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 **February** YEAR **2019**
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 8, 2019**

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.**

Most eastern OK and northwest AR received below normal rainfall this February, though portions of east central OK and west central AR were above normal. Winter weather this month included some light snow and some freezing rain. 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 2019 ranged from 0.5" to around 6" northwest to southeast across eastern OK and northwest AR. This corresponds to 110% to around 200% of the normal February rainfall in portions of east central and southeast OK and most of northwest AR, and 25% to 90% of normal for most of northeast OK and portions of southeast OK (Fig. 1b).

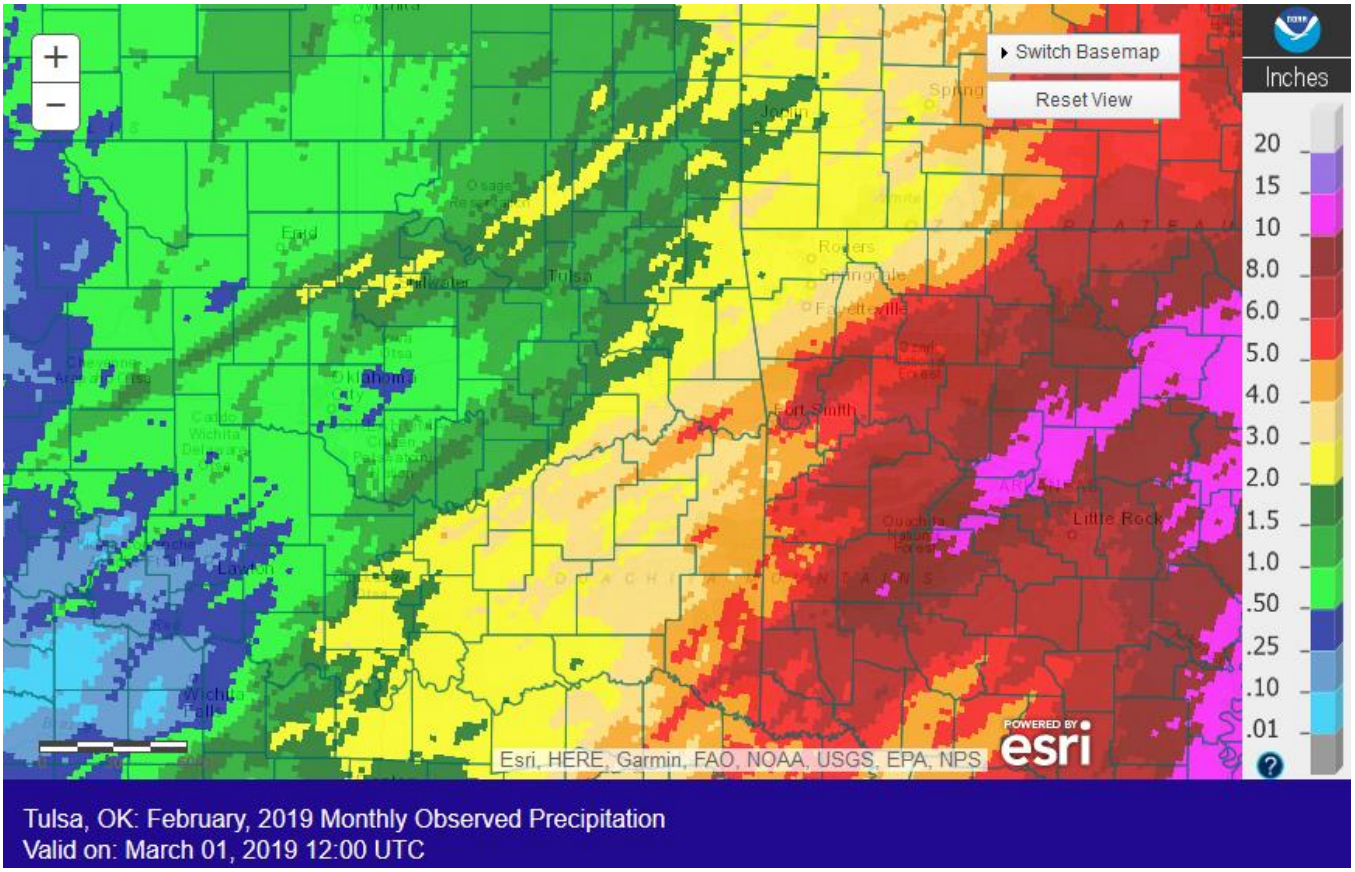


Fig. 1a. Estimated Observed Rainfall for February 2019

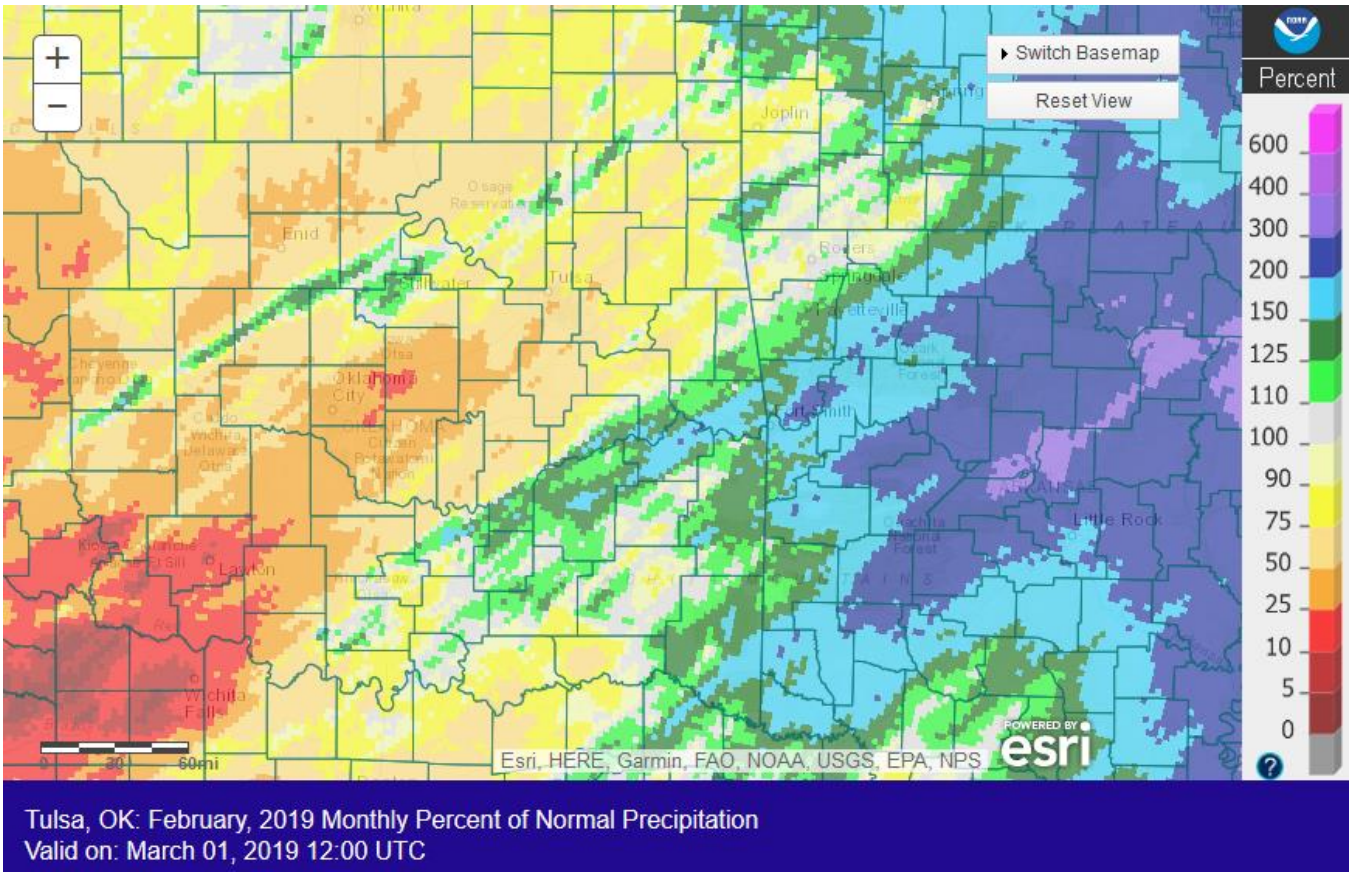


Fig. 1b. Estimated % of Normal Rainfall for February 2019

In Tulsa, OK, February 2019 ranked as the 47th coldest February (39.9°F; since records began in 1905), the 54th driest February (1.23", tied 2007, 1909; since records began in 1888), and the 20th least snowy February (Trace, tied 18 other years; since records began in 1900). Fort Smith, AR had the 38th warmest February (46.0°F, tied 1986; since records began in 1883), the 21st wettest February (5.05"; since records began in 1883), and the 37th least snowy February (Trace, tied 22 other years; since records began in 1884). Fayetteville, AR had the 26th warmest (42.1°F), the 22nd wettest (3.26"), and 10th least snowy (Trace, tied 14 other years) February since records began in 1950.

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

St. Paul 1E, AR (coop)	6.80	Ozark, AR (coop)	6.23	Ozark 4.6S, AR (coco)	5.89
Riverdale 4.2E, AR (coco)	5.46	Charleston 1.7E, AR (coco)	5.44	Mountainburg 2NE, AR (coop)	5.33
Van Buren 0.7SSE, AR (coco)	5.28	Uniontown 2.1ESE, AR (coco)	5.25	Van Buren 2.1NNW (coco)	5.21

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

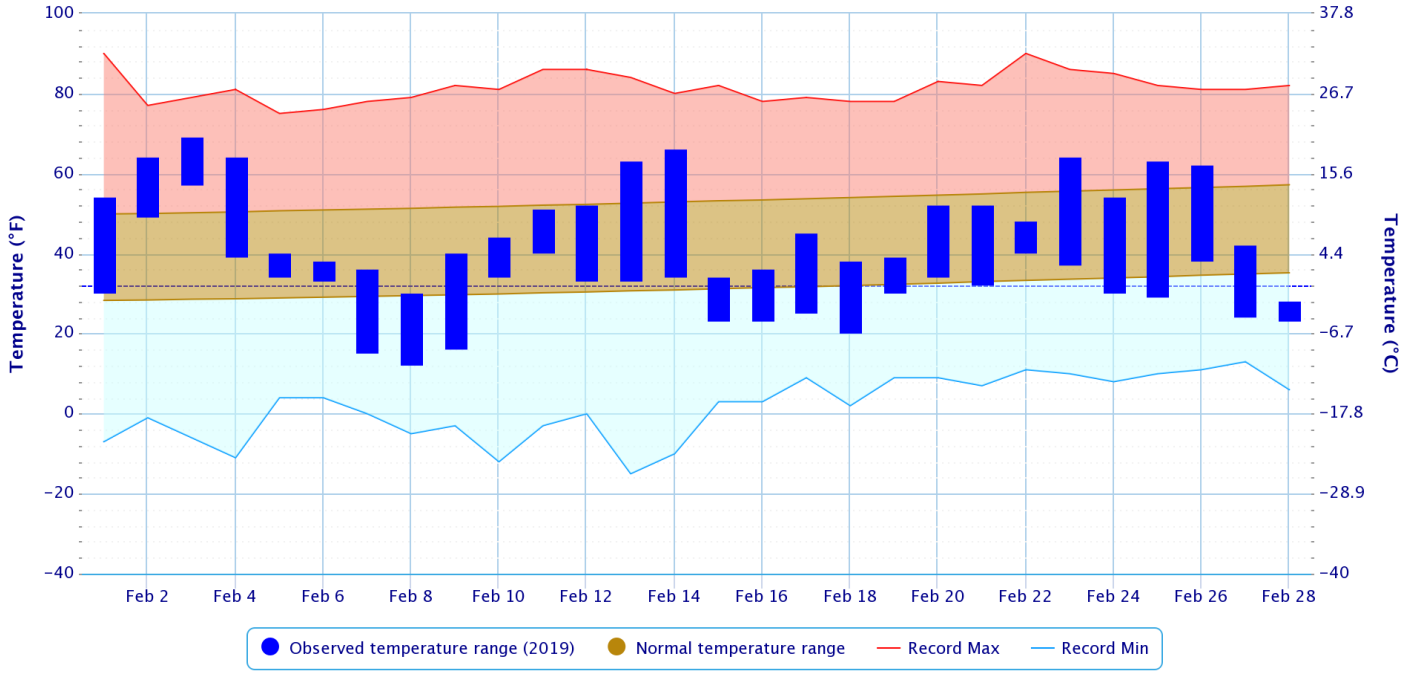
Jenks Riverside Arpt, OK (ASOS)	0.82	Foraker, OK (meso)	1.09	Bristow, OK (meso)	1.13
Tulsa, OK (ASOS)	1.23	Bixby, OK (meso)	1.27	Vinita, OK (meso)	1.30
Burbank, OK (meso)	1.38	Tulsa, OK (meso)	1.48	Okmulgee, OK (meso)	1.48

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

Rank since 1921	Last 30 Days Jan 30 – Feb 28	Year-to-Date (Jan 1 – Feb 28)	Winter 2018-19 (Dec 1 – Feb 28)	Last 120 Days (Nov 1 – Feb 28)	Water Year-to-Date (Oct 1 – Feb 28)	Cool Growing Season (Sep 1 – Feb 28)	Last 365 Days (Mar 1, 2018– Feb 28, 2019)
Northeast OK	46th driest	14th wettest	**6th wettest**	20th wettest	16th wettest	31st wettest	42nd driest
East Central OK	35th wettest	17th wettest	**7th wettest**	22nd wettest	21st wettest	24th wettest	24th wettest
Southeast OK	34th wettest	38th wettest	15th wettest	29th wettest	12th wettest	**9th wettest**	22nd wettest
Statewide	49th driest	30th wettest	15th wettest	31st wettest	15th wettest	**7th wettest**	20th wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

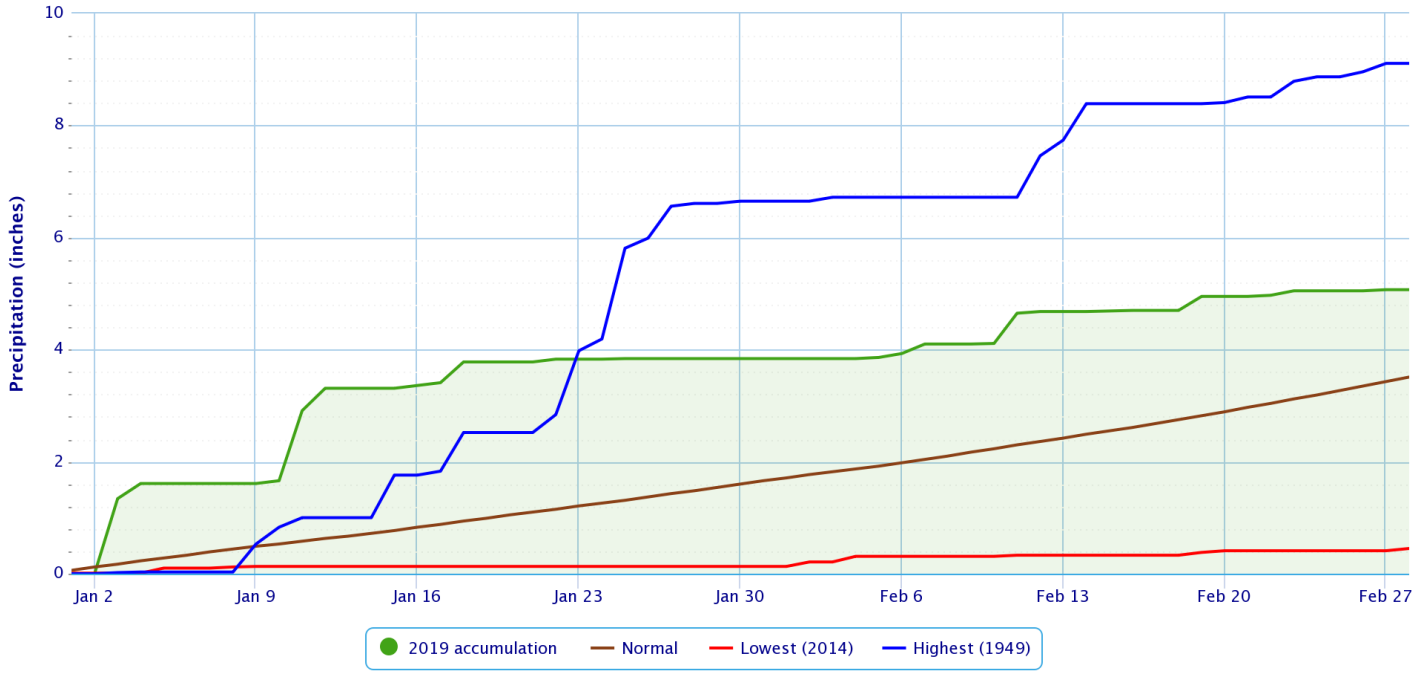
Period of Record – 1905-01-06 to 2019-02-28. Normals period: 1981-2010. Click and drag to zoom chart.



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



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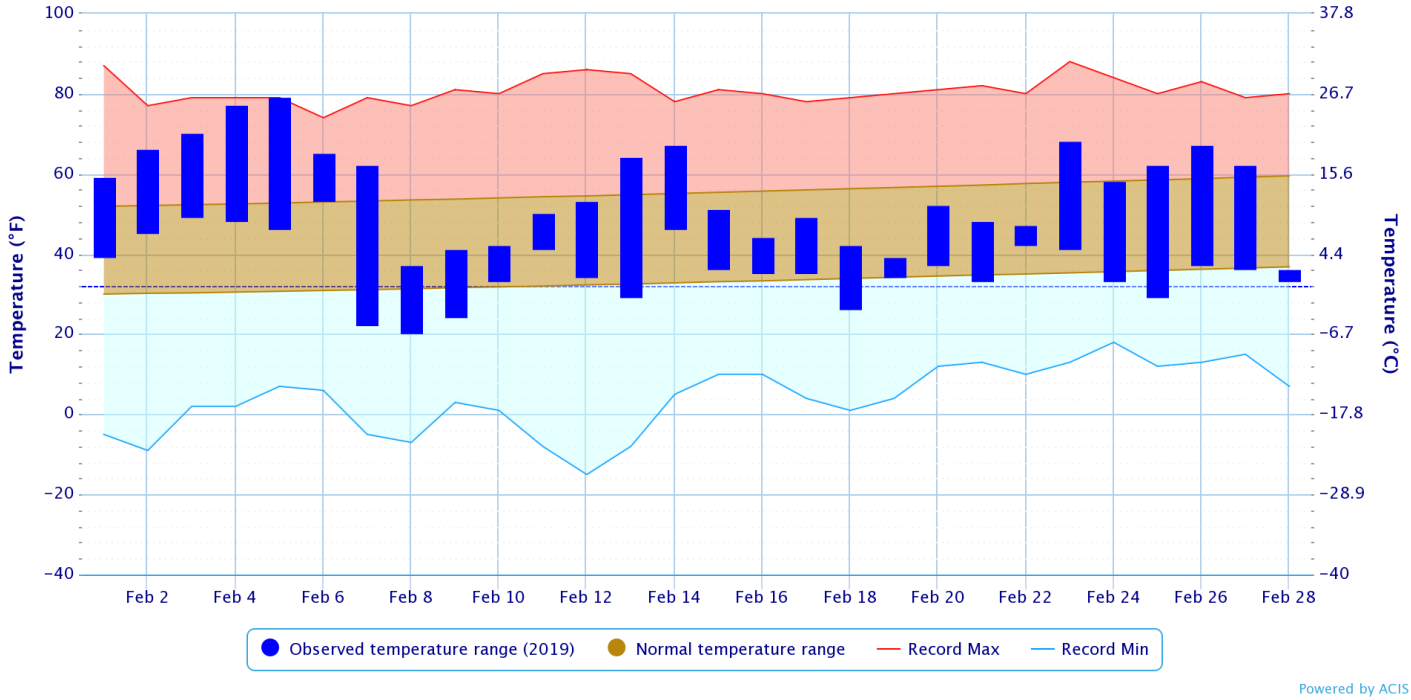
Daily Temperature Data – Fort Smith Area, AR (ThreadEx)

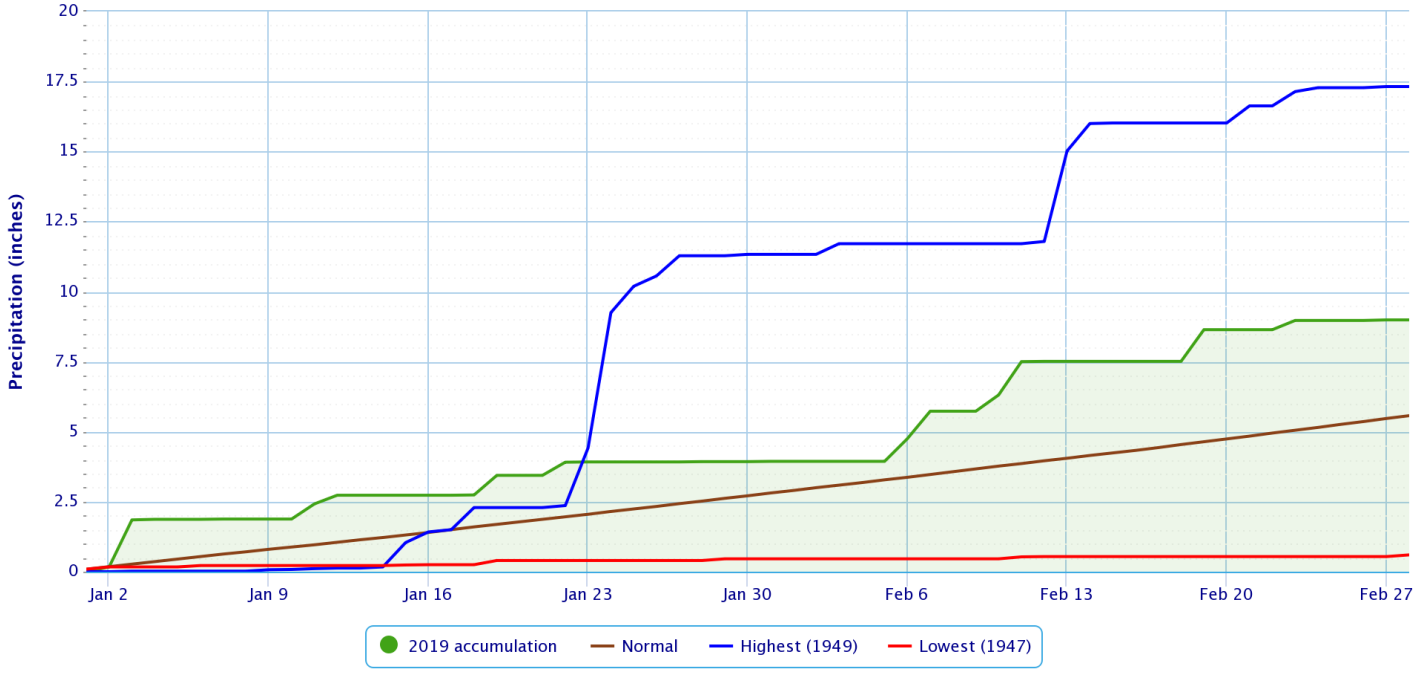
Period of Record – 1882-06-01 to 2019-02-28. Normals period: 1981-2010. Click and drag to zoom chart.



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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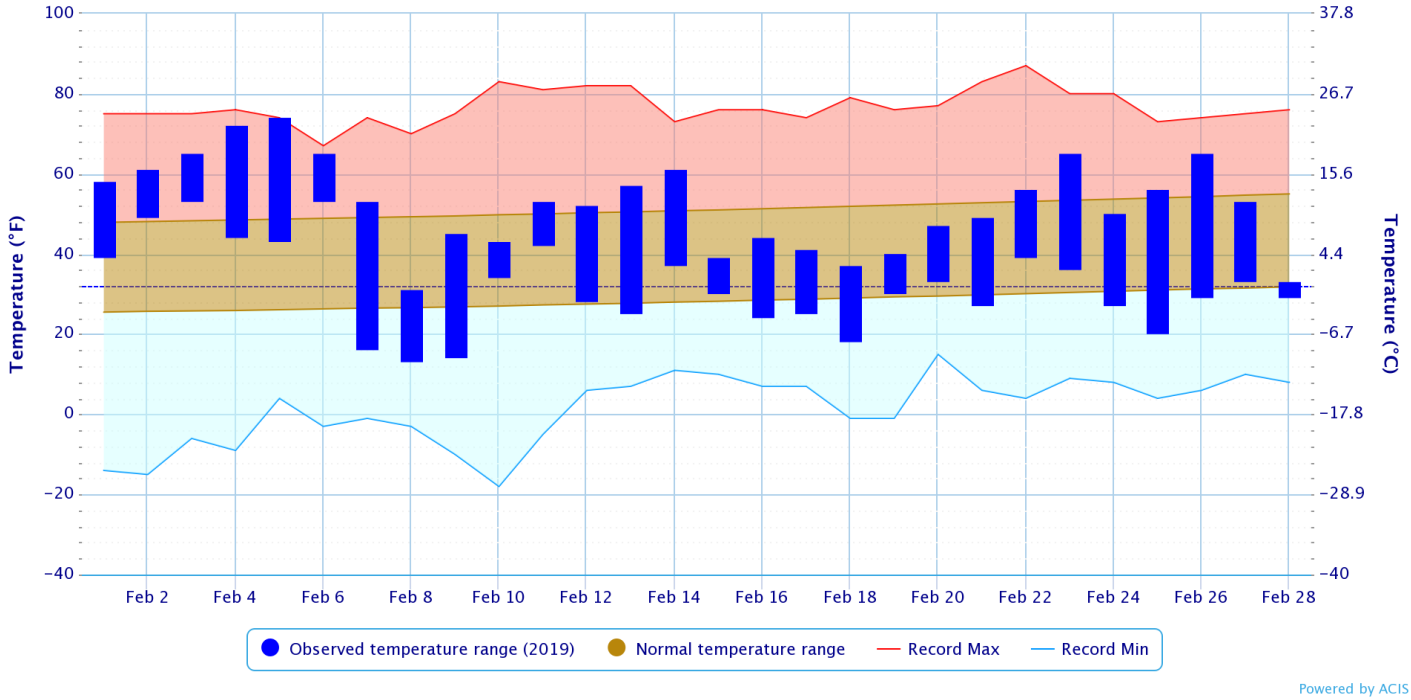
Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

Period of Record – 1949-07-14 to 2019-02-28. Normals period: 1981-2010. Click and drag to zoom chart.



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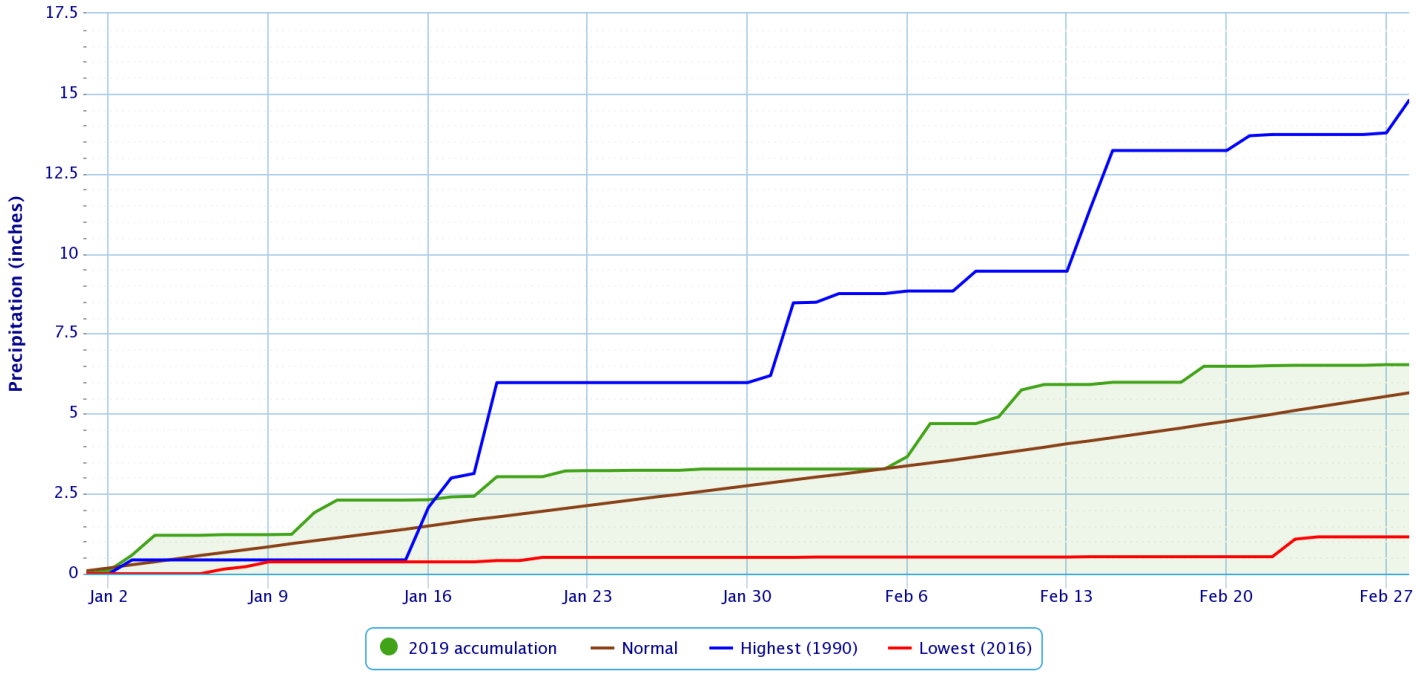
Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

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



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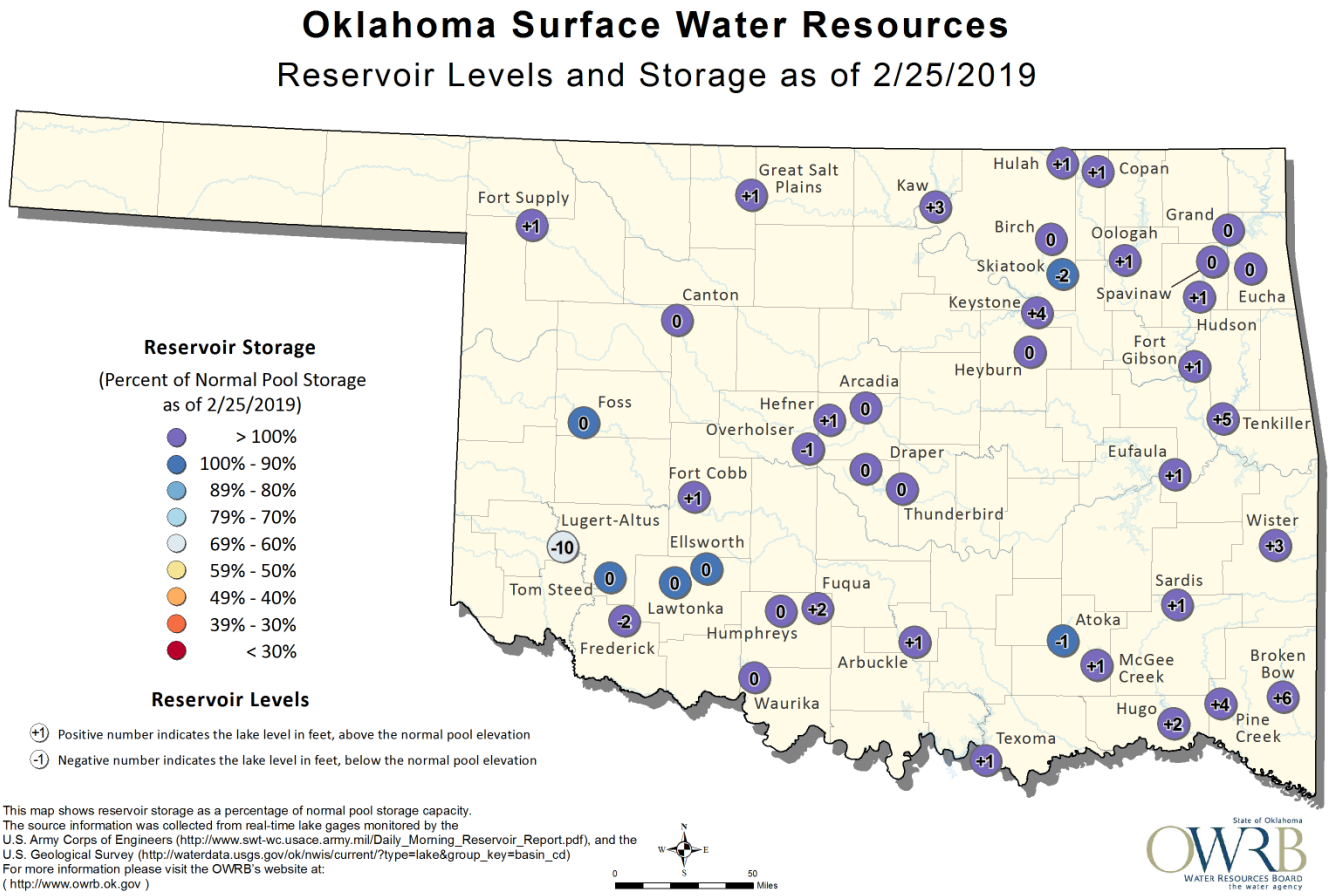
Winter (Dec-Jan-Feb) 2018-19

In Tulsa, OK, Winter 2018-19 ranked as the 55th coldest Winter (39.7°F, tied 1945-46; since records began in 1905-06) and the 11th wettest Winter (8.65"; since records began in 1888-89). Fort Smith, AR had the 30th warmest Winter (43.5°F, tied 1940-41, 1907-08; since records began in 1882-83) and the 5th wettest Winter (14.50"; since records began in 1882-83). Fayetteville, AR had the 23rd warmest (39.2°F) and the 14th wettest (10.19") Winter since records began in 1949-50.

Reservoirs



According to the USACE, several lakes in the HSA were above ±3% of their conservation pool level as of 2/28/2019: Beaver Lake 126%, Sardis Lake 108%, Tenkiller Lake 107%, Kaw Lake 105%, Hugo Lake 105%, Eufaula Lake 105%, Hudson Lake 105%, and Oologah Lake 104%. Only one reservoir was below 3% of its conservation pool storage as of 2/28/2019: Skiatook Lake 95%.

Drought

According to the U.S. Drought Monitor (USDM) from February 26, 2019 (Figs. 2, 3), no drought or abnormally dry conditions were present across eastern OK and northwest AR.

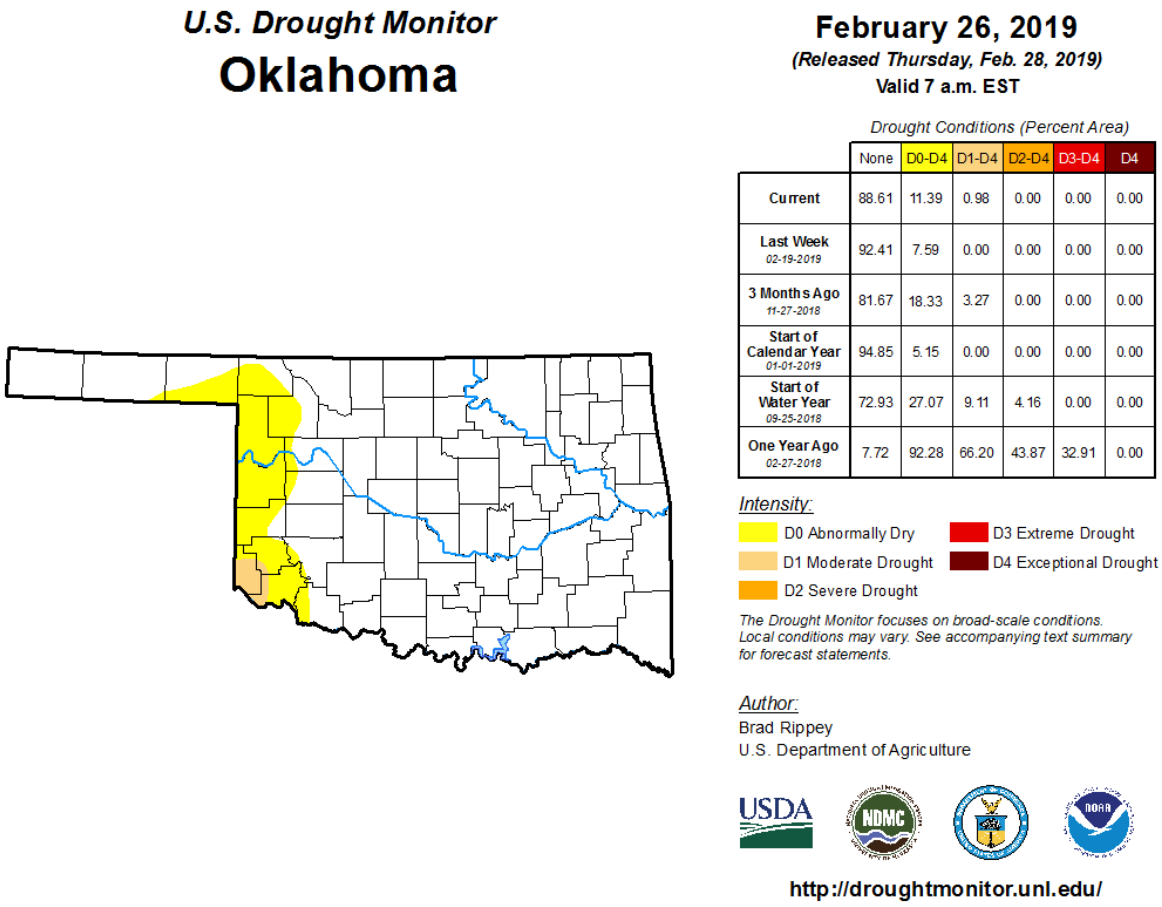


Fig. 2. Drought Monitor for Oklahoma

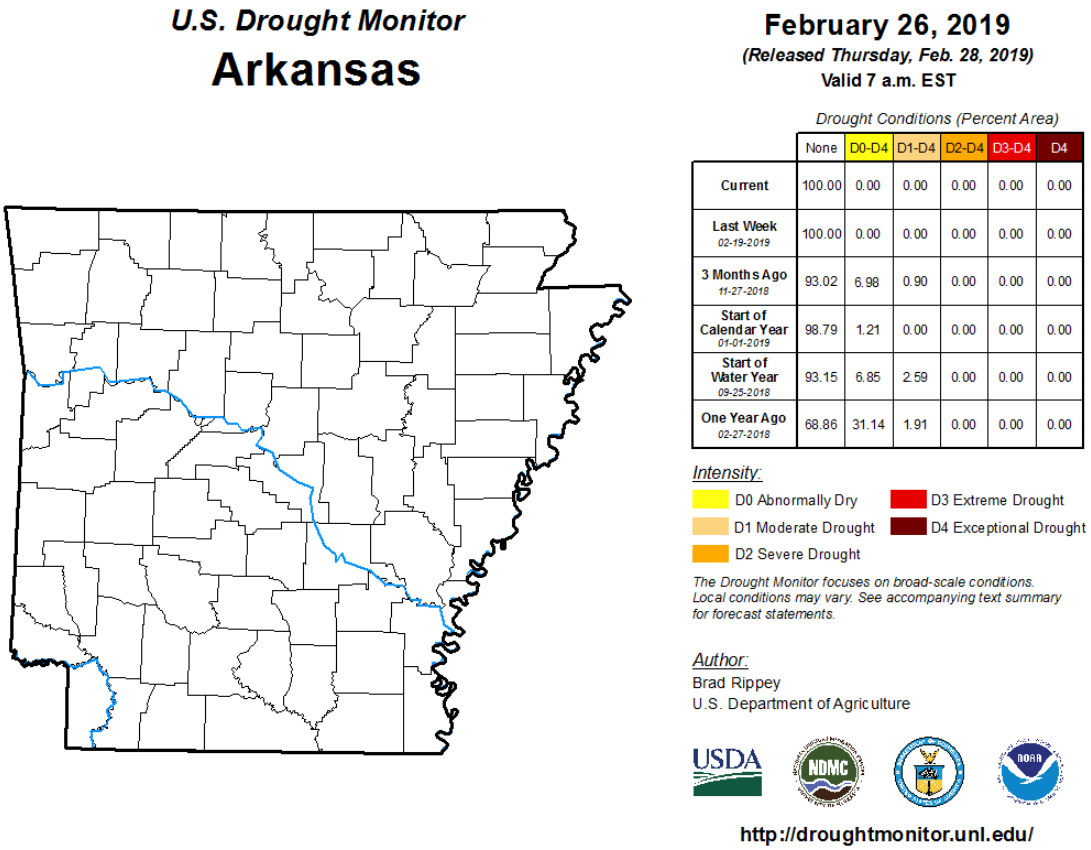


Fig. 3. Drought Monitor for Arkansas

Outlooks

The Climate Prediction Center (CPC) outlook for March 2019 (issued February 28, 2019) indicates an enhanced chance for below normal temperatures and slightly increased odds for above median precipitation across all of eastern OK and northwest AR. This outlook takes into account weather conditions forecast over the first two weeks of March, the weeks 3-4 outlook, and the Madden Julian Oscillation (MJO) that favors below-normal temperatures for much of the central US over the next couple of weeks. El Niño conditions were not heavily considered.

For the 3-month period March-April-May 2019, CPC is forecasting an equal chance for above, near, and below normal temperatures and a slightly enhanced chance for above median precipitation across all of eastern OK and northwest AR (outlook issued February 21, 2019). This outlook is based on both statistical and dynamical forecast tools, decadal timescale climate trends, and to a small extent, influence from El Niño. According to CPC, the combined effect of the ocean-atmosphere system is consistent with borderline weak El Niño conditions starting in January 2019. "Sub-seasonal tropical variability as manifest in the Madden-Julian Oscillation (MJO) had limited the atmospheric response to the oceanic El Niño conditions, but the atmosphere has now aligned more with the ocean. The MJO is forecast to remain active, through at least the beginning of March. Connections from the MJO to the mid-latitudes tend to become weaker during spring, so variability driven by the MJO plays less of a role in the seasonal outlook." There is a 55% chance that El Niño conditions will continue through spring 2019. CPC issued an El Niño Advisory on February 14, 2019.

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

Showers and isolated thunderstorms developed primarily over east central OK into northwest AR during the evening of the 5th and continued into the early morning hours of the 6th as warm air advection increased north of a warm front that was draped from south central OK to central AR. Most of the locations that saw this activity received around 0.75" or less of rain, but portions of Pittsburg, Haskell, and Sequoyah Counties received 1"-2" of rain (Fig. 4).

On the 6th, a nearly stationary front bifurcated the area and resulted in a large temperature gradient from northeast OK/far northwest AR to southeast OK/west central AR. To the north was a shallow artic airmass, while south of the boundary was a warm, moist Gulf airmass. Showers and isolated thunderstorms in TX moved northeast into southeast OK during the morning of the 6th, and continued northeastward into northwest AR. This activity continued through the afternoon, with isolated showers and thunderstorms remaining over eastern OK and west central AR during the early evening hours. By mid-evening, a cluster of thunderstorms over north central OK moved east into northeast OK and far northwest AR. Another larger complex moved east from central OK into eastern OK around midnight. Showers and thunderstorms then affected eastern OK and western AR through most of the night, finally moving east of the area by sunrise on the 7th as the cold front finally pushed through with an upper-level system. With shallow cold air in place across northeast OK, some of this rain fell in sub-freezing surface temperatures, resulting in a glaze to 0.2" of ice accumulation (Fig. 5). Rainfall totals for the numerous rounds of rain ranged from 0.25" to near 2.5" (Fig. 6).

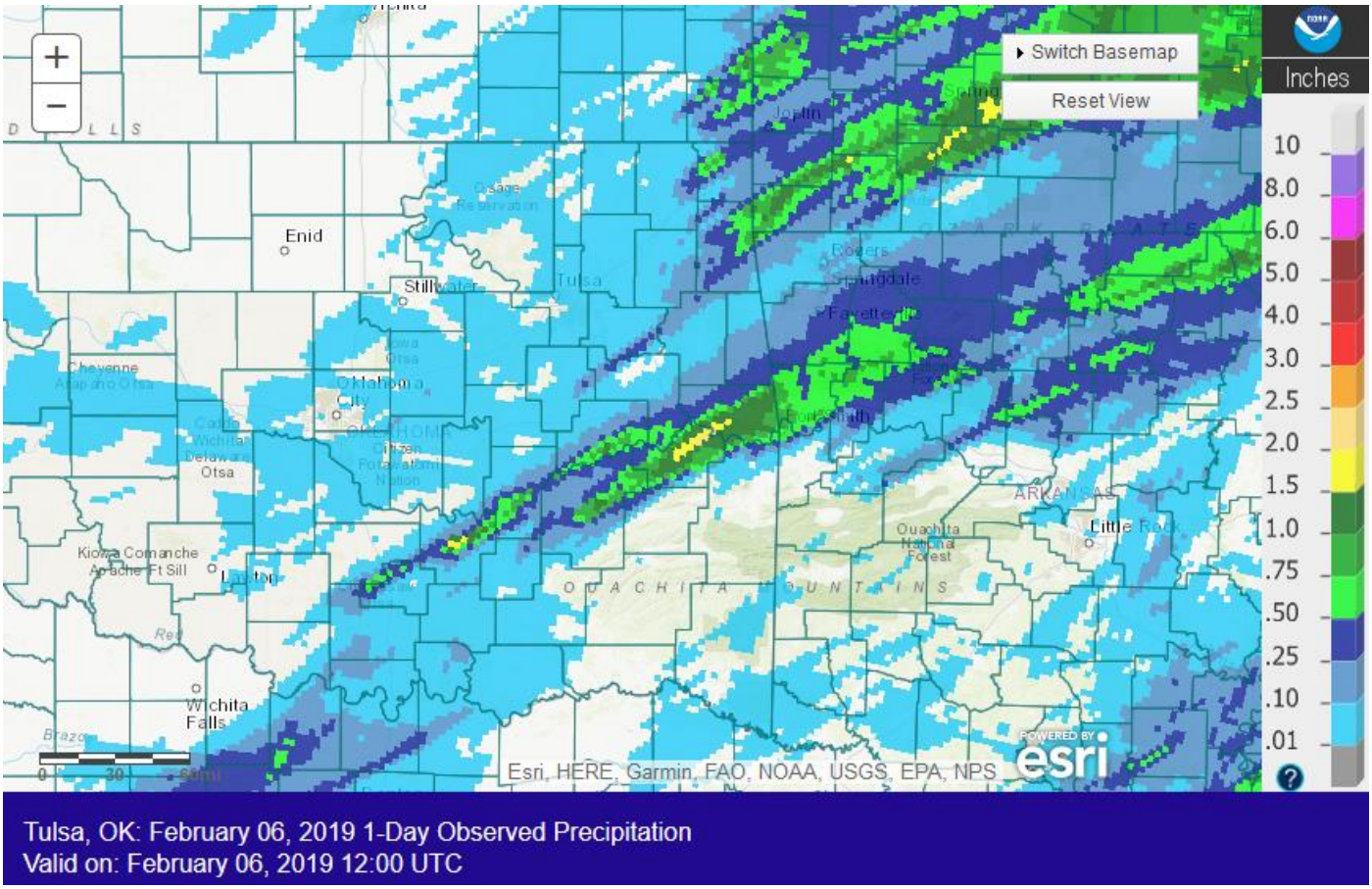


Fig. 4. 24-hour Estimated Observed Rainfall ending at 6am CST 2/06/2019.

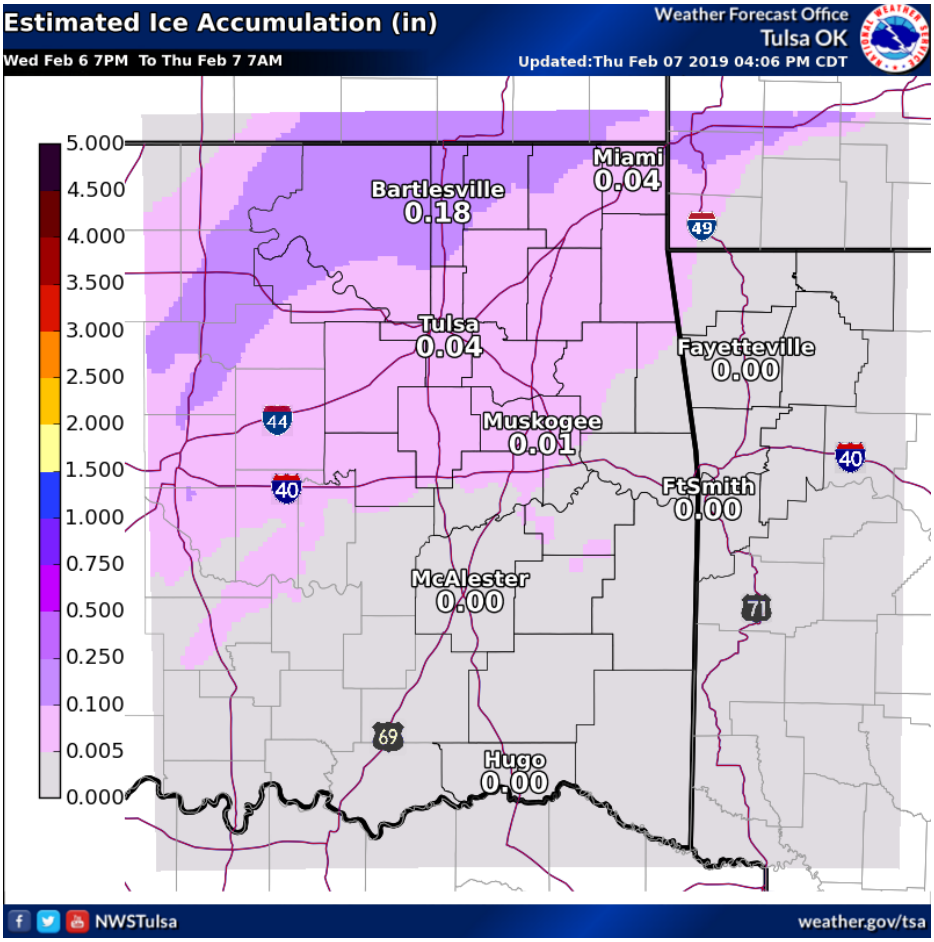


Fig. 5. Storm total ice estimated amounts ending at 4 am CST 02/07/2019.

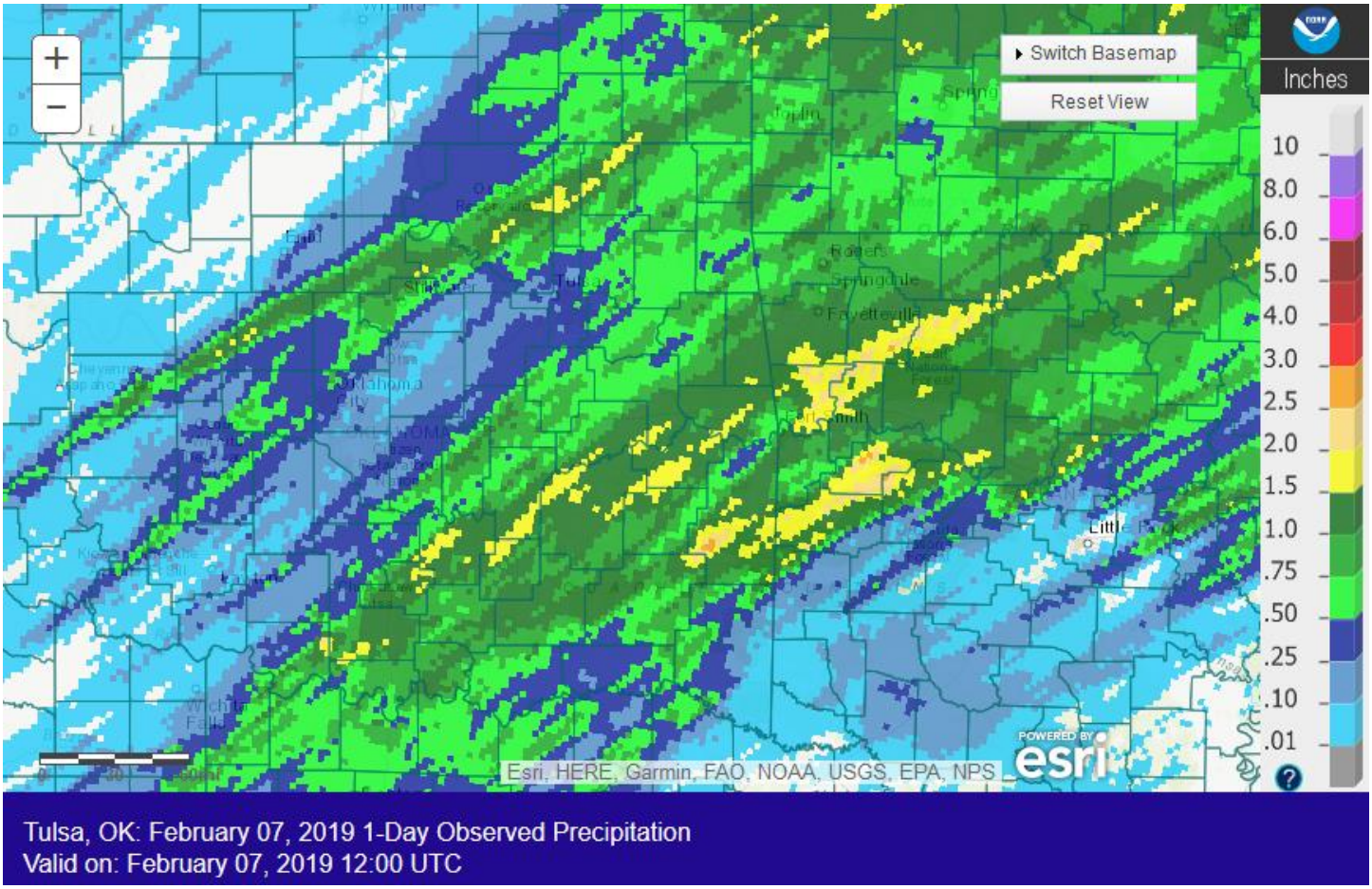


Fig. 6. 24-hour Estimated Observed Rainfall ending at 6am CST 2/07/2019.

Scattered showers affected northwest AR through the morning of the 10th, and as warm air advection lifted northward during the day, additional showers developed from southeast OK through northwest AR. This activity then continued through most of the night, bringing around 0.25" to around 1.5" of rain (Fig. 7). By sunrise on the 11th, scattered showers were impacting all of eastern OK and northwest AR. This activity became more widespread from east central OK to northwest AR as the morning progressed, coming to an end around noon. Additional scattered showers then developed during the afternoon hours, and by early evening, a large area of rain moved north out of TX into southeast OK within a broad warm conveyor belt ahead of a potent upper-level trough. This activity affected locations south of I-44 through much of the evening before moving east of the area. Meanwhile, scattered showers from north central OK moved into northeast OK and northwest AR during the late evening through overnight hours as the main upper-level system moved across the area. All of the precipitation finally came to an end in the pre-dawn hours of the 12th. Rainfall totals were around 0.25" to 1.25" for much of eastern OK and northwest AR (Fig. 8). The 2-day combined rainfall total ranged from around 0.25" to 3" (Fig. 9), resulting in minor flooding along the Poteau River near Panama (see preliminary hydrographs at the end of this report; see E3 Report for details).

Just before noon on the 19th, showers and isolated thunderstorms crossed the Red River out of TX and into southeast OK as an upper-level wave began to eject out of the desert southwest. This activity continued to spread north, affecting all of eastern OK and northwest AR during the afternoon. Near freezing temperatures combined with the wet-bulbing effect lead to snow and sleet across portions of northeast OK. Snow and sleet accumulations of 1"-2" were reported across western Osage and Pawnee Counties, with 0.25"—0.50" of sleet reported further east (Fig. 12). While most of the rain had pushed northeast of the area by mid-evening, showers and isolated thunderstorms remained over southeast OK and northwest AR through the rest of the evening, finally shifting east of the area by midnight. Temperatures were sub-freezing in the higher elevations of northwest AR, allowing for some ice accumulation of 0.1"-0.25" on elevated surfaces (Fig. 11). Rainfall totals were around 0.25" to around 1.5" (Fig. 10).

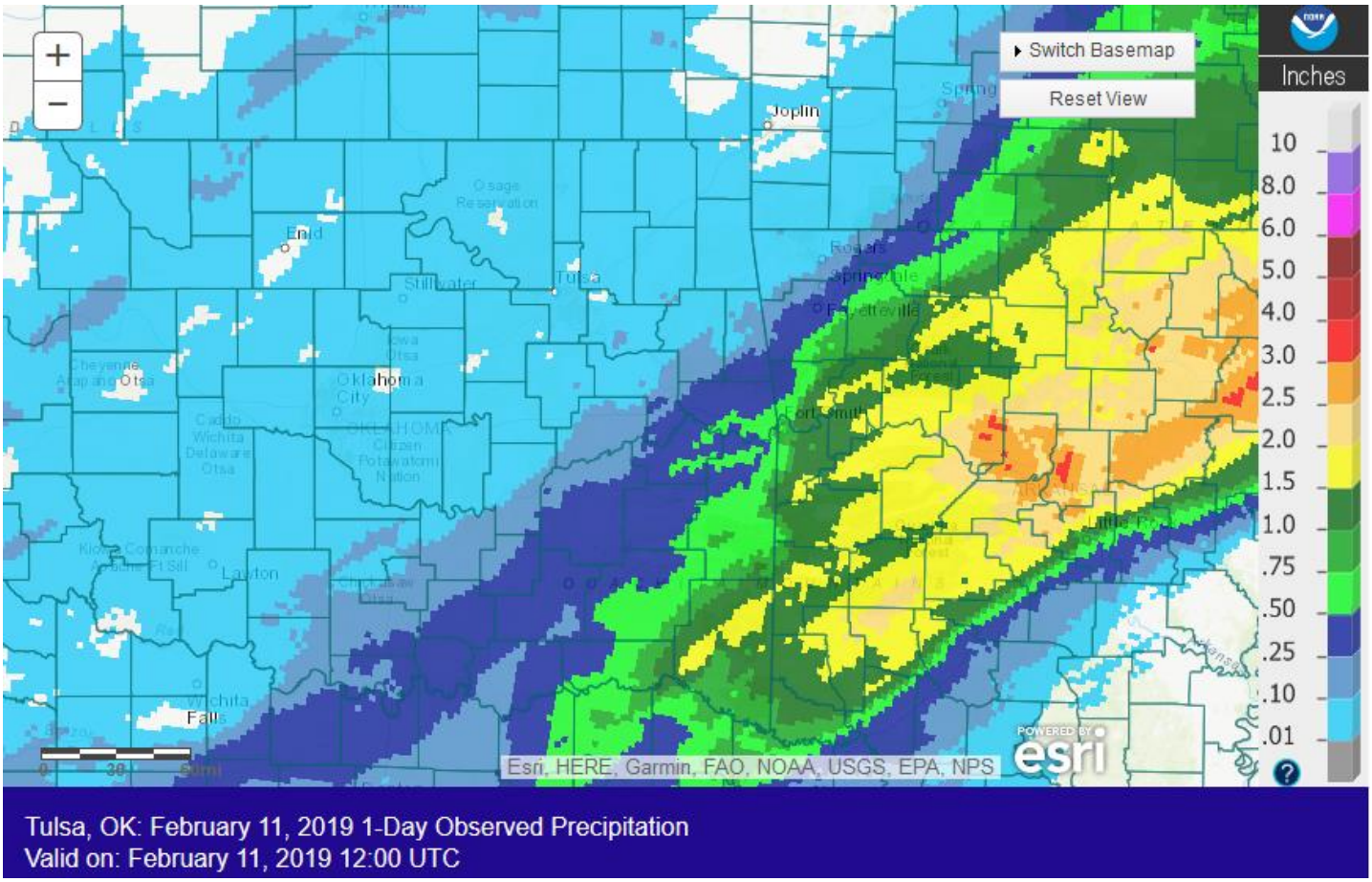


Fig. 7. 24-hour Estimated Observed Rainfall ending at 6am CST 2/11/2019.

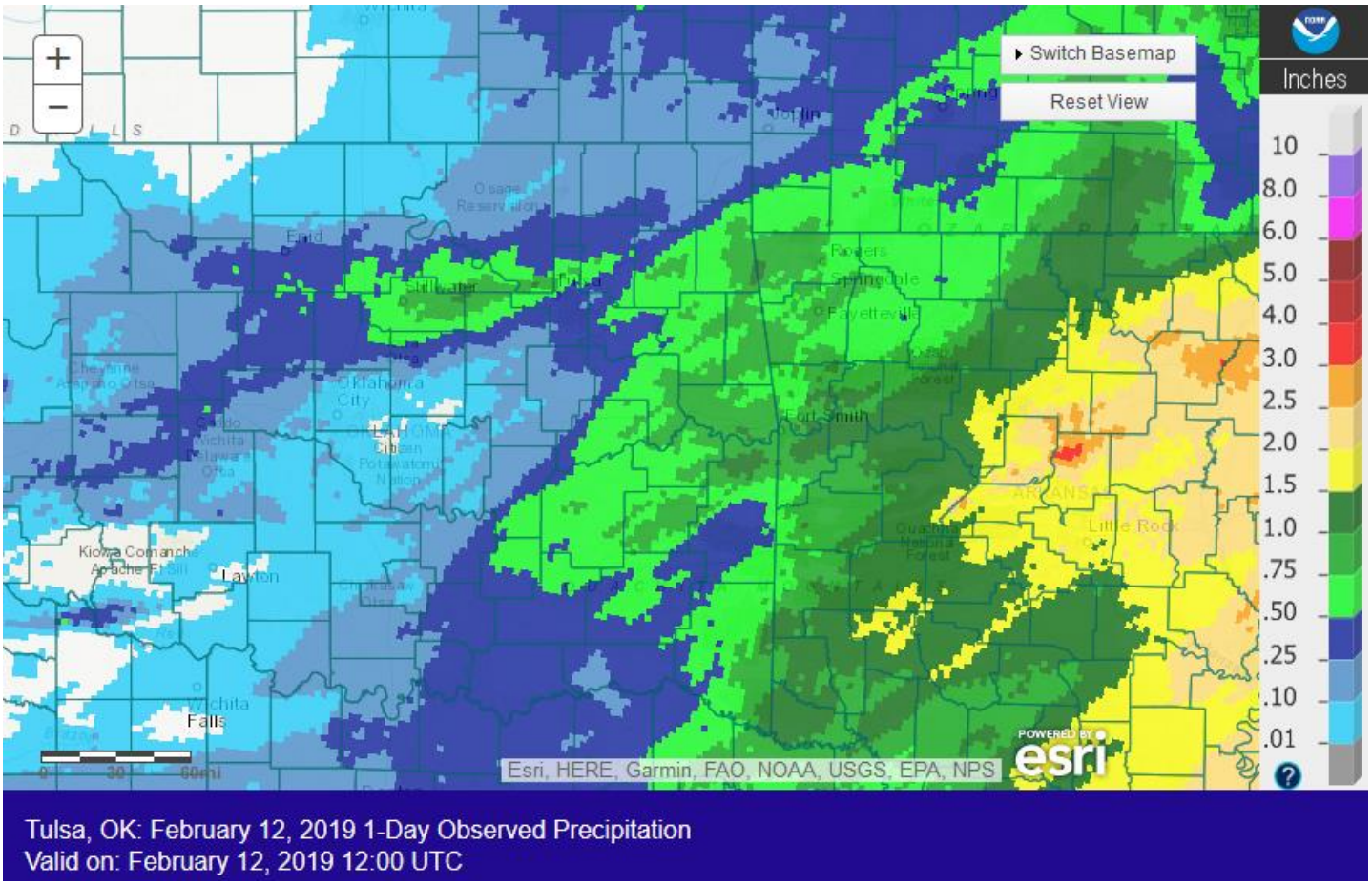


Fig. 8. 24-hour Estimated Observed Rainfall ending at 6am CST 2/12/2019.

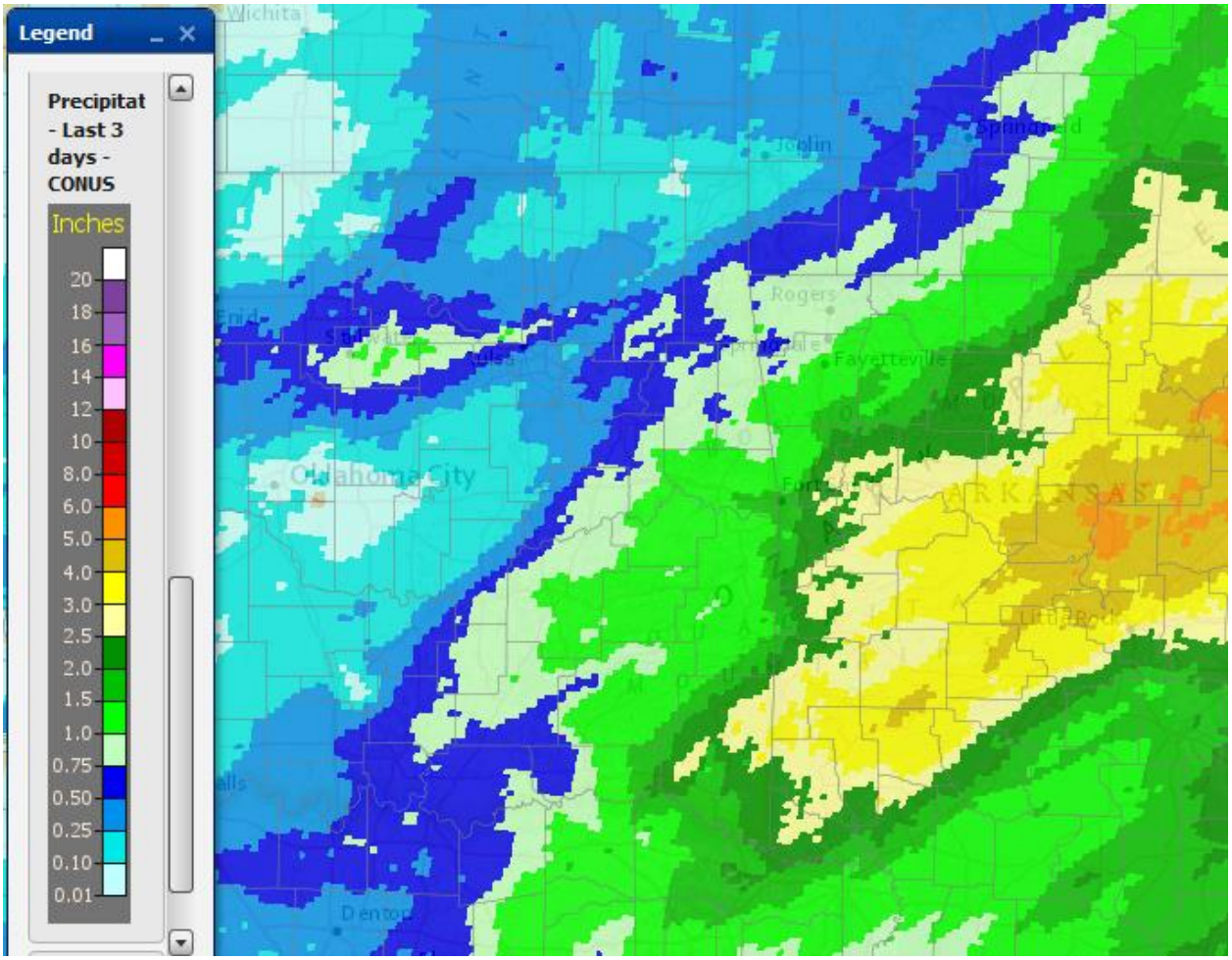


Fig. 9. 3-Day Estimated Observed Rainfall ending at 10am CST 2/12/2019.

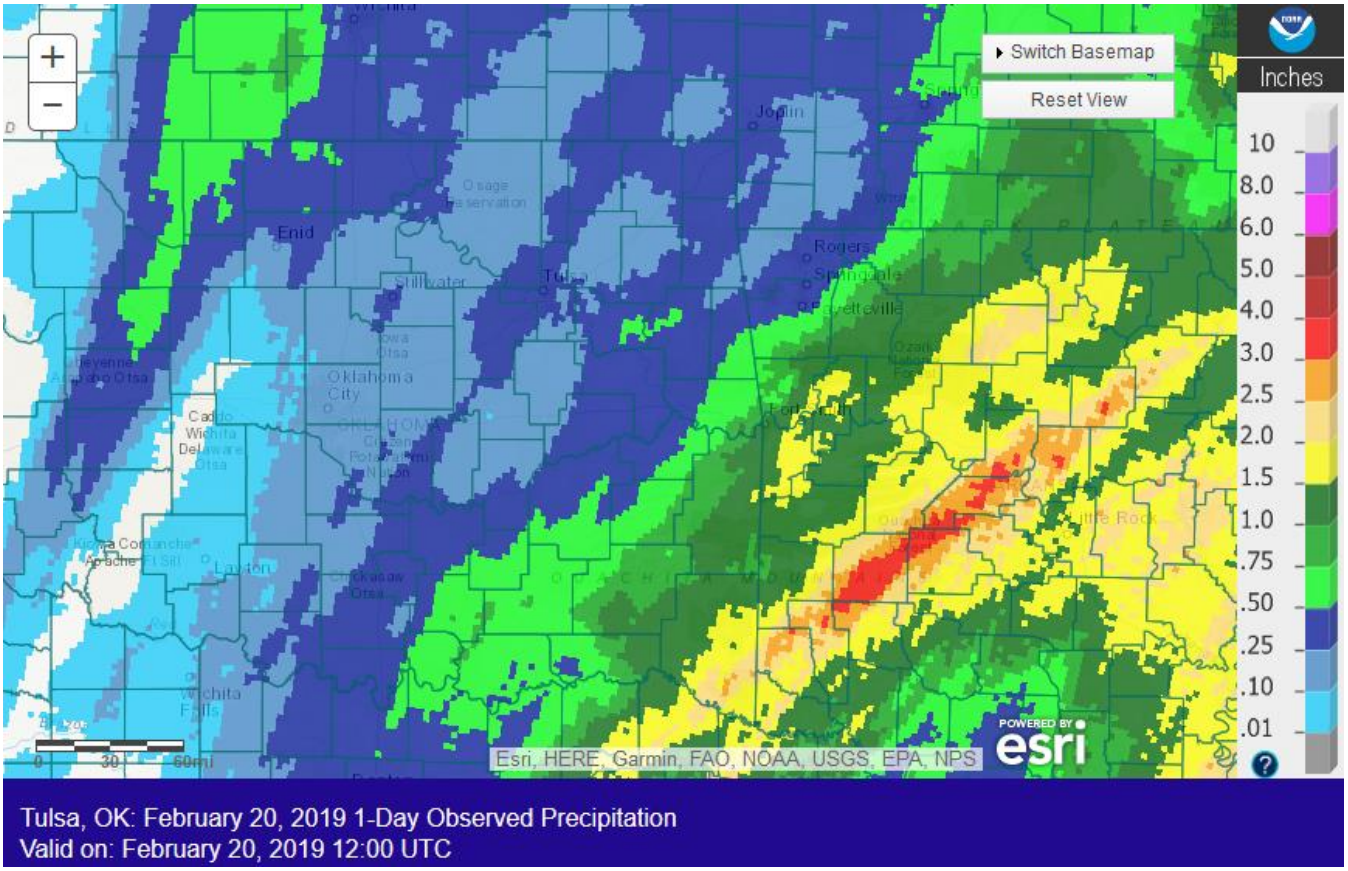


Fig. 10. 24-hour Estimated Observed Rainfall ending at 6am CST 2/20/2019.

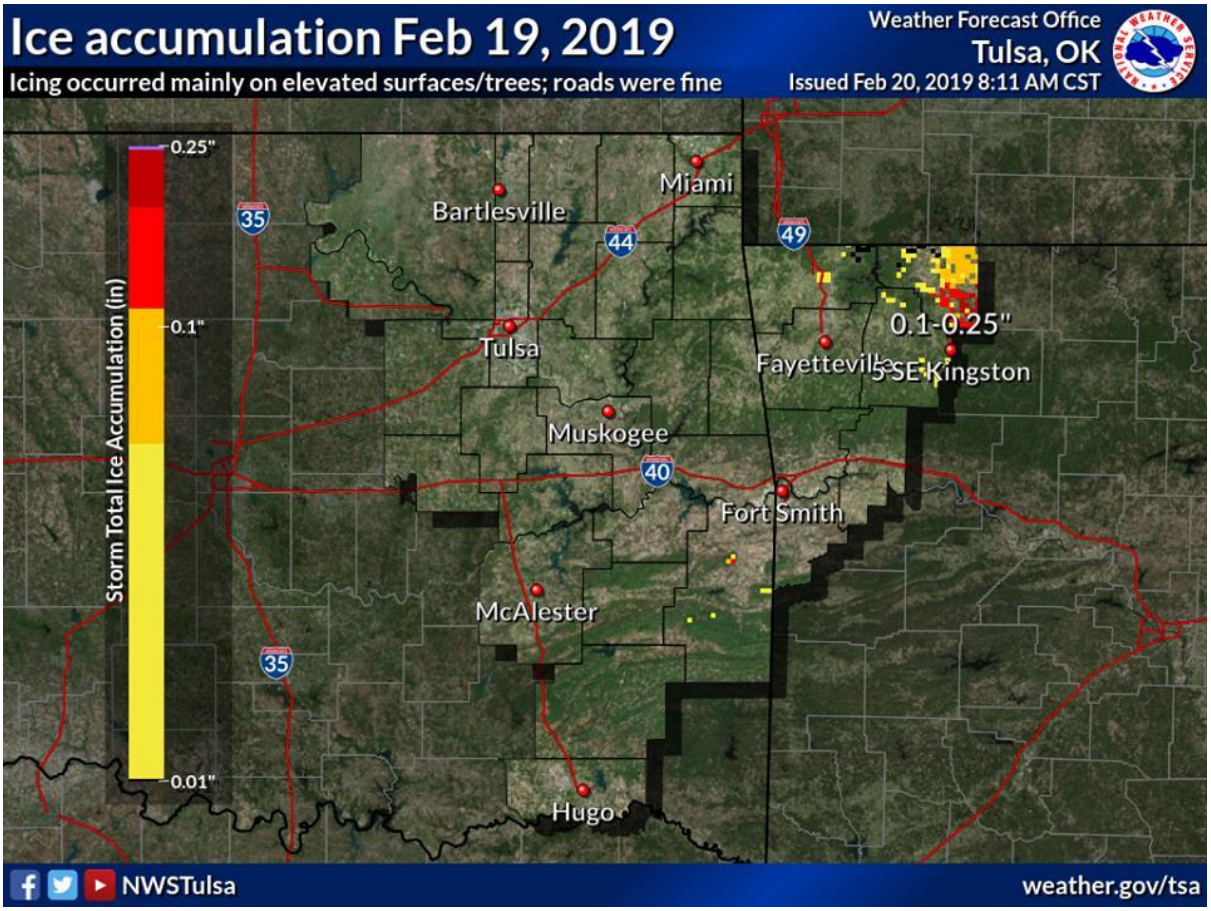


Fig. 11. Estimated icing that occurred on February 19, 2019. The elevated terrain played a key role in this event. The icing occurred on elevated surfaces and trees. The roads were not impacted.

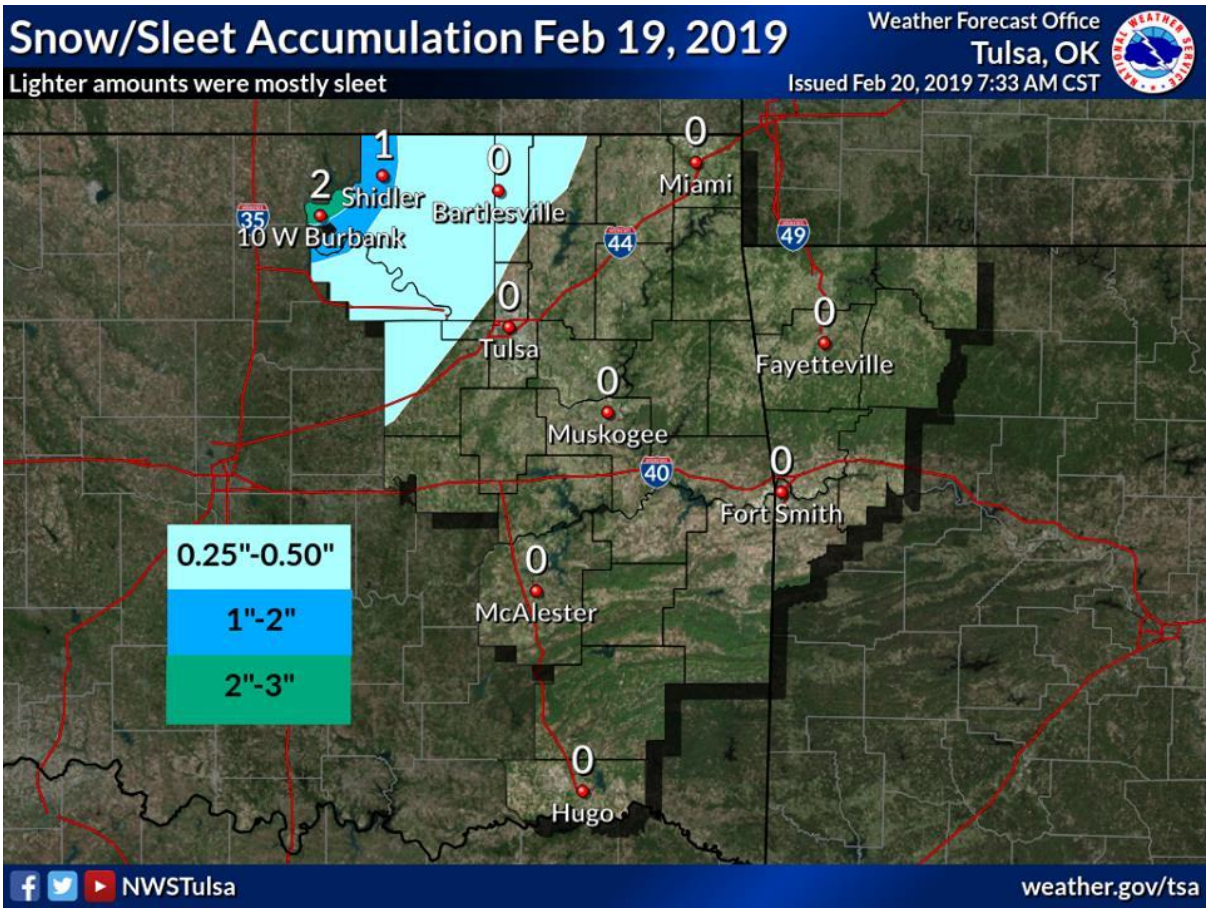


Fig. 12. Estimated snow and sleet accumulation for February 19, 2019. The lighter amounts to the east were mainly sleet.

Another shallow cold airmass slowed moved into the region on the 26th through 27th, bringing significantly colder temperatures to eastern OK and northwest AR. Temperatures were in the mid-50s to mid-60s across most of eastern OK and northwest AR the afternoon of the 26th, and near to below freezing by the afternoon of the 27th (Figs. 13-14). This resulted in 24-hour temperatures differences of 25°F to 35°F (Figs. 15-16). Freezing drizzle also accompanied this cold air, with ice accumulation on elevated surfaces. A thin glaze of ice also impacted roadways, especially bridges and overpasses, causing numerous accidents.

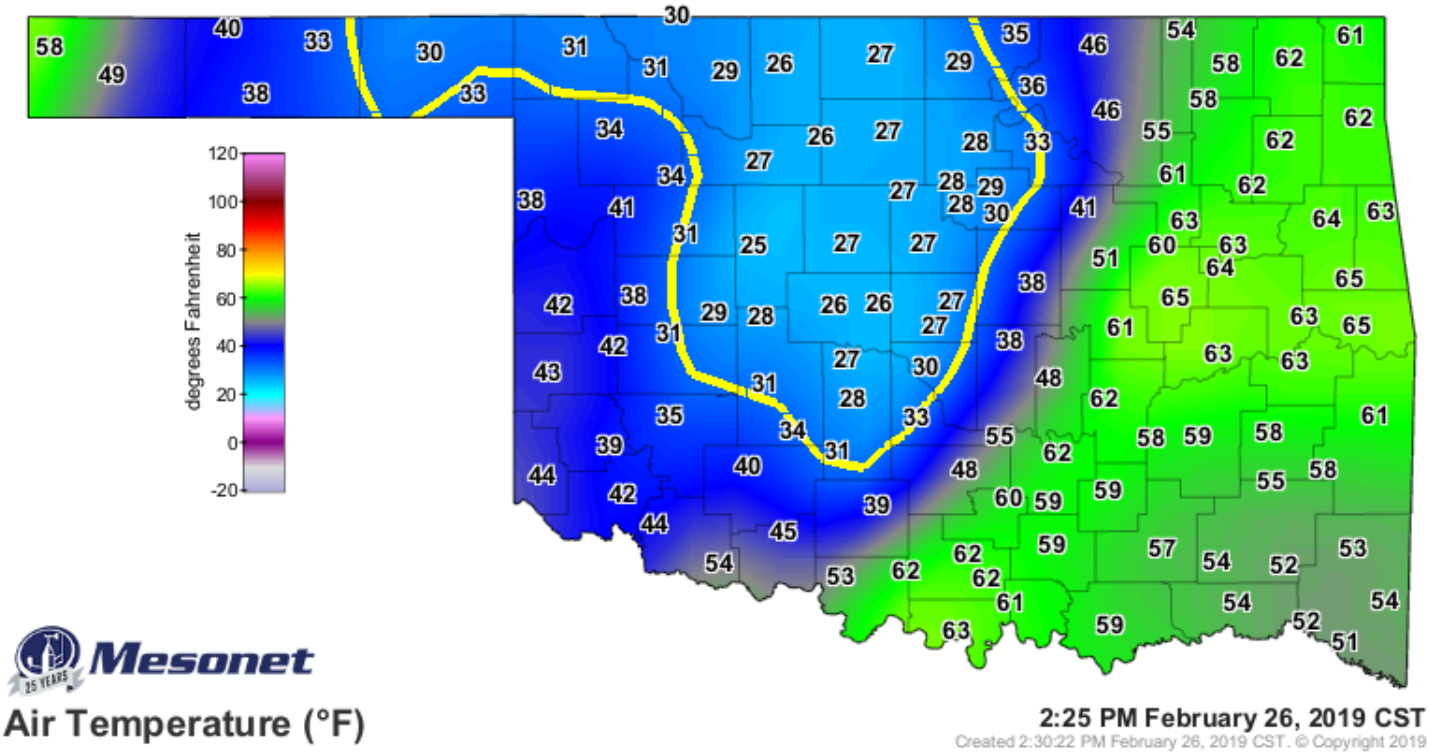


Fig. 13. OK Mesonet air temperature at 2:25 pm CST 2/26/2019.

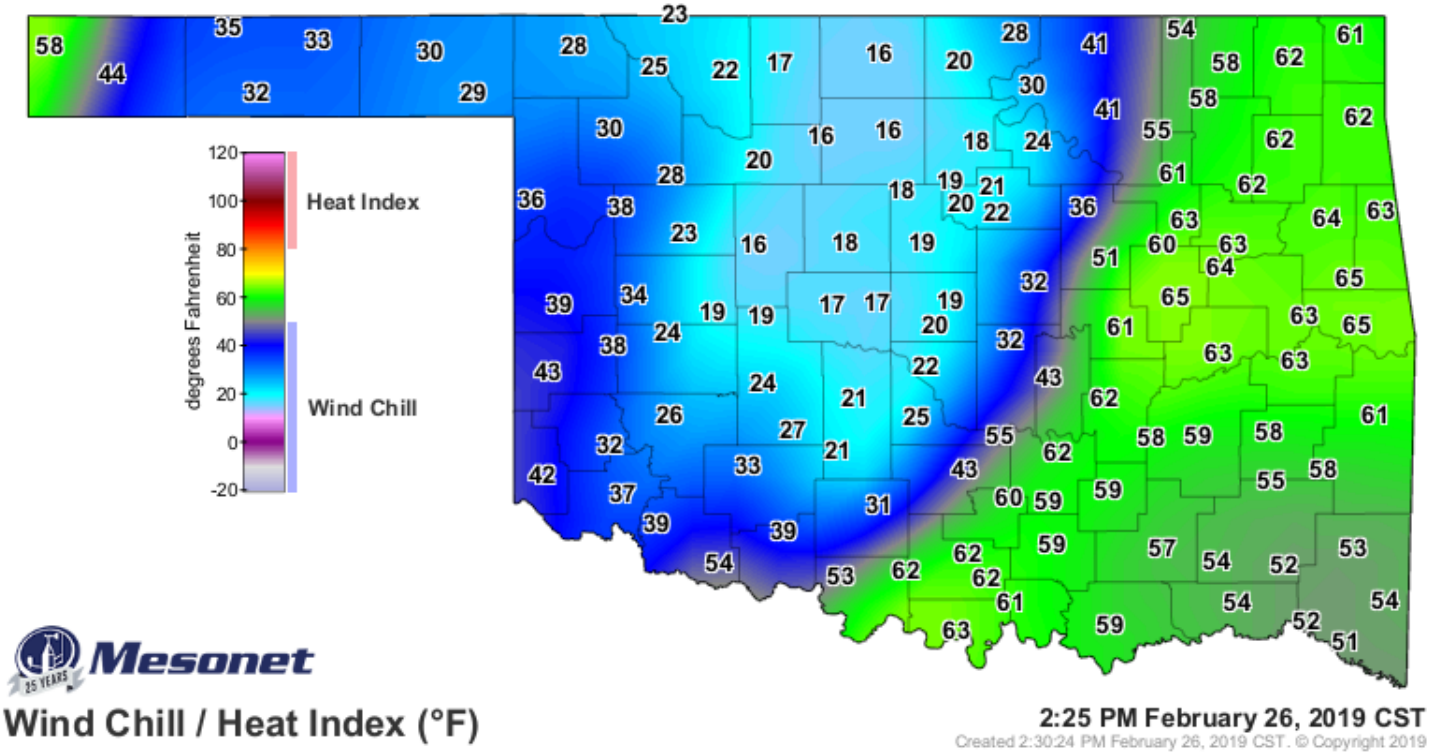


Fig. 14. OK Mesonet wind chill / heat index at 2:25 pm CST 2/26/2019.

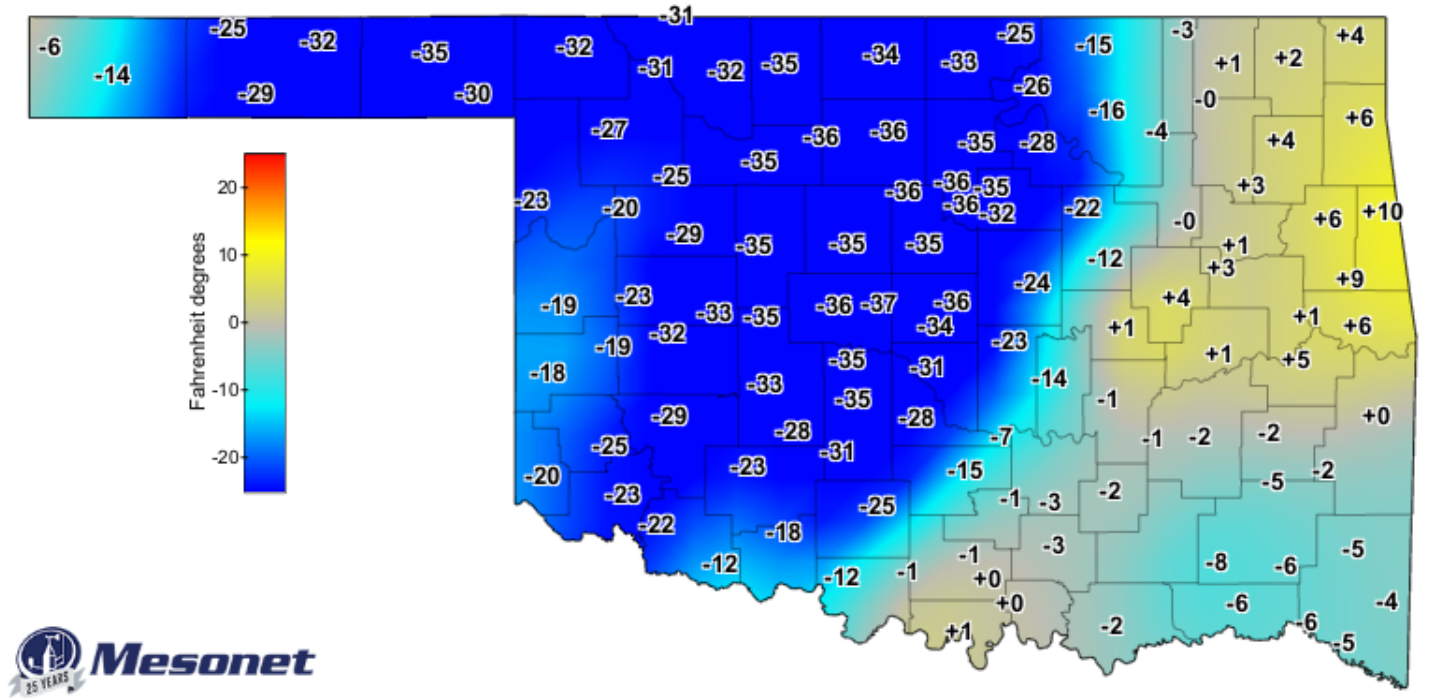


Fig. 15. OK Mesonet 24-hour temperature change at 2:30 pm CST 2/26/2019.

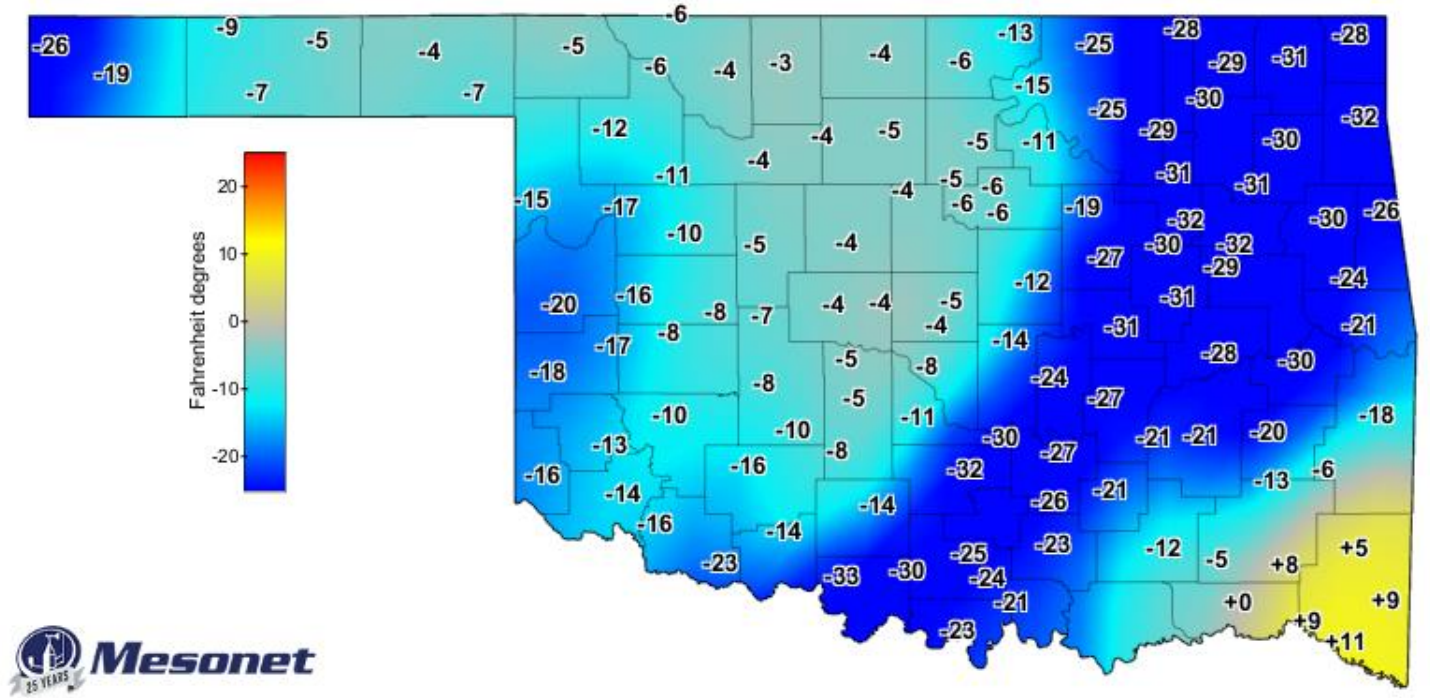


Fig. 16. OK Mesonet 24-hour temperature change at 1:30 pm CST 2/27/2019.

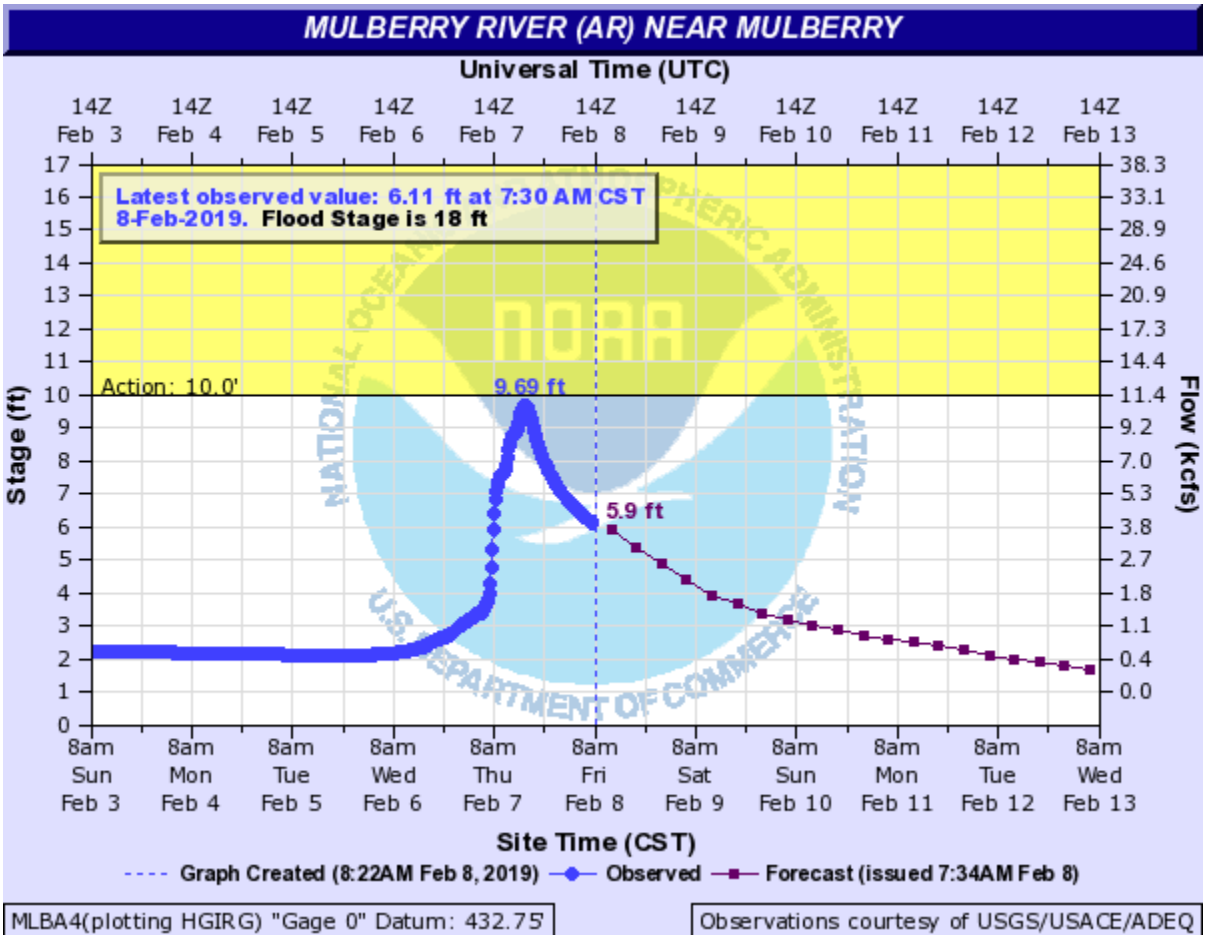
Written by:
Nicole McGavock
Service Hydrologist
WFO Tulsa

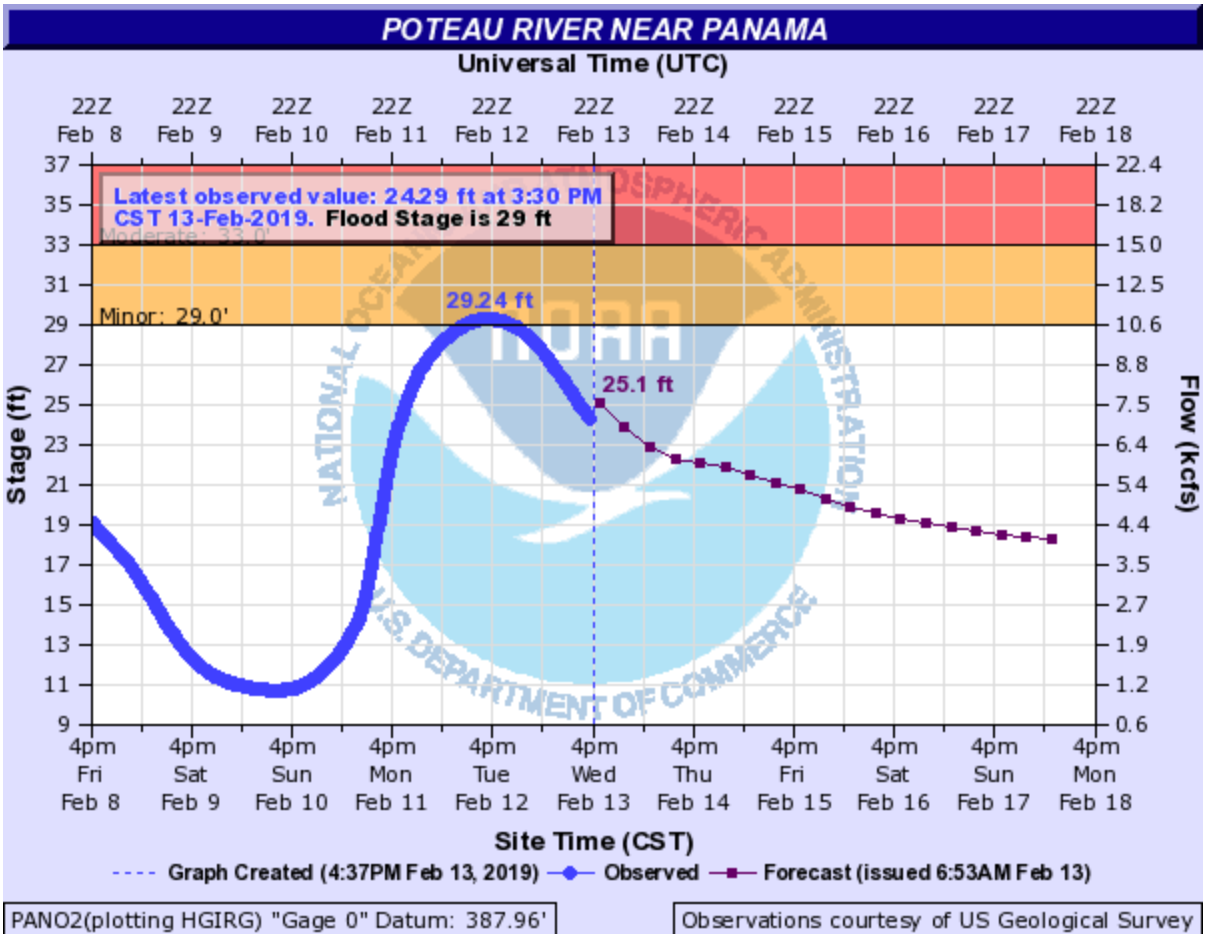
Products issued in February 2019:

*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)
1 River Flood Warnings (FLW) (includes category increases)
6 River Flood Statements (FLS)
0 River Flood Advisories (FLS) (0 Advisory FLS CON/EXT/CAN)
0 River Flood Watches (FFA) (0 Watch FFA CON/EXT/CAN)
0 River Statements (RVS)
0 Hydrologic Outlooks (ESF)
0 Drought Information Statements (DGT)

Preliminary Hydrographs:




POTEAU RIVER NEAR PANAMA
Universal Time (UTC)
22Z Feb 8
22Z Feb 9
22Z Feb 10
22Z Feb 11
22Z Feb 12
22Z Feb 13
22Z Feb 14
22Z Feb 15
22Z Feb 16
22Z Feb 17
22Z Feb 18
Latest observed value: 24.29 ft at 3:30 PM CST 13-Feb-2019. Flood Stage is 29 ft
Moderate: 33.0'
Minor: 29.0'
29.24 ft
25.1 ft
Stage (ft)
Flow (kcfs)
37
35
33
31
29
27
25
23
21
19
17
15
13
11
9
22.4
18.2
15.0
12.5
10.6
8.8
7.5
6.4
5.4
4.4
3.5
2.7
1.9
1.2
0.6
4pm Fri Feb 8
4pm Sat Feb 9
4pm Sun Feb 10
4pm Mon Feb 11
4pm Tue Feb 12
4pm Wed Feb 13
4pm Thu Feb 14
4pm Fri Feb 15
4pm Sat Feb 16
4pm Sun Feb 17
4pm Mon Feb 18
Site Time (CST)
Graph Created (4:37PM Feb 13, 2019)
Observed
Forecast (issued 6:53AM Feb 13)
PANO2(plotting HGIRG) "Gage 0" Datum: 387.96'
Observations courtesy of US Geological Survey