

<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>February</b>	YEAR <b>2020</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>March 20, 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.

A few rounds of precipitation brought some wintry weather to eastern OK and northwest AR, and minor flooding across southeast OK during leap month 2020. Normal precipitation across the Hydrologic Service Area (HSA) in February ranges from 1.8 inches in Osage County to 3.2 inches in Choctaw County. In the Ozark region of northwest Arkansas, the normal monthly precipitation is 2.9 inches. 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 February 2020 ranged from around 0.50" to around 5" across eastern OK and northwest AR, with most of the area receiving 2"-4". These rainfall totals correspond to 25%-150% of the normal February rainfall across the area, with most of eastern OK and northwest Arkansas receiving 75-125% of normal (Fig. 1b).

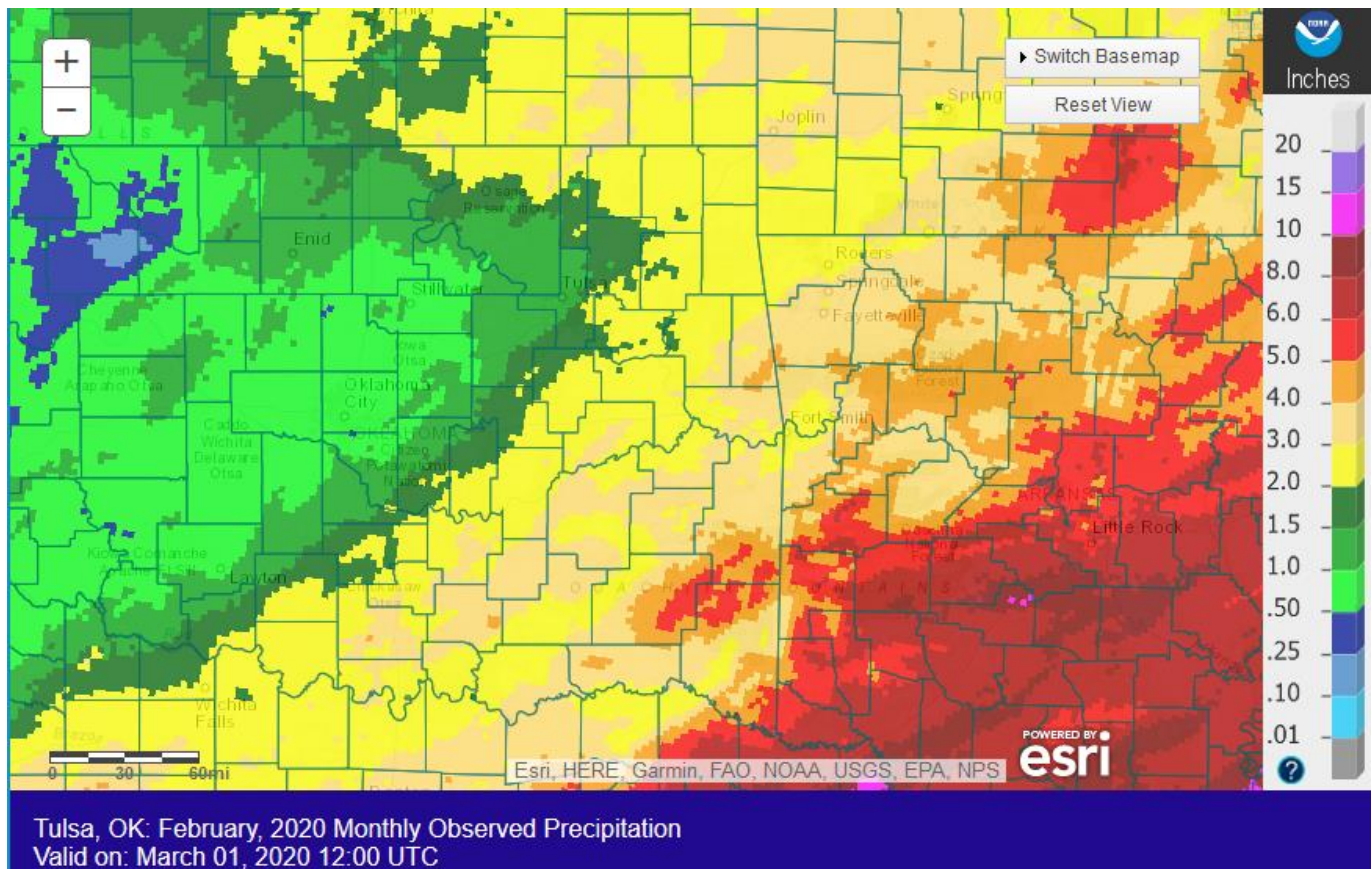


Fig. 1a. Estimated Observed Rainfall for February 2020

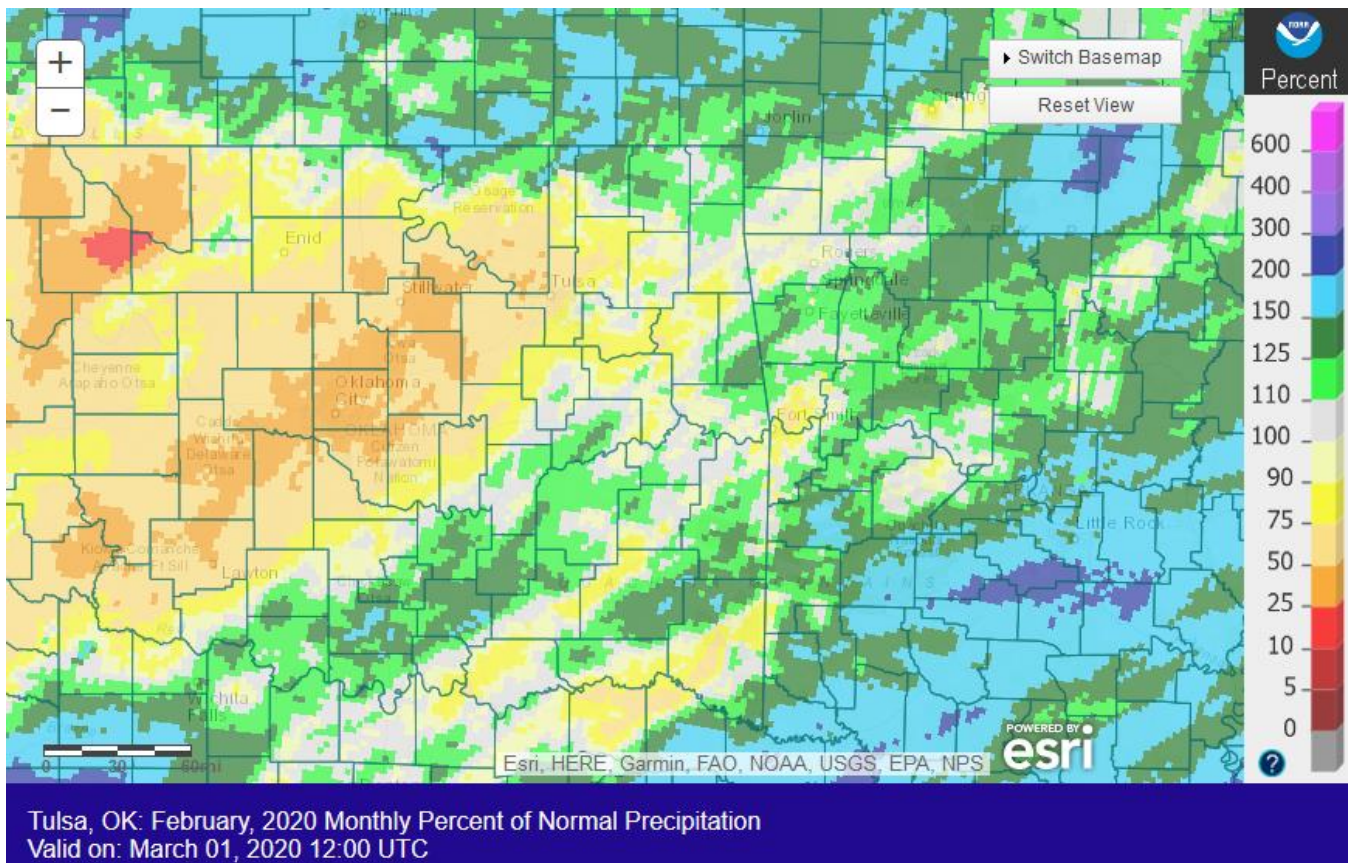


Fig. 1b. Estimated % of Normal Rainfall for February 2020

In Tulsa, OK, February 2020 ranked as the 45<sup>th</sup> warmest February (42.6°F, tied 1961; since records began in 1905), the 66<sup>th</sup> driest February (1.37"; since records began in 1888), and the 39<sup>th</sup> snowiest February (2.4", tied 2010, 1949; since records began in 1900). Fort Smith, AR had the 43<sup>rd</sup> warmest February (45.3°F, tied 1928, 1896, 1887; since records began in 1883), the 57<sup>th</sup> wettest February (2.59"; since records began in 1883), and the 37<sup>th</sup> least snowy February (Trace, tied with 23 other years; since records began in 1884). Fayetteville, AR had the 19<sup>th</sup> warmest (42.6°F, tied 2016, 1995, 1984), the 19<sup>th</sup> wettest (3.47"), and the 25<sup>th</sup> least snowy (0.1") February since records began in 1950.

Some of the larger precipitation reports (in inches) for February 2020 included:

Cloudy, OK (meso)	5.16	Pryor 6.9ESE, OK (coco)	4.45	Kingston 2S, AR (coop)	4.26
Hindsville 10NNE, AR (coop)	4.12	Ozark 4.6S, AR (coco)	4.04	Greenwood 1.4W, AR (coco)	3.99
Winslow 7NE, AR (coop)	3.92	Elkins 10.6SSE, AR (coco)	3.86	Ozark, AR (coop)	3.74

Some of the lowest precipitation reports (in inches) for February 2020 included:

Sand Springs 4.6WNW, OK (coco)	1.14	Pawnee, OK (meso)	1.27	Oilton, OK (meso)	1.28
Jenks Riverside Arpt, OK (ASOS)	1.30	Tulsa, OK (ASOS)	1.37	Bristow, OK (meso)	1.45
Skiatook, OK (meso)	1.46	Tulsa 7.7SSE, OK (coco)	1.47	Burbank, OK (meso)	1.73

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

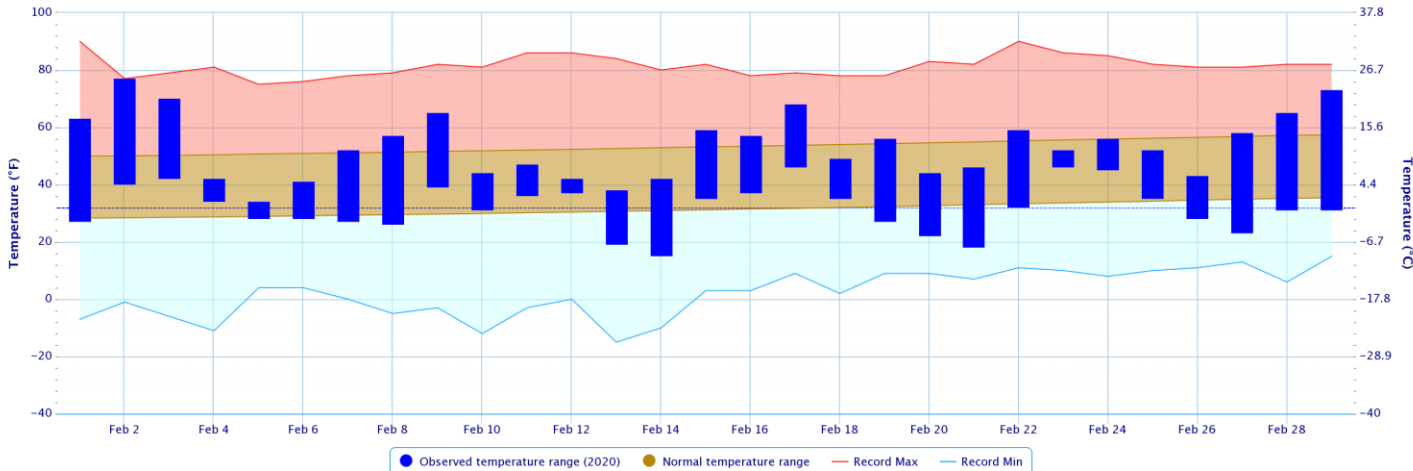
Rank since 1921	30 Days (Jan 30 - Feb 28)	Year-to-Date (Jan 1 - Feb 28)	Winter 2019-20 (Dec 1 - Feb 29)	Last 120 Days (Nov 2 - Feb 29)	Water Year-to-Date (Oct 1 - Feb 29)	Cool Growing Season (Sep 1 - Feb 29)	Last 365 Days (Mar 2, 2019 - Feb 29, 2020)
Northeast OK	38 <sup>th</sup> wettest	<b>7<sup>th</sup> wettest</b>	<b>5<sup>th</sup> wettest</b>	<b>5<sup>th</sup> wettest</b>	<b>3<sup>rd</sup> wettest</b>	<b>2<sup>nd</sup> wettest</b>	<b>1<sup>st</sup> wettest</b>
East Central OK	34 <sup>th</sup> wettest	<b>7<sup>th</sup> wettest</b>	<b>5<sup>th</sup> wettest</b>	<b>5<sup>th</sup> wettest</b>	<b>1<sup>st</sup> wettest</b>	<b>2<sup>nd</sup> wettest</b>	<b>2<sup>nd</sup> wettest</b>
Southeast OK	36 <sup>th</sup> wettest	12 <sup>th</sup> wettest	12 <sup>th</sup> wettest	<b>8<sup>th</sup> wettest</b>	<b>4<sup>th</sup> wettest</b>	<b>3<sup>rd</sup> wettest</b>	<b>2<sup>nd</sup> wettest</b>
Statewide	44 <sup>th</sup> wettest	<b>9<sup>th</sup> wettest</b>	<b>8<sup>th</sup> wettest</b>	<b>7<sup>th</sup> wettest</b>	<b>6<sup>th</sup> wettest</b>	<b>6<sup>th</sup> wettest</b>	<b>2<sup>nd</sup> wettest</b>



In Tulsa, OK, Winter 2019-20 ranked as the 11<sup>th</sup> warmest Winter (43.3°F; since records began in 1905-06) and the 28<sup>th</sup> wettest Winter (7.23"; since records began in 1888-89). Fort Smith, AR had the 12<sup>th</sup> warmest Winter (45.1°F, tied 1951-52; since records began in 1882-83) and the 47<sup>th</sup> wettest Winter (9.33"; since records began in 1882-83). Fayetteville, AR had the 2<sup>nd</sup> warmest (42.6°F) and the 15<sup>th</sup> wettest (10.30") Winter since records began in 1949-50.

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

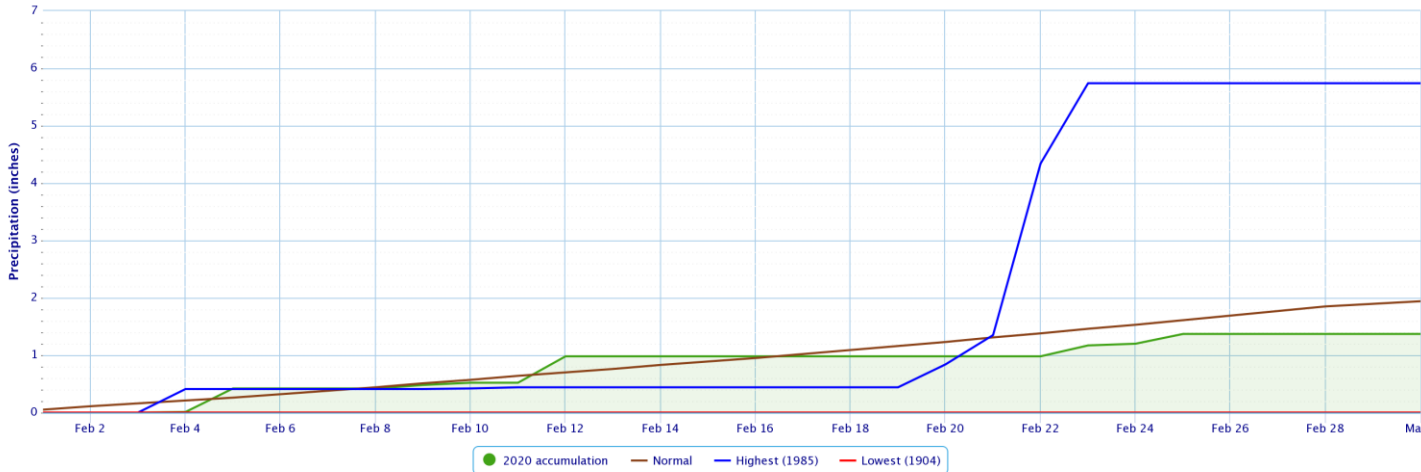
Period of Record – 1905-01-06 to 2020-03-01. Normals period: 1981-2010. Click and drag to zoom chart.



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Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

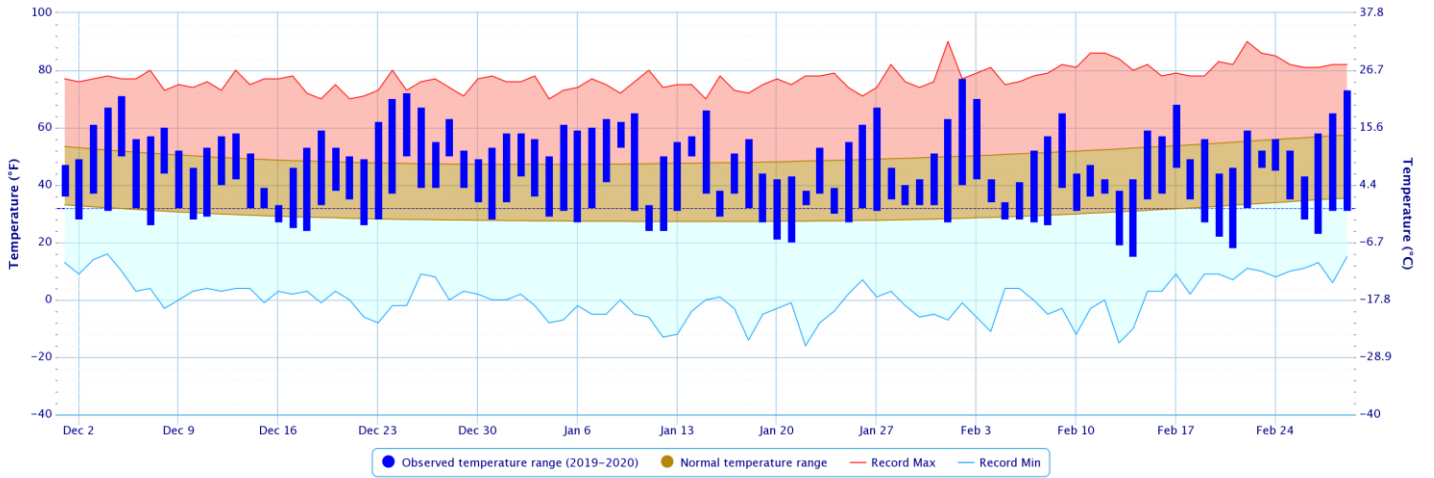
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

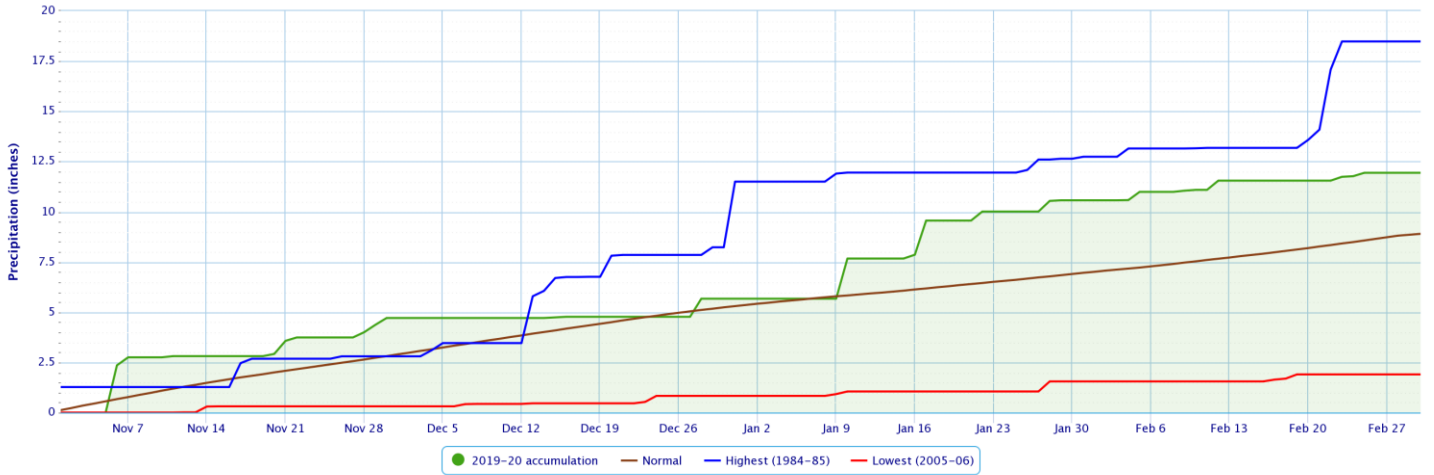
Period of Record – 1905-01-06 to 2020-03-01. Normals period: 1981-2010. Click and drag to zoom chart.



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### Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

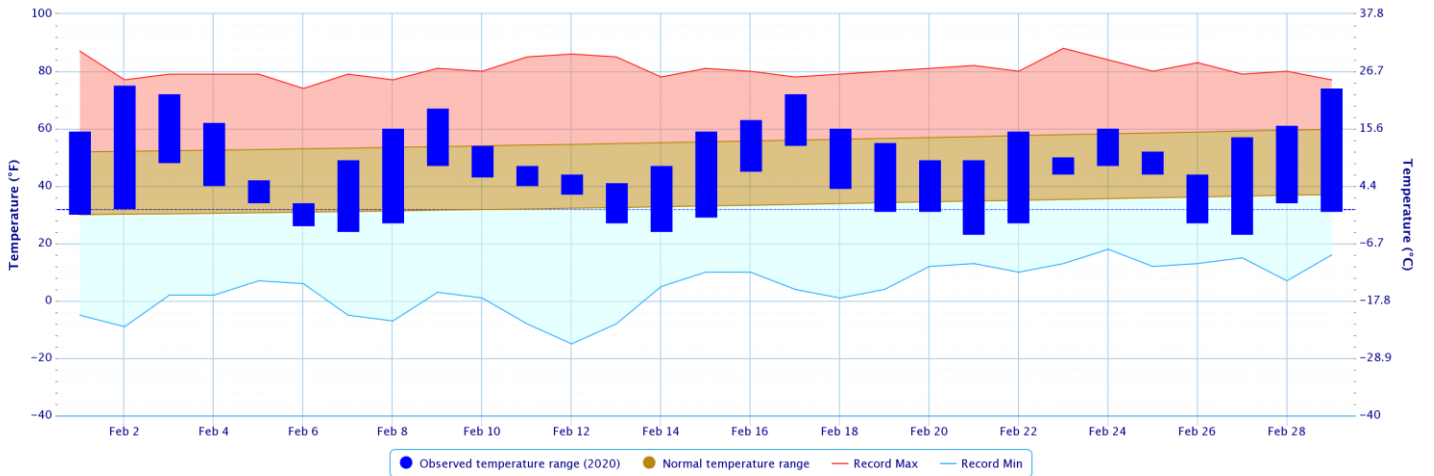
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

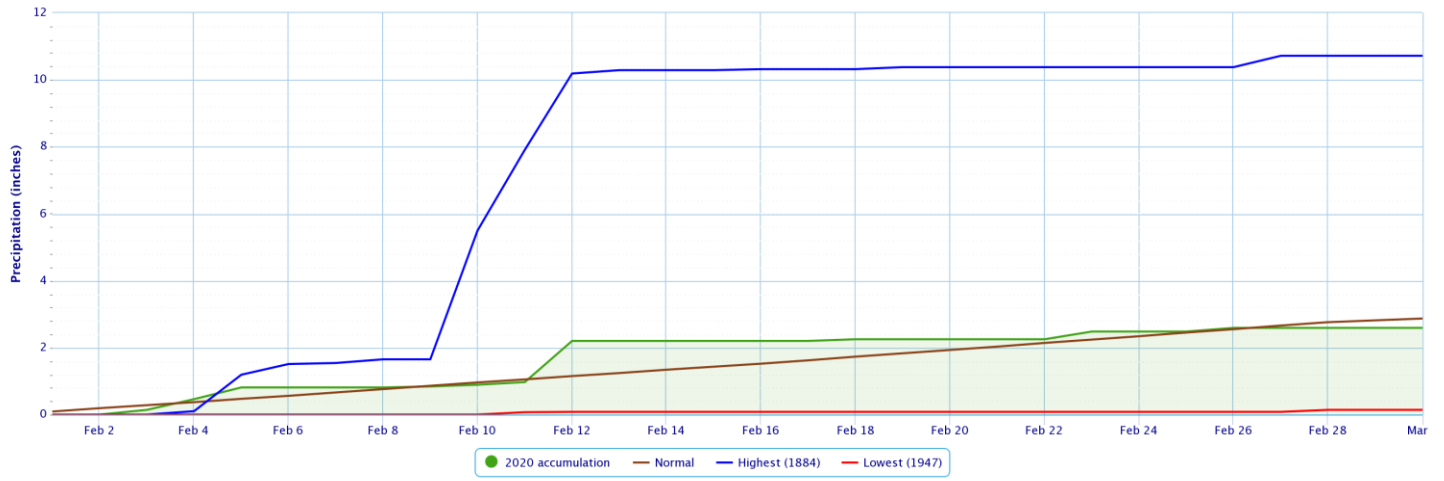
Period of Record – 1882-06-01 to 2020-03-01. Normals period: 1981-2010. Click and drag to zoom chart.



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

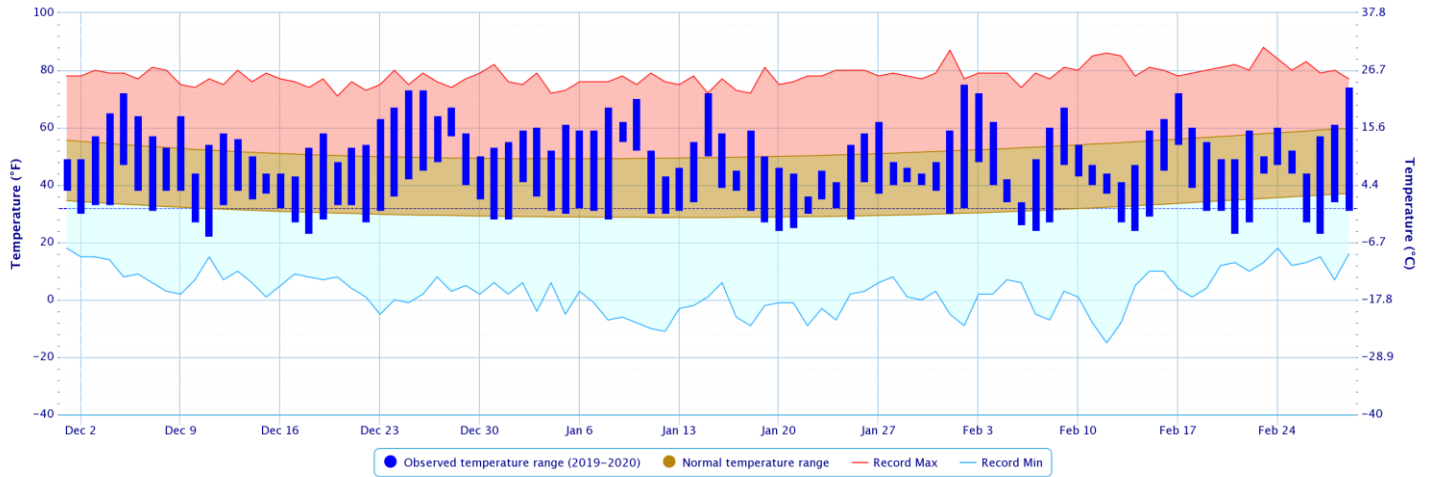
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

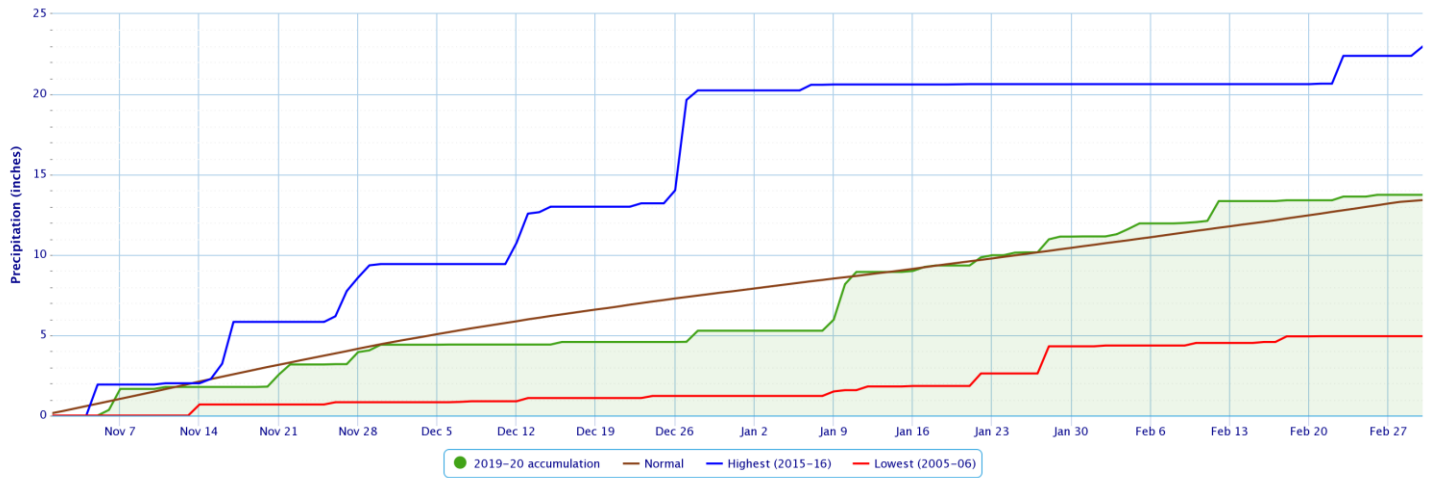
Period of Record – 1882-06-01 to 2020-03-01. Normals period: 1981-2010. Click and drag to zoom chart.



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

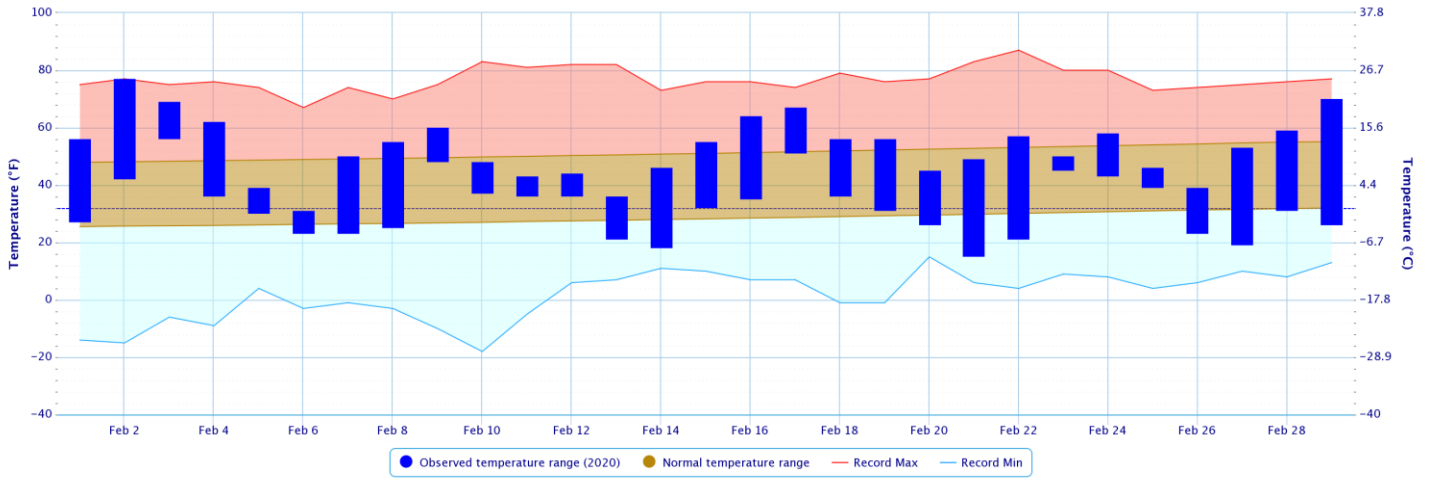
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

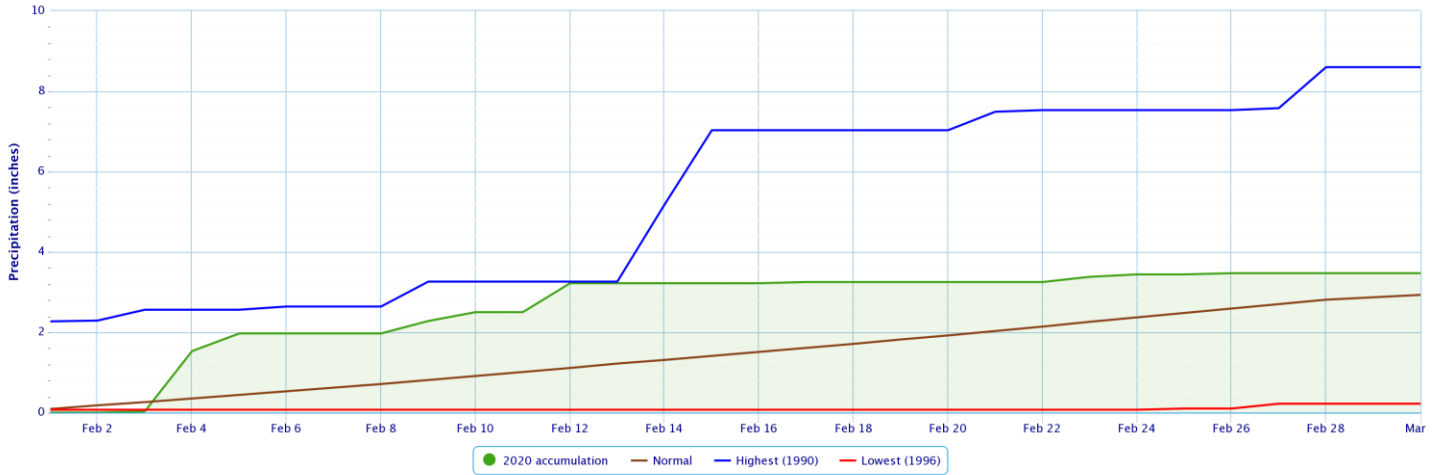
Period of Record – 1949-07-14 to 2020-03-01. Normals period: 1981-2010. Click and drag to zoom chart.



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### Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

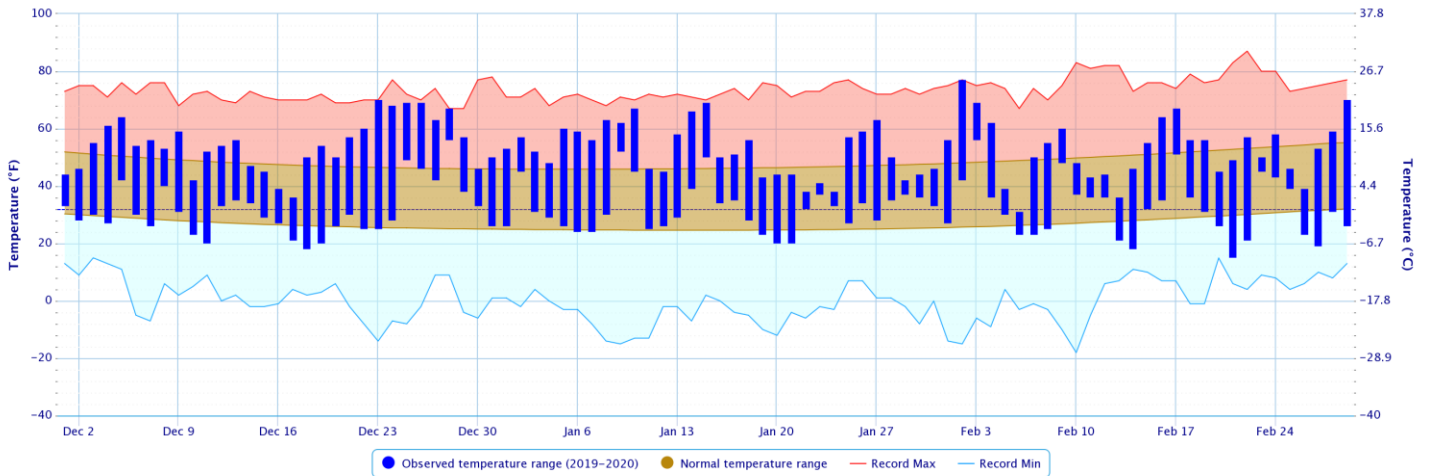
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

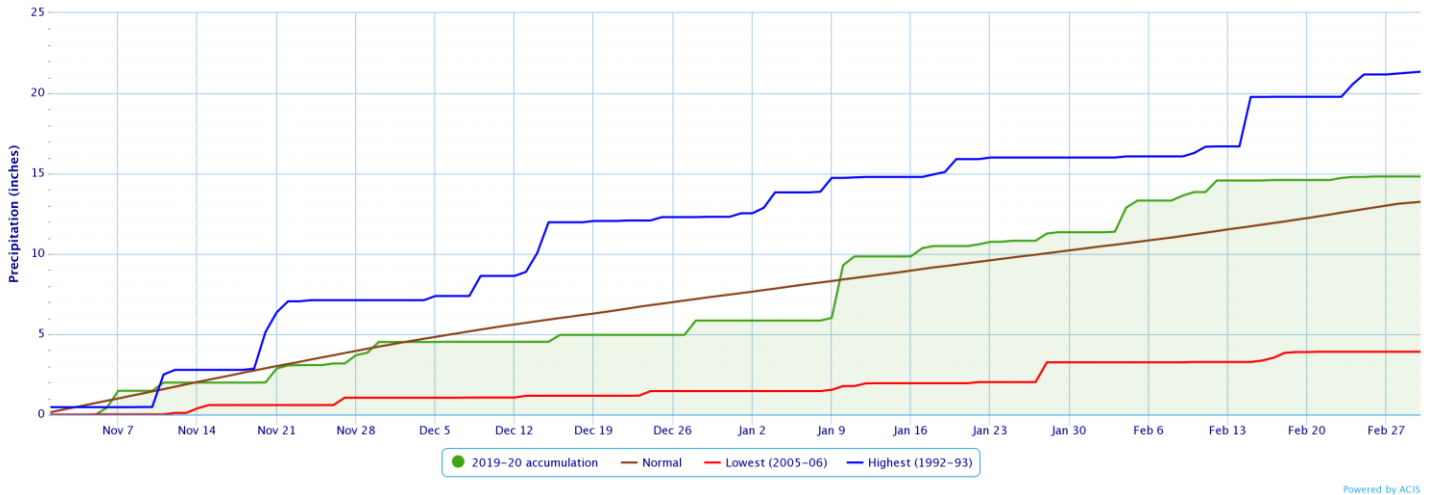
Period of Record – 1949-07-14 to 2020-03-01. Normals period: 1981-2010. Click and drag to zoom chart.



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Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

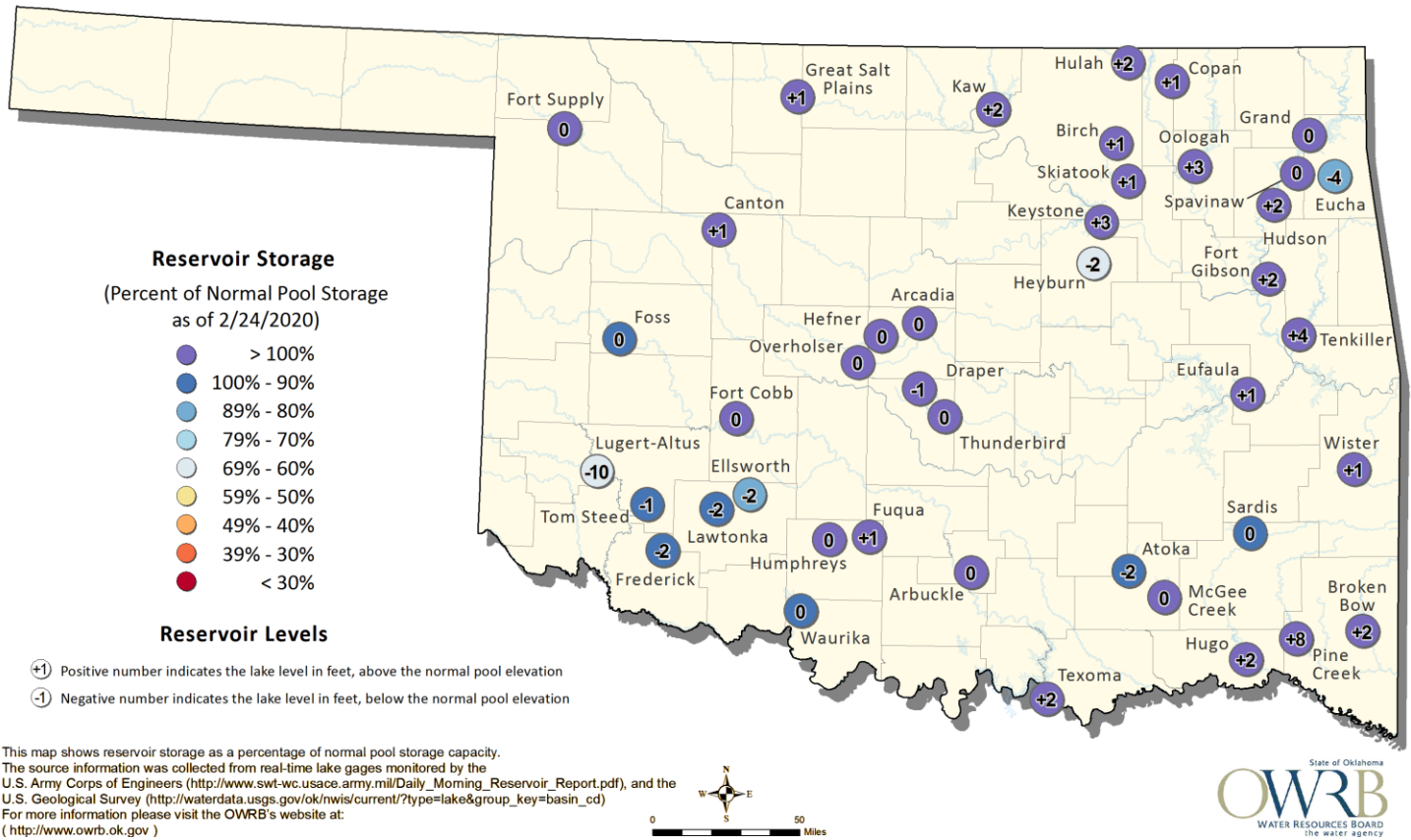
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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**Reservoirs**

**Oklahoma Surface Water Resources**  
Reservoir Levels and Storage as of 2/24/2020



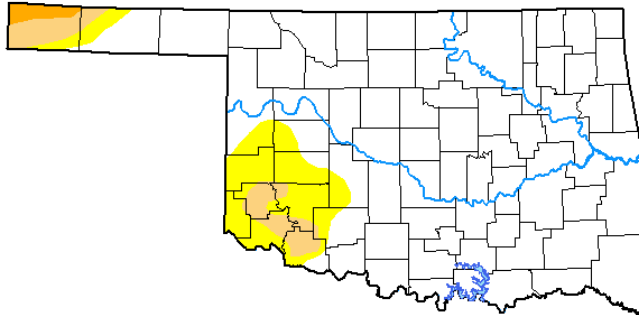
According to the USACE, a few of the lakes in the HSA were utilizing more than 5% of their flood control pools as of 3/02/2020: Beaver Lake 79%, Oologah Lake 16%, Grand Lake 16%, and Hudson Lake 12%.

**Drought**

According to the [U.S. Drought Monitor](#) (USDM) from February 25, 2020 (Figs. 2, 3), eastern OK and northwest AR were drought free.

**U.S. Drought Monitor  
Oklahoma**

**February 25, 2020**  
(Released Thursday, Feb. 27, 2020)  
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	86.53	13.47	4.66	0.84	0.00	0.00
<b>Last Week</b> 02-19-2020	85.83	14.17	4.66	0.85	0.00	0.00
<b>3 Months Ago</b> 11-26-2019	76.05	23.95	12.58	3.67	0.00	0.00
<b>Start of Calendar Year</b> 12-31-2019	76.45	23.55	10.47	3.64	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> 02-26-2019	88.61	11.39	0.98	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:**  
David Miskus  
NOAA/NWS/NCEP/CPC



Fig. 2. Drought Monitor for Oklahoma

**U.S. Drought Monitor  
Arkansas**

**February 25, 2020**  
(Released Thursday, Feb. 27, 2020)  
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	100.00	0.00	0.00	0.00	0.00	0.00
<b>Last Week</b> 02-19-2020	100.00	0.00	0.00	0.00	0.00	0.00
<b>3 Months Ago</b> 11-26-2019	93.10	6.90	0.00	0.00	0.00	0.00
<b>Start of Calendar Year</b> 12-31-2019	86.68	13.32	4.35	0.31	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> 02-26-2019	100.00	0.00	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:**  
David Miskus  
NOAA/NWS/NCEP/CPC



Fig. 3. Drought Monitor for Arkansas



## Outlooks

The [Climate Prediction Center](#) (CPC) outlook for March 2020 (issued February 29, 2020) indicates an enhanced chance for above normal temperatures across all of eastern OK and northwest AR. This outlook also indicates an enhanced chance for above median precipitation across western AR and along the OK/AR state line, and equal chances for above, near, and below median precipitation across most of eastern OK. This outlook takes into account dynamical model guidance and the weeks 3-4 outlook.

For the 3-month period March-April-May 2020, CPC is forecasting a slightly enhanced chance for above normal temperatures south of I-40 in southeast OK and west central AR, and equal chances for above, near, or below normal temperatures across the remainder of northeast OK and northwest AR. This outlook also calls for a slightly enhanced chance for above median rainfall in northwest AR, and an equal chance for above, near, or below median rainfall across all of eastern OK (outlook issued February 20, 2020). 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 spring (~60% chance) and the upcoming summer (~50% chance).

**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)

An area of showers and isolated thunderstorms developed over southeast OK and west central AR, ahead of a cold front, during the evening hours of the 3<sup>rd</sup>, increasing in coverage and expanding northward through the overnight hours. The rain continued through the morning hours of the 4<sup>th</sup> before ending from west to east. Rainfall totals were around 0.50" to around 1.5" along and southeast of a line from McIntosh County OK to Benton County AR (Fig. 4). Little to no rain fell northeast of this line. The cold front brought much colder temperatures to the region.

A winter storm began to impact the area shortly after midnight on the 5<sup>th</sup>. Precipitation first spread into eastern OK from the southwest and continued to expand eastward through the overnight and morning hours. By mid-morning, most of eastern OK and northwest AR was receiving precipitation. For areas roughly along the I-44 corridor, the low- and mid-level temperature structure supported a wintry mix, with some portions of northeast OK cold enough to support all snow at the onset. As the cold air deepened through the morning, most of northeast OK and a portion of east central OK transitioned to all snow. The highest snow/sleet totals occurred near the I-44 corridor, where strong frontogenetic forcing spread into northeast OK in association with the approaching upper-level storm system. Additionally, embedded convective elements resulted in enhanced upward motion and led to locally higher snow/sleet rates. Some light icing occurred further to the southeast of the snow/sleet area where surface temperatures were below freezing. The heavier rain and snow had ended by noon across the region, but a secondary wave of light snow redeveloped over northeast OK during the afternoon and evening as the main upper-level trough moved through the region. The storm then quickly exited the region by midnight. Sleet/snowfall totals ranged from around 0.3" to around 5", with the highest accumulations across northeast OK (Figs. 5-7). Rainfall and liquid equivalent totals were 0.25" to around 1". Rainfall from the 3<sup>rd</sup>-5<sup>th</sup>, resulted in rises along the Illinois River, though it remained below flood stage.

A lead impulse lifted northeast across the Plains ahead of an upper-level low near the Baja Peninsula, which caused precipitation to spread across eastern OK and northwest AR during the afternoon and evening hours of the 10<sup>th</sup>. This precipitation was a mixture of rain and sleet across eastern OK and a rain, snow, and sleet mixture across western AR. Light snow accumulation was reported on primarily elevated surfaces across far northwest AR. Very light mixed precipitation also continued across far northern OK and northern AR through the early overnight hours, with no additional accumulation. Rainfall and liquid equivalent totals ranged from a few hundredths of an inch to around one quarter of an inch.

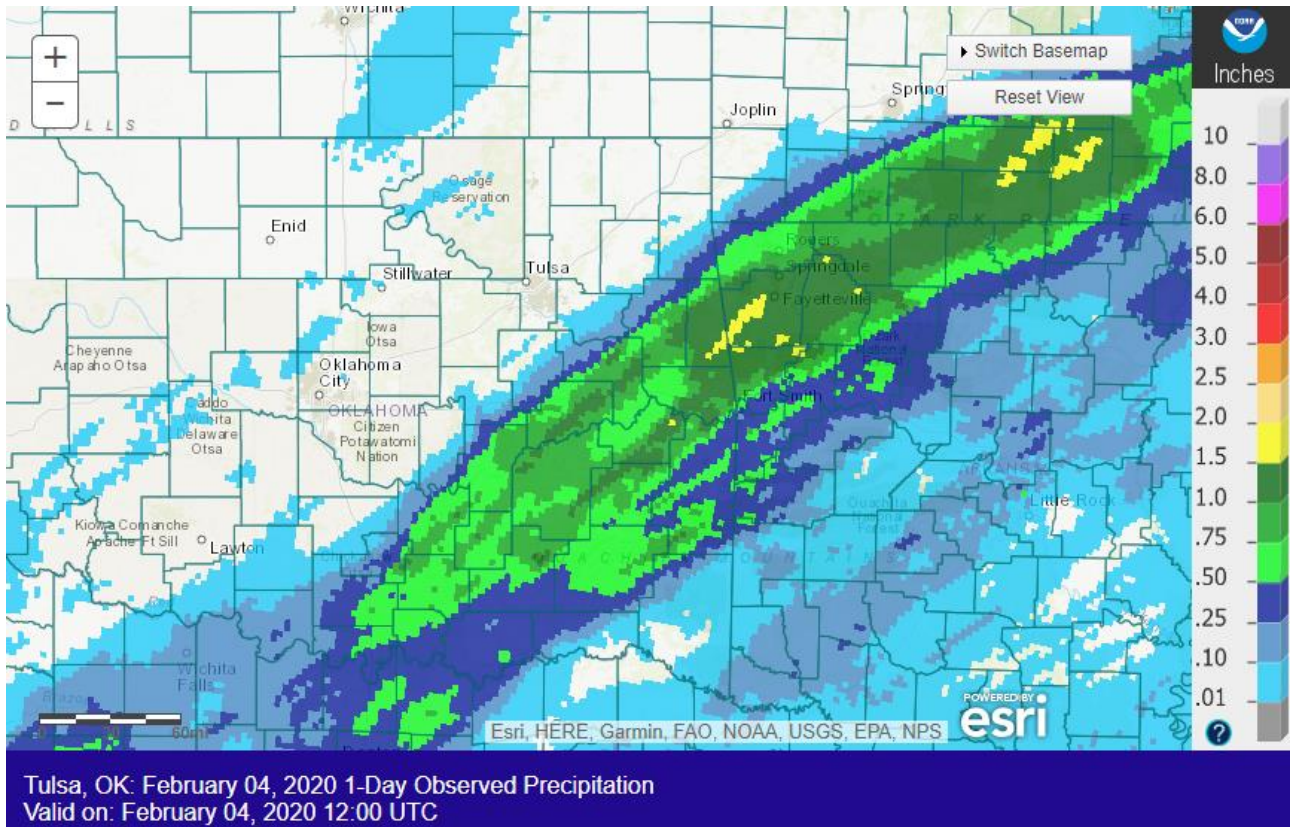


Fig. 4. 24-hour Estimated Observed Rainfall ending at 6am CST 2/04/2020.

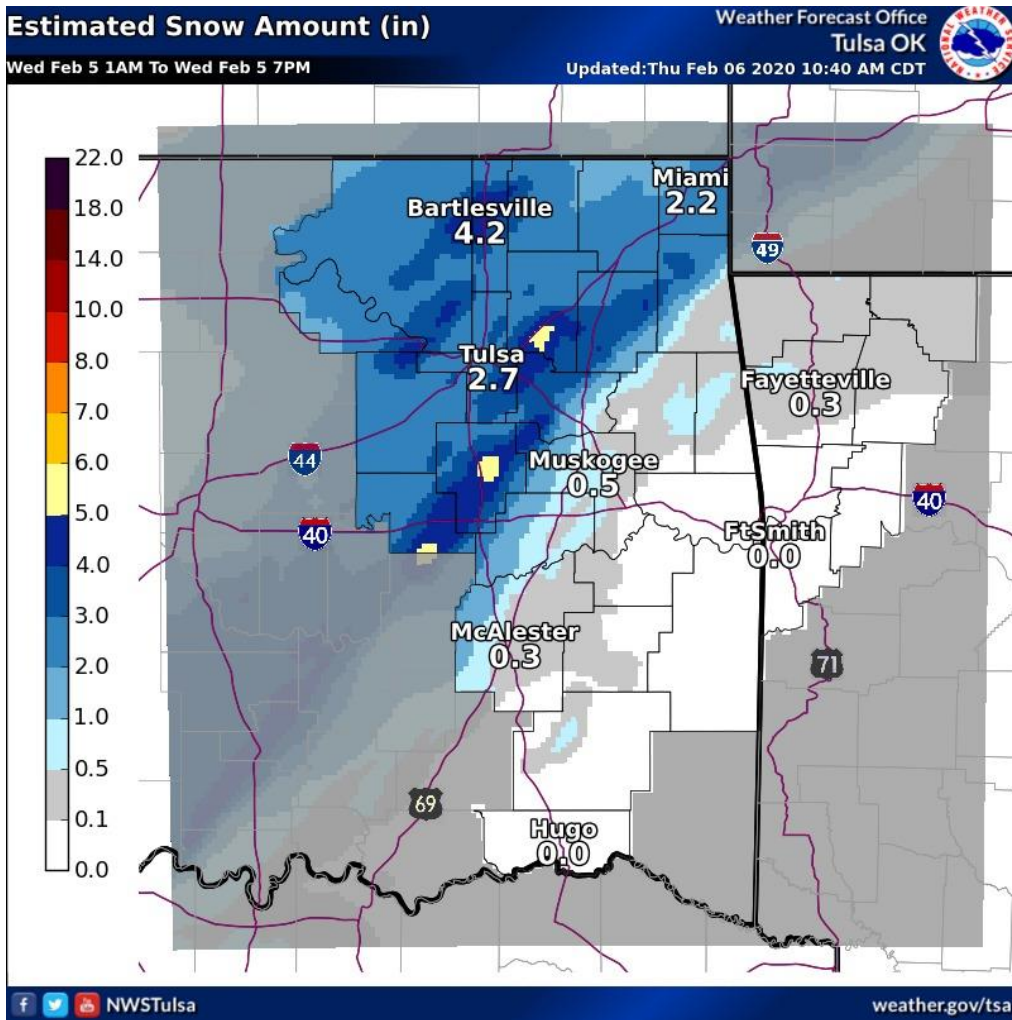


Fig. 5. Estimated sleet/snow accumulation for 2/05/2020.



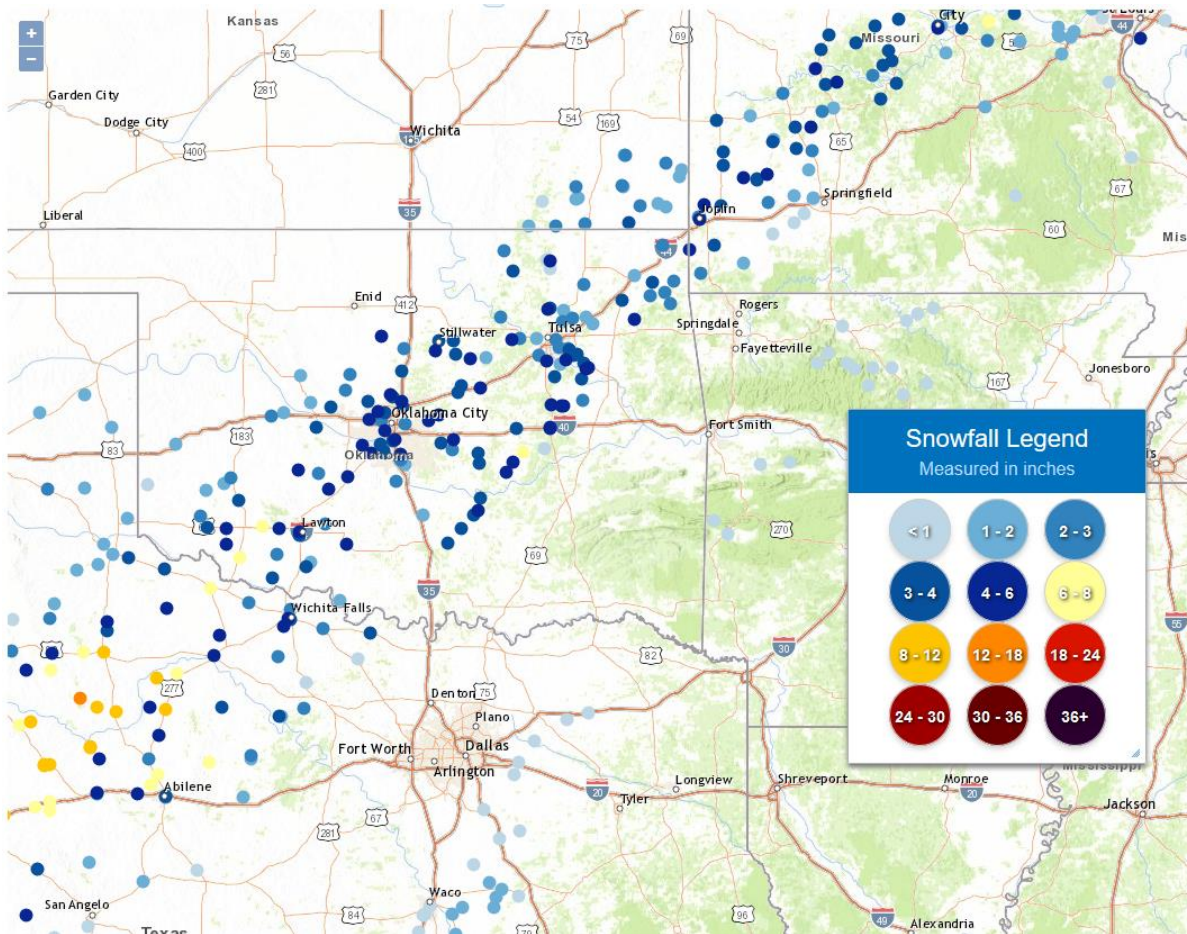


Fig. 6. Estimated sleet/snow accumulation for 2/05/2020.

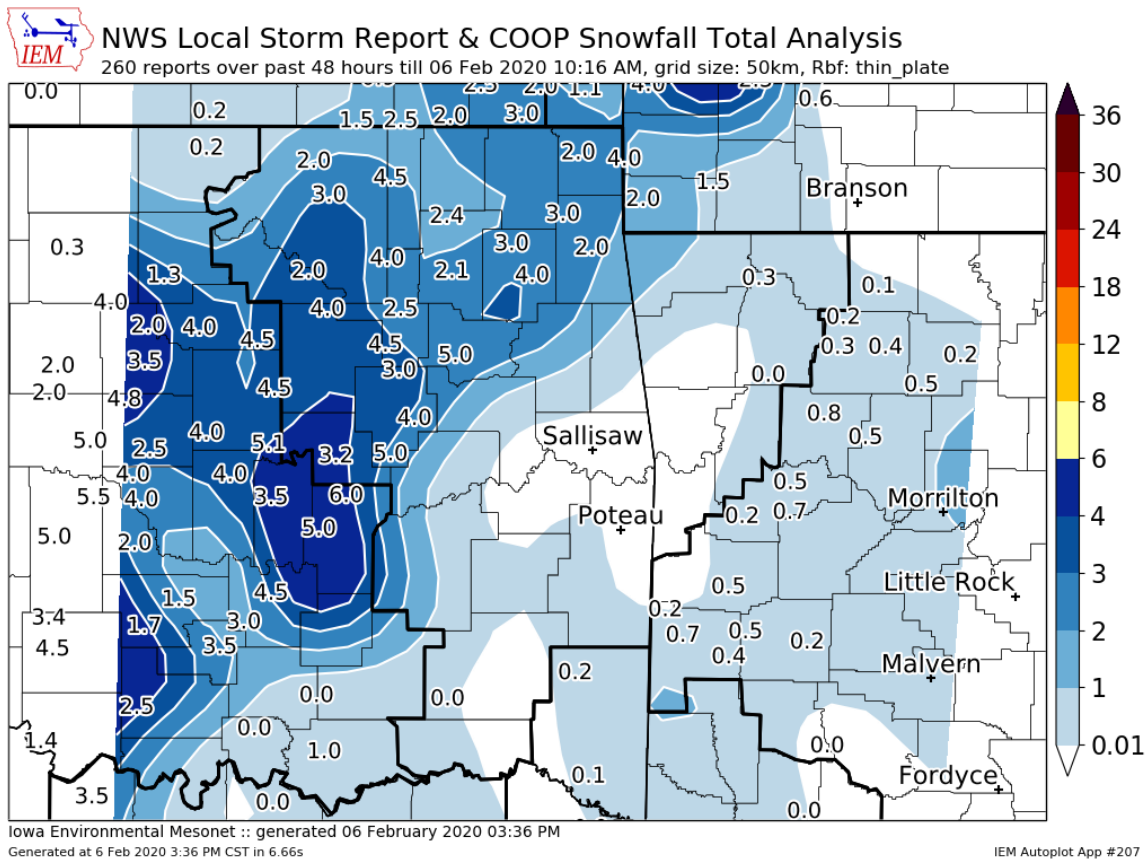


Fig. 7. Estimated sleet/snow accumulation for 2/05/2020.

During the morning hours of the 11<sup>th</sup>, a persistent band of precipitation moved northeastward across portions of eastern OK and northwestern AR, producing pockets of sleet and snow. Little to no accumulation occurred with this activity. By early evening, rain began to move north out of TX and into southeast OK within a strong warm advection pattern ahead of approaching wave that was moving into the Texas panhandle region. This activity continued to expand northward during the evening, though remained south of the I-44 corridor. After midnight, the rain became more widespread and heavier across southeast OK and west central AR. However, by 6 am on the 12<sup>th</sup>, widespread showers and isolated thunderstorms were affecting all of eastern OK and northwest AR. By 6 am, locations south of I-40 had received around 0.50" to near 1.5" of rain, with generally around 0.25" or less north of I-40. The widespread precipitation finally began to shift eastward during the late morning, coming to an end by noon on the 12<sup>th</sup>. A second upper-level feature within the northern jet stream then caused some additional light rain to move across northeast OK and northwest AR, generally north of I-40, during the afternoon and evening hours. Enough cooling occurred that some snow and sleet mixed in with the rain. The upper-level system finally shifted east of the region, with all of the precipitation coming to an end by midnight. An additional 0.50"-1" of rain fell after 6 am southeast of I-44, with 0.10"-0.50" along and northwest of I-44. The total rainfall from the active weather pattern resulted in 0.75" to around 2" of rain southeast of a line from Okemah to Miami (Figs. 8-10). This rainfall impacted the Poteau River basin, with minor flooding along the Poteau River near Panama (see preliminary hydrographs at the end of this report; see E3 Report for details).

Frontogenetical forcing increased ahead of the approaching upper-level system during the afternoon of the 23<sup>rd</sup>. Light showers developed over eastern OK and northwest AR during the morning and early afternoon hours, but the moderate to heavy rain, with isolated thunderstorms, remained across far northern OK and southern KS during the afternoon and evening hours as forcing increased from a strong low-level jet. Widespread moderate rainfall continued through midnight, then became more scattered during the overnight hours as the main upper-level system moved across the area. The rainfall shifted east of the region by mid-morning on the 24<sup>th</sup>. Rainfall totals across the northern tier of OK counties and southern KS were 0.50" to around 1.50", with isolated totals near 2.50" (Fig. 11). This rainfall fell over the upper portions of the Verdigris and Neosho River basins, causing rises along the creeks and rivers. However, only the Neosho River exceeded flood stage, with moderate flooding occurring along the Neosho River near Commerce (see preliminary hydrographs at the end of this report; see E3 Report for details).

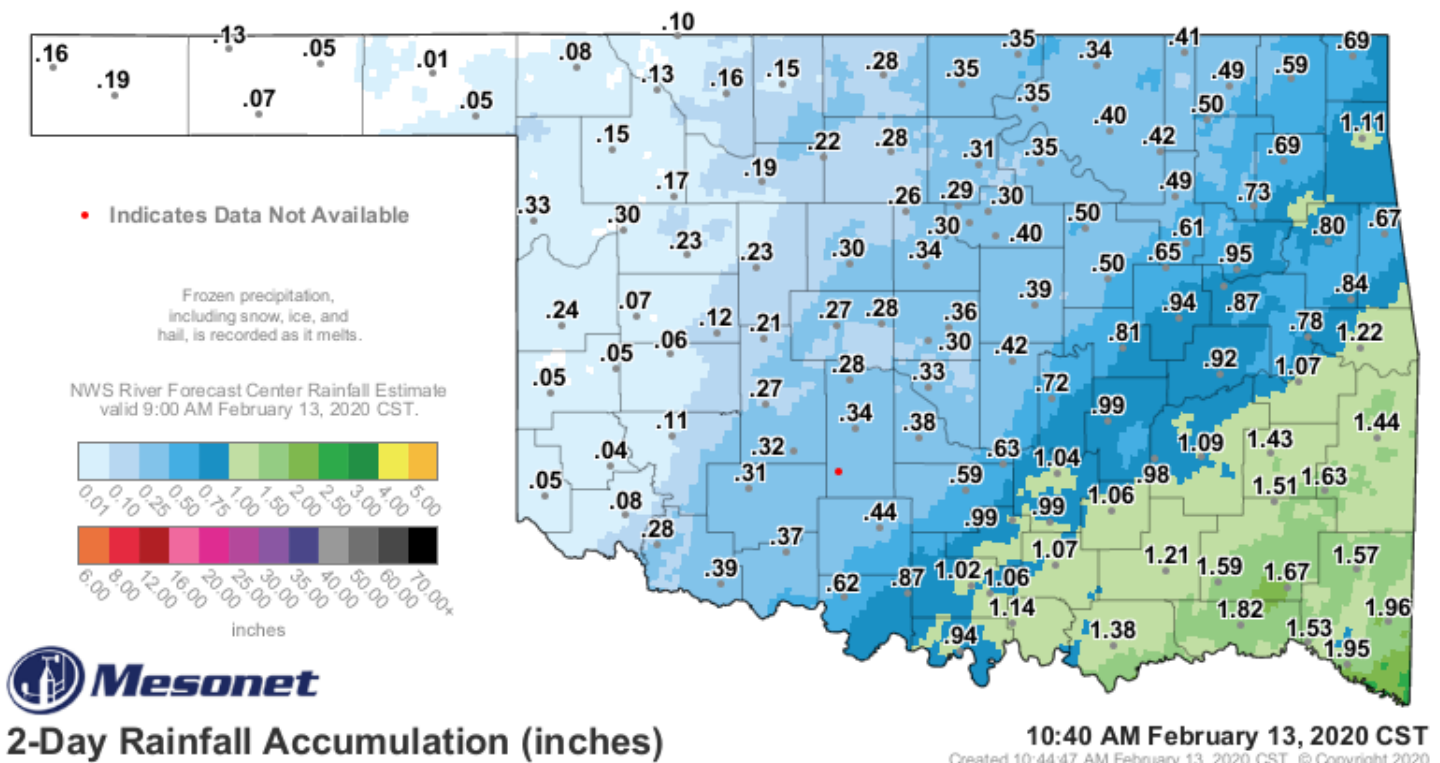
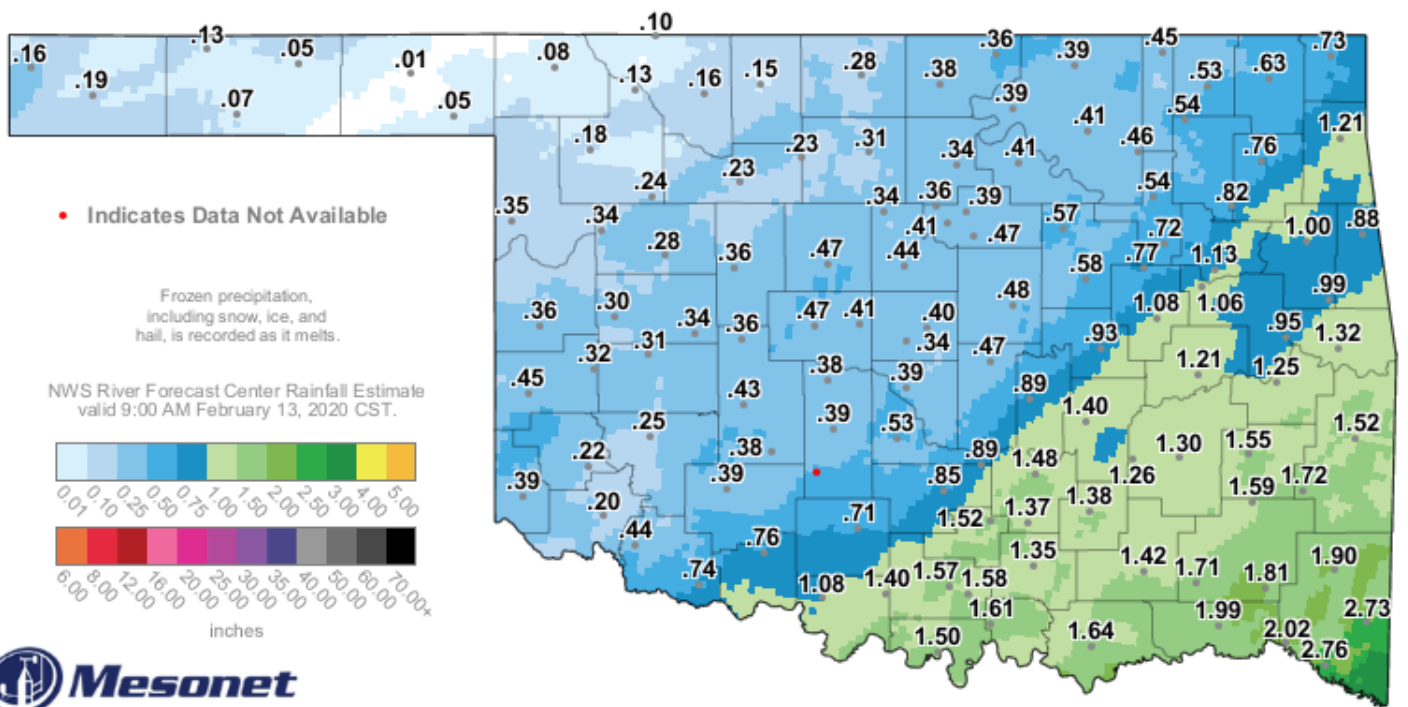


Fig. 8. OK Mesonet (values) and NWS RFC rainfall estimate (image) 2-day rainfall ending at 10:40 am CST 2/13/2020.





### 3-Day Rainfall Accumulation (inches)

Fig. 9. OK Mesonet (values) and NWS RFC rainfall estimate (image) 3-day rainfall ending at 10:40 am CST 2/13/2020.

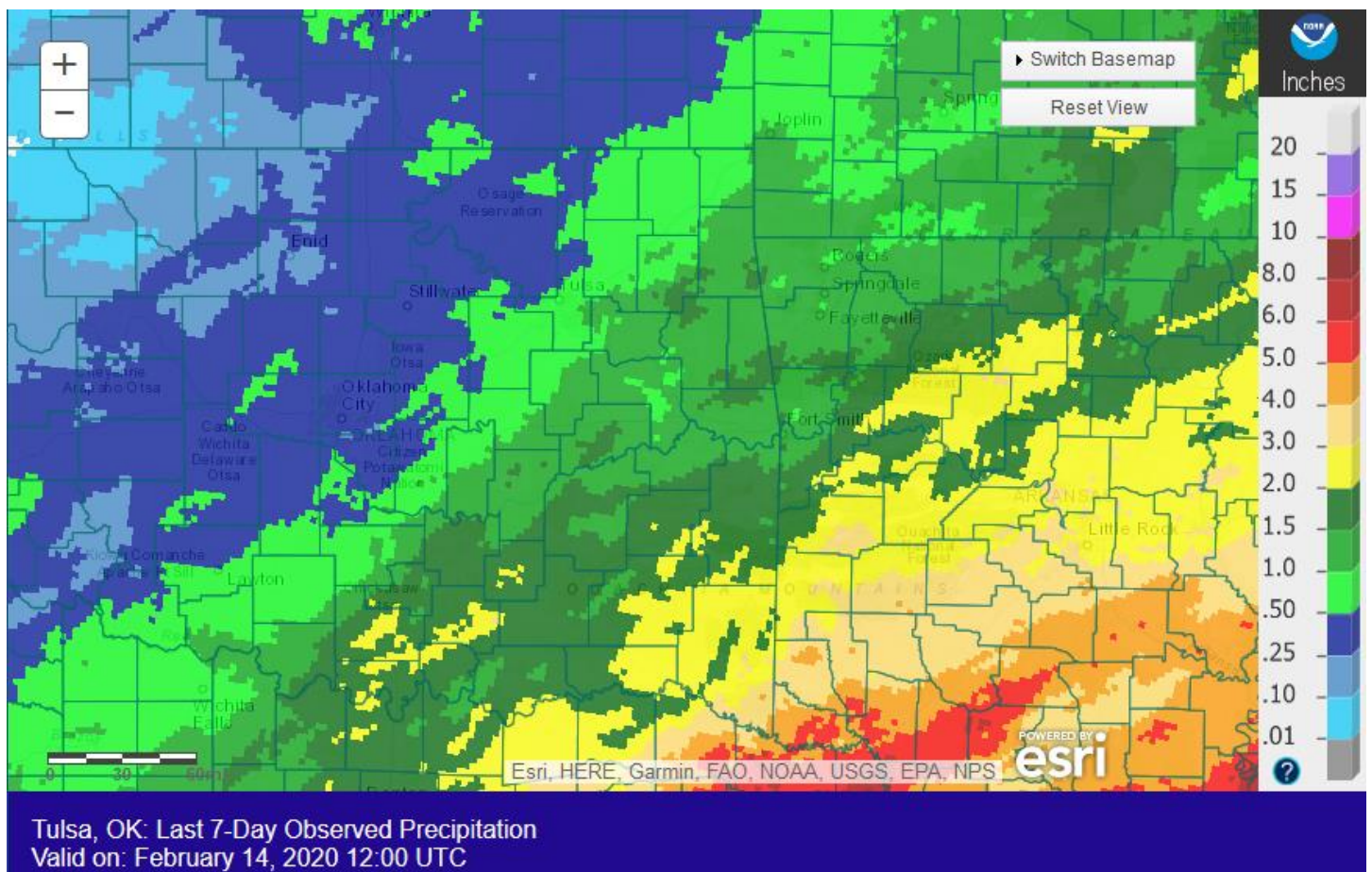


Fig. 10. 24-hour Estimated Observed Rainfall ending at 6am CST 2/14/2020.

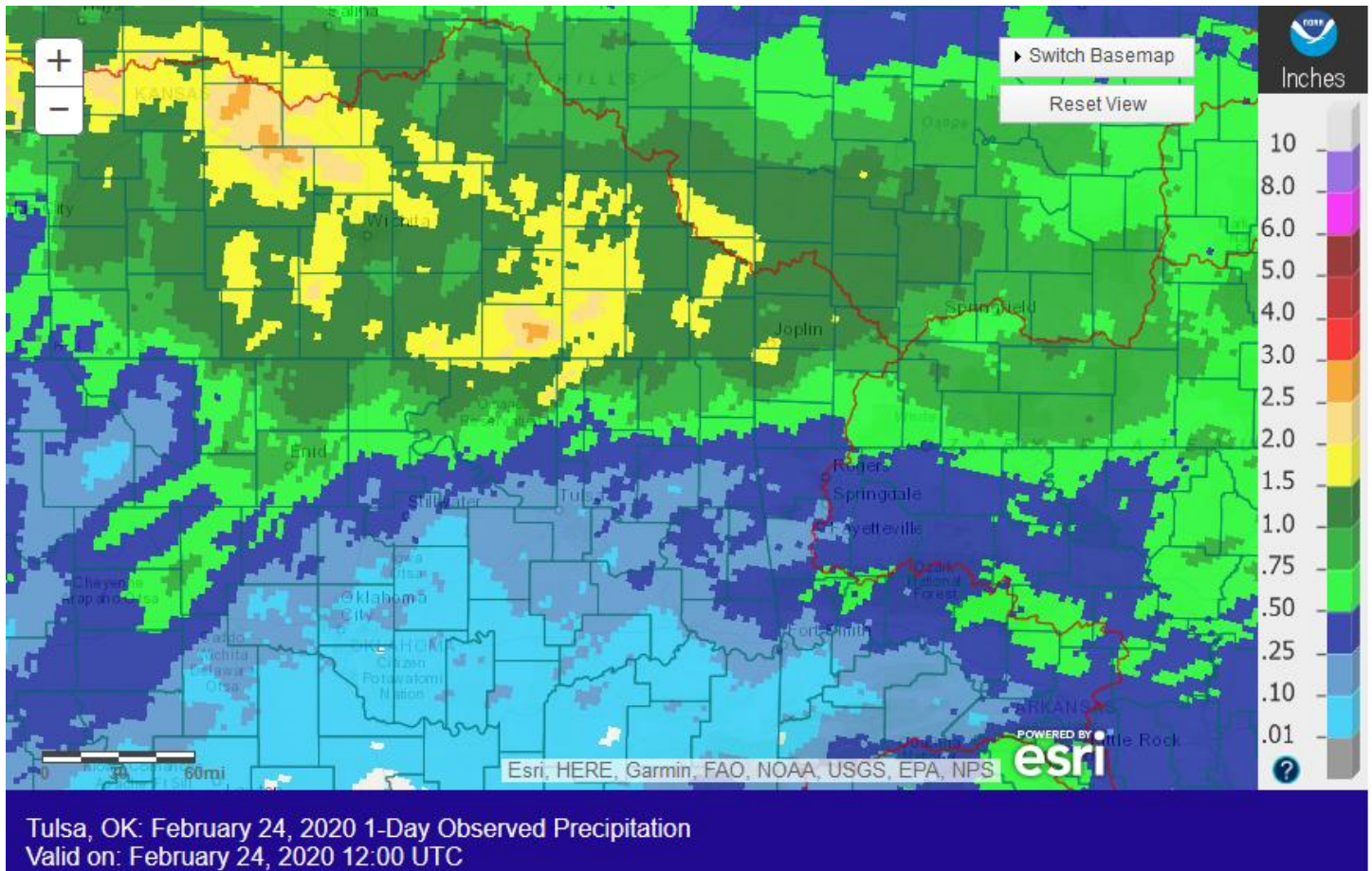


Fig. 11. 7-day Estimated Observed Rainfall ending at 6am CST 2/24/2020.

Written by:

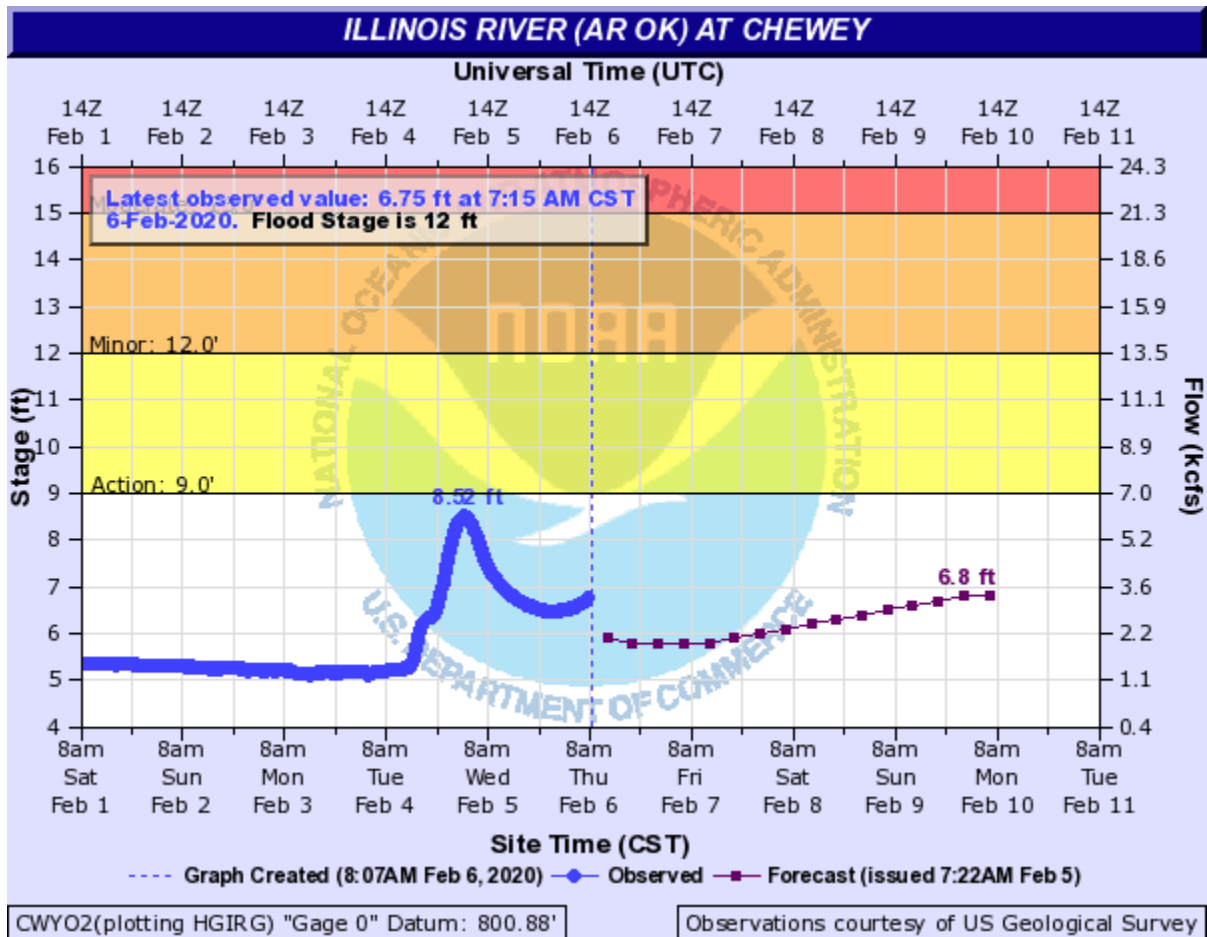
Nicole McGavock  
 Service Hydrologist  
 WFO Tulsa

**Products issued in February 2020:**

- \*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

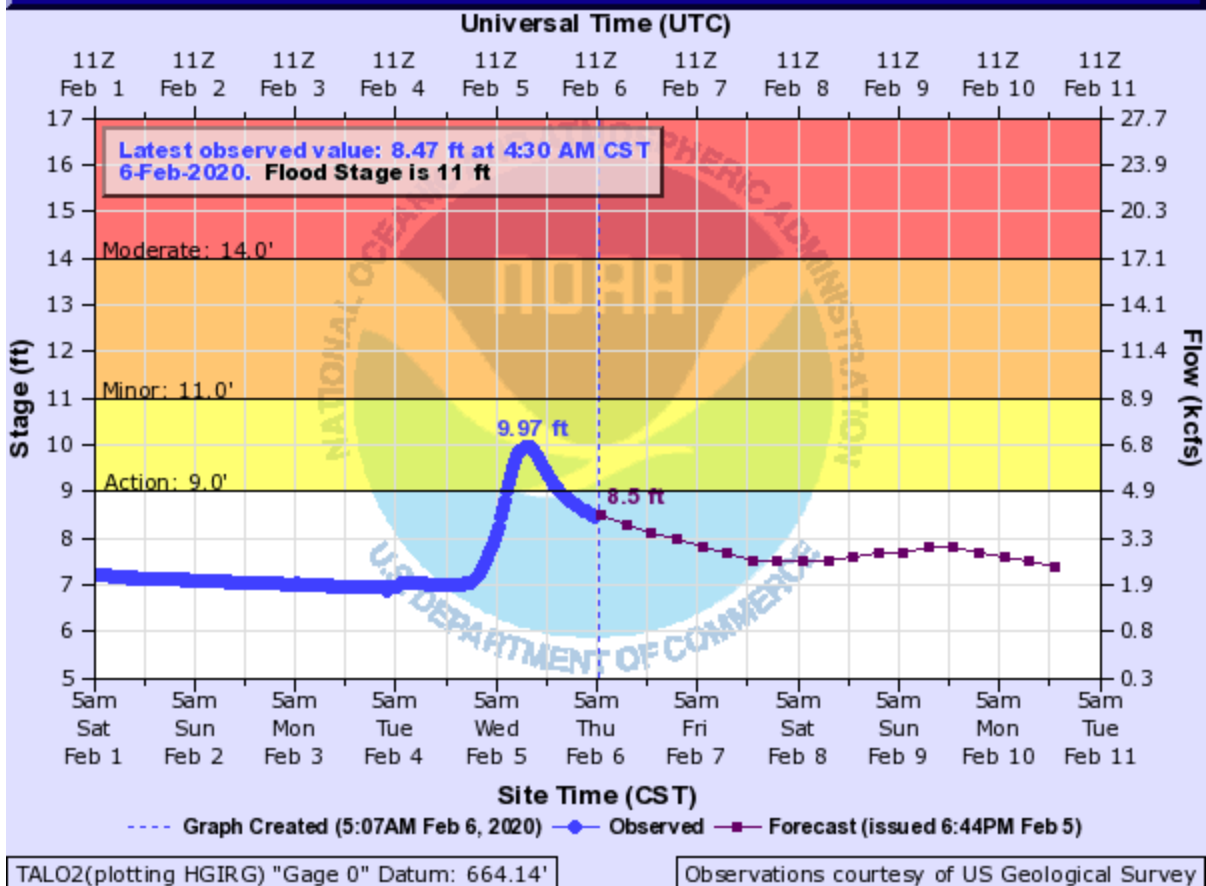
- 0 Flash Flood Warnings (FFW)
- 0 Flash Flood Statements (FFS)
- 0 Flash/Areal Flood Watches (FFA) (0 Watch FFA CON/EXT/EXA/EXB/CAN)
- 0 Urban and Small Stream Advisories (FLS)
- 0 Areal Flood Warnings (FLW)
- 0 Areal Flood Statements (FLS)
- 4 River Flood Warnings (FLW) (includes category increases)
- 25 River Flood Statements (FLS)
- 3 River Flood Advisories (FLS) (9 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:**

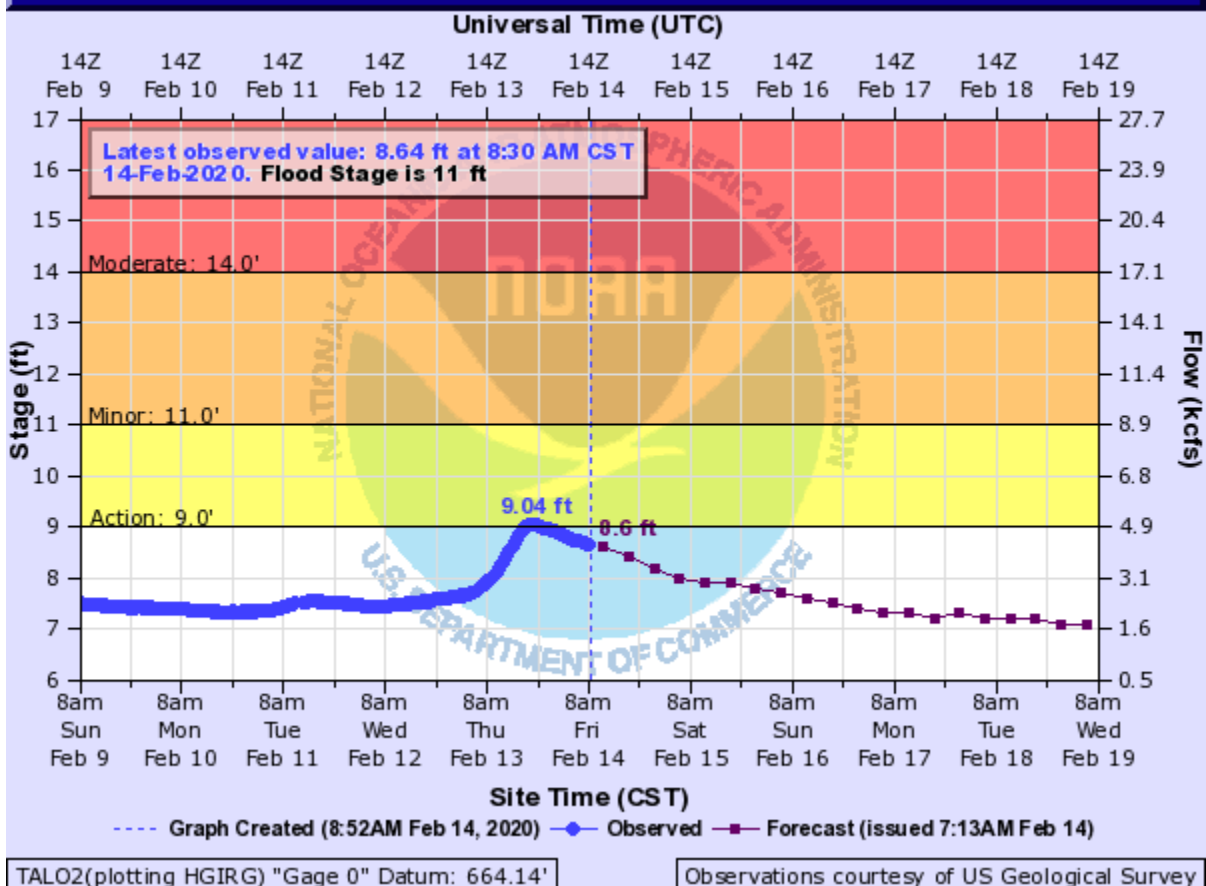




## ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH



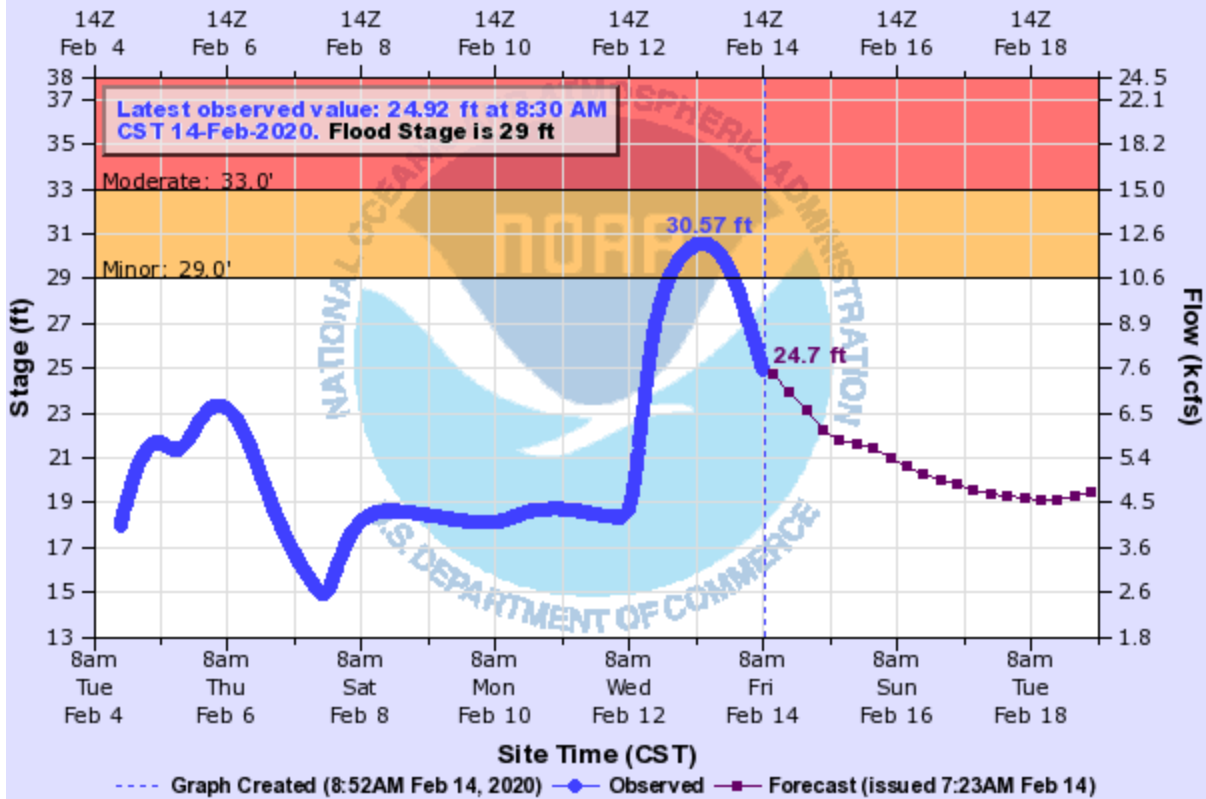
## ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH





## POTEAU RIVER NEAR PANAMA

Universal Time (UTC)

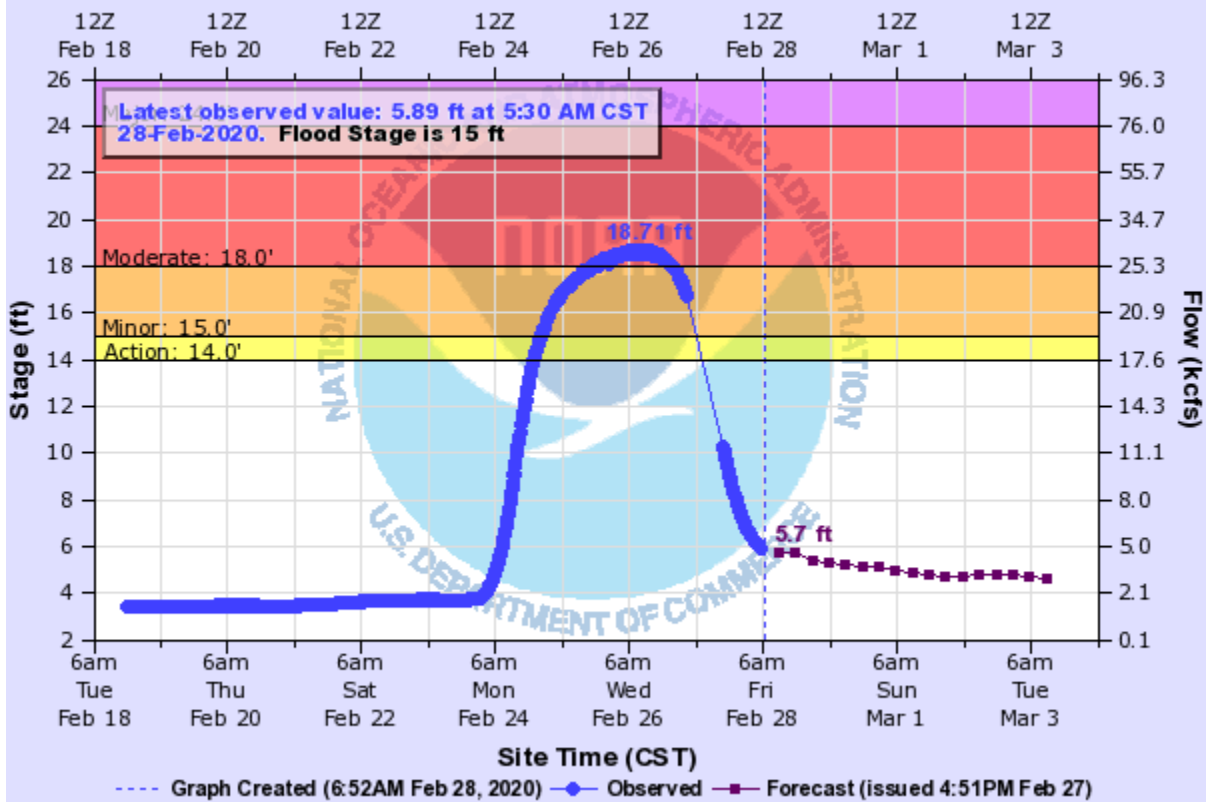


PANO2(plotting HGIRG) "Gage 0" Datum: 387.96'

Observations courtesy of US Geological Survey

## NEOSHO RIVER NEAR COMMERCE

Universal Time (UTC)



COMO2(plotting HGIRG) "Gage 0" Datum: 748.97'

Observations courtesy of US Geological Survey