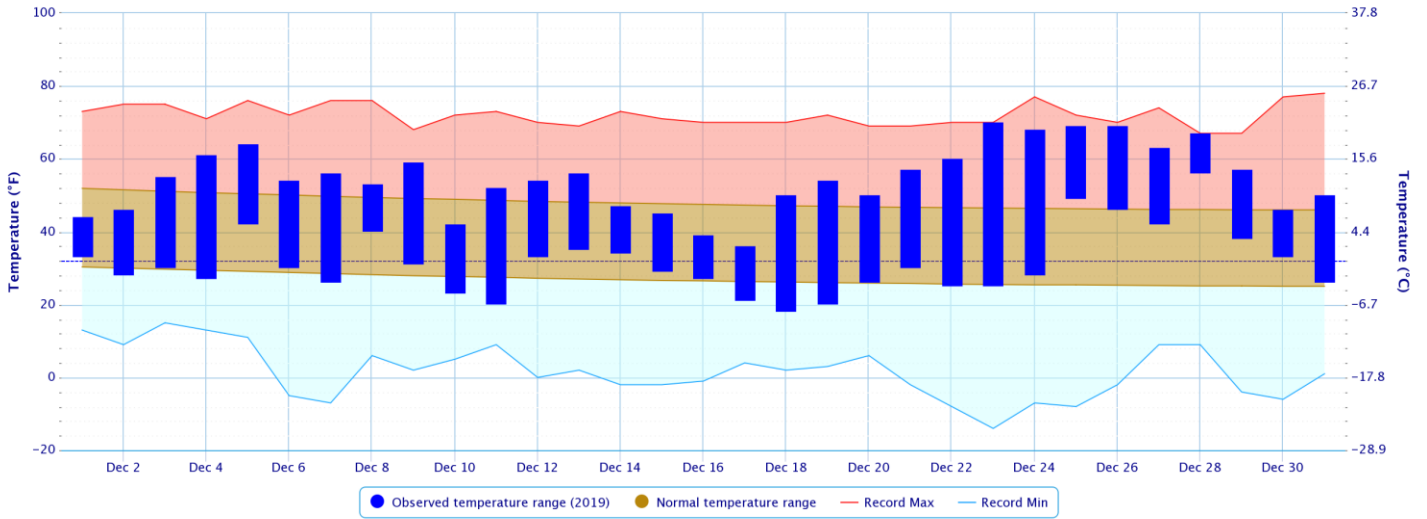
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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### Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

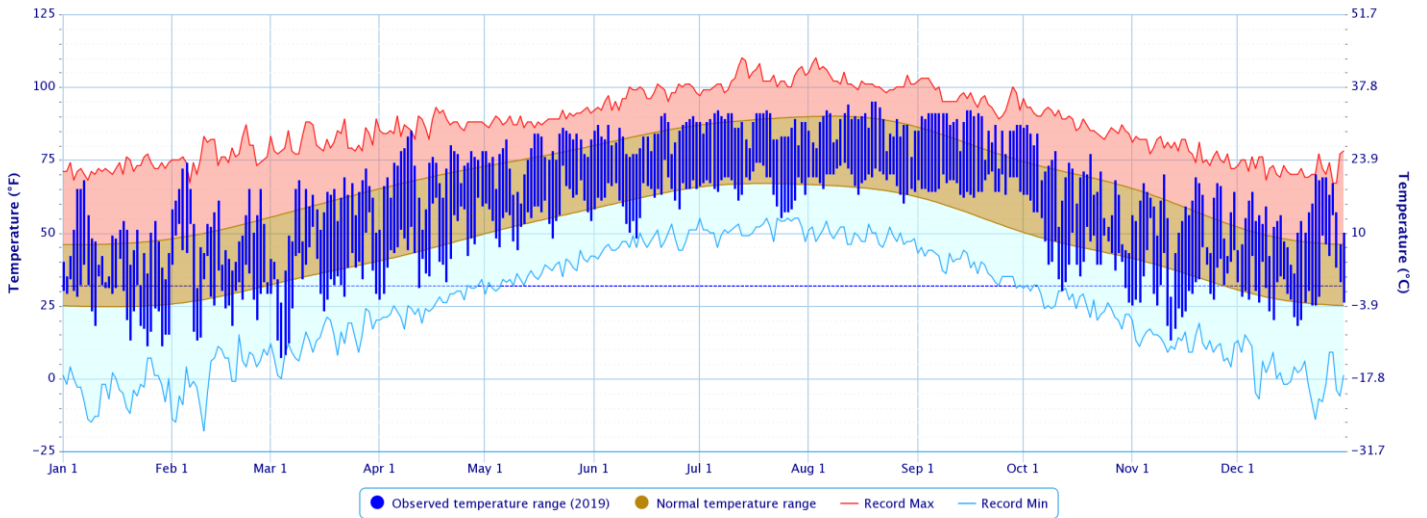
Period of Record – 1949-07-14 to 2020-01-02. Normals period: 1981-2010. Click and drag to zoom chart.



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### Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

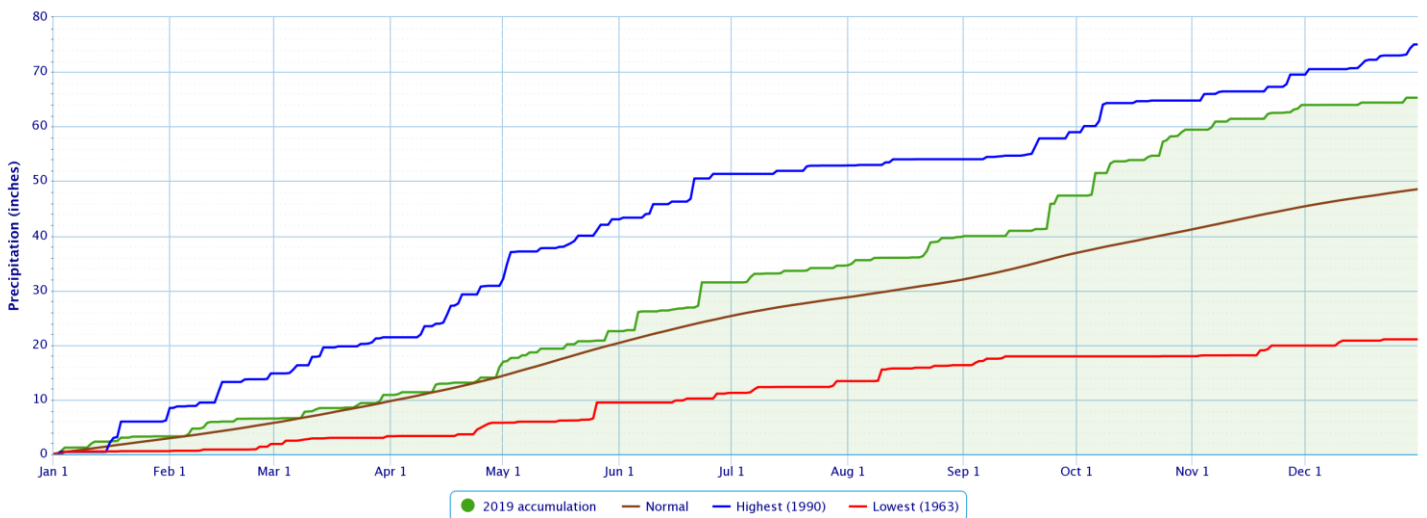
Period of Record – 1949-07-14 to 2020-01-02. Normals period: 1981-2010. Click and drag to zoom chart.



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



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**Annual 2019 Summary**

Using the radar-derived estimated observed precipitation from the RFCs (Figs. 2a, 3a), rainfall totals for 2019 ranged from 40" to 85" across eastern OK and northwest AR. These rainfall totals correspond to 110%-200% of the normal annual rainfall across eastern OK and northwest Arkansas, except southeast OK were totals were 75%-125% of normal (Figs. 2b, 3b). A large portion of northeast OK and northwest AR along and northeast of a Stillwater, OK to Fort Smith line received 20"-40" more than normal (Figs. 2c, 3c). The northeast OK climate division recorded its wettest year on record with 63.20" of rain in 2019, greatly exceeding the previous record of 57.82" in 1973 (records began in 1895; Fig. 4).

This heavy rain, which also fell across north central OK and central and eastern KS, resulted in mainstem river flooding each month this year, with major and record-breaking flooding occurring in May-June 2019 (Fig. 5; see May and June E5 reports for details). The numerous storm systems also brought 69 tornadoes to eastern OK and northwest AR in 2019, the 2<sup>nd</sup> highest total for the NWS Tulsa county warning area (Fig. 5; see all tornado information and tracks at <https://arcg.is/1X8eW1>). Figure 6 shows some of the extremes seen in 2019 in OK based on measurements from the OK Mesonet.

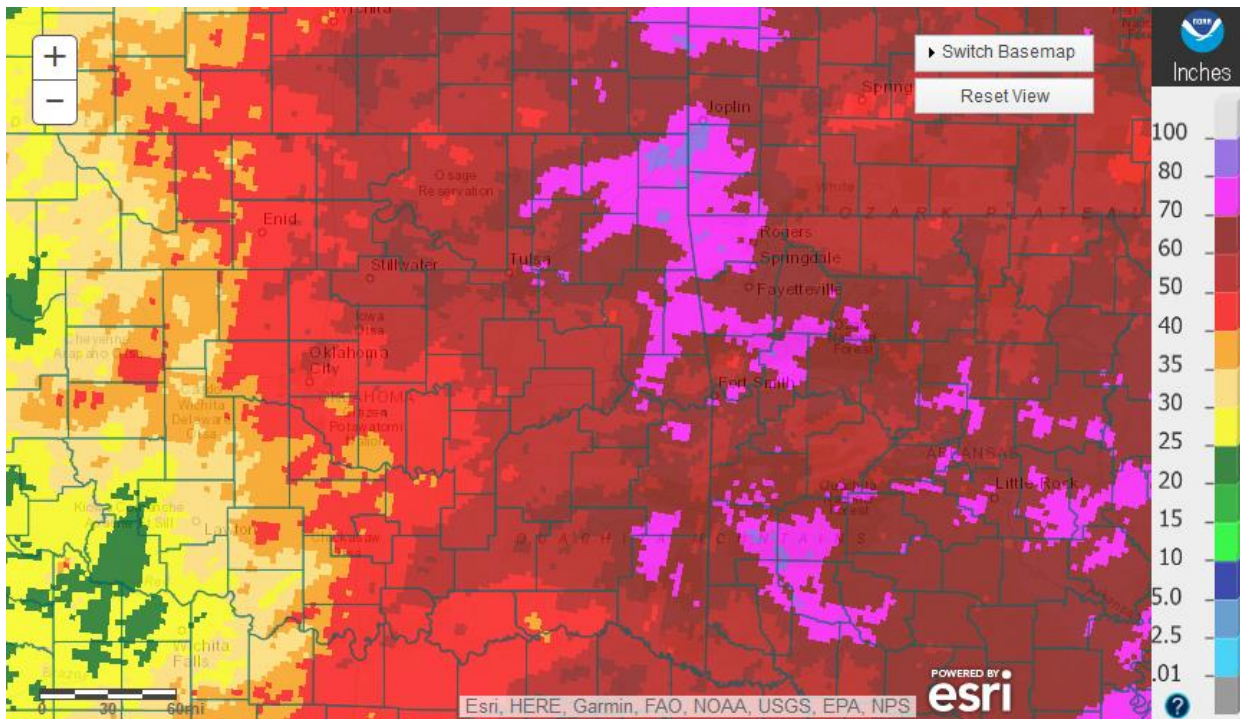
In Tulsa, OK, 2019 ranked as the 48<sup>th</sup> warmest Year (60.9°F; since records began in 1905), the 4<sup>th</sup> wettest Year (59.55"; since records began in 1888), and the 12<sup>th</sup> least snowy (1.4"; since records began in 1900). Fort Smith, AR had the 27<sup>th</sup> warmest Year (62.7°F, tied 1990; since records began in 1883), the 3<sup>rd</sup> wettest Year (67.50"; since records began in 1882), and the 24<sup>th</sup> least snowy Year (1.0"; since records began in 1884). Fayetteville, AR had the 22<sup>nd</sup> warmest (57.9°F, tied 1963), the 5<sup>th</sup> wettest (65.26"), and the 11<sup>th</sup> least snowy (1.9", tied 1962) Year since records began in 1950.

Some of the larger precipitation reports (in inches) for 2019 included:

Jay 3.3NNE, OK (coco)	84.15	Gravette, AR (coop)	82.87	Miami, OK (meso)	81.64
Wyandotte 7.3NE, OK (coco)	81.04	Jay, OK (meso)	80.67	Decatur 2.6ESE, AR (coco)	80.46
Spavinaw, OK (coop)	80.40	Bella Vista 2.0E, AR (coco)	79.78	Winslow 7NE, AR (coop)	79.52

Some of the lowest precipitation reports (in inches) for 2019 included:

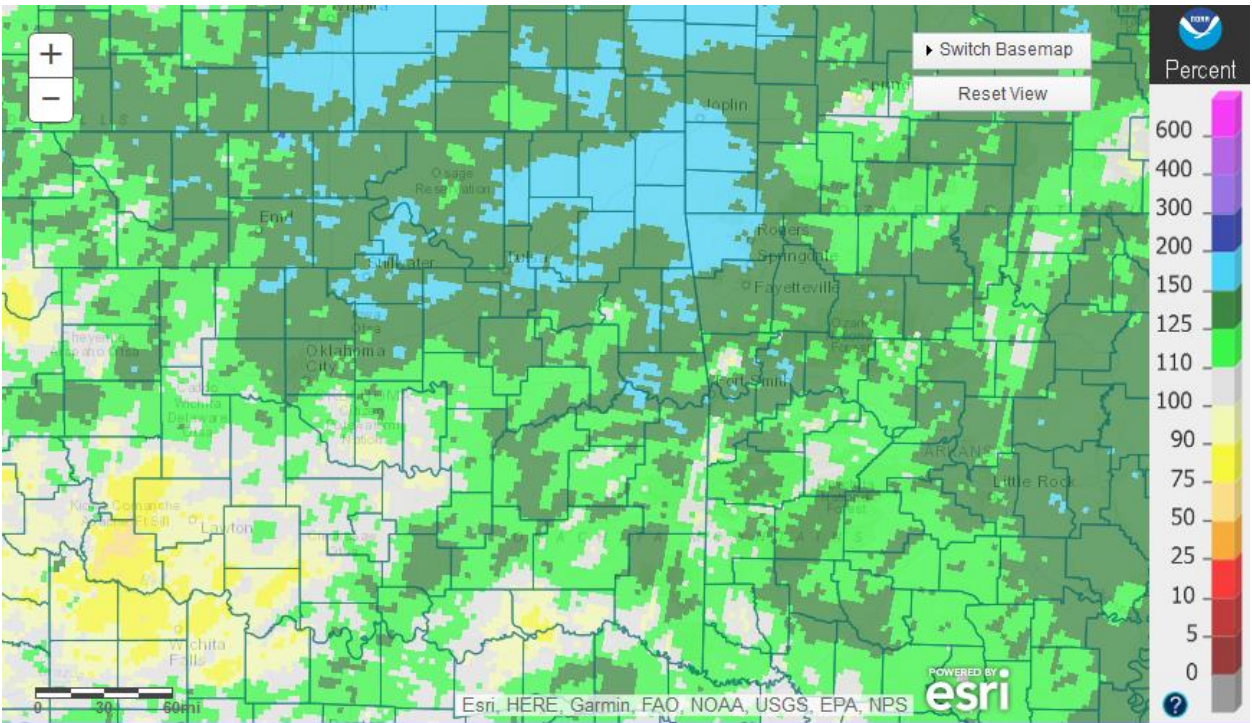
Foraker, OK (meso)	48.33	Muskogee, OK (ASOS)	48.48	Okemah, OK (meso)	49.42
Burbank, OK (meso)	52.52	Haskell, OK (meso)	52.90	Wilburton, OK (meso)	52.90
Sperry 6.7WNW, OK (coco)	53.87	Hugo, OK (meso)	54.70	Bartlesville, OK (ASOS)	55.18



Tulsa, OK: 2019 Annual Observed Precipitation  
Valid on: January 01, 2020 12:00 UTC

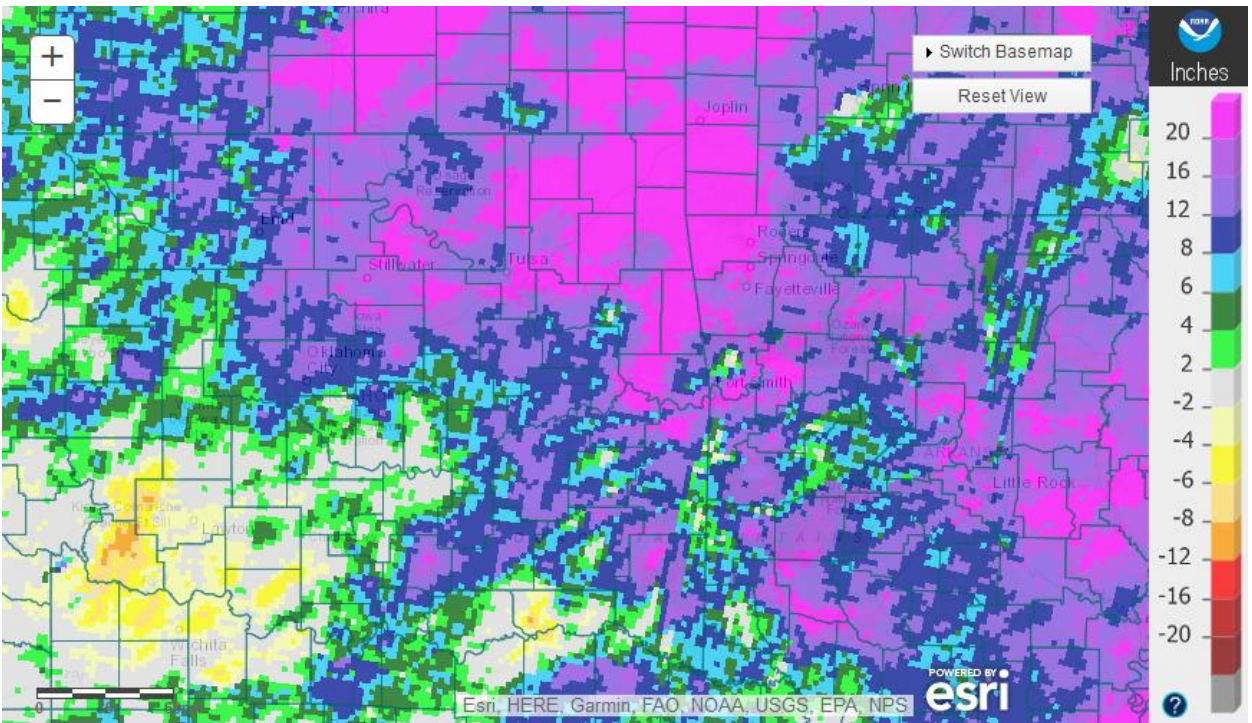
Fig. 2a. Estimated Observed Rainfall for 2019





Tulsa, OK: 2019 Annual Percent of Normal Precipitation  
Valid on: January 01, 2020 12:00 UTC

Fig. 2b. Estimated % of Normal Rainfall for 2019



Tulsa, OK: 2019 Annual Departure from Normal Precipitation  
Valid on: January 01, 2020 12:00 UTC

Fig. 2c. Estimated Departure from Normal Rainfall for 2019



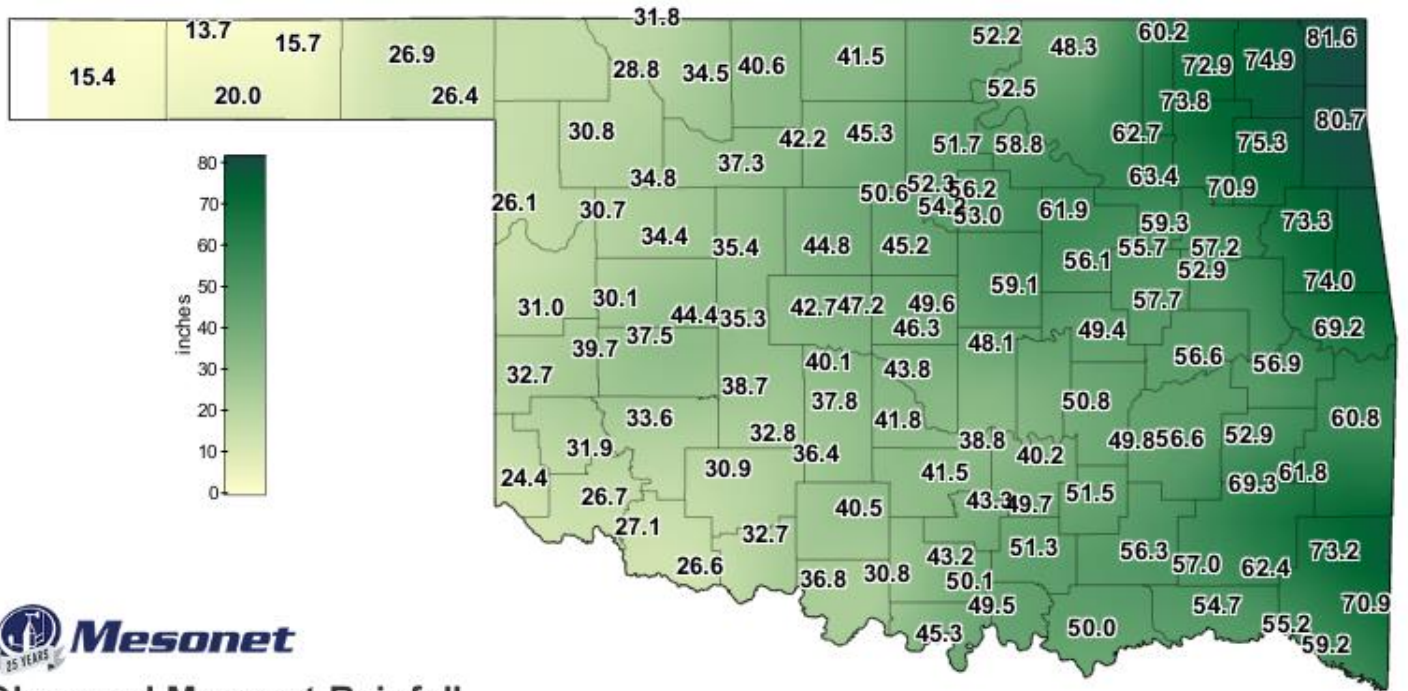


Fig. 3a. OK Mesonet rainfall measurement (values) and estimate (image) from January 1 – December 31, 2019.

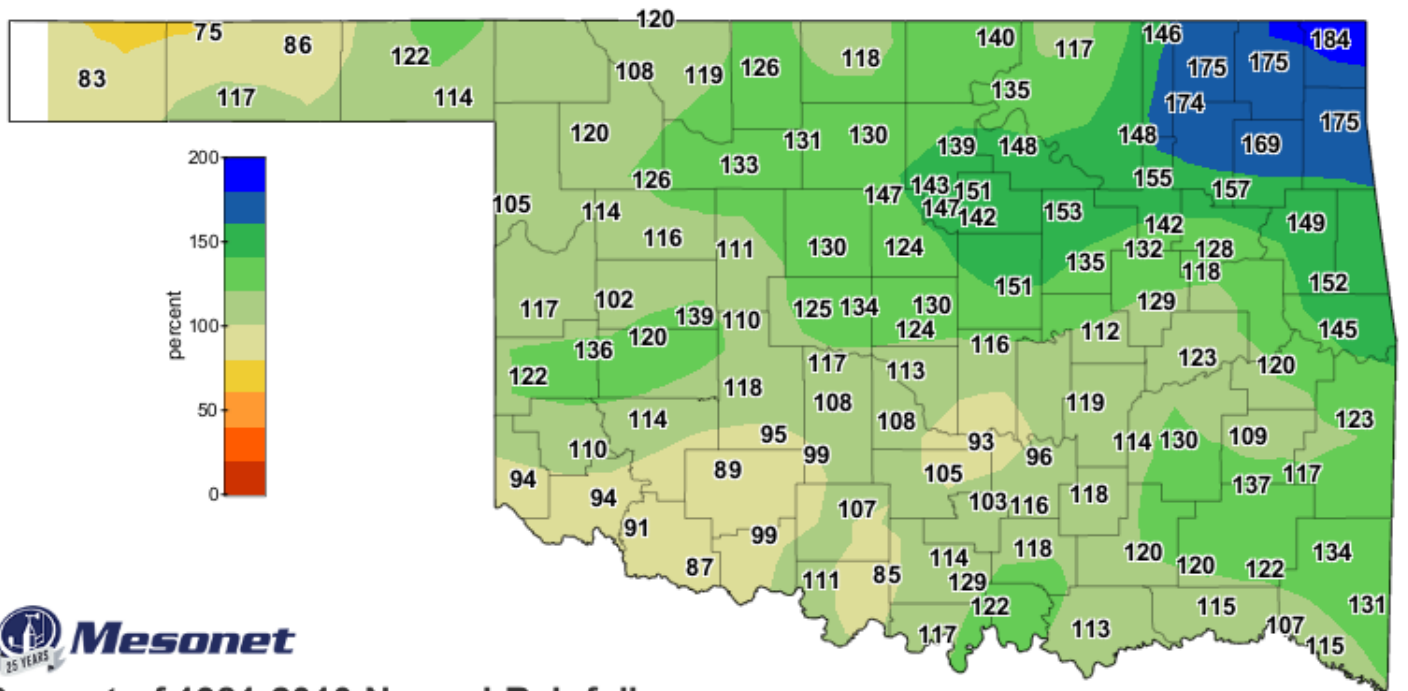
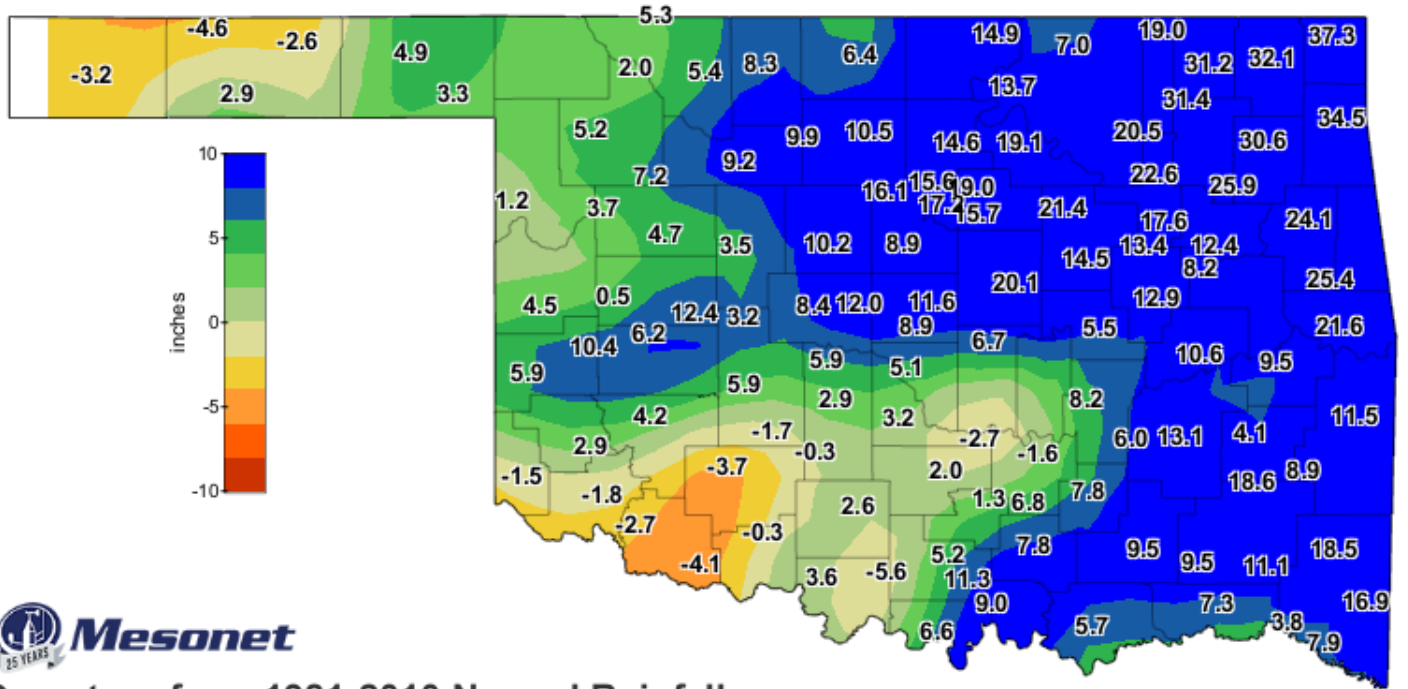


Fig. 3b. OK Mesonet rainfall measurement (values) and estimate (image) percent of the 1981-2010 normal for the period January 1 – December 31, 2019.





**Departure from 1981-2010 Normal Rainfall  
Calendar Year to Date**

Jan 1, 2019 through Dec 31, 2019  
Created 12:02:10 PM January 1, 2020 UTC. Copyright 2020

Fig. 3c. OK Mesonet rainfall measurement (values) and estimate (image) departure from the 1981-2010 normal for the period January 1 – December 31, 2019.

**Oklahoma, Climate Division 3, Precipitation, January-December**

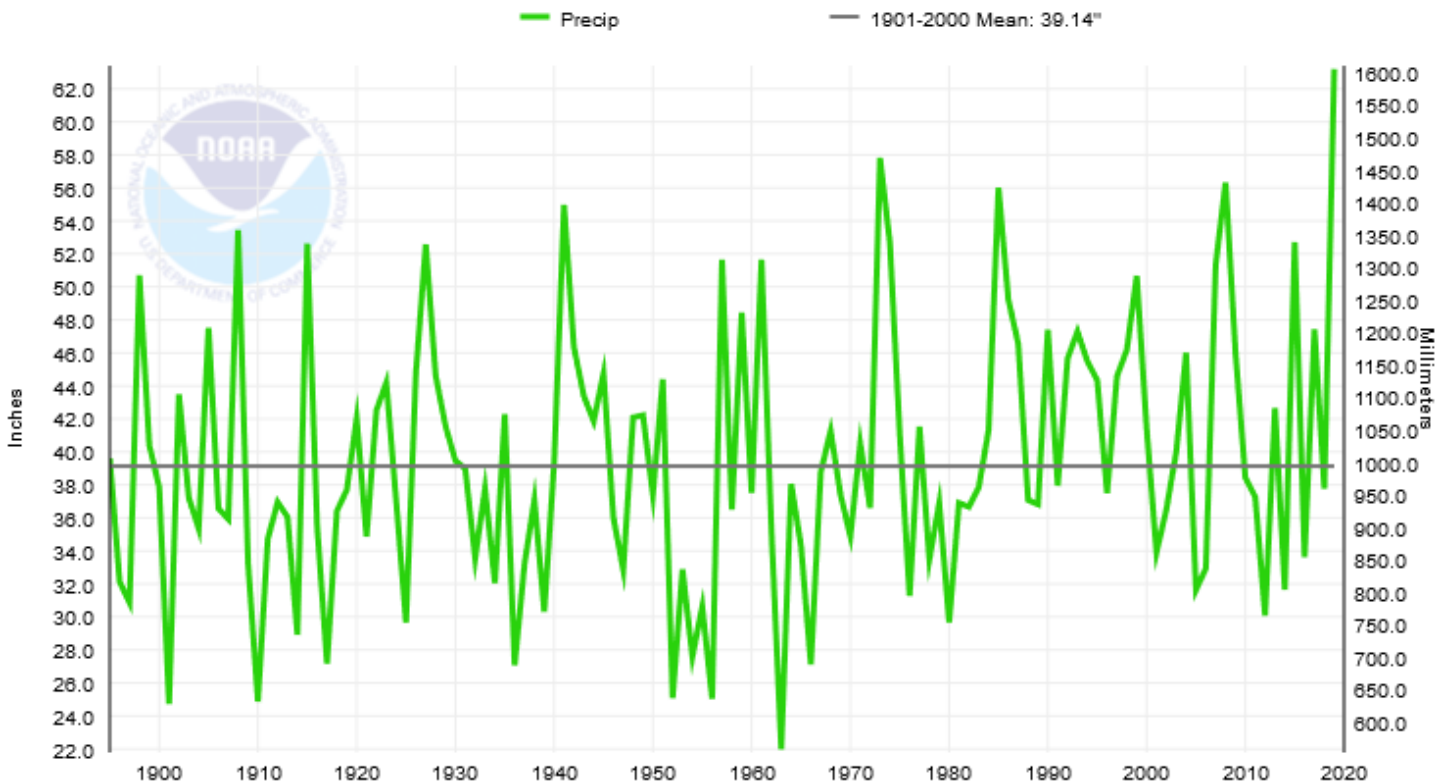
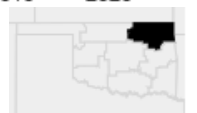


Fig. 4. Time series of January-December Rainfall from 1895 through 2019 for OK Climate Division 3 (northeast OK).



# Memorable 2019 Weather-Wise

Weather Forecast Office  
Tulsa, OK



Severe Thunderstorms, Flooding Made Headlines

Issued January 1, 2020 7:40 AM CST

**69** Tornadoes, **2<sup>nd</sup> Highest Total** for Eastern Oklahoma & Northwest Arkansas Since 1950

	2019 Preliminary Rainfall Total	Historical Rank
Tulsa	59.55"	4 <sup>th</sup> Wettest (Since 1888)
Fort Smith	67.50"	3 <sup>rd</sup> Wettest (Since 1882)
Fayetteville	67.50"	5 <sup>th</sup> Wettest (Since 1950)

	2019 Preliminary Average Temp	Historical Rank
Tulsa	60.9°F	48 <sup>th</sup> Warmest (Since 1905)
Fort Smith	62.6°F	28 <sup>th</sup> Warmest (Since 1883)
Fayetteville	57.9°F	22 <sup>nd</sup> Warmest (Since 1950)

	Highest Temp	Lowest Temp
Tulsa	101°F (8/19, 20)	9°F (3/4)
Fort Smith	101°F (8/12)	15°F (3/4)
Fayetteville	95°F (8/19, 20)	7°F (3/4)

	Preliminary Peak Crest	Historical Rank
Arkansas River near Ponca City	22.26' on 5/24	<b>NEW RECORD</b>
Arkansas River at Tulsa	23.41' on 5/29	2 <sup>nd</sup> Highest
Arkansas River near Haskell	24.24' on 5/29	2 <sup>nd</sup> Highest
Arkansas River near Muskogee	46.39' on 5/26	2 <sup>nd</sup> Highest
Arkansas River at Van Buren	40.79' on 6/1	<b>NEW RECORD</b>
Arkansas River at Ozark	374.99' on 5/30	2 <sup>nd</sup> Highest
Neosho River near Commerce	25.51' on 5/24	5 <sup>th</sup> Highest
Caney River near Collinsville	37.12' on 5/23	3 <sup>rd</sup> Highest
Bird Creek at Avant	36.52' on 5/21	<b>NEW RECORD</b>
Bird Creek near Sperry	31.29' on 5/22	4 <sup>th</sup> Highest
Bird Creek near Owasso	29.84' on 5/23	4 <sup>th</sup> Highest

NWSTulsa

[weather.gov/tsa](http://weather.gov/tsa)

Fig. 5. 2019 statistics and extremes.

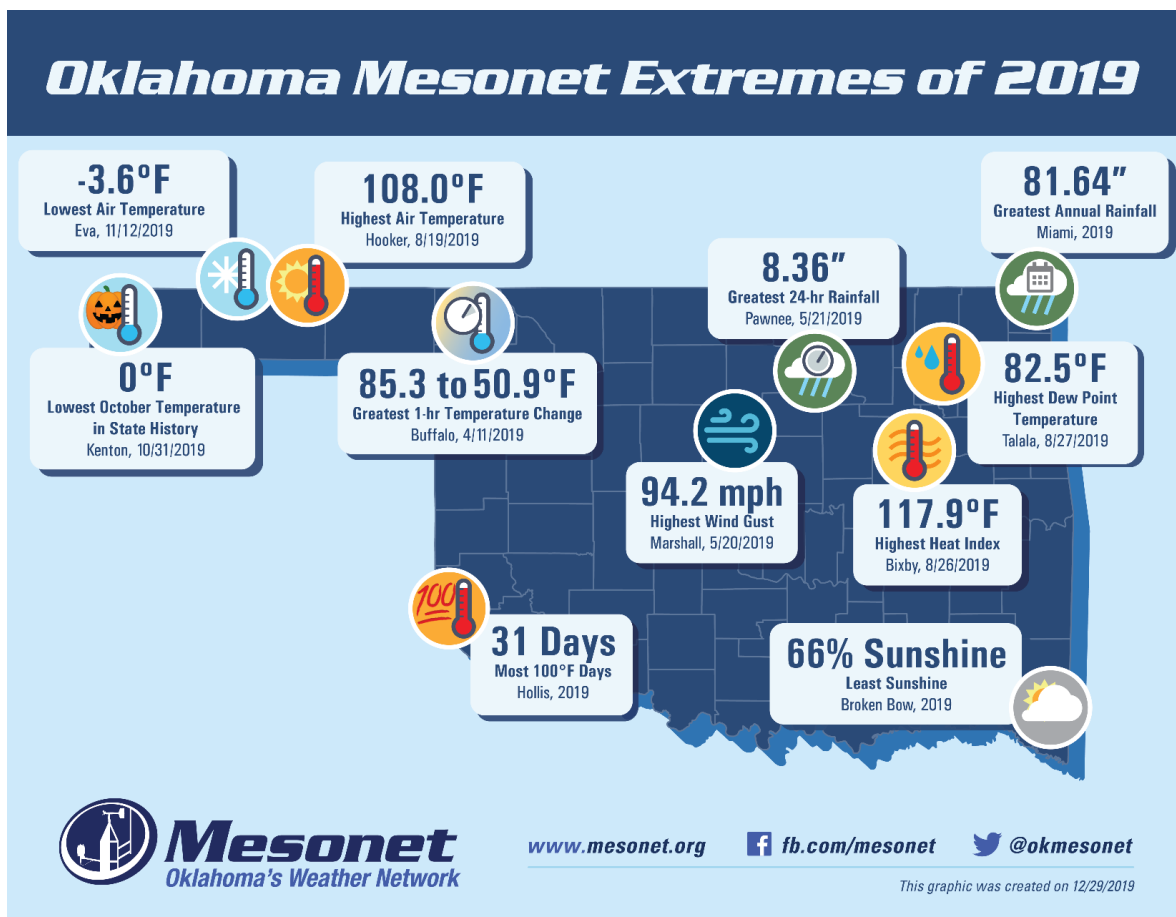


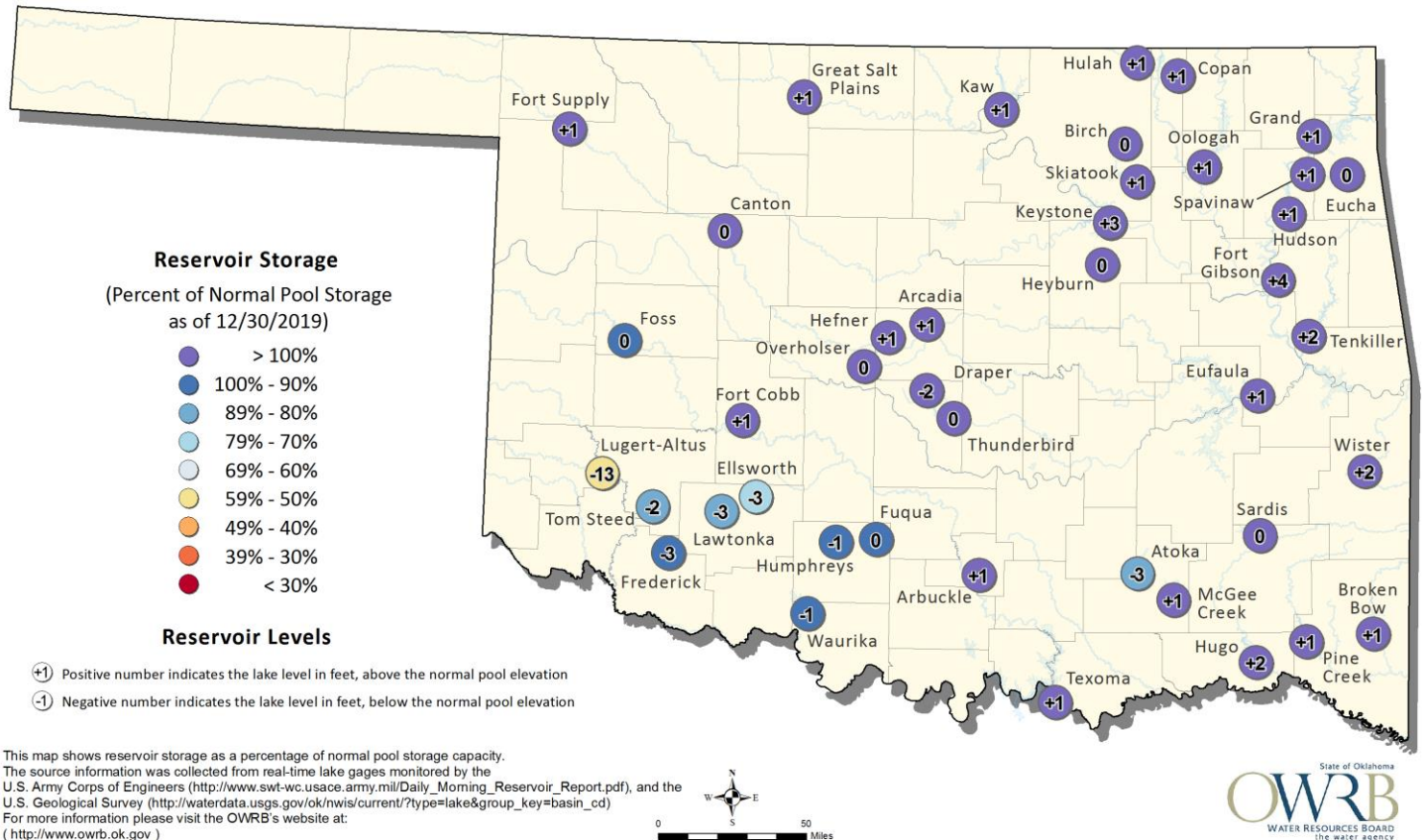
Fig. 6. Image courtesy of the OCS Mesonet. Extremes based on data measured only at Oklahoma Mesonet sites.



## Reservoirs

# Oklahoma Surface Water Resources

## Reservoir Levels and Storage as of 12/30/2019



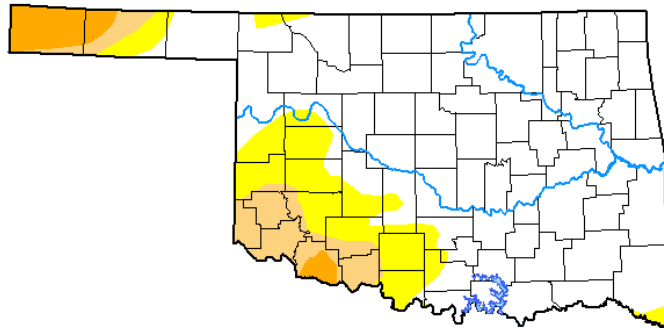
According to the USACE, several of the lakes in the HSA were utilizing more than 3% of their flood control pools as of 1/03/2020: Beaver Lake 32%, Grand Lake 12%, Ft. Gibson Lake 8%, Hudson Lake 7%, Eufaula Lake 7%, Sardis Lake 6%, Keystone Lake 5%, Wister Lake 5%, Hugo Lake 5%, and Tenkiller Lake 4%.

## Drought

According to the [U.S. Drought Monitor](#) (USDM) from December 31, 2019 (Figs. 7, 8), eastern OK and northwest AR were drought free.

# U.S. Drought Monitor Oklahoma

**December 31, 2019**  
(Released Thursday, Jan. 2, 2020)  
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	76.45	23.55	10.47	3.64	0.00	0.00
<b>Last Week</b> 12-24-2019	60.87	39.13	18.07	3.64	0.00	0.00
<b>3 Months Ago</b> 10-01-2019	71.94	28.06	11.08	1.01	0.00	0.00
<b>Start of Calendar Year</b> 01-01-2019	94.85	5.15	0.00	0.00	0.00	0.00
<b>Start of Water Year</b> 10-01-2019	71.94	28.06	11.08	1.01	0.00	0.00
<b>One Year Ago</b> 01-01-2019	94.85	5.15	0.00	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

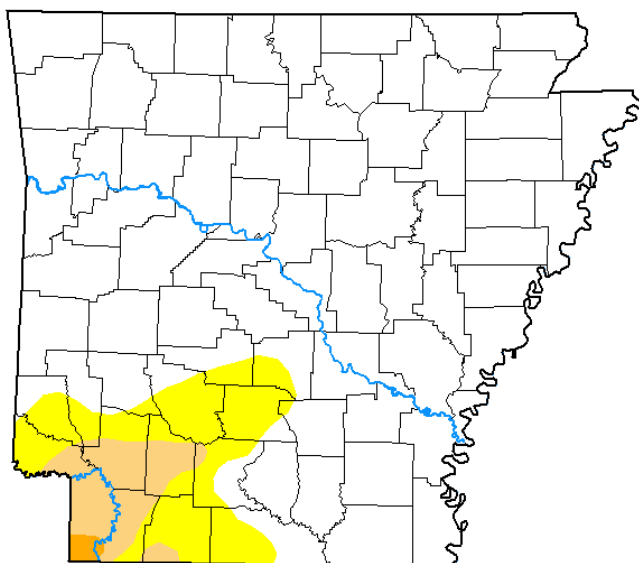


[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

Fig. 7. Drought Monitor for Oklahoma

# U.S. Drought Monitor Arkansas

**December 31, 2019**  
(Released Thursday, Jan. 2, 2020)  
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	86.68	13.32	4.35	0.31	0.00	0.00
<b>Last Week</b> 12-24-2019	86.68	13.32	4.46	0.08	0.00	0.00
<b>3 Months Ago</b> 10-01-2019	54.35	45.65	11.77	5.79	0.00	0.00
<b>Start of Calendar Year</b> 01-01-2019	98.79	1.21	0.00	0.00	0.00	0.00
<b>Start of Water Year</b> 10-01-2019	54.35	45.65	11.77	5.79	0.00	0.00
<b>One Year Ago</b> 01-01-2019	98.79	1.21	0.00	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](https://droughtmonitor.unl.edu)

Fig. 8. Drought Monitor for Arkansas



## Outlooks

The [Climate Prediction Center](#) (CPC) outlook for January 2020 (issued December 31, 2019) indicates an enhanced chance for above normal temperatures and equal chances for above, near, and below median precipitation across all of eastern OK and northwest AR. This outlook takes into account dynamical model guidance and the weeks 3-4 outlook.

For the 3-month period January-February-March 2020, CPC is forecasting a slightly enhanced chance for above normal temperatures along and south of I-40, and equal chances for above, near, or below normal temperatures north of I-40. This outlook also calls for an equal chance for above, near, or below median rainfall across all of eastern OK and northwest AR (outlook issued December 19, 2019). This outlook is based on both statistical and dynamical forecast tools, and decadal timescale climate trends. According to CPC, the combined effect of the ocean-atmosphere system is consistent with ENSO neutral conditions. The consensus forecast is for ENSO neutral conditions to be the most likely through the winter (70% chance) and the upcoming spring (near 65% chance). With ENSO-neutral favored to persist through the upcoming winter, the odds of other sub-seasonal factors, such as the Arctic Oscillation (AO), will play a larger role in the temperature pattern.

**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](http://water.weather.gov/precip/index.php?location_type=wfo&location_name=tsa)

Scattered rain showers began to develop on the morning of November 29<sup>th</sup> in a zone of stronger isentropic lift and warm air advection ahead of a cold front and continued through the afternoon hours. Deeper low-level moisture surged north into the area by evening as a strong upper-level jet streak lifted into the Central Plains in association with larger scale upper low moving over the Intermountain West. Scattered thunderstorms affected locations along and north of I-40 through the evening hours. A few of these storms became severe, producing hail of 1.25" (half dollar size) - 2" (hen egg size) in northeast OK. These thunderstorms shifted east of the region by midnight. A line of showers and thunderstorms then developed across eastern OK during the overnight hours with the aid of a 60 knot southwesterly low-level jet and a potent mid-level low spinning over western Nebraska. At the surface, a warm front had surged northward to near I-40, and a Pacific cold front stretched across northeast OK into south-central OK. This line of rain continued to move east across eastern OK and northwest AR, exiting the area by mid-morning on the 30<sup>th</sup> as the cold front moved east through the region. Rainfall totals from both rounds of precipitation ranged from 0.10" to near 2.5" (Fig. 9). The heaviest rain of 1.5"-2.5" fell over the Illinois River basin, resulting in minor flooding along the Illinois River on December 1<sup>st</sup> (see preliminary hydrographs at the end of this report; see E3 Report for details).

Nearly all forms of precipitation – freezing drizzle, freezing rain, snow, sleet, thundersleet, thunderstorms, rain, drizzle, and hail – fell across eastern OK and northwest AR on the 16<sup>th</sup>. Light freezing drizzle, with pockets of sleet and snow flurries, impacted portions of northeast OK and northwest AR during the early morning hours within an area of sub-freezing temperatures. Ice accumulations were light, with a glaze on elevated surfaces and slick spots primarily on bridges and overpasses. Precipitation, including thunderstorms and thundersleet, developed during the morning within an area of warm advection in advance of an approaching upper-level trough. The convective activity ended by noon, and the freezing line stretched from southeast OK into northwest AR. Bands of light snow, freezing drizzle, and drizzle continued through the afternoon and evening before exiting the area as the upper-level wave lifted northeast. Despite all of the precipitation types, rainfall/liquid equivalent totals were light. Portions of far eastern OK and northwest AR received around 0.50"-1.5" of rain, with much of the region seeing around 0.10" or less (Fig. 10). Snow/sleet/ice accumulations were generally a trace, though a few locations reported 0.1"-0.2" of snow/sleet.

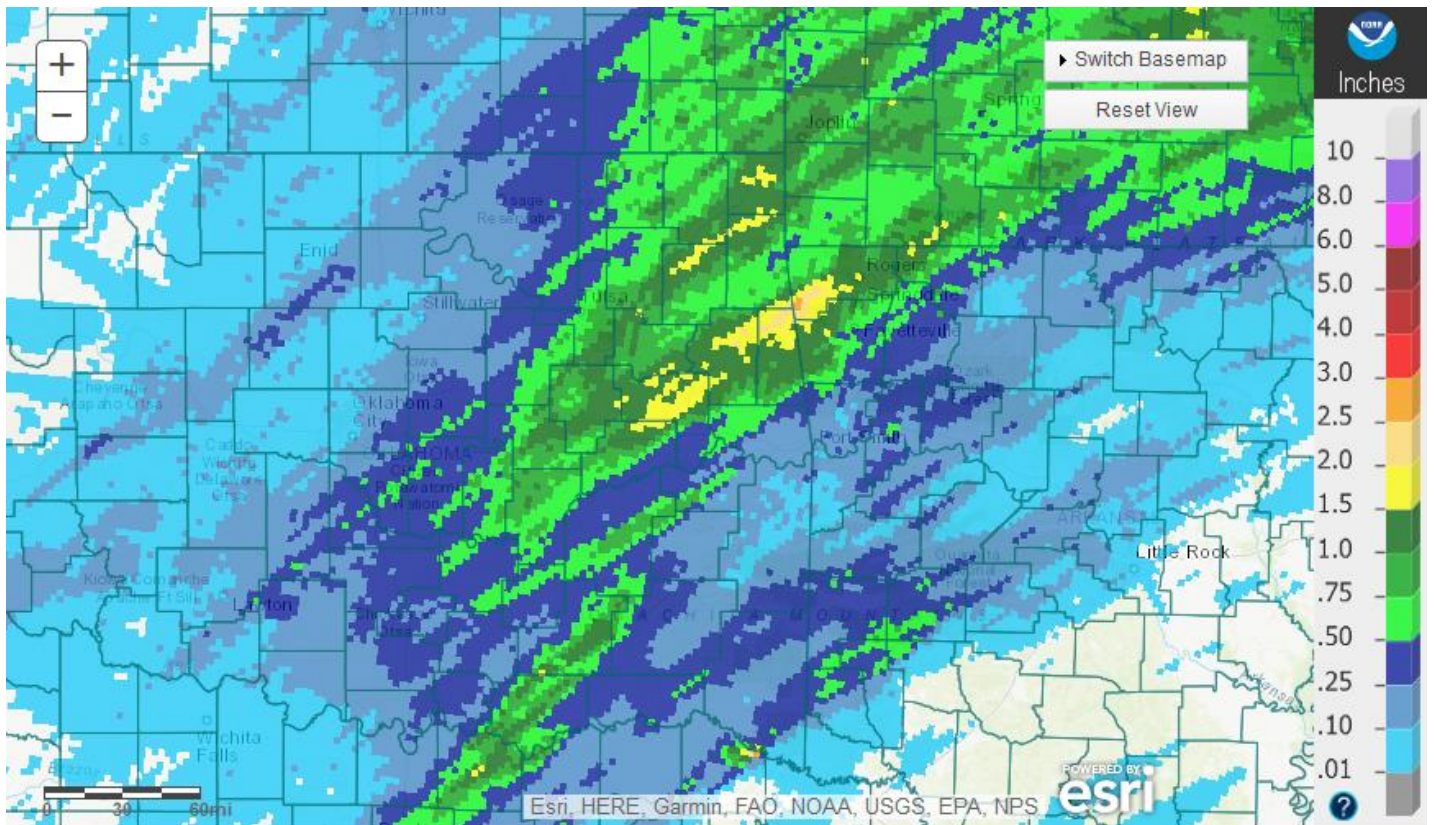


Fig. 9. 24-hour Estimated Observed Rainfall ending at 6am CST 11/30/2019.

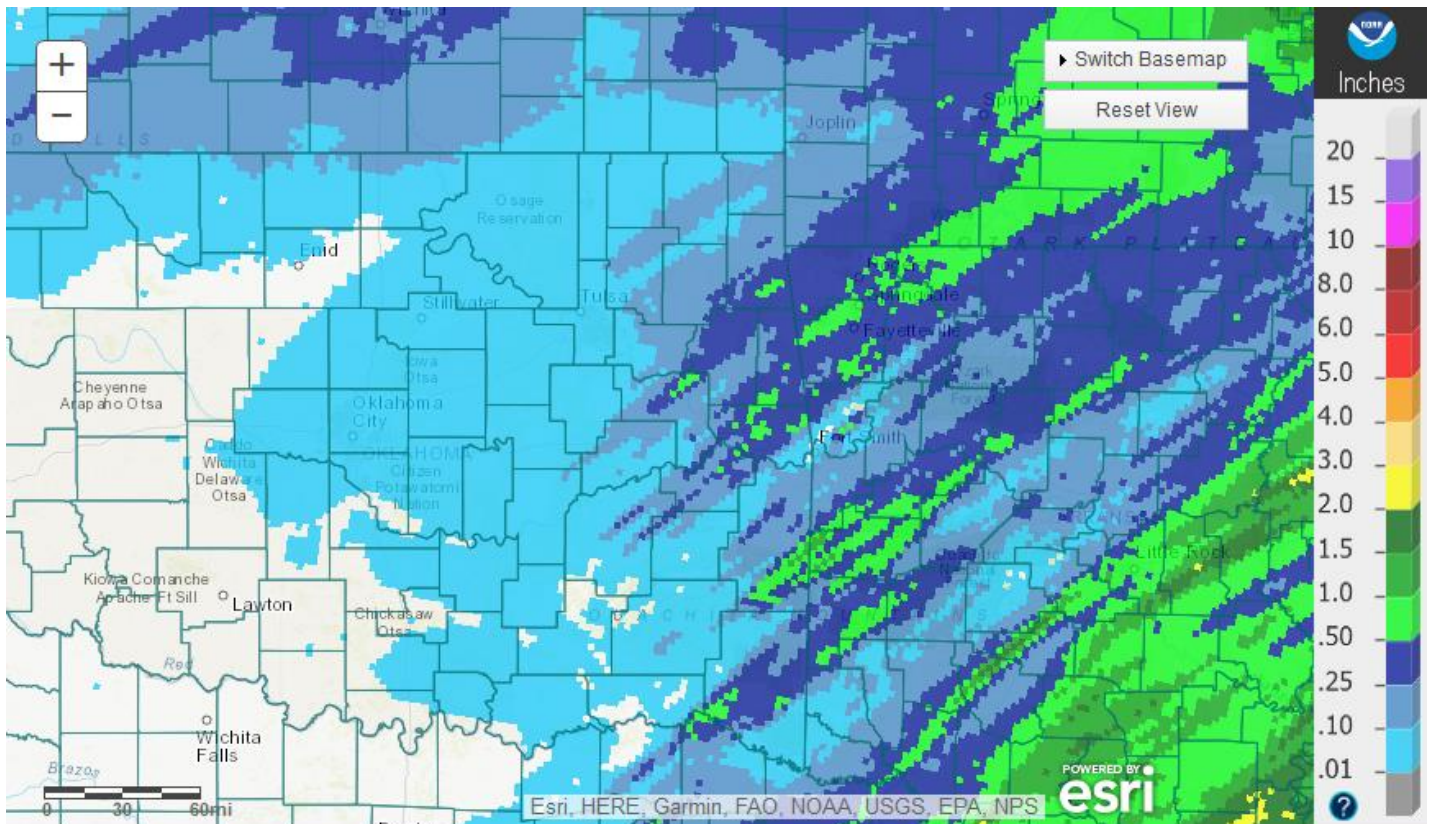


Fig. 10. 48-hour Estimated Observed Rainfall ending at 6am CST 12/17/2019.



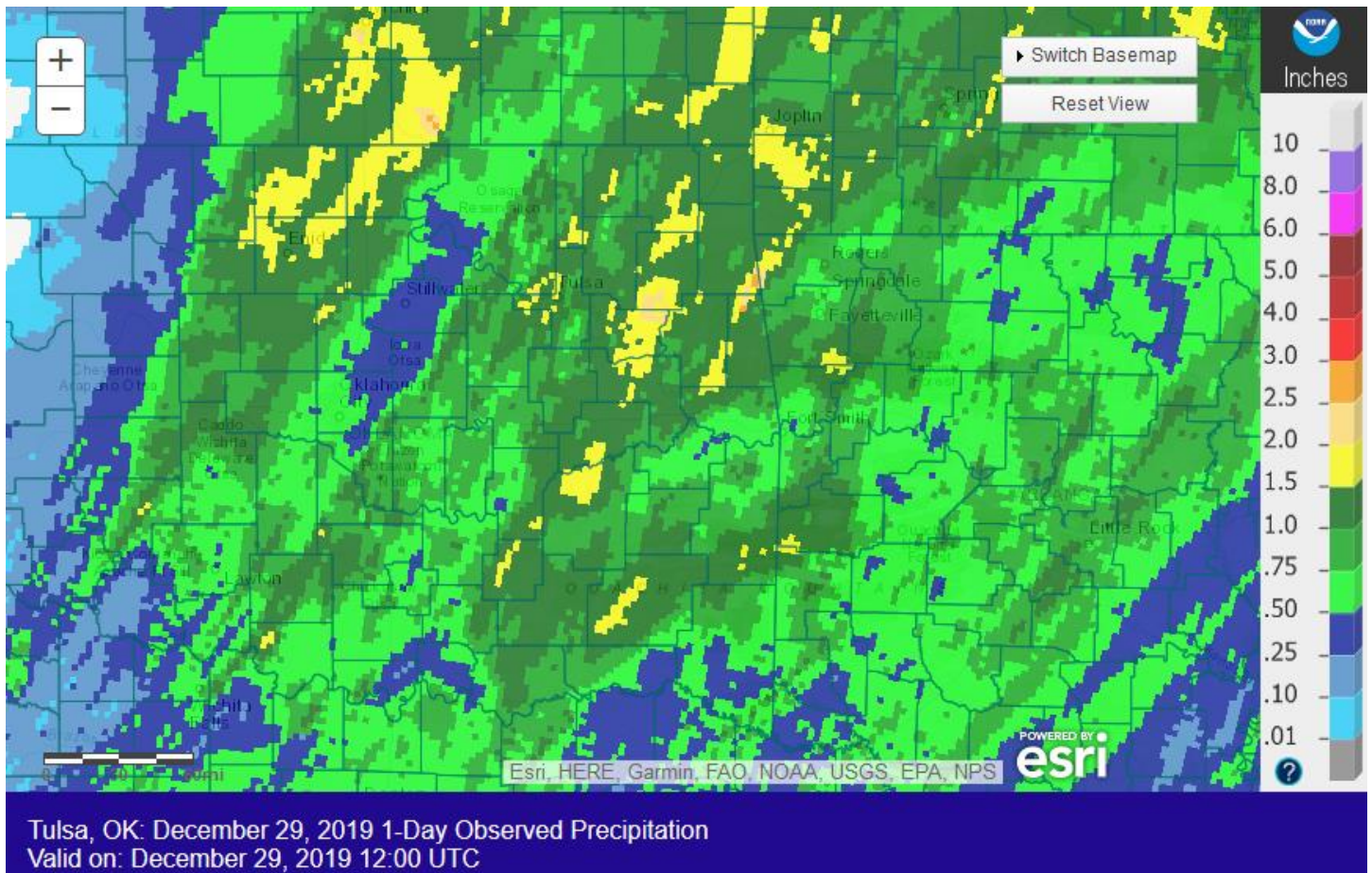


Fig. 11. 24-hour Estimated Observed Rainfall ending at 6am CST 12/29/2019.

On the 28<sup>th</sup>, a line of showers and isolated thunderstorms spread east into eastern OK by mid-morning and into northwest AR by noon. A second, more intense, line of storms moved east into the region during the mid-afternoon as a strong 150 kt upper-level jet streak lifted into the region ahead of the main upper-level trough axis. Broken lines of thunderstorms developed ahead of an approaching cold front and moved through eastern OK during the afternoon and early evening hours. Although instability was weak, low LCL heights, dewpoints in the 60s, and the very strong low-level wind shear was more than enough to support the development of low-level rotation in a couple of the stronger convective lines. One such line produced a weak (EF0) tornado in Broken Arrow, OK (see <https://arcg.is/1X8eW1> for more information). These storms pushed east of the area by midnight on the 29<sup>th</sup>. Rainfall totals across all of eastern OK and northwest AR ranged from around 0.50" to around 2.5", with the majority of the area receiving 0.75"-1.5" (Fig. 11). This rainfall resulted in a rise to Action Stage along Flint Creek near Kansas (see preliminary hydrographs at the end of this report).

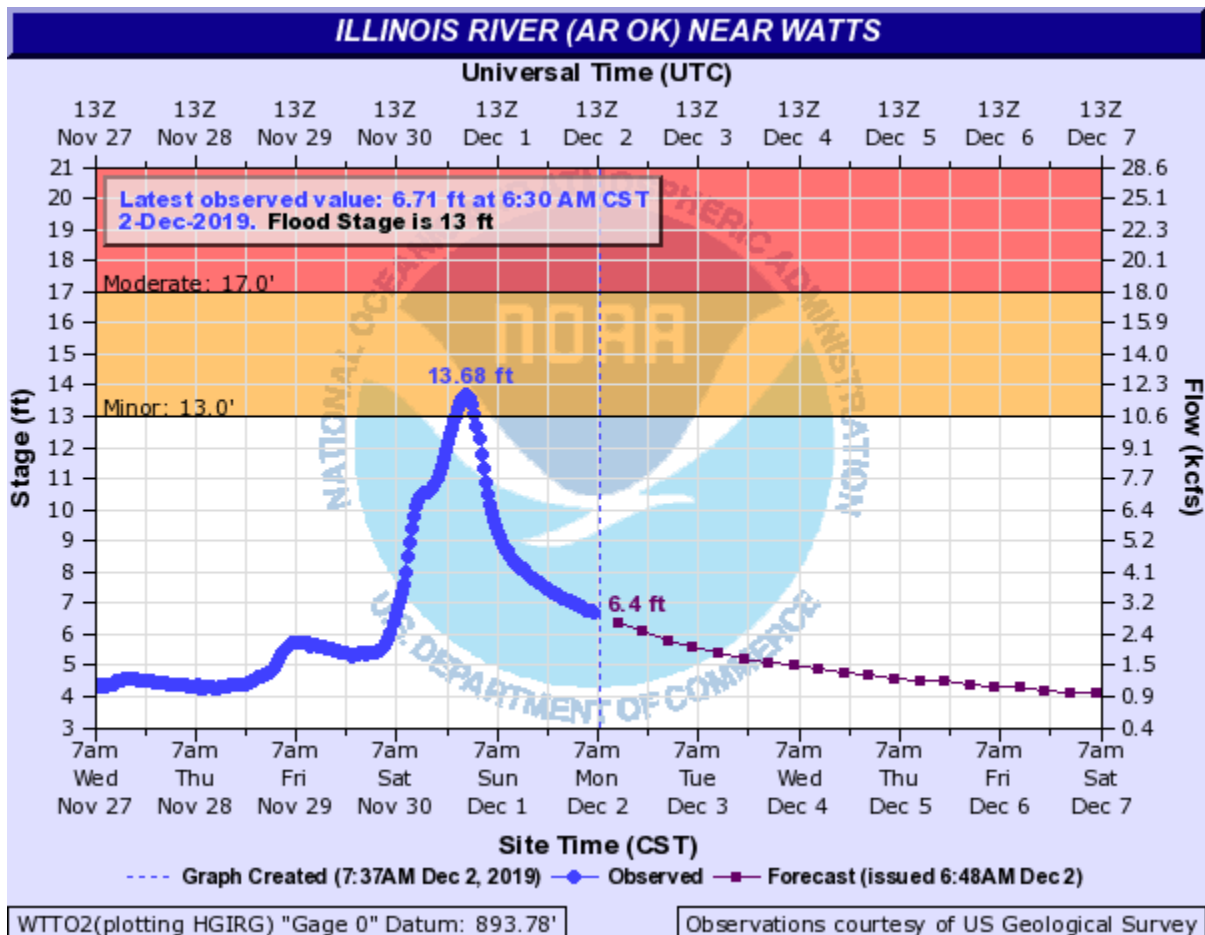
Written by:  
 Nicole McGavock  
 Service Hydrologist  
 WFO Tulsa

**Products issued in December 2019:**

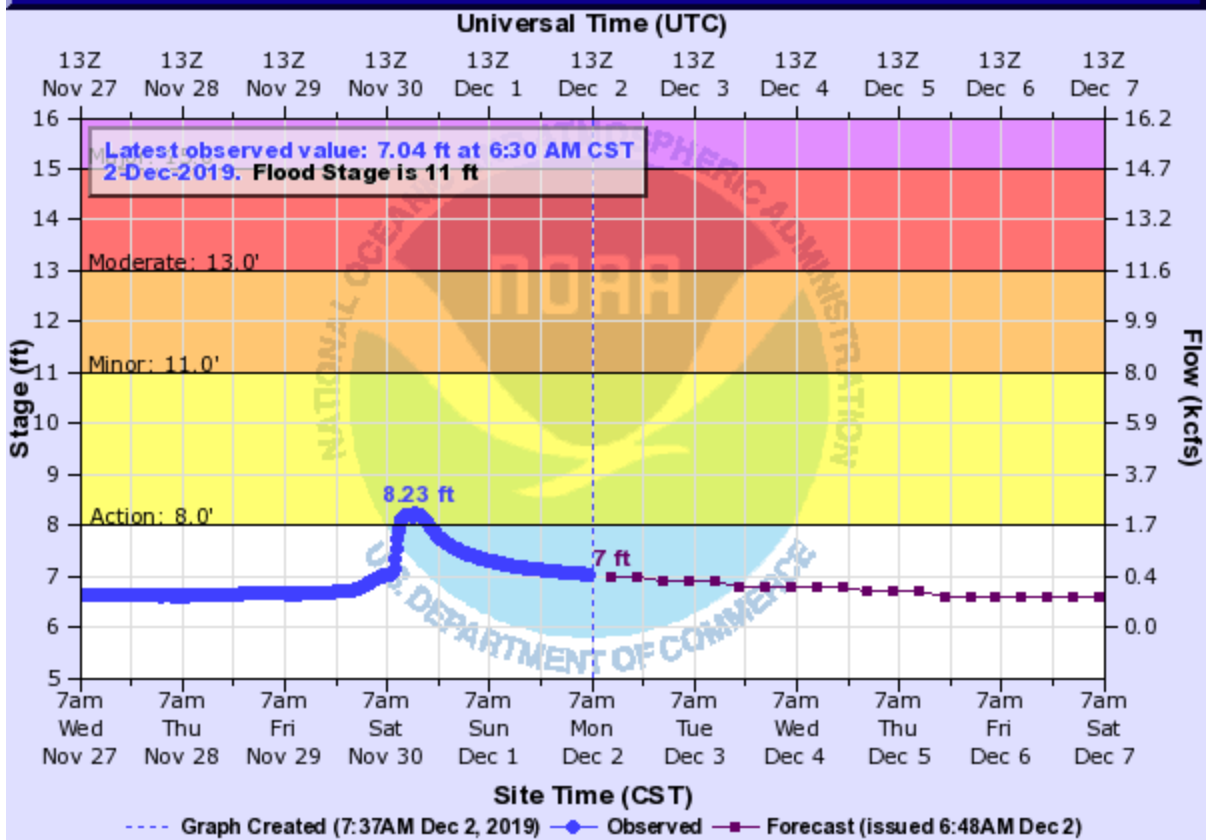
- \*CWYO2 became a daily river forecast point September 7, 2016
- \*MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014
- \*Mixed case River Flood products began July 31, 2013

- 0 Flash Flood Warnings (FFW)
- 0 Flash Flood Statements (FFS)
- 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)
- 6 River Flood Statements (FLS)
- 1 River Flood Advisories (FLS) (5 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:**



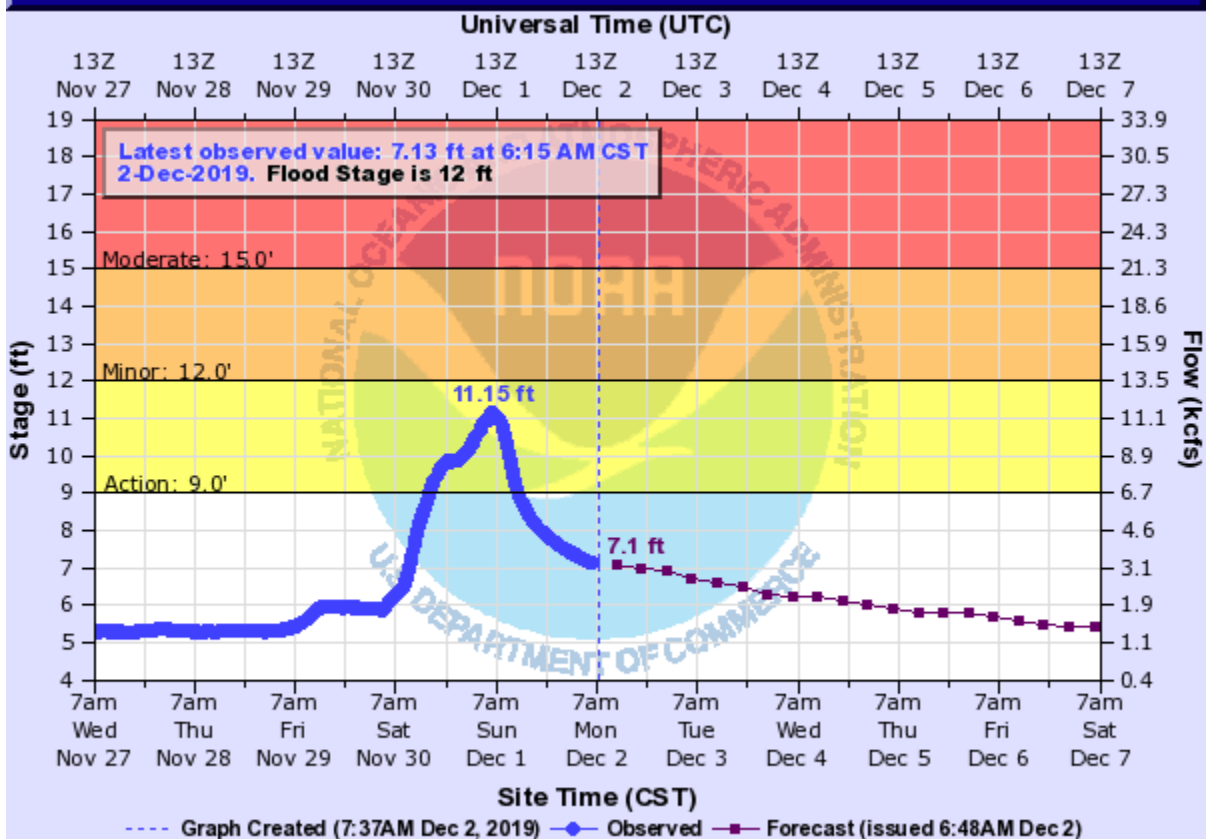
## FLINT CREEK (OK) NEAR KANSAS



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

Observations courtesy of US Geological Survey

## ILLINOIS RIVER (AR OK) AT CHEWEY

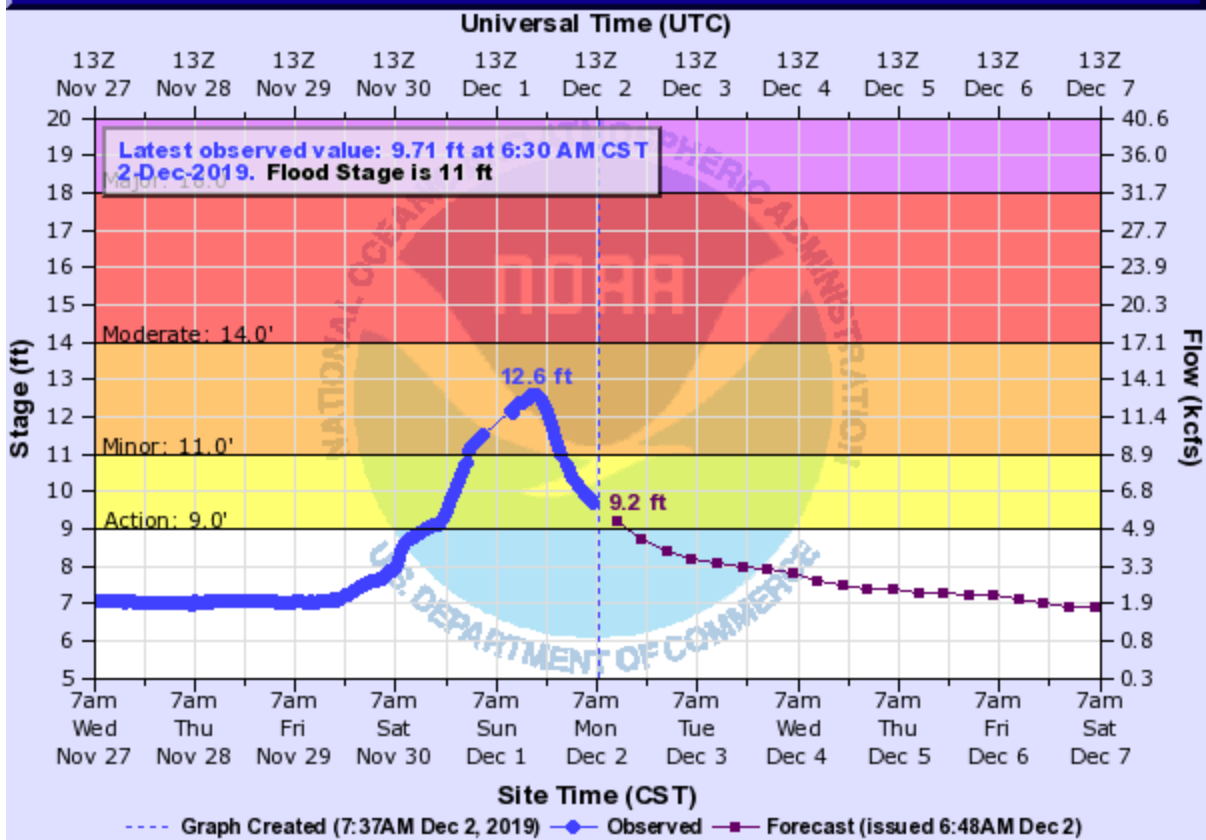


CWYO2(plotting HGIRG) "Gage 0" Datum: 800.88'

Observations courtesy of US Geological Survey



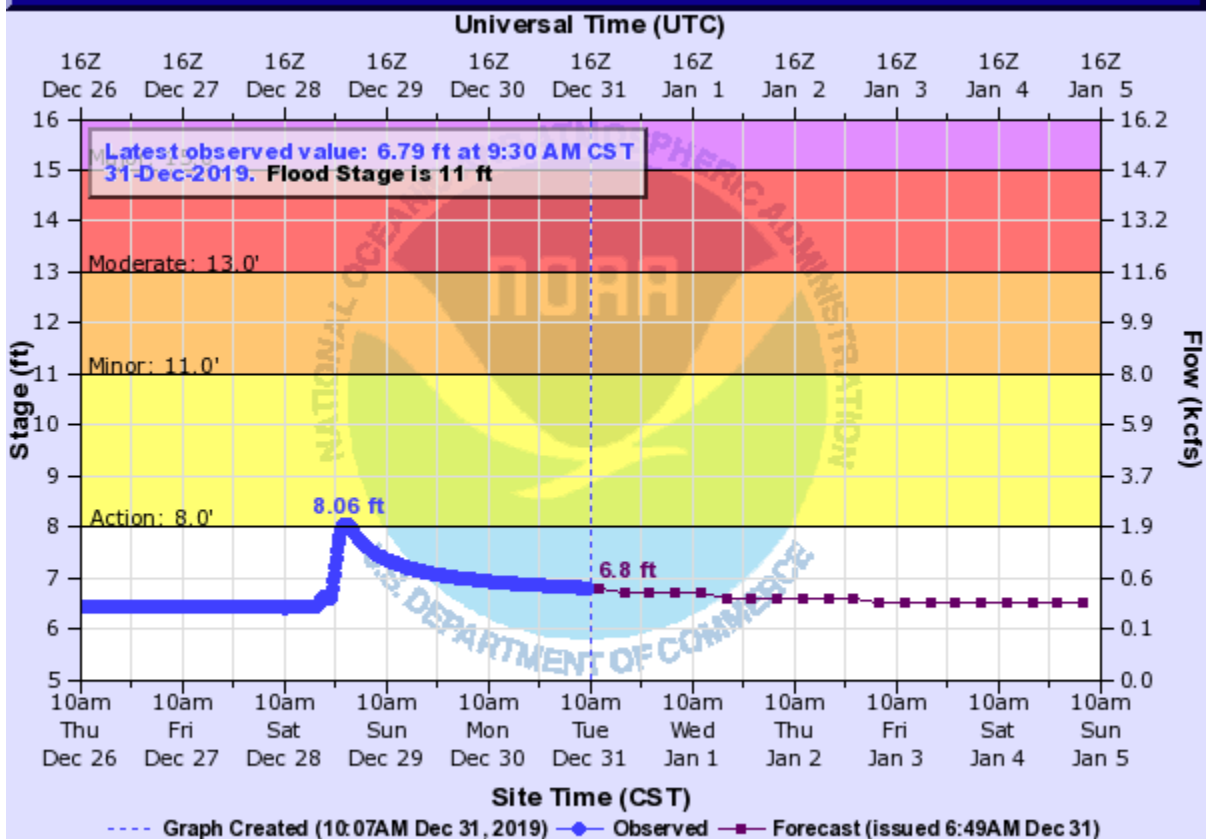
## ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH



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

Observations courtesy of US Geological Survey

## FLINT CREEK (OK) NEAR KANSAS



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

Observations courtesy of US Geological Survey