

<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>
		REPORT FOR: MONTH <b>August</b> YEAR <b>2019</b>
<b>MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS</b>		SIGNATURE <b>Steven F. Piltz</b> (Meteorologist-in-Charge)
TO: Hydrometeorological Information Center, W/OH2 NOAA / National Weather Service 1325 East West Highway, Room 7230 Silver Spring, MD 20910-3283		DATE <b>September 10, 2019</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.

Several rounds of heavy rain resulted in flash flooding this month. A new record August rainfall of 11.70" was set in Fort Smith, AR, surpassing the previous record of 10.89" in 1890. Northeastern Oklahoma experienced its wettest August on record with an average of 8.78", 5.54" above normal. Normal rainfall for August ranges from 2.6 inches in McIntosh County to 3.8 inches in Ottawa County. In the Ozark region of northwest Arkansas, rainfall averages 3.7 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 August 2019 ranged from 0.50" to near 17" across eastern OK and northwest AR. A large portion of the HSA received 5"-8" of rain this month, with several areas seeing 10"-15". A smaller portion of Choctaw and southern Pushmataha Counties only had 0.50" to 1.5". These rainfall totals correspond to 150%-500% of the normal August rainfall in eastern OK and northwest AR generally north of a McAlester to Poteau line (Fig. 1b). South of this line in southeast OK, the rainfall corresponds to generally 25%-90% of the normal August rainfall.

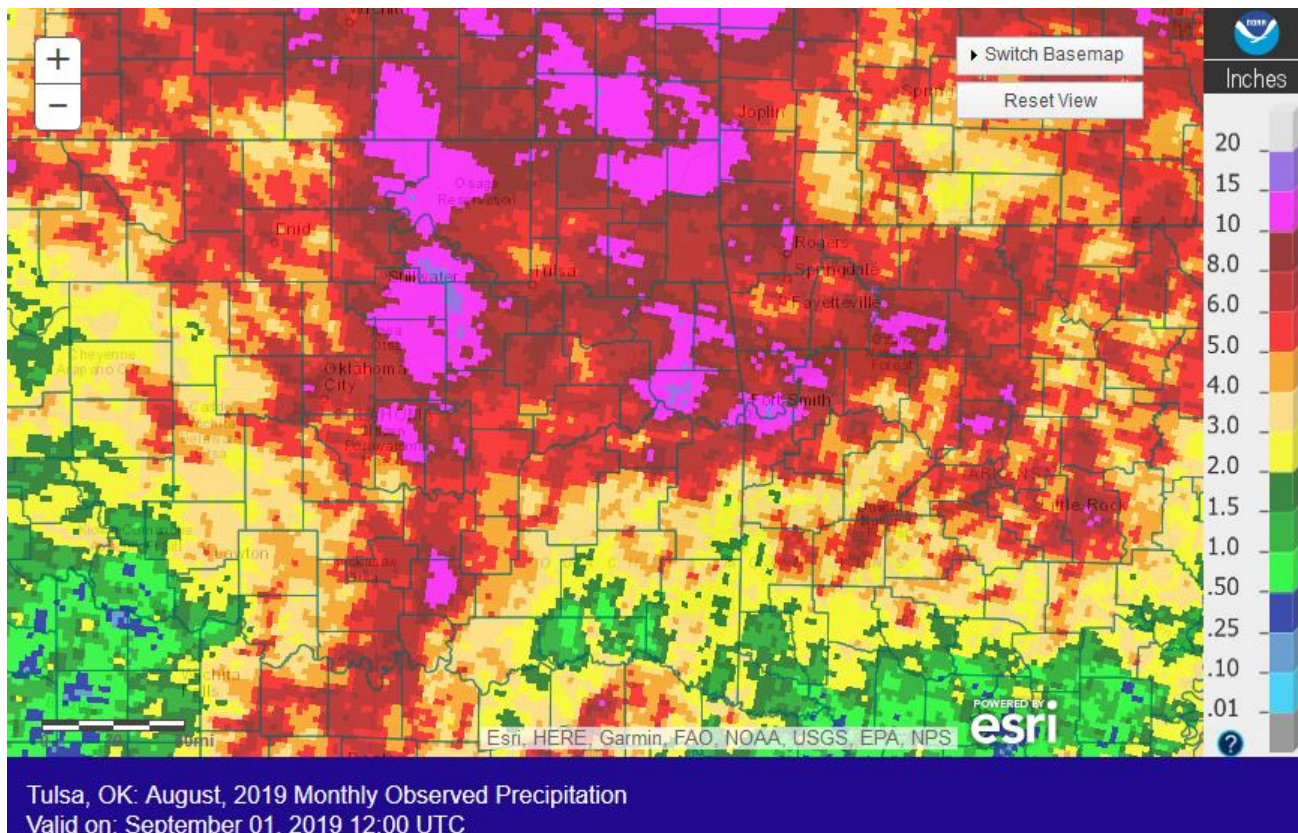


Fig. 1a. Estimated Observed Rainfall for August 2019



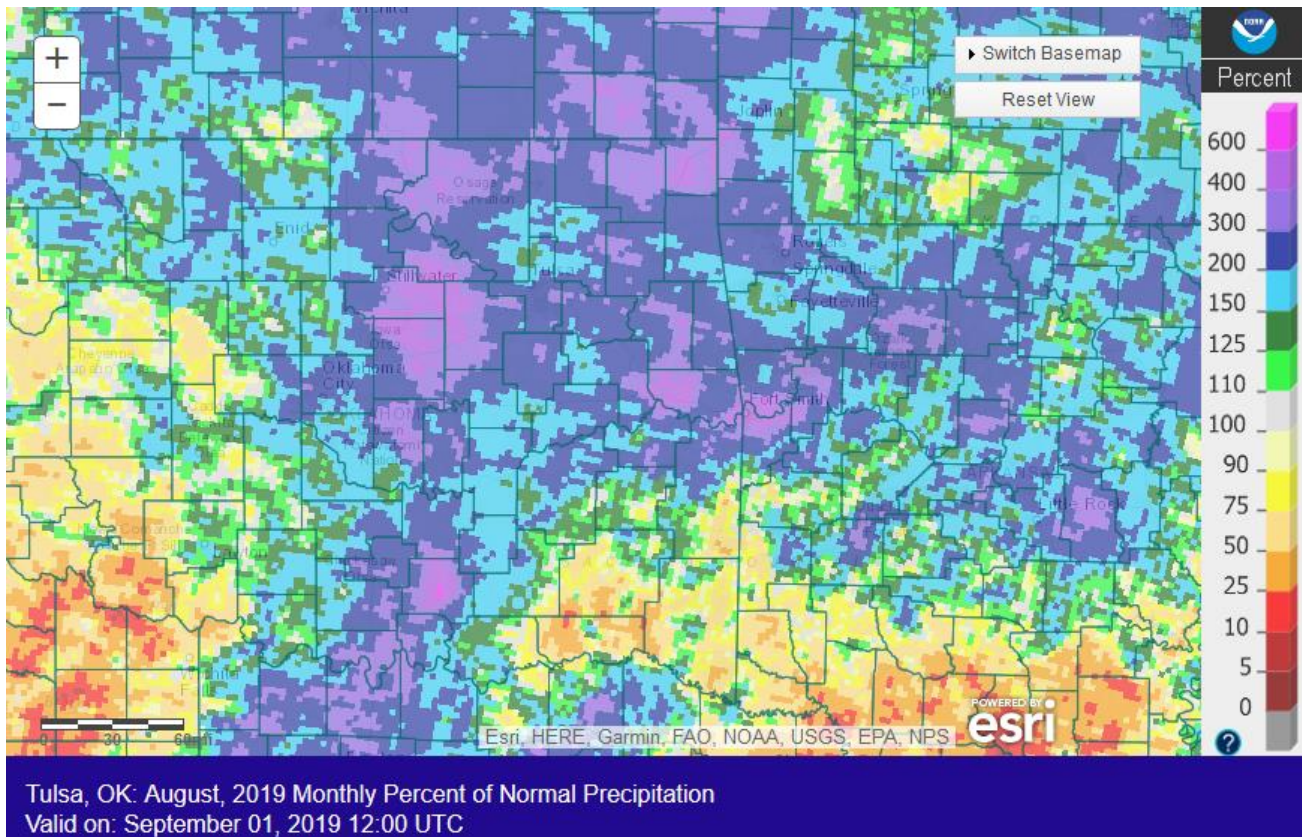


Fig. 1b. Estimated % of Normal Rainfall for August 2019

In Tulsa, OK, August 2019 ranked as the 55<sup>th</sup> warmest August (82.2°F, tied 1975; since records began in 1905) and the 15<sup>th</sup> wettest August (5.89"; since records began in 1888). Fort Smith, AR had the 40<sup>th</sup> warmest August (83.0°F, tied 1978, 1922, 1907; since records began in 1882) and the Record wettest August (11.70", previous record 10.89" in 1890; since records began in 1882). Fayetteville, AR had the 25<sup>th</sup> warmest (77.7°F, tied 1977) and the 18<sup>th</sup> wettest (5.24") August since records began in 1949.

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

Vian 5.3ENE, OK (coco)	15.00	Oilton, OK (meso)	13.64	Miami, OK (meso)	13.27
Drumright 0.6SW, OK (coco)	13.11	Webbers Falls, OK (meso)	13.03	Sallisaw 1.0SE, OK (coco)	12.90
Burbank, OK (meso)	12.63	Vinita, OK (meso)	12.32	Ralston, OK (coop)	12.13

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

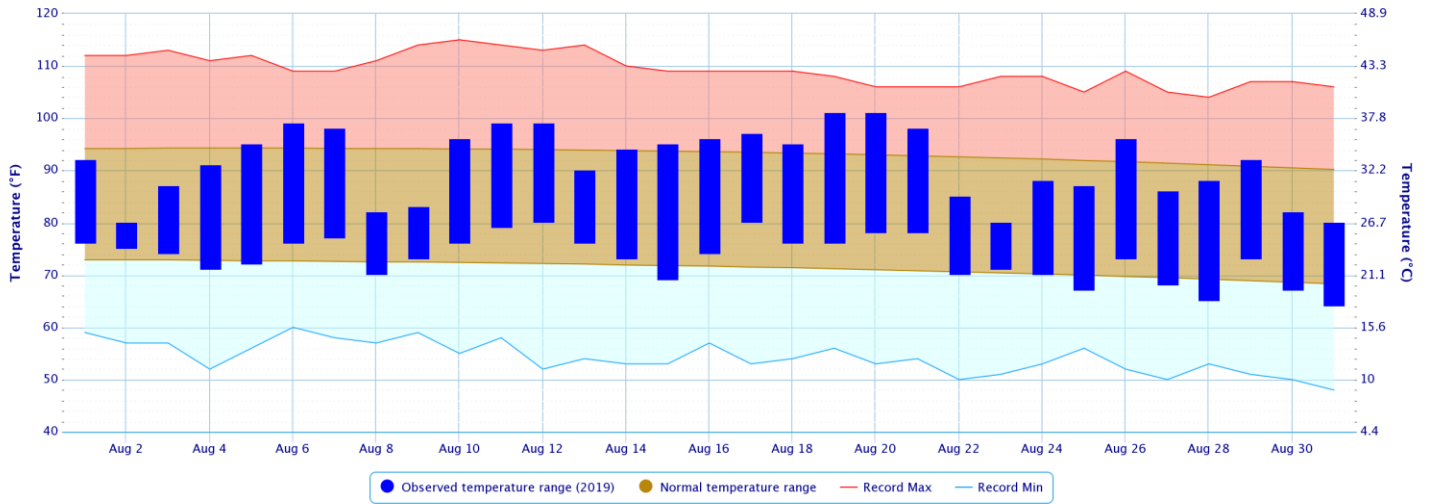
Antlers 5NW, OK (meso)	1.37	Antlers, OK (coop)	2.60	Cloudy, OK (meso)	2.73
Talihina, OK (meso)	3.80	Hugo, OK (meso)	3.81	Wilburton, OK (meso)	3.91
Elkins 1.7SE, AR (coco)	4.38	Haskell, OK (meso)	4.24	Clayton, OK (meso)	4.70

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

Rank since 1921	Last 30 Days (Aug 2 – Aug 31)	Last 60 Days (Jul 3 – Aug 31)	Summer 2019 (Jun 1 – Aug 31)	Last 120 Days (May 4 – Aug 31)	Warm Growing Season (Mar 1 – Aug 31)	Year-to-Date (Jan 1 – Aug 31)	Water Year-to-Date (Oct 1 – Aug 31)	Last 365 Days (Sep 1, 2018 – Aug 31, 2019)
Northeast OK	1 <sup>st</sup> wettest	7 <sup>th</sup> wettest	6 <sup>th</sup> wettest	1 <sup>st</sup> wettest	2 <sup>nd</sup> wettest	2 <sup>nd</sup> wettest	2 <sup>nd</sup> wettest	4 <sup>th</sup> wettest
East Central OK	1 <sup>st</sup> wettest	15 <sup>th</sup> wettest	11 <sup>th</sup> wettest	9 <sup>th</sup> wettest	9 <sup>th</sup> wettest	6 <sup>th</sup> wettest	5 <sup>th</sup> wettest	6 <sup>th</sup> wettest
Southeast OK	35 <sup>th</sup> wettest	44 <sup>th</sup> driest	28 <sup>th</sup> wettest	23 <sup>rd</sup> wettest	14 <sup>th</sup> wettest	15 <sup>th</sup> wettest	6 <sup>th</sup> wettest	4 <sup>th</sup> wettest
Statewide	3 <sup>rd</sup> wettest	27 <sup>th</sup> wettest	27 <sup>th</sup> wettest	4 <sup>th</sup> wettest	4 <sup>th</sup> wettest	4 <sup>th</sup> wettest	1 <sup>st</sup> wettest	1 <sup>st</sup> wettest

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

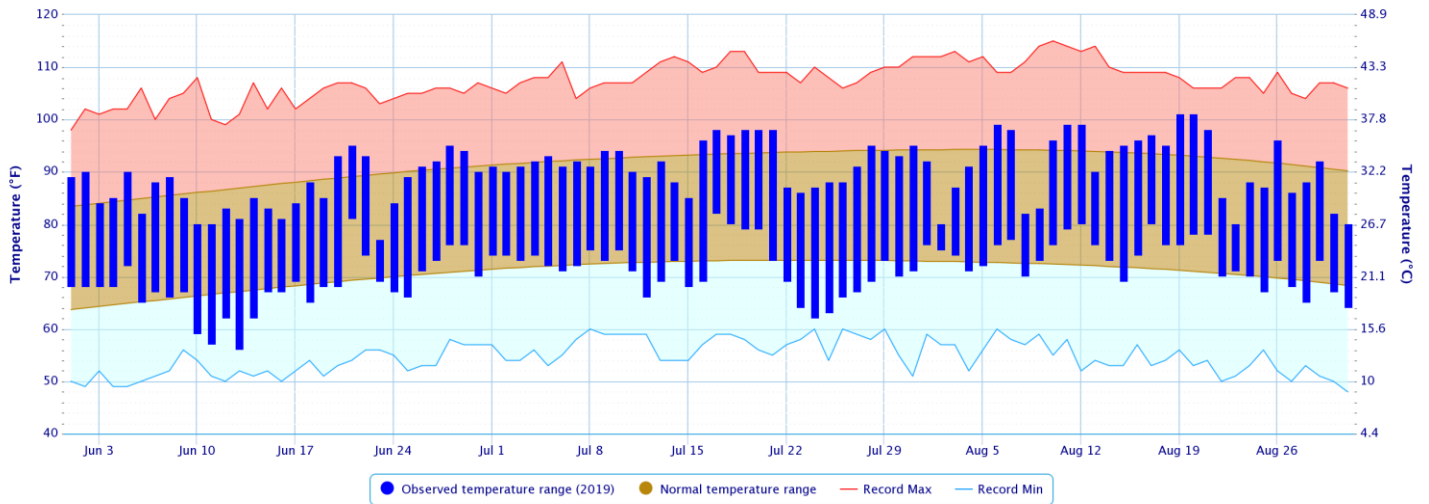
Period of Record – 1905-01-06 to 2019-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



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

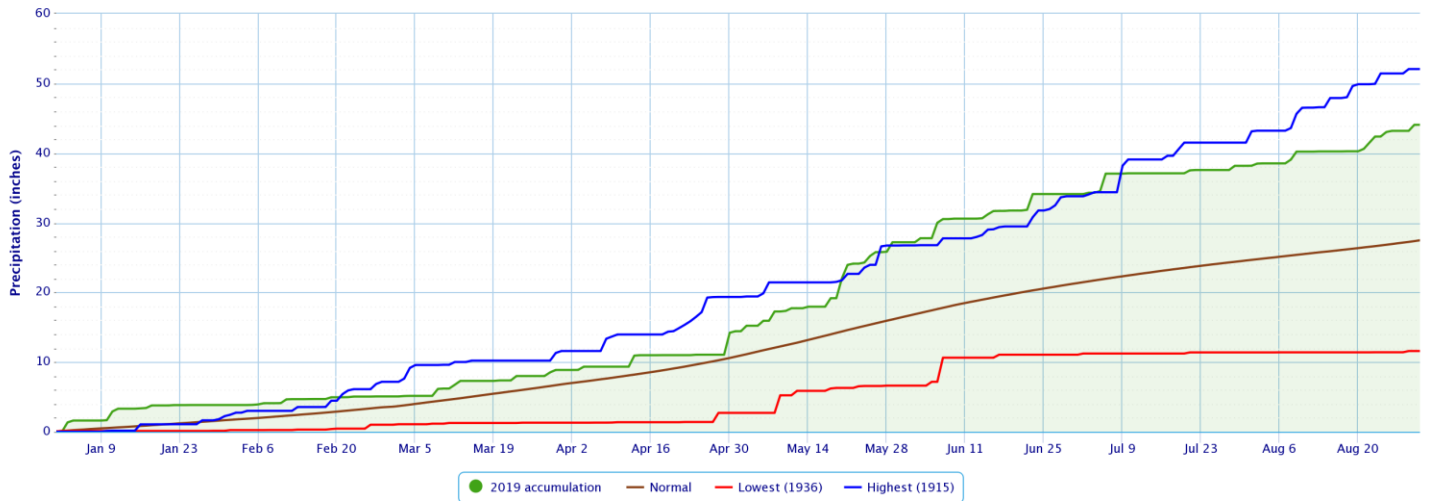
Period of Record – 1905-01-06 to 2019-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



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

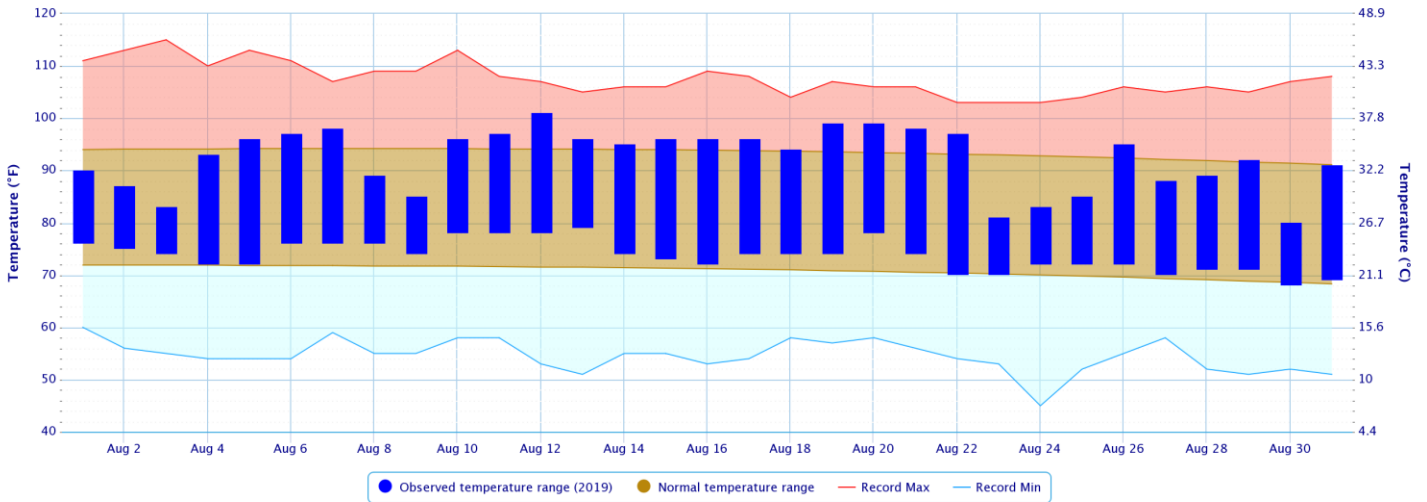
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

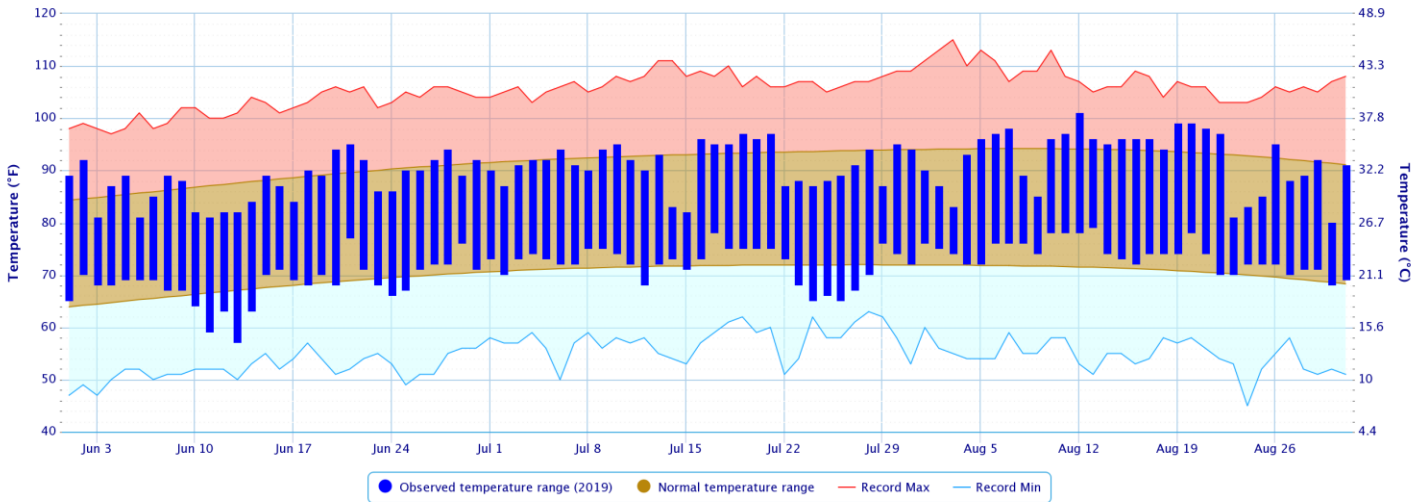
Period of Record – 1882-06-01 to 2019-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



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

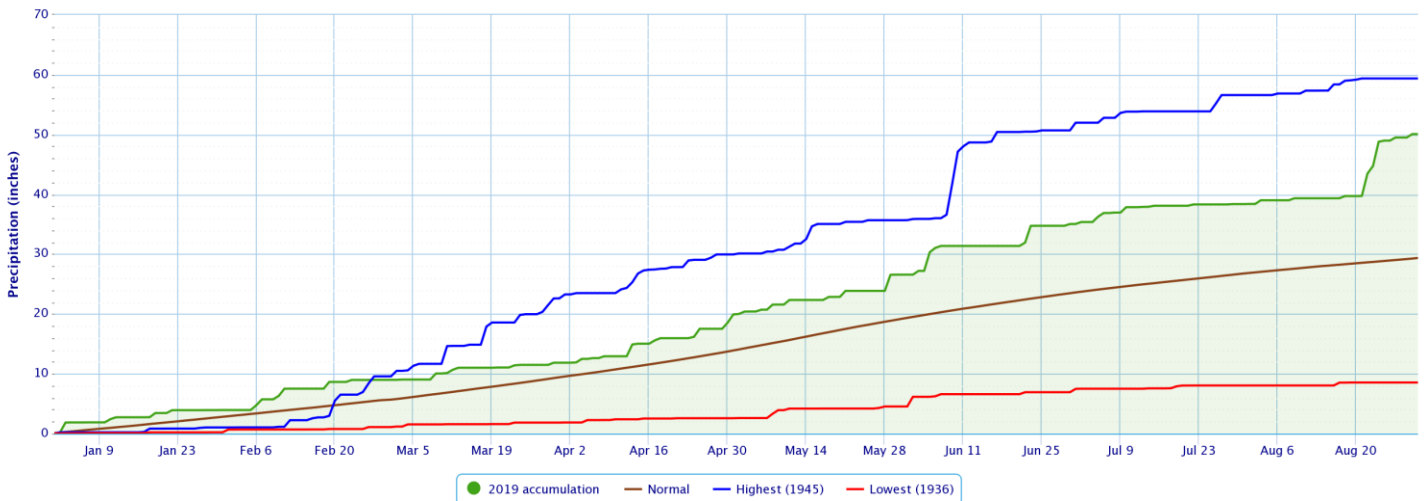
Period of Record – 1882-06-01 to 2019-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



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

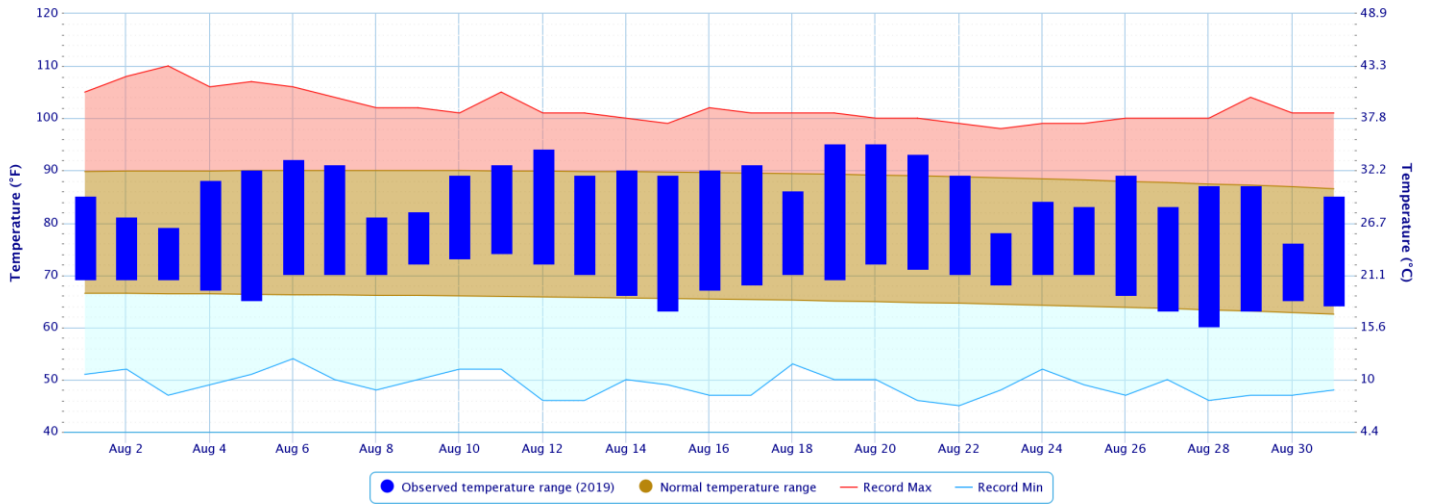
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

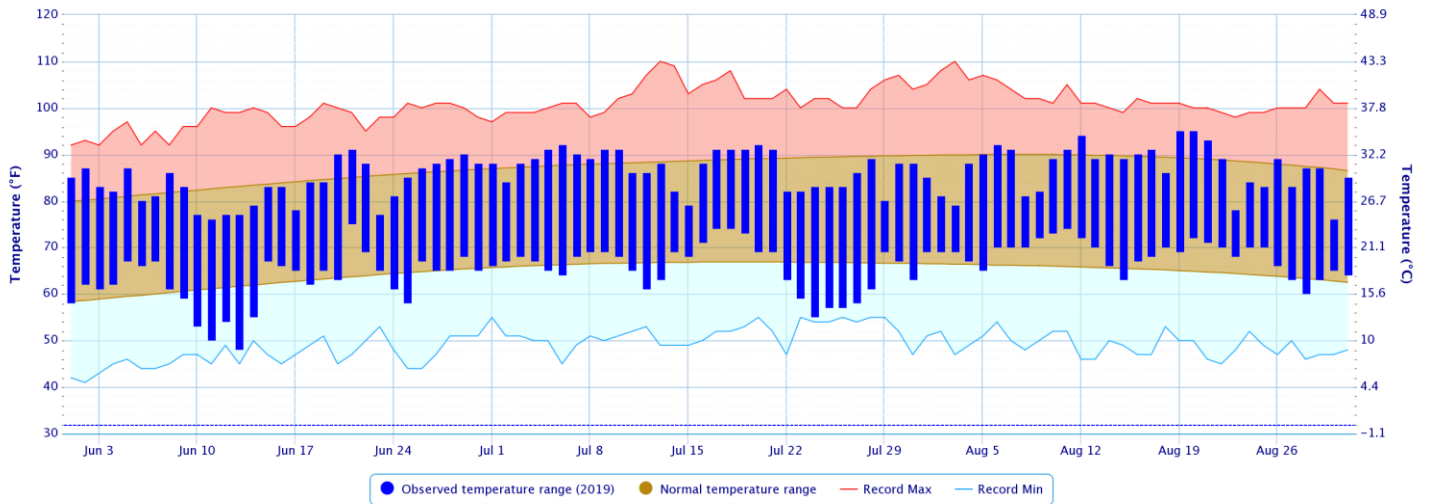
Period of Record – 1949-07-14 to 2019-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



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

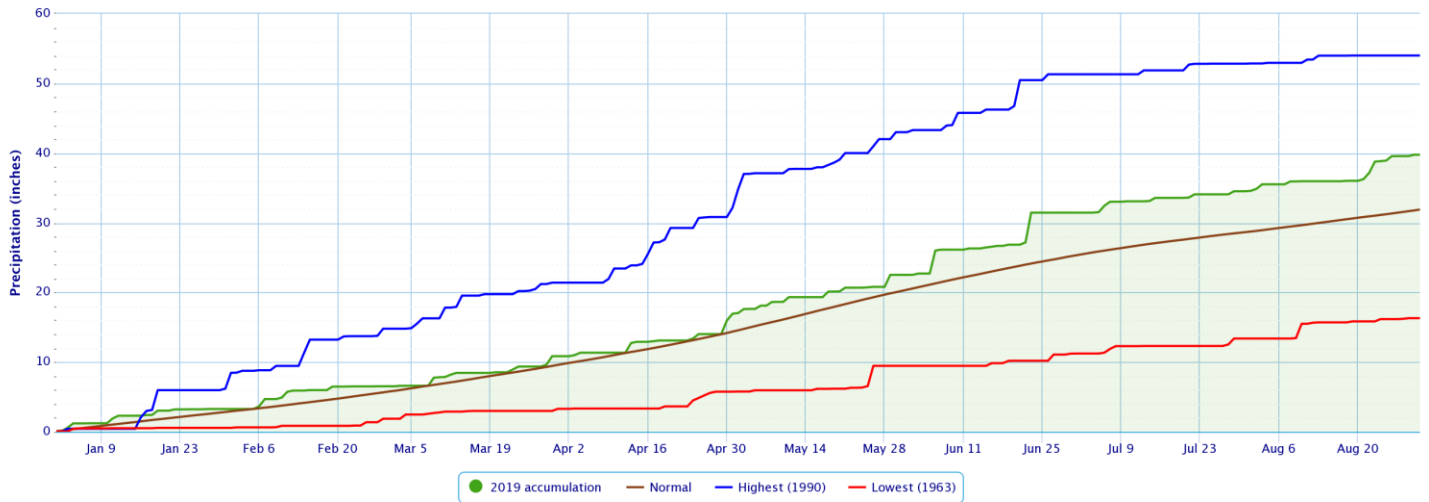
Period of Record – 1949-07-14 to 2019-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



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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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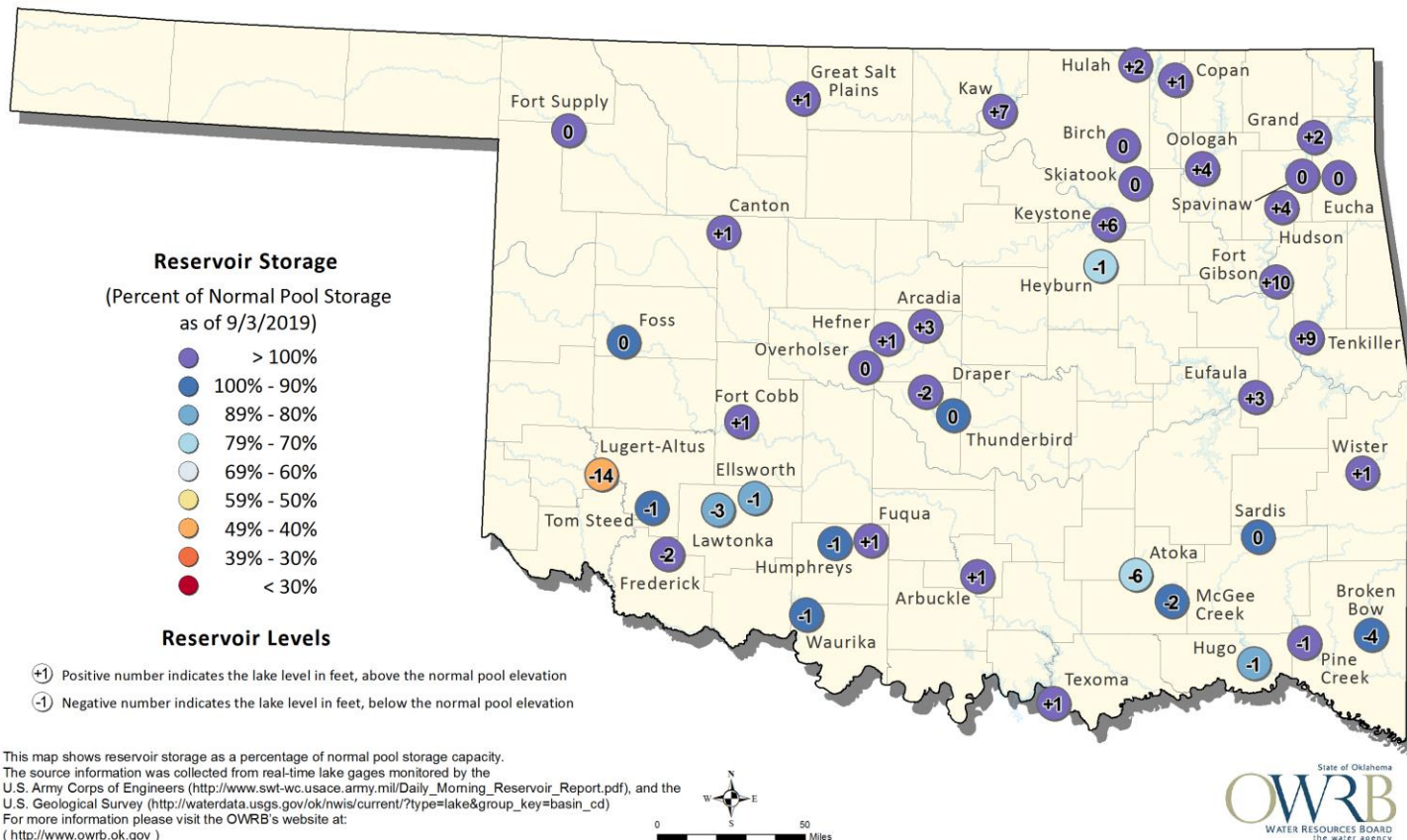


## Summer (June-July-August) 2019

In Tulsa, OK, Summer 2019 ranked as the 42<sup>nd</sup> coldest Summer (80.4°F, tied 2013, 1947; since records began in 1905) and the 14<sup>th</sup> wettest Summer (16.86"; since records began in 1888). Fort Smith, AR had the 56<sup>th</sup> warmest Summer (80.9°F, tied 1987; since records began in 1882) and the 3<sup>rd</sup> wettest Summer (23.50"; since records began in 1882). Fayetteville, AR had the 25<sup>th</sup> coldest (75.7°F, tied 1968, 1960) and the 6<sup>th</sup> wettest (17.24") Summer since records began in 1950.

## Reservoirs

### Oklahoma Surface Water Resources Reservoir Levels and Storage as of 9/3/2019



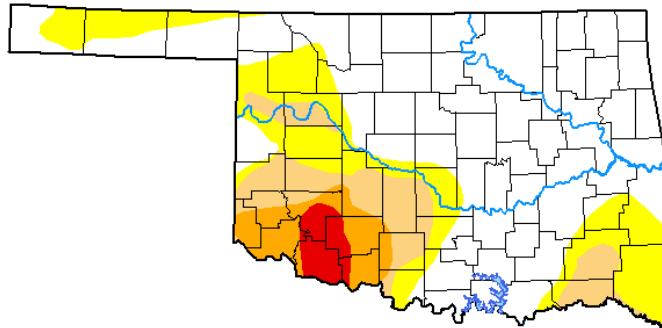
According to the USACE, most of the lakes in the HSA were utilizing more than 3% of their flood control pools as of 9/03/2019: Beaver Lake 40%, Eufaula Lake 23%, Tenkiller Lake 23%, Ft. Gibson Lake 23%, Hudson Lake 18%, Grand Lake 17%, Oologah Lake 14%, Kaw Lake 14%, and Keystone Lake 11%. One lake was below the top of its conservation pool: Hugo Lake 92%.

## Drought

According to the [U.S. Drought Monitor](#) (USDM) from August 27, 2019 (Figs. 2, 3), Moderate (D1) Drought had developed over portions of Pushmataha and Choctaw Counties. Abnormally dry, but not in drought, conditions (D0) were present in portions of Latimer, Le Flore, Pushmataha, and Choctaw Counties. The remainder of eastern OK and northwest AR was drought free.

# U.S. Drought Monitor Oklahoma

**August 27, 2019**  
(Released Thursday, Aug. 29, 2019)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	61.77	38.23	18.47	7.94	2.62	0.00
<b>Last Week</b> 08-20-2019	50.05	49.95	24.24	11.87	0.00	0.00
<b>3 Months Ago</b> 05-28-2019	100.00	0.00	0.00	0.00	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> 09-25-2018	72.93	27.07	9.11	4.16	0.00	0.00
<b>One Year Ago</b> 08-28-2018	53.85	46.15	31.47	18.63	5.65	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. See accompanying text summary for forecast statements.

Author:

Jessica Blunden  
NCEI/NOAA

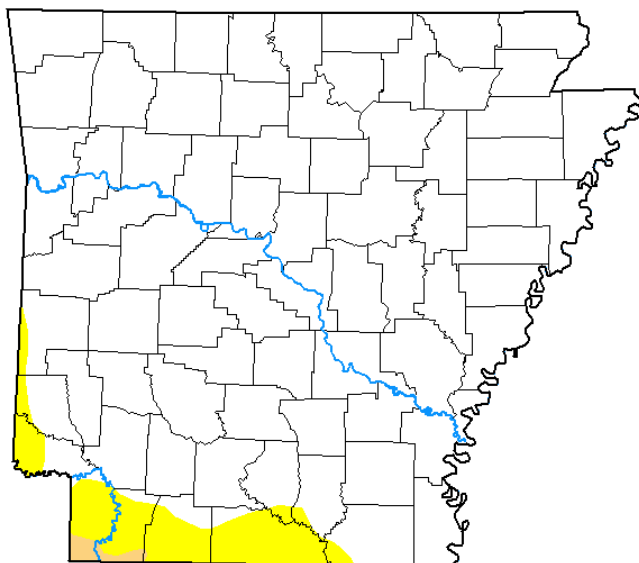


[droughtmonitor.unl.edu](http://droughtmonitor.unl.edu)

Fig. 2. Drought Monitor for Oklahoma

# U.S. Drought Monitor Arkansas

**August 27, 2019**  
(Released Thursday, Aug. 29, 2019)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	93.85	6.15	0.41	0.00	0.00	0.00
<b>Last Week</b> 08-20-2019	98.10	1.90	0.00	0.00	0.00	0.00
<b>3 Months Ago</b> 05-28-2019	100.00	0.00	0.00	0.00	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> 09-25-2018	93.15	6.85	2.59	0.00	0.00	0.00
<b>One Year Ago</b> 08-28-2018	85.49	14.51	6.08	0.43	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. See accompanying text summary for forecast statements.

Author:

Jessica Blunden  
NCEI/NOAA



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

Fig. 3. Drought Monitor for Arkansas

## Outlooks

The [Climate Prediction Center](#) (CPC) outlook for September 2019 (issued August 31, 2019) indicates equal chances for above, near, or below normal temperatures and precipitation across all of eastern OK and northwest AR. This outlook takes into account dynamical model guidance and the weeks 3-4 outlook. There is no Madden-Julian Oscillation (MJO) currently present, and one is not expected to emerge for the first several weeks of September. Therefore, the MJO is unlikely to impact the mid-latitude circulation pattern in September. The general forecast pattern for the upcoming month is troughing over the Bering Sea, a ridge over western North America, and troughing over northeastern North America.

For the 3-month period September-October-November 2019, CPC is forecasting a significantly enhanced chance for above normal temperatures and equal chances for above, near, or below median rainfall across all of eastern OK and northwest AR (outlook issued August 15, 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 has consistent with a transition to ENSO neutral from July through early-August. The consensus forecast is for ENSO neutral conditions to be the most likely through the winter, and a very low chance for La Niña. CPC issued its final El Niño Advisory on August 8, 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](http://water.weather.gov/precip/index.php?location_type=wfo&location_name=tsa)

Through the morning hours of the 1<sup>st</sup>, showers and thunderstorms moved south out of southeast KS into far northeast OK and northwest AR, where around 0.25" to around 1.5" of rain fell. However, higher totals of 1.5" to near 6" of rain fell over far eastern KS (Fig. 4), affecting the Neosho River basin. This water resulted in minor flooding along the Neosho River near Commerce (see preliminary hydrographs at the end of this report; see E3 Report for details).

Early in the morning of the 2<sup>nd</sup>, a band of showers and thunderstorms developed across eastern KS as a result of isentropic lift within a very moist airmass. This band continued to develop southward into north central/northeast OK through the morning hours, producing heavy rain across eastern Kay, western Osage, Pawnee, and western Creek Counties. This activity weakened through the mid- to late-morning hours as it spread eastward. Light rain continued through the afternoon before mostly dissipating by mid-evening. Just before midnight, thunderstorms developed again west of Highway 75 within a zone of isentropic lift to the north and east of a surface frontal boundary as an upper-level disturbance embedded within the north-northwest flow aloft moved into the region. This activity then dissipated around noon on the 3<sup>rd</sup>. Meanwhile, new showers and thunderstorms developed further east across far eastern OK and northwest AR in another zone of isentropic lift. These scattered showers and thunderstorms continued through the afternoon hours and dissipated by mid-evening. By 7am CDT 8/03/2019, 1"-4" of rain had fallen across eastern Kay, western Osage, Pawnee, and Creek Counties (Fig. 5), and an additional 1"-5" fell between 7am and noon (Fig. 6). The scattered showers and thunderstorms produced isolated areas of 1.5"-3" (Fig. 6).

Several rounds of rain affected the Neosho River basin in southeast KS during the afternoon and evening hours on the 7<sup>th</sup>. A line of showers and thunderstorms developed along an outflow boundary from this activity over northwest AR and adjacent OK counties during the afternoon hours. Later that night, new convection developed over southeast KS and continued to develop south into northeast OK and northwest AR around midnight. These thunderstorms continued through the early to mid-morning hours, generally along and north of Highway 412. By 7 am on the 8<sup>th</sup>, rainfall totals across far northeast OK and northwest AR were 0.25" to around 3" (Fig. 7). Moderate flooding occurred along the Neosho River near Commerce from this rainfall (see preliminary hydrographs at the end of this report; see E3 Report for details). This rainfall also resulted in rises along the Verdigris River near Lenapah, though the river crested just below flood stage.



As a surface boundary sagged south, more showers and thunderstorms developed along it from southwest OK to northeast OK. The southern portion of this line died out by noon, with showers and thunderstorms continuing across northeast OK and northwest AR through the afternoon. Convection renewed along the boundary from southeast OK into northwest AR mid-evening. As the front stalled out, more convection developed near it, from Ponca City, OK to Ozark, AR, after midnight on the 9<sup>th</sup> as another upper-level wave interacted with a low-level jet and warm air advection near the front. By 7 am on the 9<sup>th</sup>, rainfall totals ranged from a few hundredths to near 6", with the heaviest widespread rainfall over Washington, Crawford, and Franklin Counties in west central AR (Fig. 8). This rainfall resulted in a quick rise along the Mulberry River near Mulberry, though the river remained just below flood stage. Flash flooding was reported in Mountainburg, AR (Crawford County), where multiple homes were flooded (up to 14" of water in some), water rescues were required, several roads were closed, and a bridge was washed out. Other parts of Crawford County, as well as areas of Franklin County, reported numerous road closures due to flash flooding. Bands of elevated showers and thunderstorms continued through the morning across eastern OK and northwest AR within a convergent zone of the low-level jet. Precipitable water values were over 2", resulting in additional heavy rainfall from the strongest of the storms. Most of the rain came to an end by early afternoon. Shortly after midnight on the 10<sup>th</sup>, showers and thunderstorms once again developed across northeast OK and northwest AR, continuing through the mid-morning hours before dissipating or moving out of the area. Rainfall totals by 7 am on the 10<sup>th</sup> ranged from around one tenth of an inch to around 5" (Fig. 9).

The 7-day rainfall total ending on the morning of August 12 was a widespread 2"-4" and localized areas of 4"-6" from west central AR, through northeast OK, and into southeast KS (Fig. 10). The 14-day rainfall was widespread 2"-5" with several pockets of 5"-10" (Fig. 11). Rainfall over the mid- to upper-Neosho River basin on the 10<sup>th</sup>-12<sup>th</sup> resulted in another minor flood along the Neosho River near Commerce as the flood wave moved downstream (see preliminary hydrographs at the end of this report; see E3 Report for details).

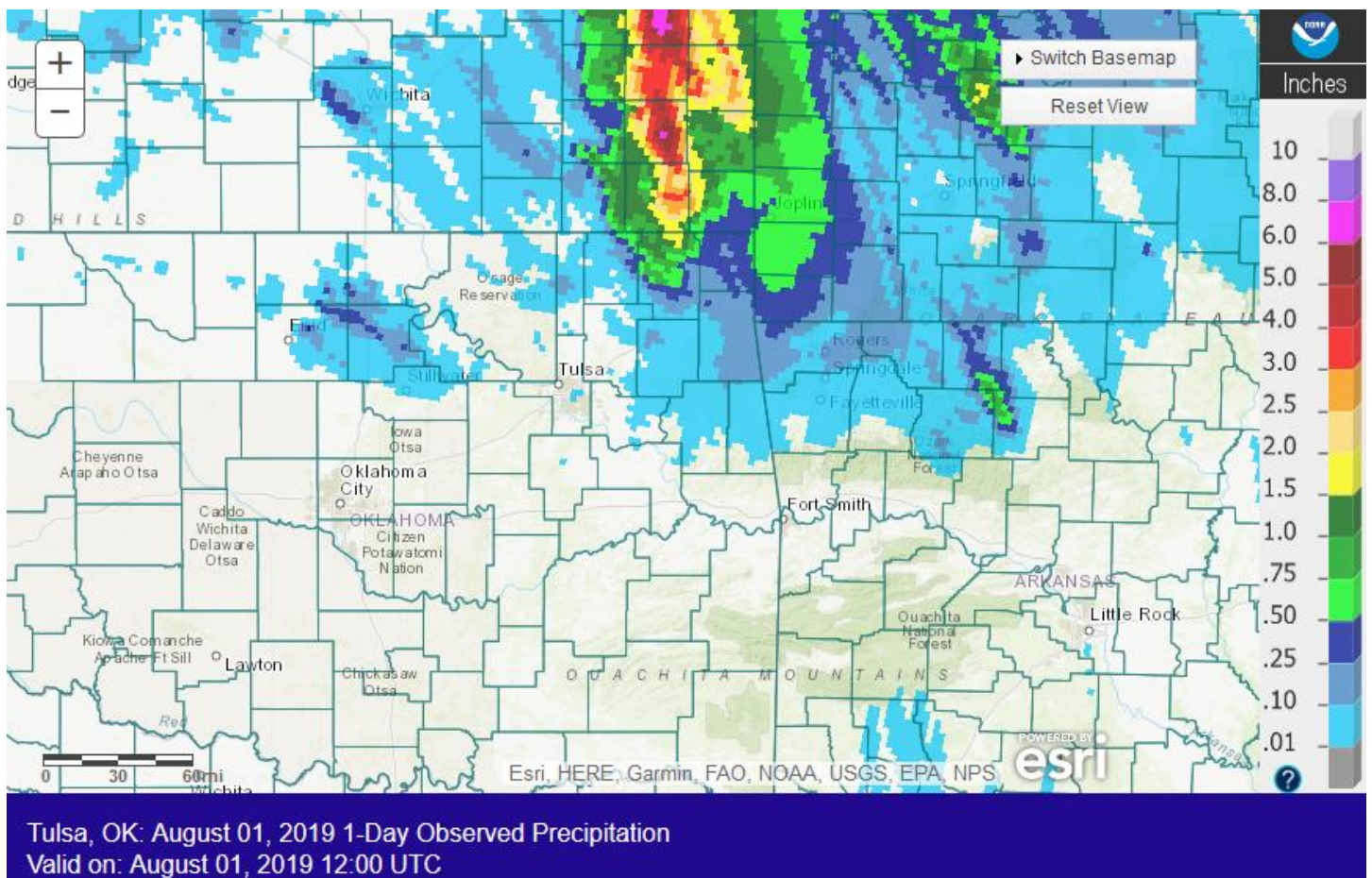
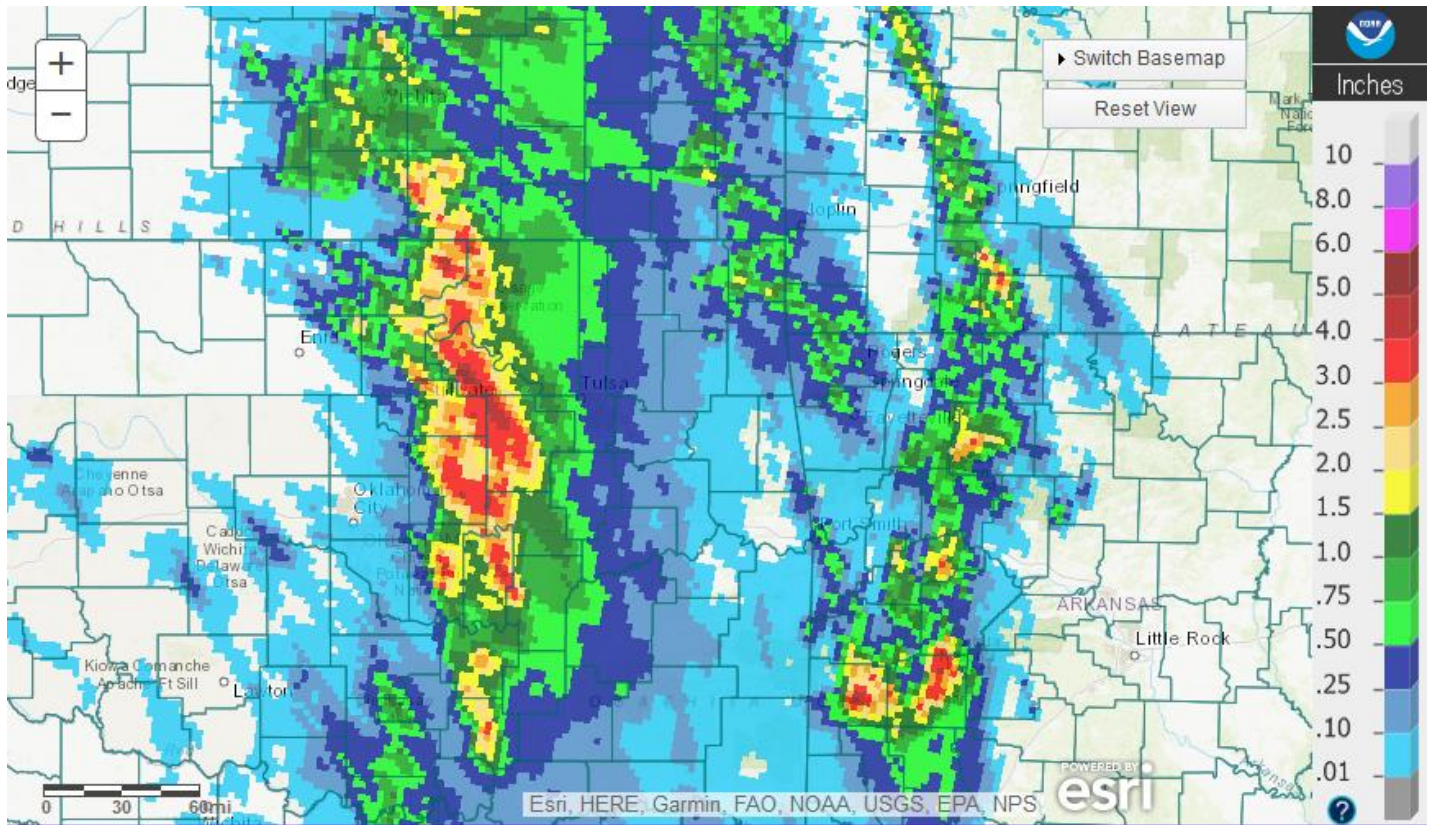


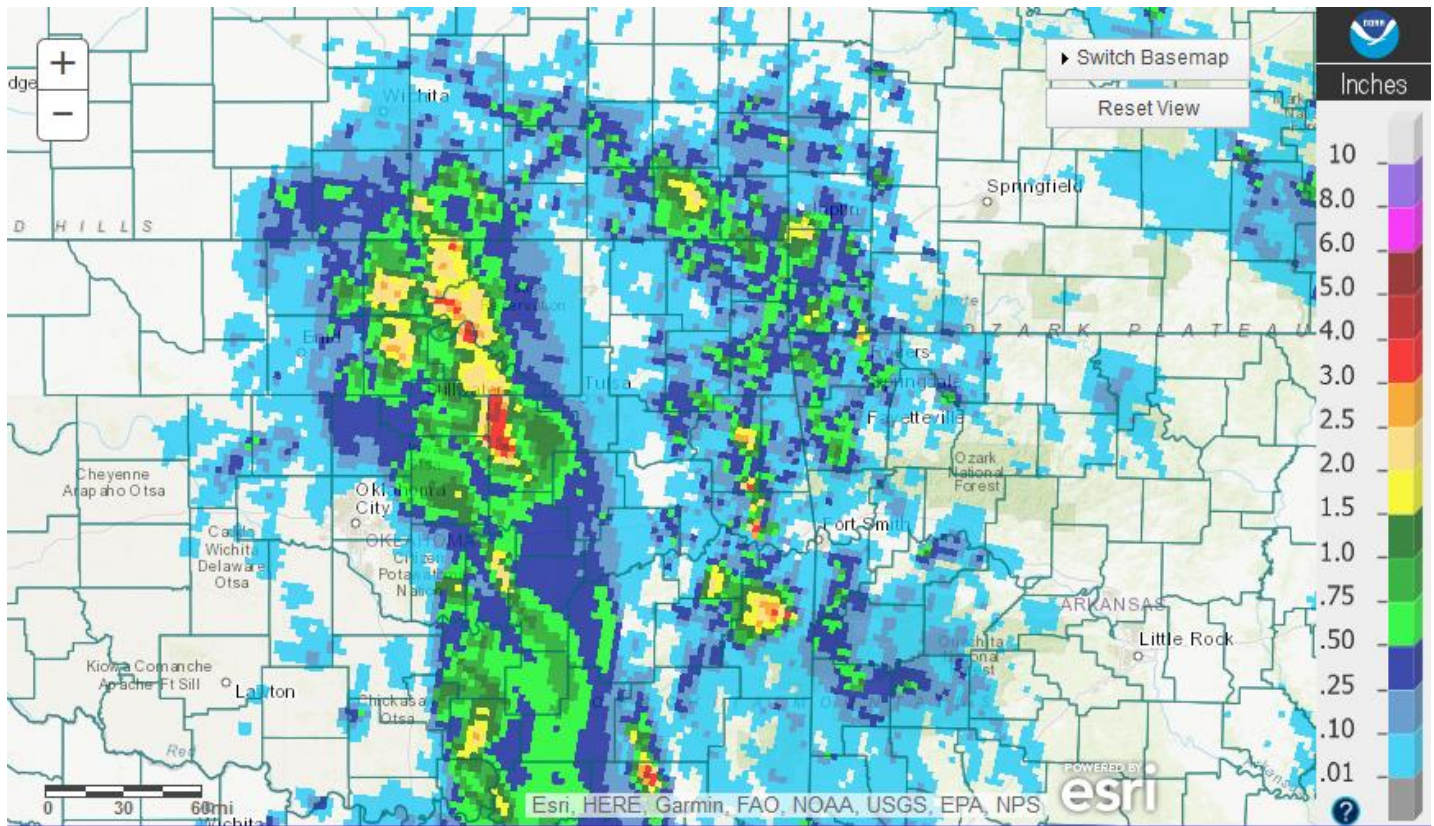
Fig. 4. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/01/2019.





Tulsa, OK: August 03, 2019 1-Day Observed Precipitation  
Valid on: August 03, 2019 12:00 UTC

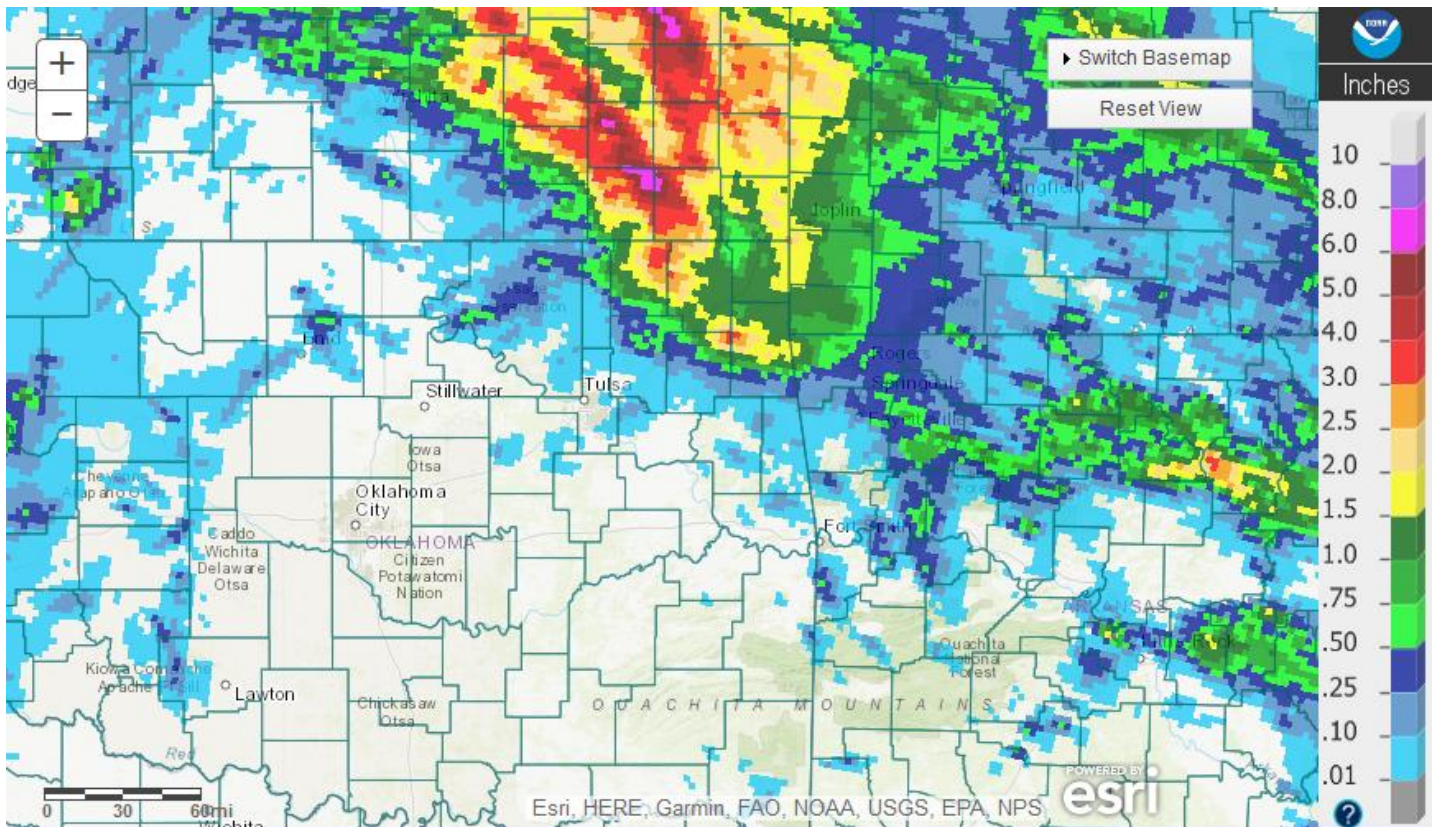
Fig. 5. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/03/2019.



Tulsa, OK: August 04, 2019 1-Day Observed Precipitation  
Valid on: August 04, 2019 12:00 UTC

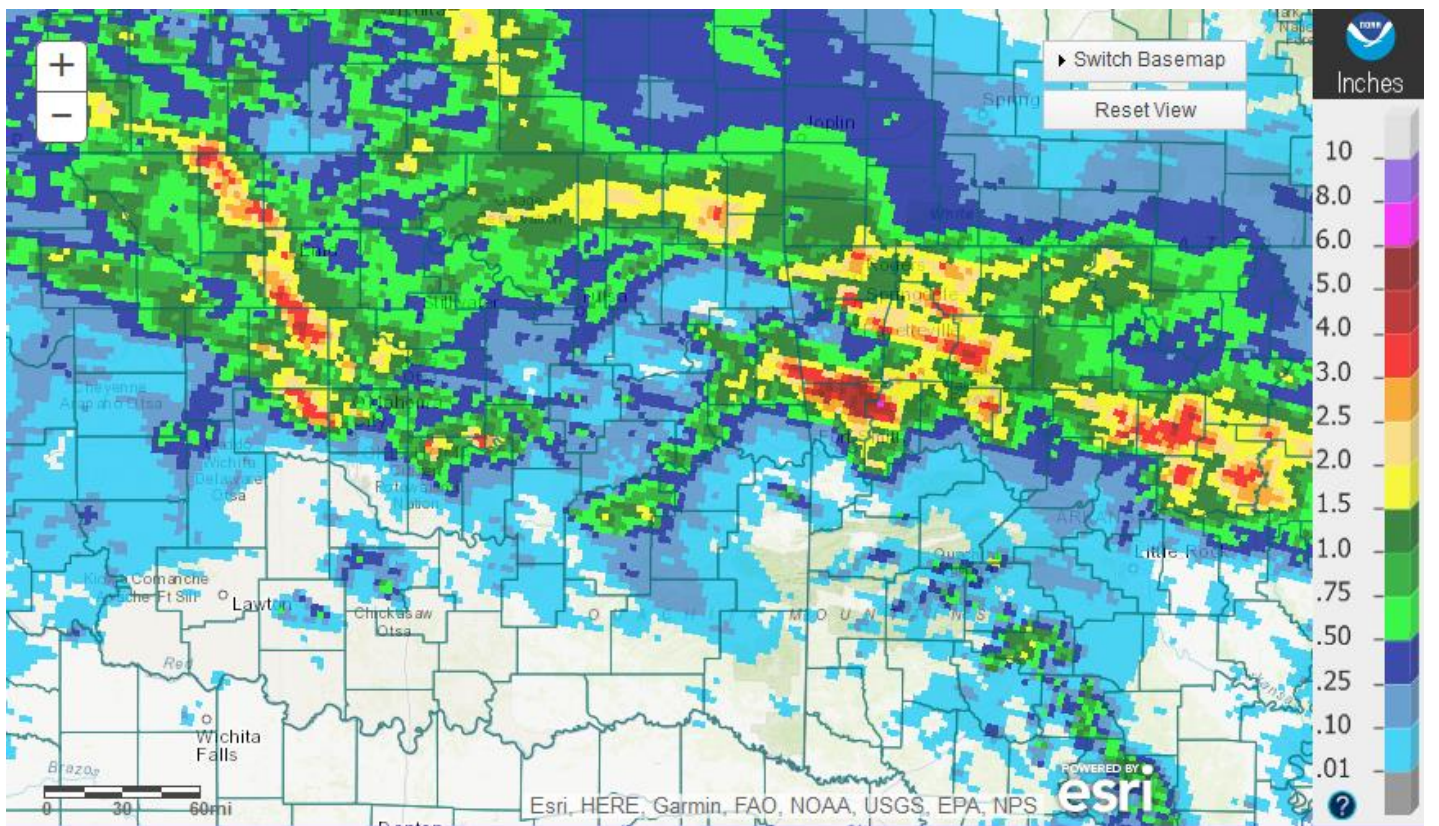
Fig. 6. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/04/2019.





Tulsa, OK: August 08, 2019 1-Day Observed Precipitation  
Valid on: August 08, 2019 12:00 UTC

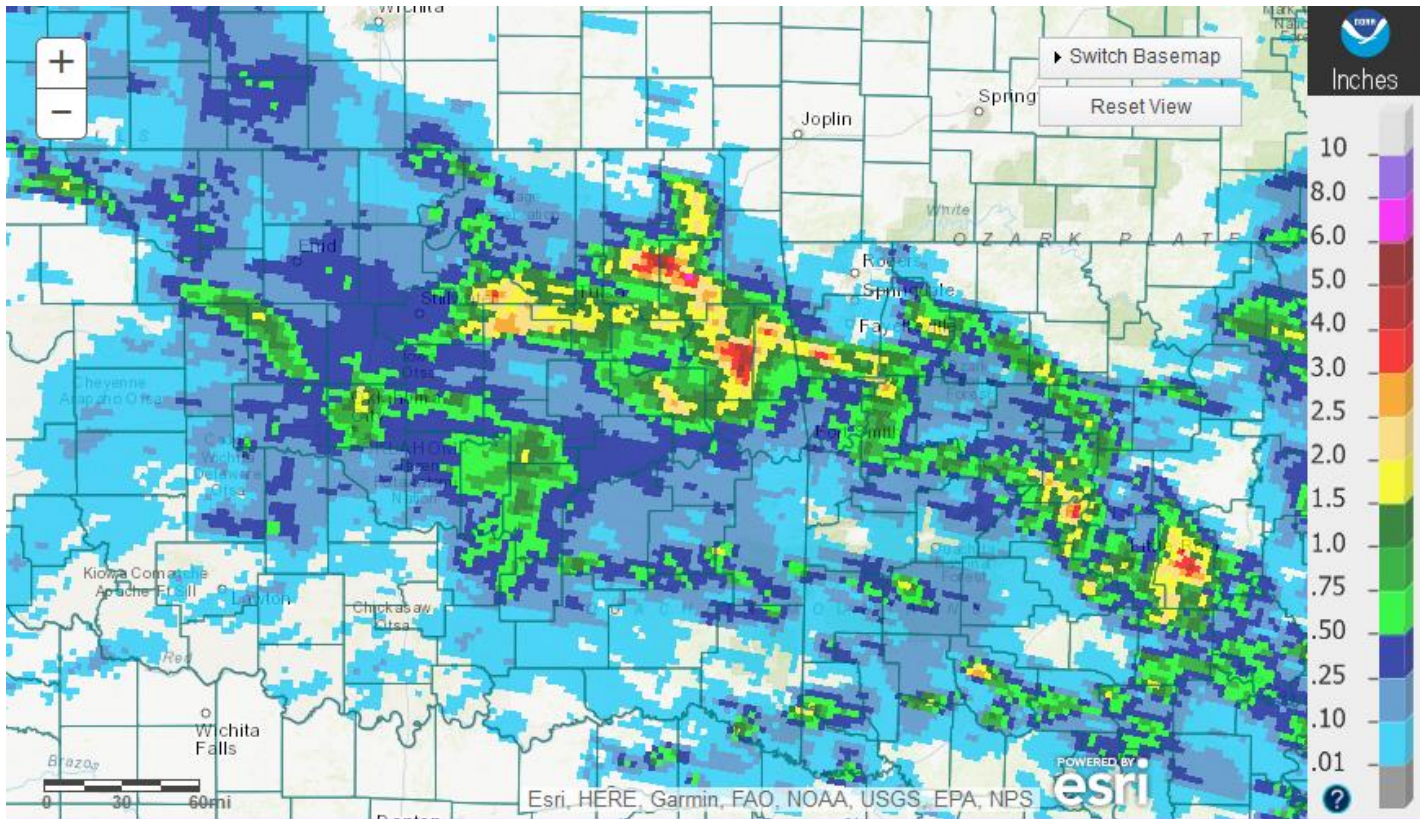
Fig. 7. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/08/2019.



Tulsa, OK: August 09, 2019 1-Day Observed Precipitation  
Valid on: August 09, 2019 12:00 UTC

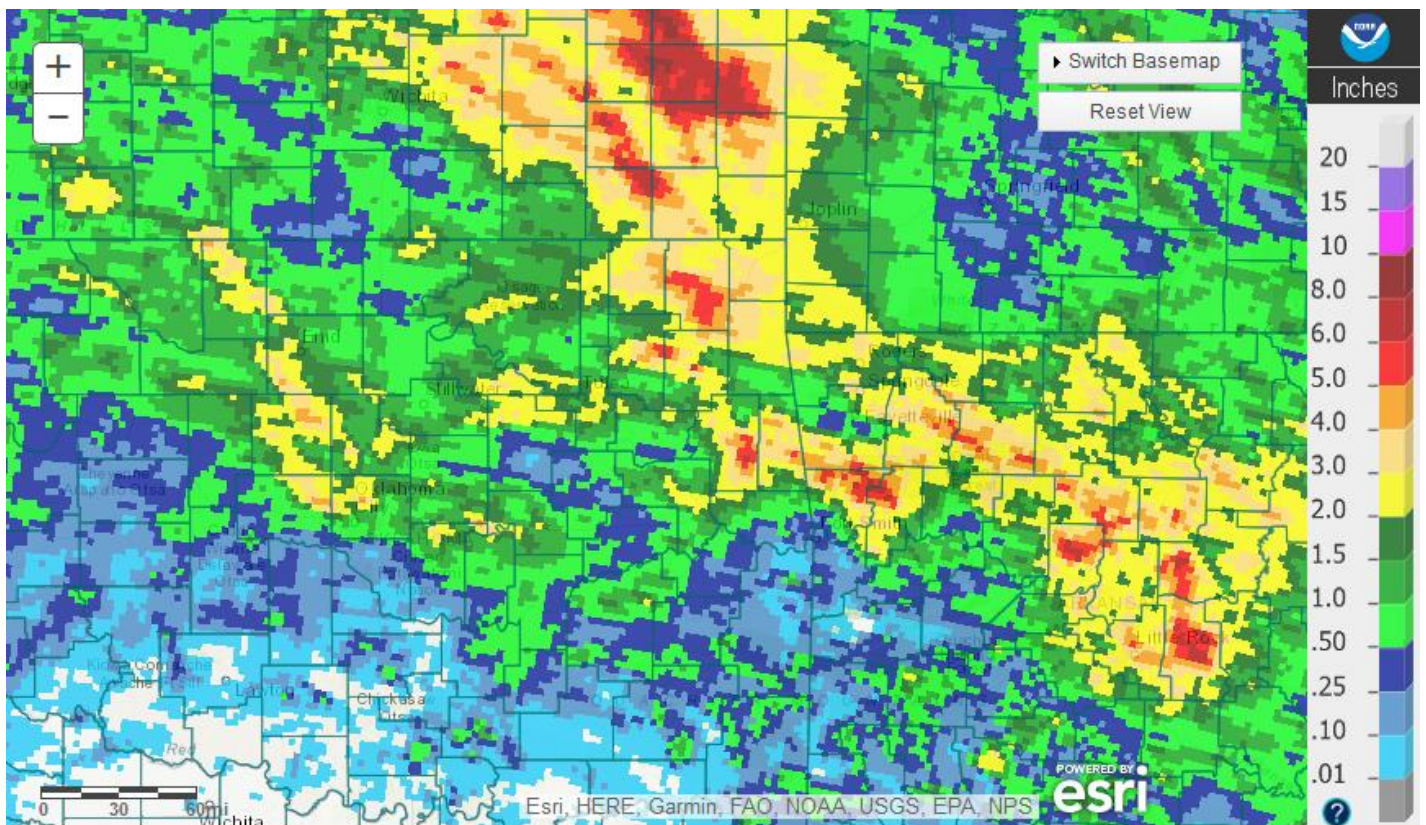
Fig. 8. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/09/2019.





Tulsa, OK: August 10, 2019 1-Day Observed Precipitation  
Valid on: August 10, 2019 12:00 UTC

Fig. 9. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/10/2019.



Tulsa, OK: Last 7-Day Observed Precipitation  
Valid on: August 12, 2019 12:00 UTC

Fig. 10. 7-day Estimated Observed Rainfall ending at 7am CDT 8/12/2019.



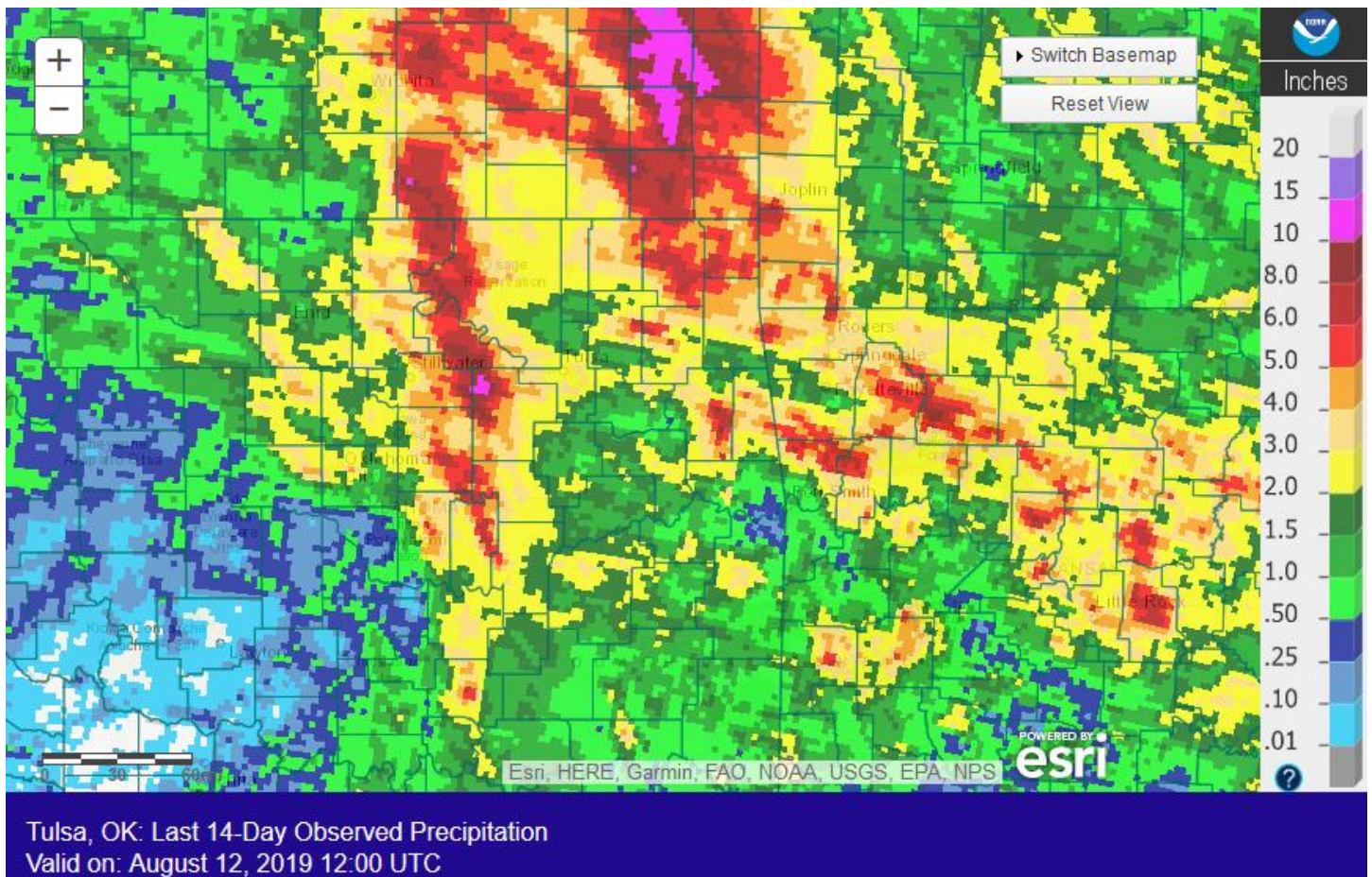


Fig. 11. 14-day Estimated Observed Rainfall ending at 7am CDT 8/12/2019.

Showers and thunderstorms developed during the early morning hours of the 16<sup>th</sup> along an outflow boundary across far southeast KS and northeast OK, and then continued through the morning and early afternoon hours across northeast OK and northwest AR. Isolated thunderstorms redeveloped across far northeast OK during the heat of the afternoon, then dissipated by mid-evening. Rainfall was generally around 0.25" to around 1", though there were isolated areas of 1" to around 1.5" of rain. Around sunrise on the 17<sup>th</sup>, showers and thunderstorms moved south out of southeast KS into northeast OK. Scattered convection continued across northeast OK through the morning and afternoon hours. A thunderstorm complex moved across KS after midnight on the 18<sup>th</sup>, and crossed into far northeast OK in the predawn hours. Most of the activity on the 17<sup>th</sup>-18<sup>th</sup> occurred across the counties that border the OK/KS state line, bringing a total of 0.50"-2.5" of rain by 7 am on the 18<sup>th</sup>. The multiple rounds of rainfall over the lower portion of the Neosho River basin led to the river rising to within a few inches of flood stage near Commerce on the 18<sup>th</sup> (see preliminary hydrographs at the end of this report).

Scattered showers and thunderstorms developed over the area during the heat of the afternoon on the 21<sup>st</sup> and then dissipated with the loss of heating by late evening. A change in the weather pattern from high heat and humidity to a more unsettled pattern began on the 22<sup>nd</sup>, as a surface boundary sagged into the region and became nearly stationary. A series of mid-level shortwaves, embedded within west-northwest flow aloft, interacted with the boundary, resulting in numerous rounds of rain through the 27<sup>th</sup>. The first round of rain occurred around midnight on the 22<sup>nd</sup> along the OK/KS border, driven by outflow from southern KS storms. This activity continued through the morning hours across northeast OK and northwest AR. Rainfall totals ranged from 0.10" to 4", with widespread 1"-3" near the OK/KS state line (Figs. 12, 13).

During the late afternoon of the 22<sup>nd</sup>, thunderstorms developed from east central OK into northwest AR. These storms continued across far east central OK and west central AR through the evening. Meanwhile, a cluster of thunderstorms over central OK moved northeast into northeast OK and far northwest AR during the evening. Convection continued to develop after midnight on the 23<sup>rd</sup>, covering much of east central and northeast OK and northwest and west central AR, as considerable transport of moisture (precipitable water values of 1.5"-2") interacted with a quasi-stationary surface boundary just south of I-40. Far east central OK and west central AR received heavy rain for many hours before the storms dissipated around noon. By 7 am on the 23<sup>rd</sup>, widespread 1.5" to 4" of rain had fallen across northeast and east central OK and northwest and west central AR, with the heaviest rainfall of 3"-8" occurring along the Arkansas River Valley (Figs. 14-16).

After only a short break from the rain, showers and thunderstorms once again developed near the I-40 corridor, in response to a left-over mesoscale convective vortex (MCV), shortly after midnight on the 24<sup>th</sup> and continued until shortly after noon. Additional heavy rain fell across the same region that was recently saturated, causing additional flash flooding and, unfortunately, a fatality when a 47-year old woman delivering newspapers in Fort Smith, AR drove into water over a road early on the 24<sup>th</sup>. Sebastian County Emergency Management reported 64 homes experienced flooding (38 in Fort Smith, 19 in Lavaca, and 7 in Barling) from all of this rainfall. 24-hour rainfall totals by 7 am on the 24<sup>th</sup> ranged from 0.50" to around 3", with much higher totals of 3"-8" across southern Crawford, northern Sebastian, and southwestern Franklin Counties (Fig. 17). An additional 0.75"-3" of rain fell after 7 am through around noon (Fig. 18).

A weakening thunderstorm complex moved southeast into the area around sunrise on the 25<sup>th</sup>. A line of scattered showers and thunderstorms moved through most of eastern OK and northwest AR by mid-afternoon. Locations generally along and north of Highway 412 received widespread 0.25" to around 2" of rain, with scattered totals of around 0.75" or less elsewhere (Fig. 19). Through the morning of the 26<sup>th</sup>, the 7-day rainfall total ranged from 2"-12" across all of eastern OK and northwest AR, except for far southeast OK, which only received around 1" or less. The heaviest rainfall of 8"-12" in 7 days was across Sequoyah, northern Le Flore, Crawford, and Sebastian Counties (Figs. 20, 21). 5"-8" fell in parts of Osage, Creek, Tulsa, Okmulgee, Haskell, and Franklin Counties as well.

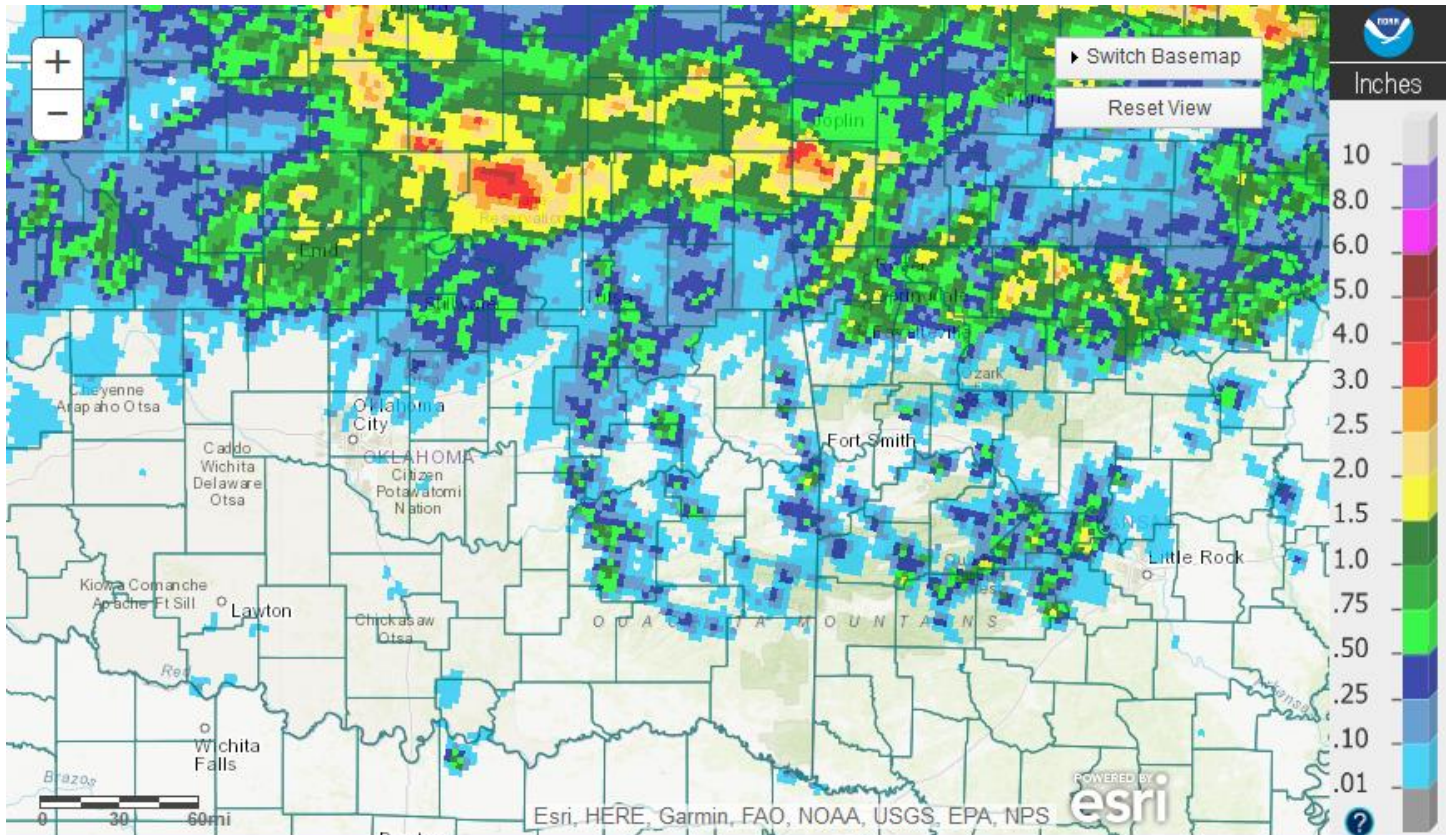
An advancing cold front encountered a very unstable airmass as it moved into northeast OK and northwest AR on the evening of the 26<sup>th</sup>. A line of scattered thunderstorms quickly developed north of I-44 mid-evening and progressed southeast through the overnight hours. The last of the rain moved south of the Red River into TX by mid-morning on the 27<sup>th</sup>. Despite a faster storm movement with this activity, high rain rates occurred due to precipitable water values near 2". Much of far eastern OK received 1"-2.5" of rain, with localized amounts of 2.5" to 4" (Figs. 22, 23). Across western AR, totals were 0.25" to near 1".

Rainfall totals over the 7 days ending on August 27 were 2"-12" in OK (Fig. 24). According to the Oklahoma Climatological Survey, the top-10 rainfall measurements in Oklahoma over the 7-days ending on the 27<sup>th</sup> were:

Webbers Falls	9.64"	Okmulgee	5.42"	Sallisaw	8.51"
Foraker	5.21"	Inola	5.98"	Hectorville	5.20"
Beaver	5.84"	Cookson	5.07"	Miami	5.63"
Pryor	5.02"				

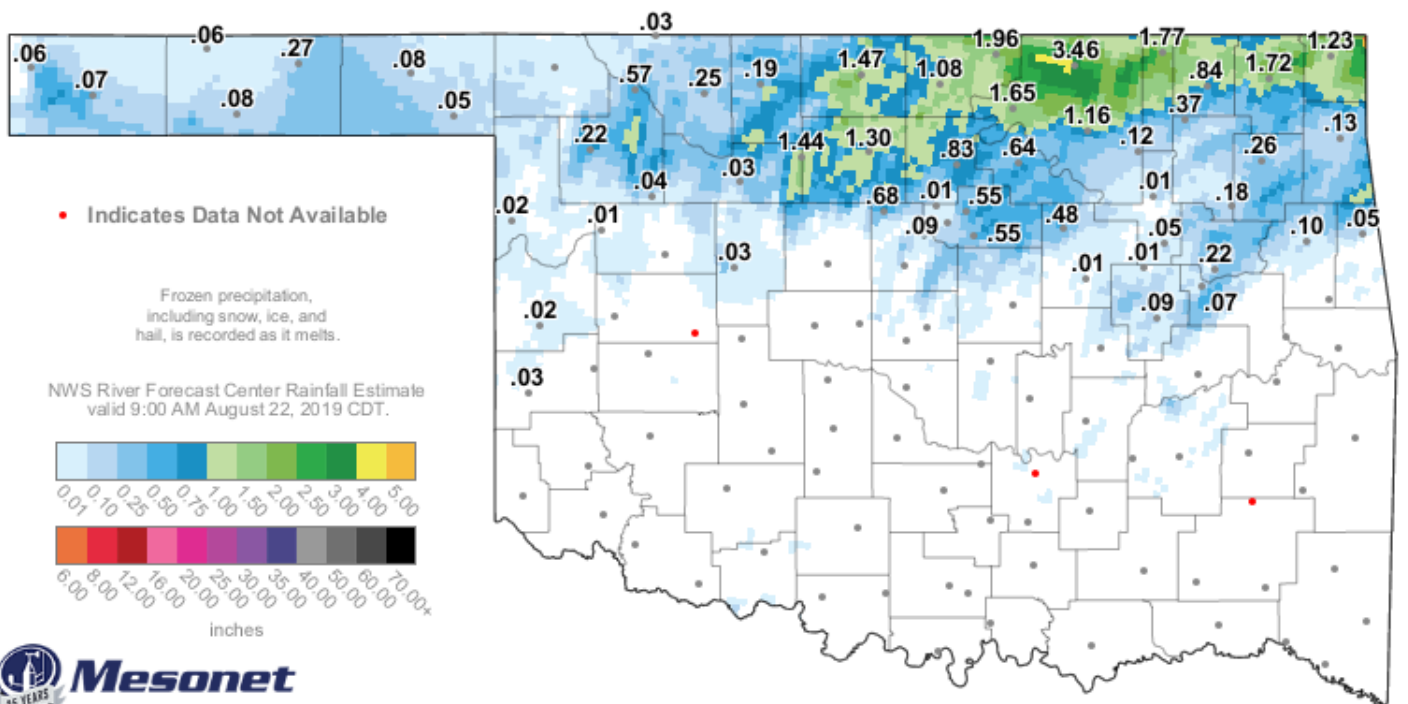
In the pre-dawn hours of the 30<sup>th</sup>, a line of thunderstorms moved out of KS into north central and northeast OK, continuing to the southeast across all of eastern OK and northwest AR through mid-morning hours. Some showers lingered through the afternoon across southeast OK. Rainfall totals were around 0.50" to around 1.5" for most of the area (Figs. 25-27).





Tulsa, OK: August 22, 2019 1-Day Observed Precipitation  
Valid on: August 22, 2019 12:00 UTC

Fig. 12. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/22/2019.

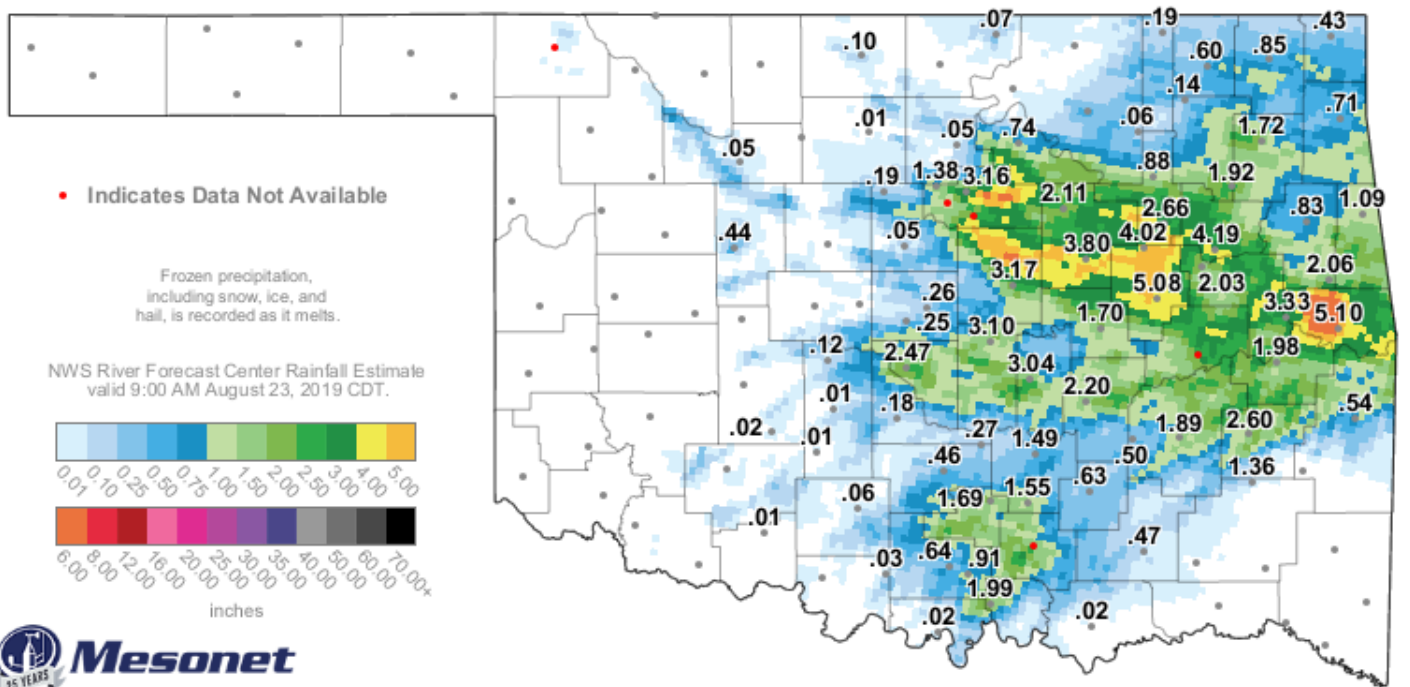


12-Hour Rainfall Accumulation (inches)

10:00 AM August 22, 2019 CDT

Created 10:05:54 AM August 22, 2019 CDT. © Copyright 2019

Fig. 13. OK Mesonet (values) and NWS RFC rainfall estimate (image) 12-hour rainfall ending at 10:00 am CDT 08/22/2019.

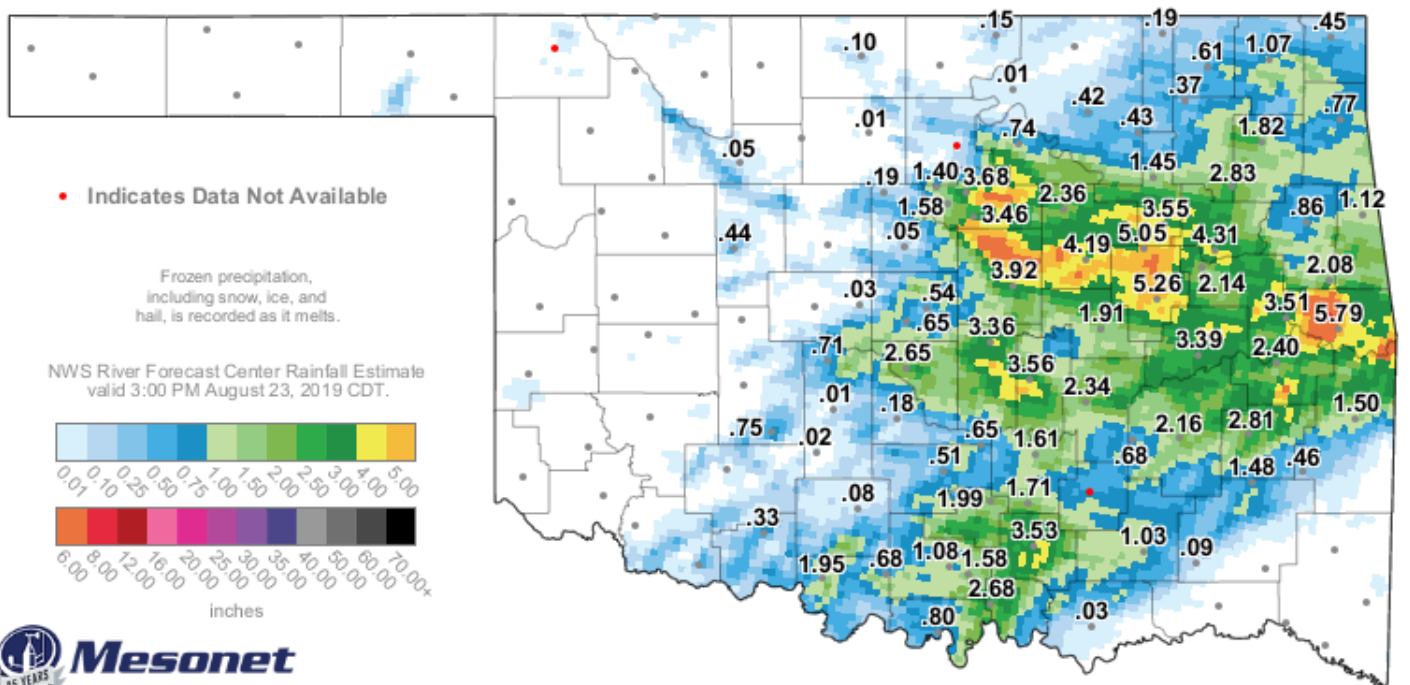


### 12-Hour Rainfall Accumulation (inches)

10:40 AM August 23, 2019 CDT

Created 10:45:56 AM August 23, 2019 CDT. © Copyright 2019

Fig. 14. OK Mesonet (values) and NWS RFC rainfall estimate (image) 12-hour rainfall ending at 10:40 am CDT 08/23/2019.



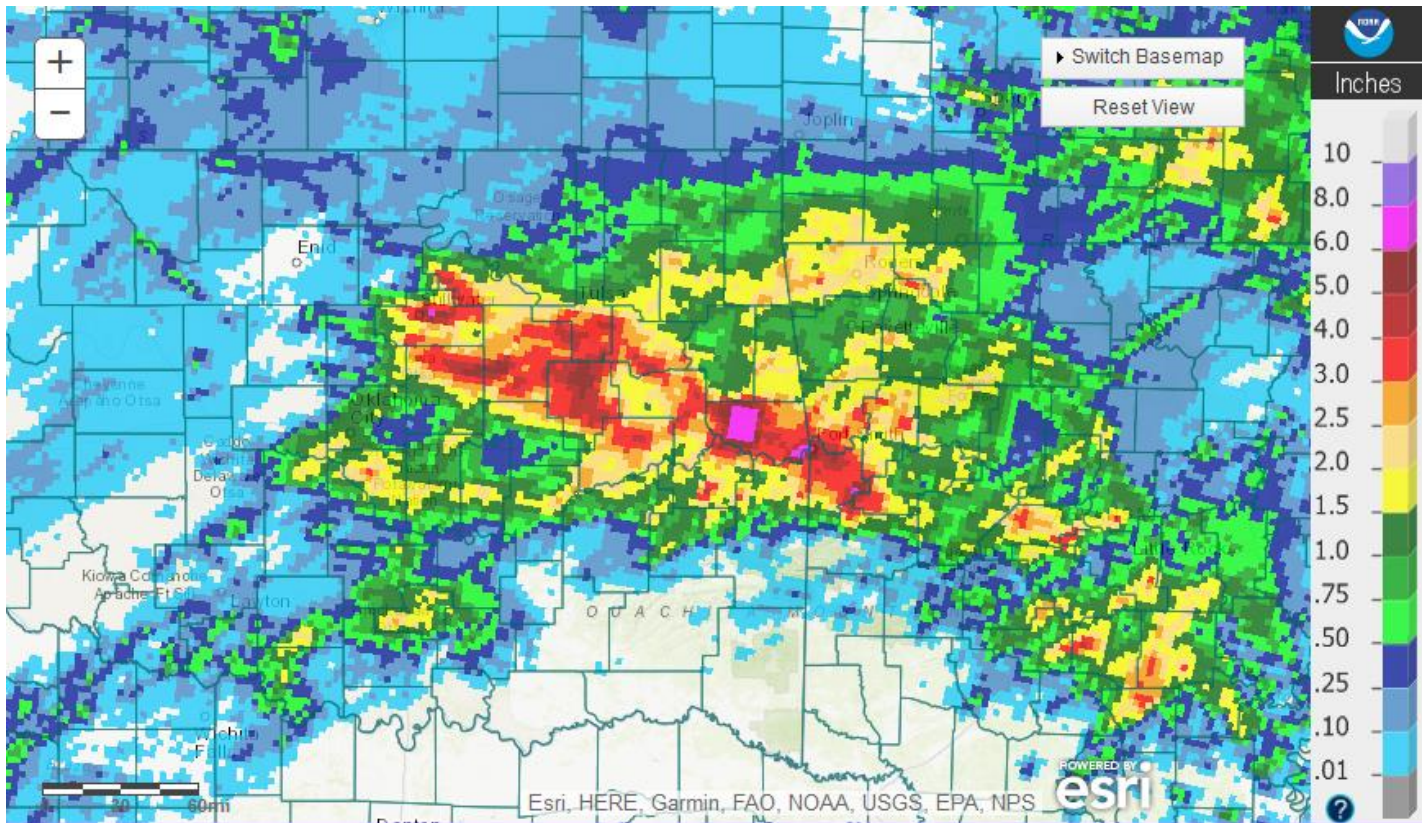
### 24-Hour Rainfall Accumulation (inches)

3:45 PM August 23, 2019 CDT

Created 3:50:55 PM August 23, 2019 CDT. © Copyright 2019

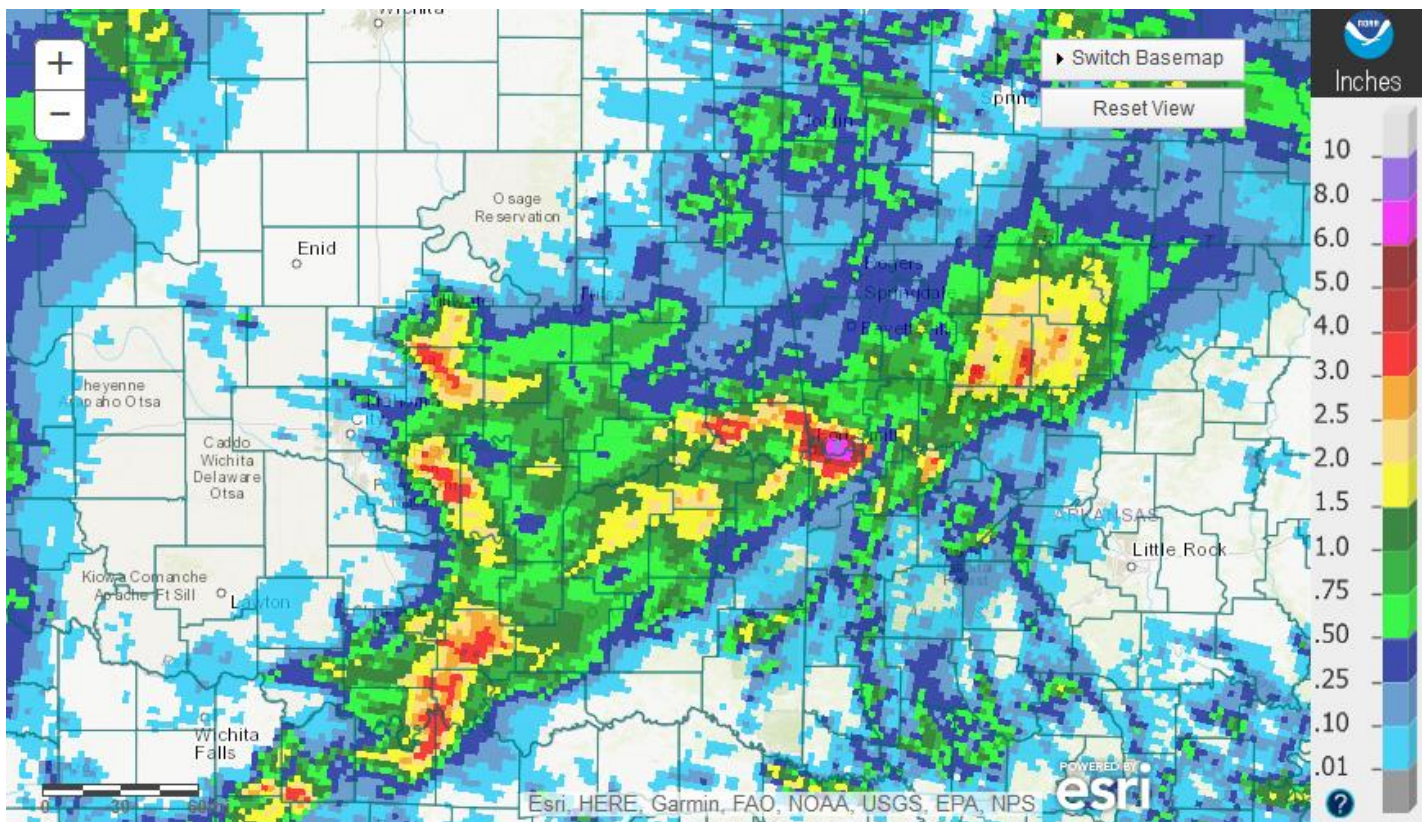
Fig. 15. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 3:45 pm CDT 08/23/2019.





Tulsa, OK: August 23, 2019 1-Day Observed Precipitation  
Valid on: August 23, 2019 12:00 UTC

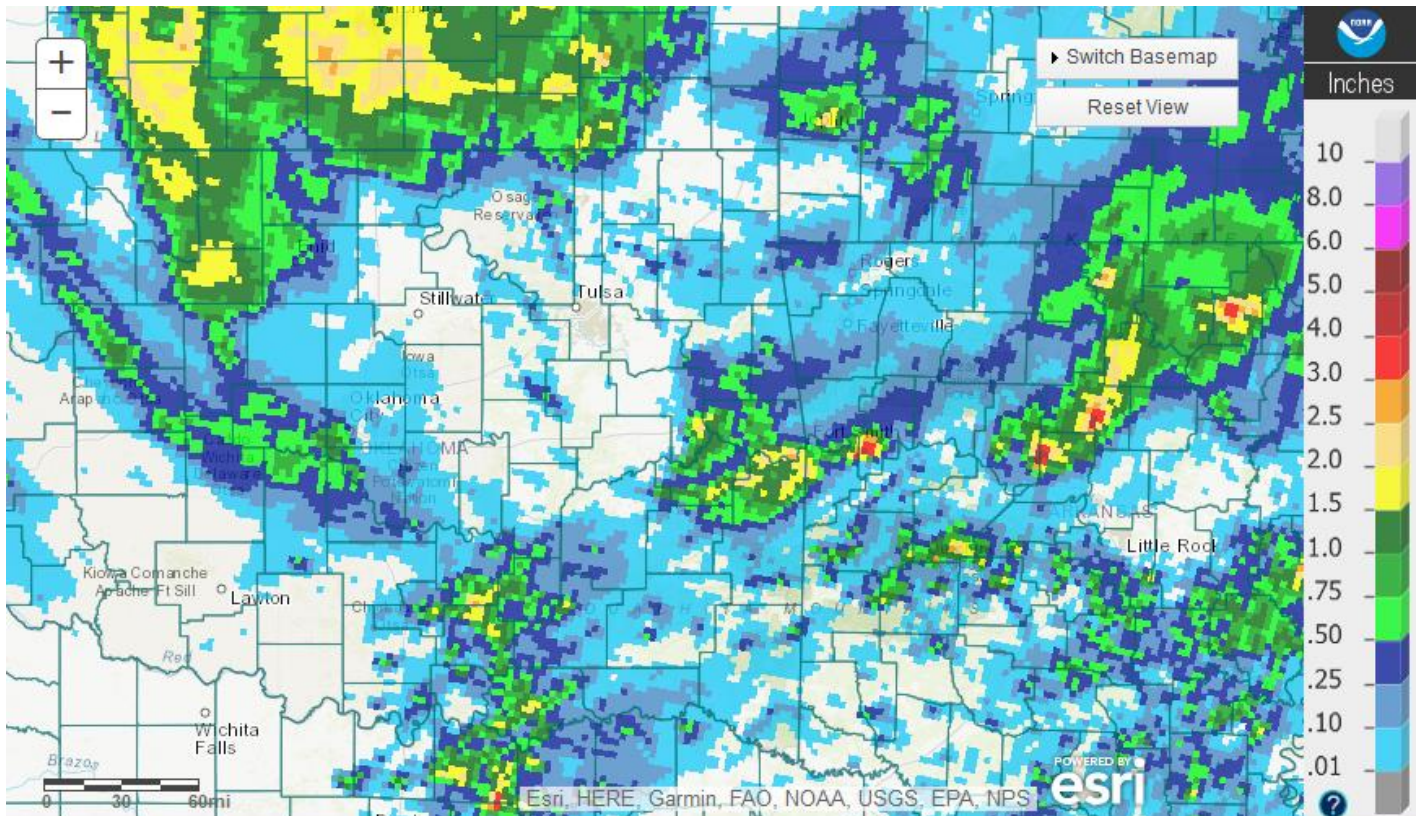
Fig. 16. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/23/2019.



Tulsa, OK: August 24, 2019 1-Day Observed Precipitation  
Valid on: August 24, 2019 12:00 UTC

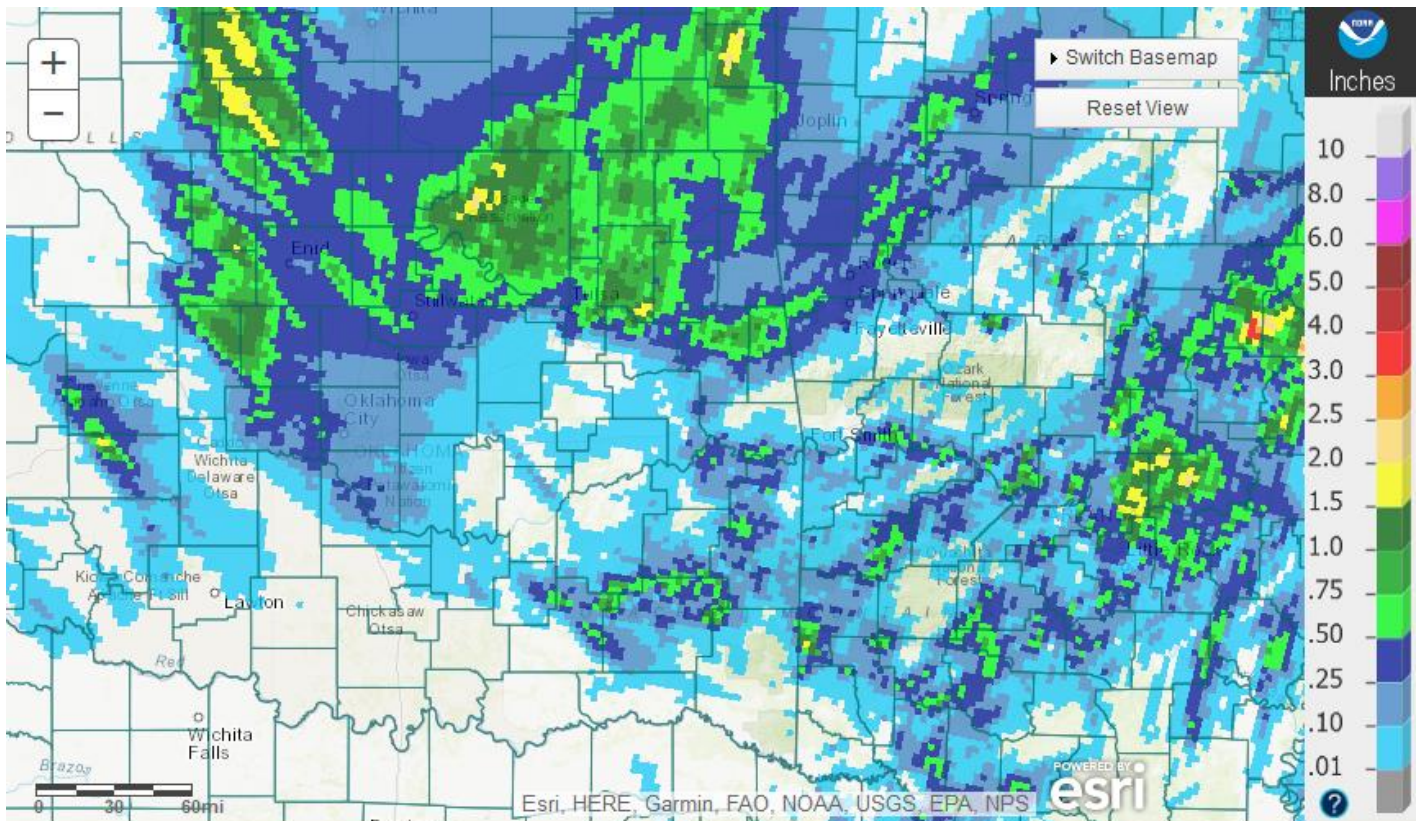
Fig. 17. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/24/2019.





Tulsa, OK: August 25, 2019 1-Day Observed Precipitation  
Valid on: August 25, 2019 12:00 UTC

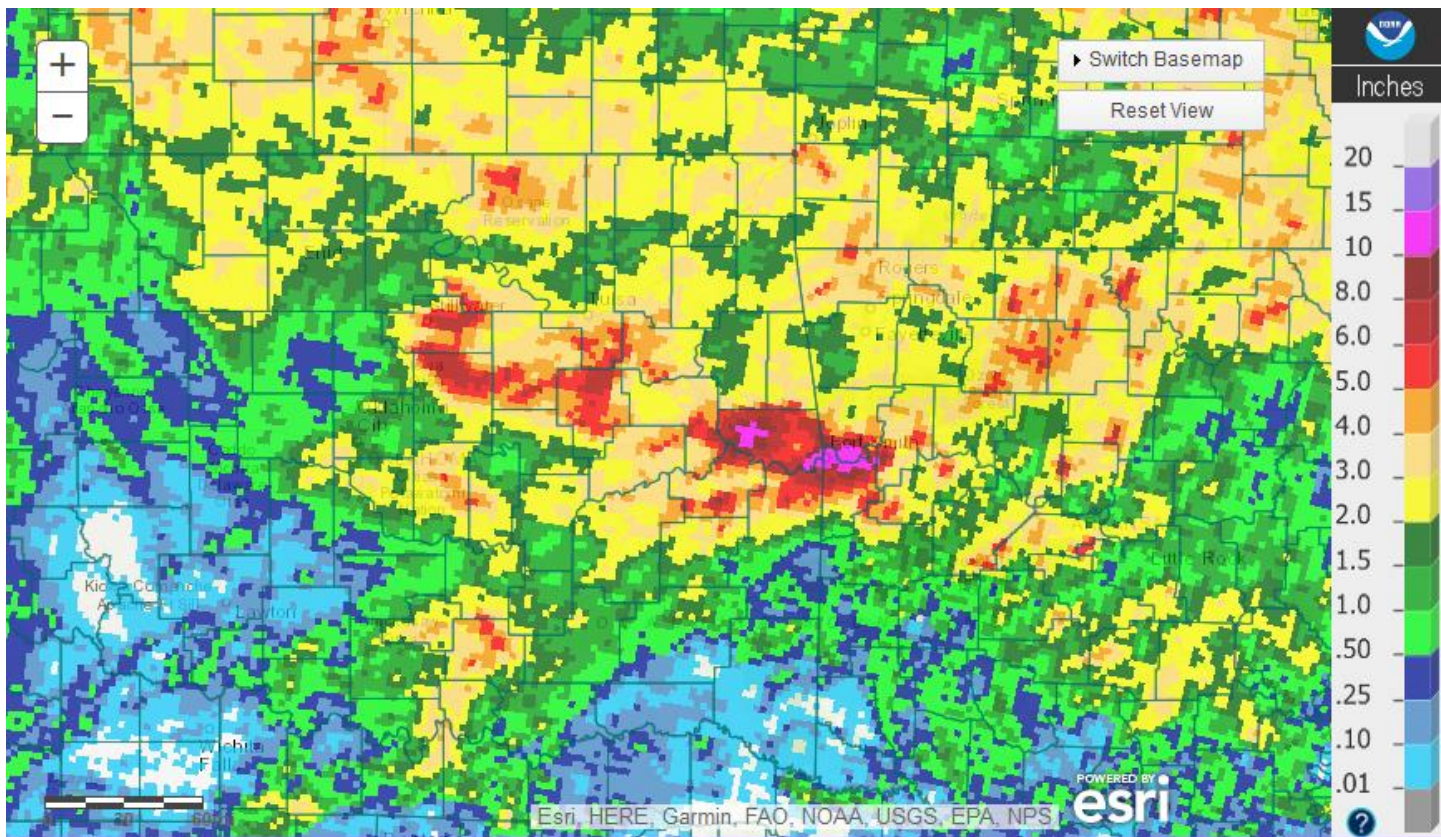
Fig. 18. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/25/2019.



Tulsa, OK: August 26, 2019 1-Day Observed Precipitation  
Valid on: August 26, 2019 12:00 UTC

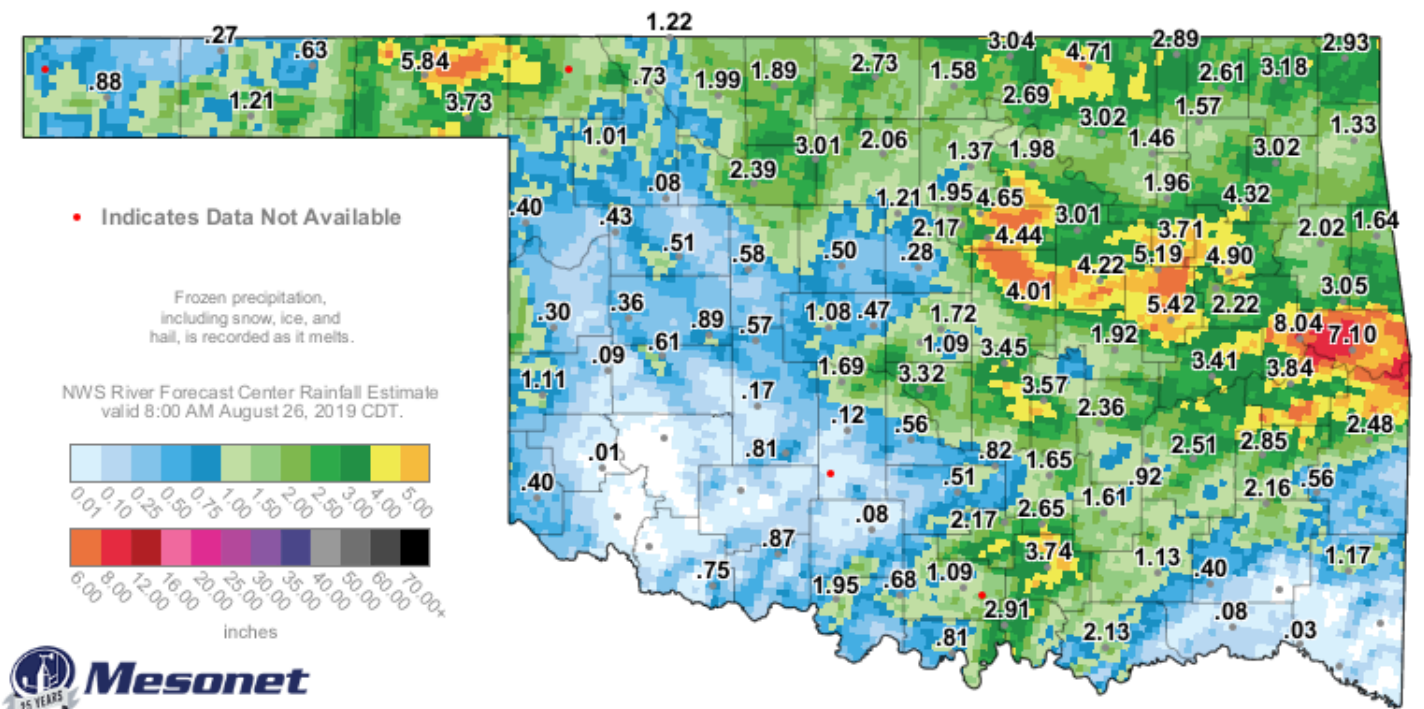
Fig. 19. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/26/2019.





Tulsa, OK: Last 7-Day Observed Precipitation  
Valid on: August 26, 2019 12:00 UTC

Fig. 20. 7-day Estimated Observed Rainfall ending at 7am CDT 8/26/2019.



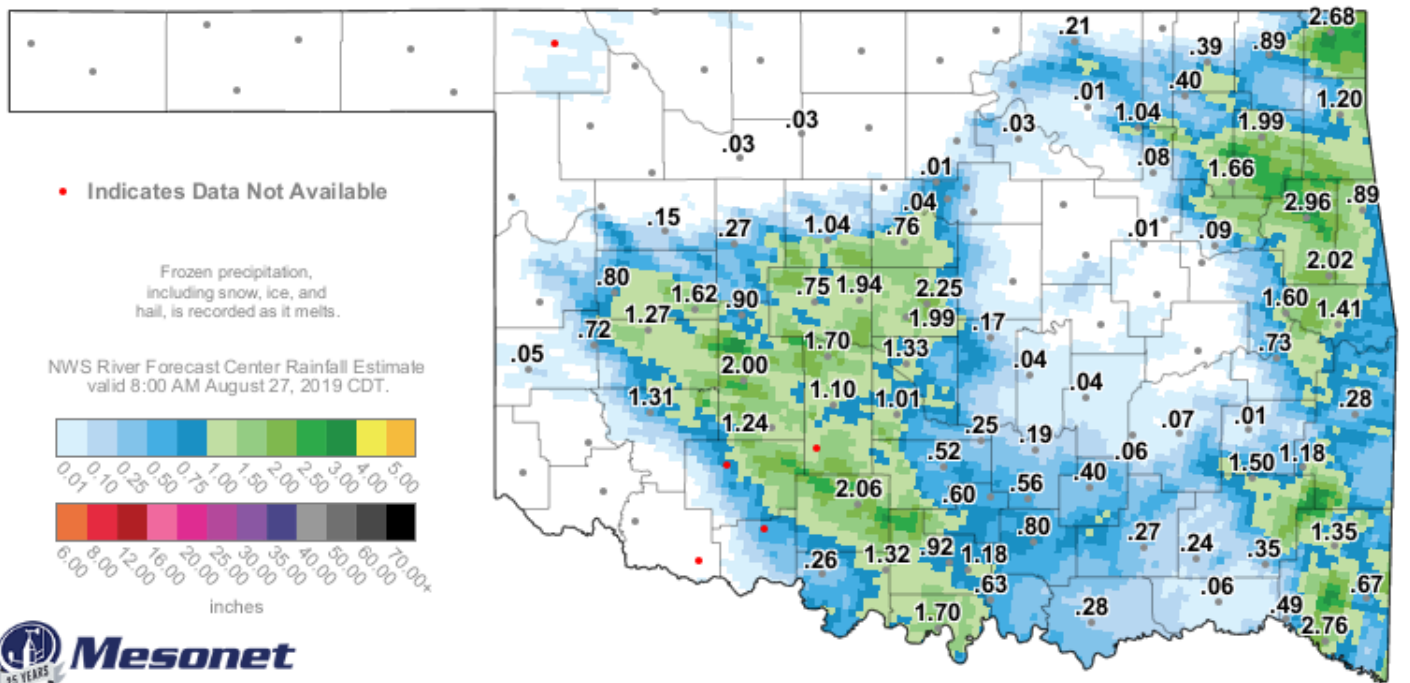
7-Day Rainfall Accumulation (inches)

9:10 AM August 26, 2019 CDT

Created 9:15:58 AM August 26, 2019 CDT. © Copyright 2019

Fig. 21. OK Mesonet (values) and NWS RFC rainfall estimate (image) 7-day rainfall ending at 9:10 am CDT 08/26/2019.



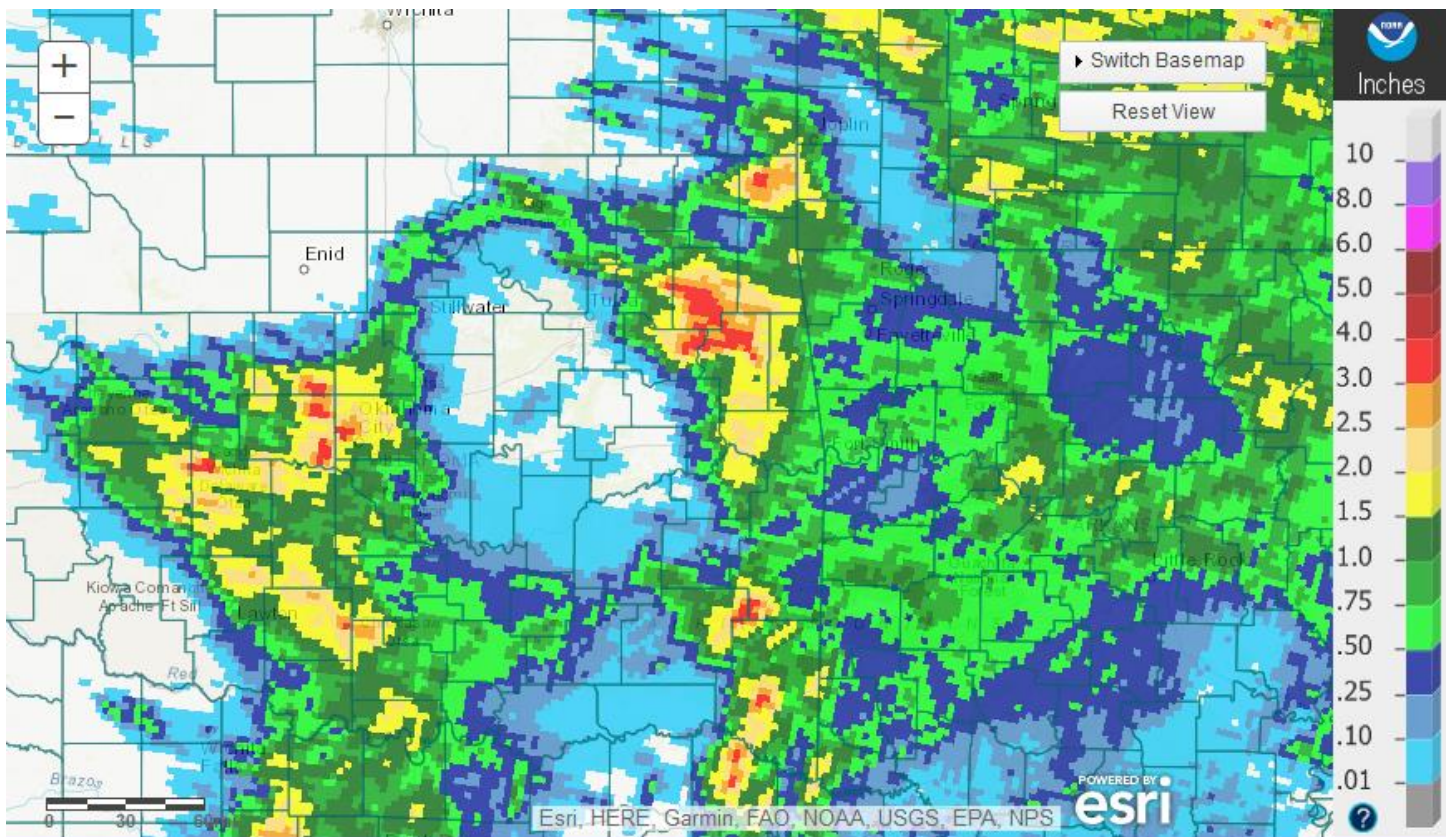


### 12-Hour Rainfall Accumulation (inches)

9:00 AM August 27, 2019 CDT

Created 9:05:55 AM August 27, 2019 CDT. © Copyright 2019

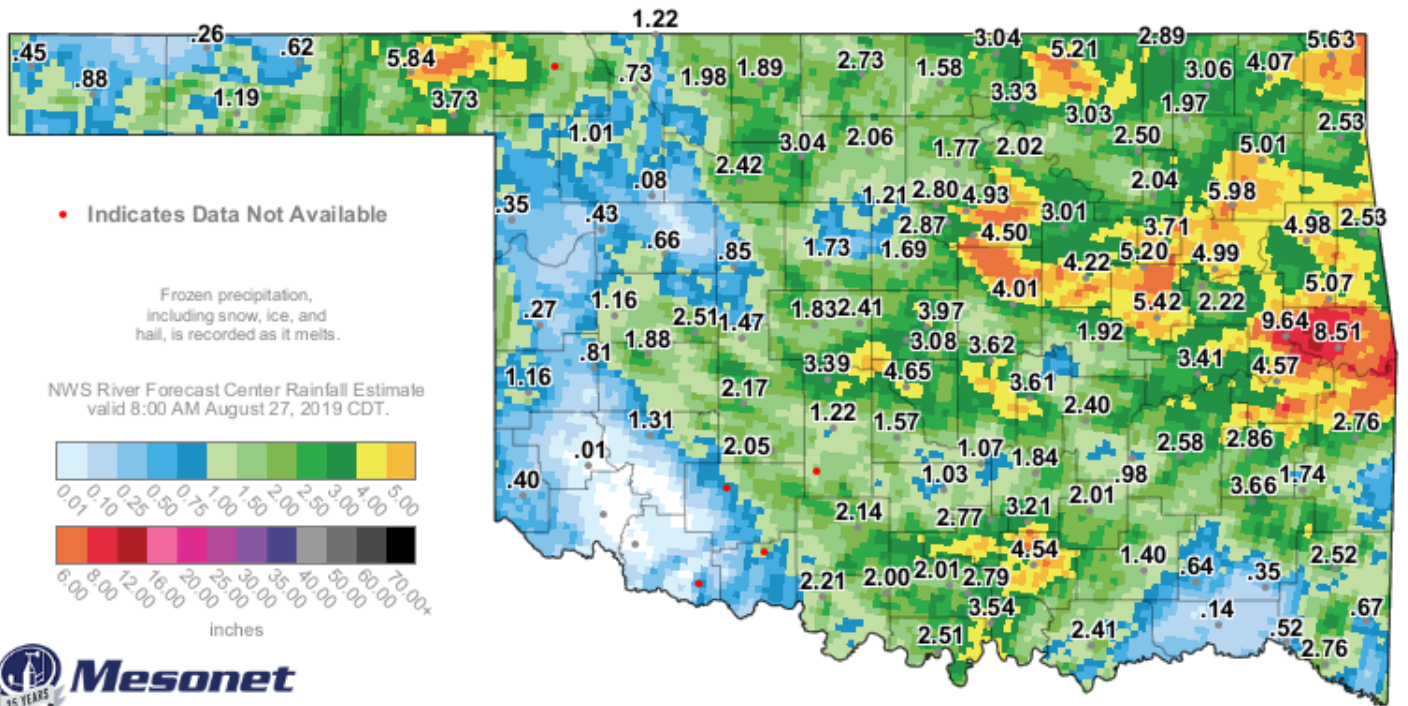
Fig. 22. OK Mesonet (values) and NWS RFC rainfall estimate (image) 12-hour rainfall ending at 9:00 am CDT 08/27/2019.



Tulsa, OK: August 27, 2019 1-Day Observed Precipitation  
Valid on: August 27, 2019 12:00 UTC

Fig. 23. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/27/2019.



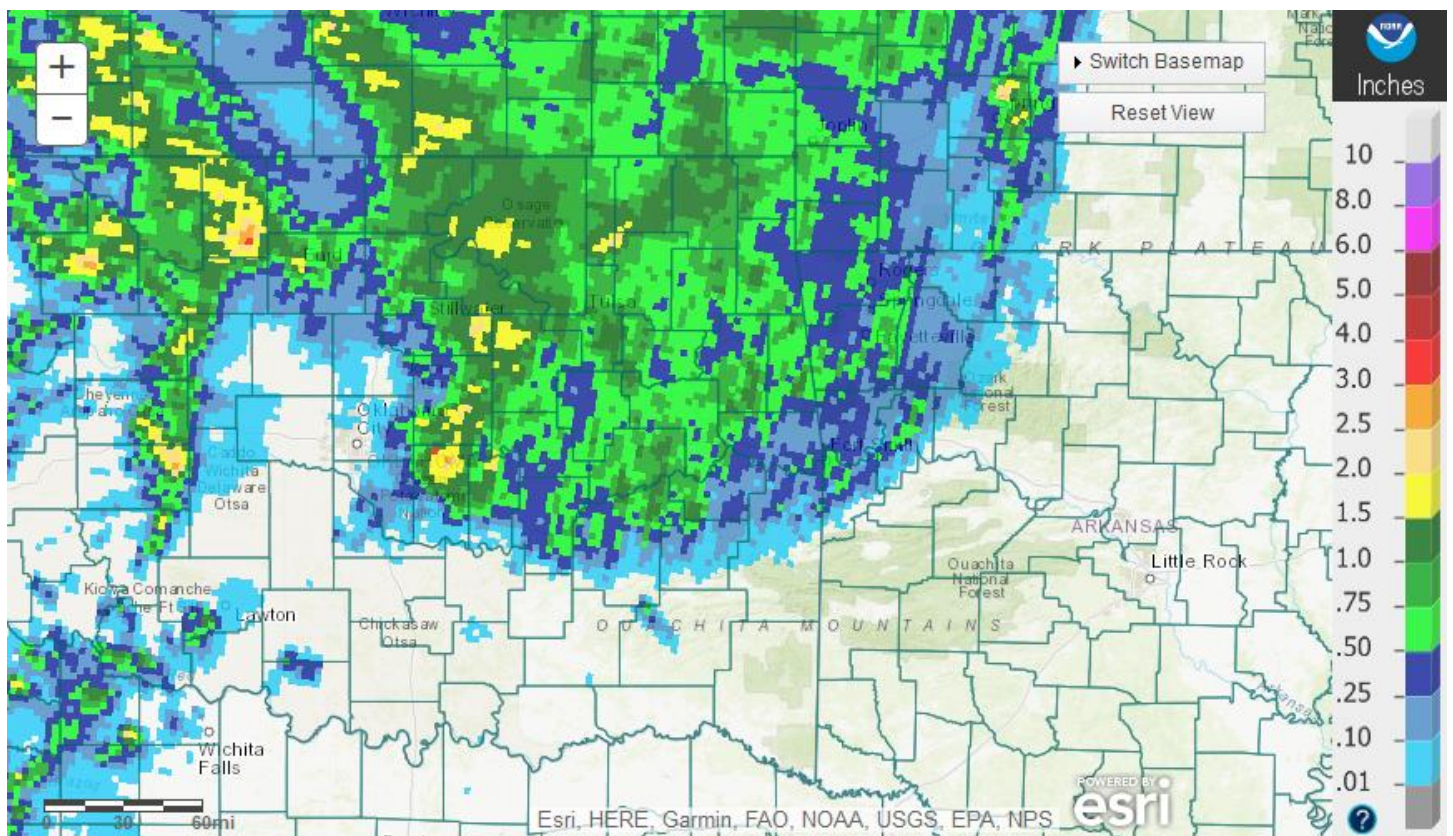


## 7-Day Rainfall Accumulation (inches)

9:00 AM August 27, 2019 CDT

Created 9:05:56 AM August 27, 2019 CDT. © Copyright 2019

Fig. 24. OK Mesonet (values) and NWS RFC rainfall estimate (image) 7-day rainfall ending at 9:00 am CDT 08/27/2019.

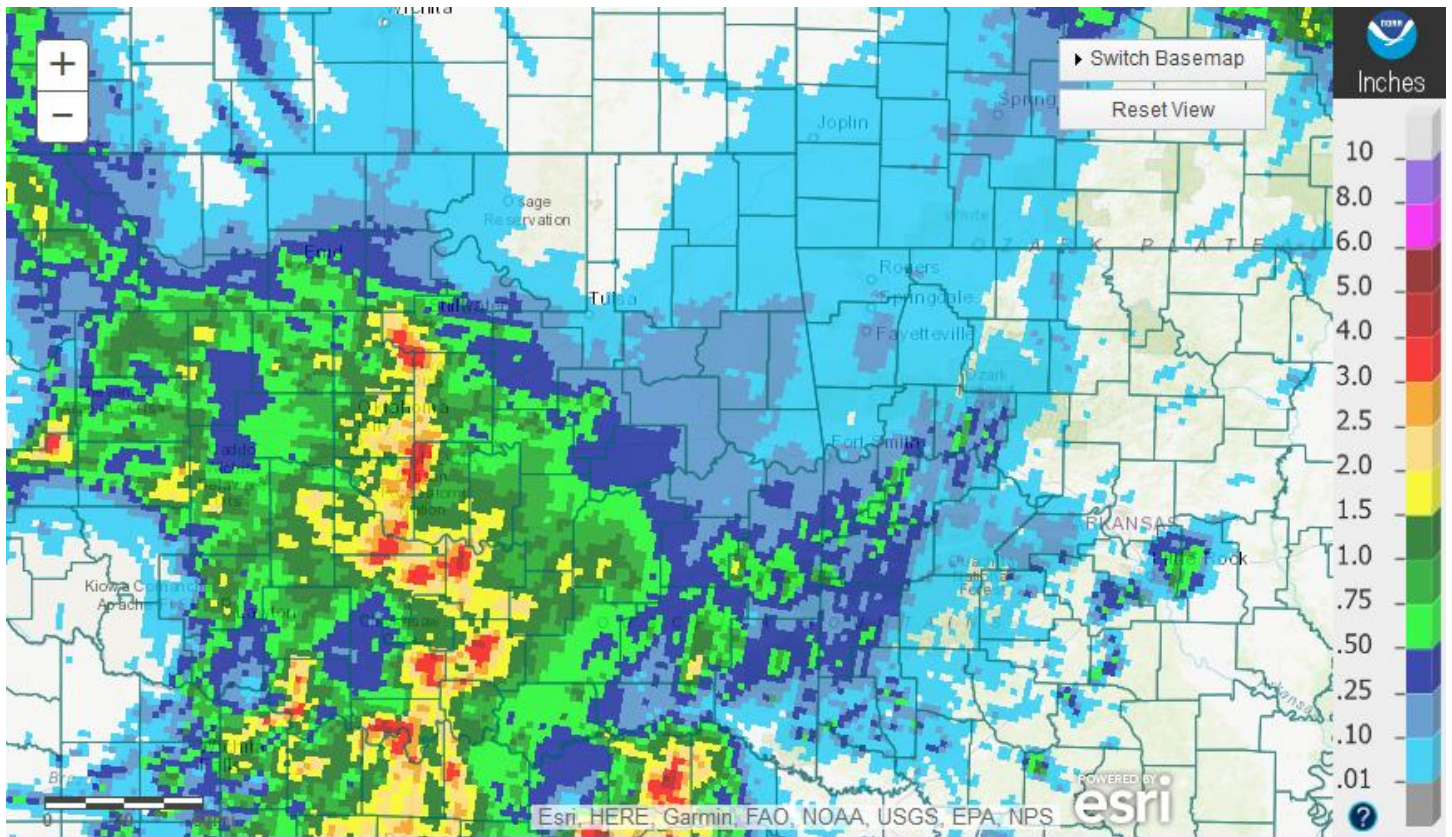


Tulsa, OK: August 30, 2019 1-Day Observed Precipitation

Valid on: August 30, 2019 12:00 UTC

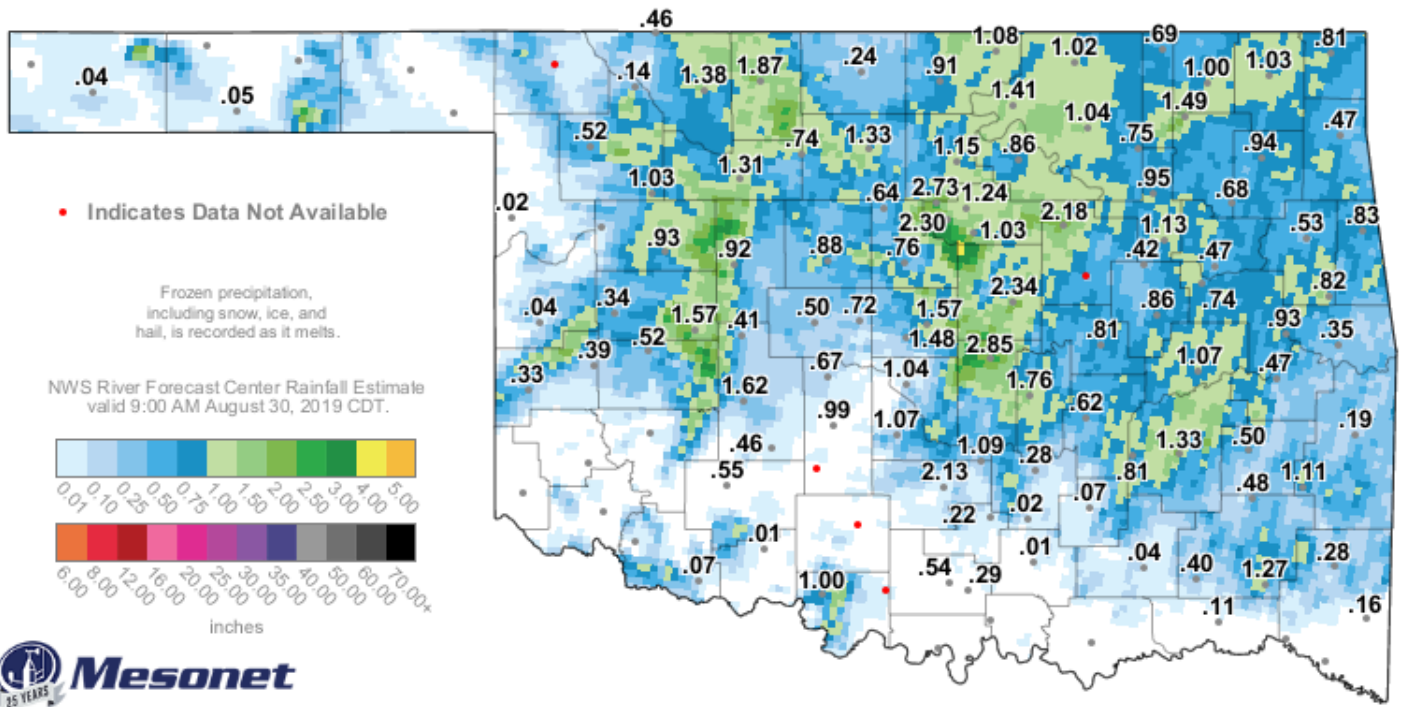
Fig. 25. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/30/2019.





Tulsa, OK: August 31, 2019 1-Day Observed Precipitation  
Valid on: August 31, 2019 12:00 UTC

Fig. 26. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/31/2019.



**24-Hour Rainfall Accumulation (inches)**

10:30 AM August 30, 2019 CDT

Created 10:35:48 AM August 30, 2019 CDT. © Copyright 2019

Fig. 27. OK Mesonet (values) and NWS RFC rainfall estimate (image) 24-hour rainfall ending at 10:30 am CDT 08/30/2019.



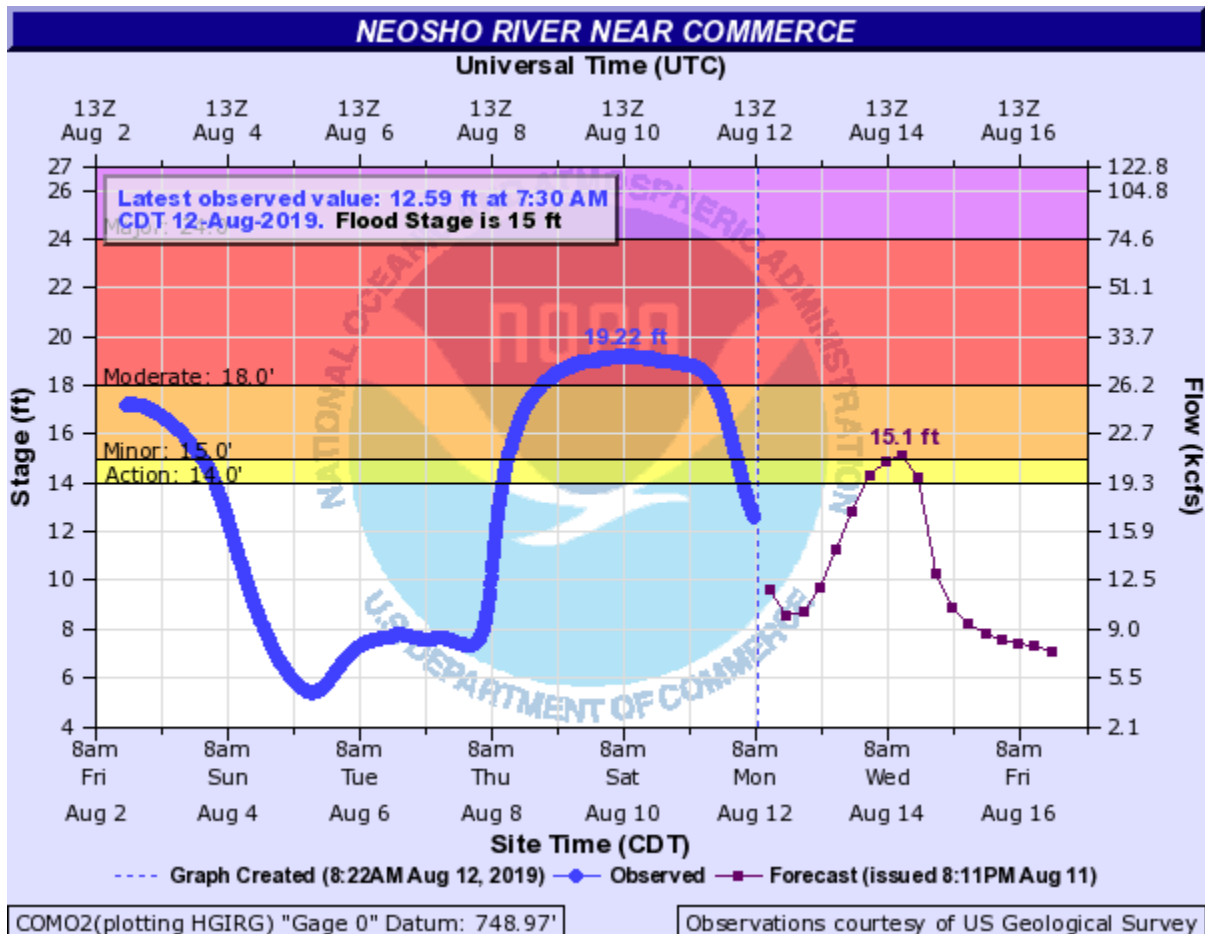
Written by:  
 Nicole McGavock  
 Service Hydrologist  
 WFO Tulsa

**Products issued in August 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

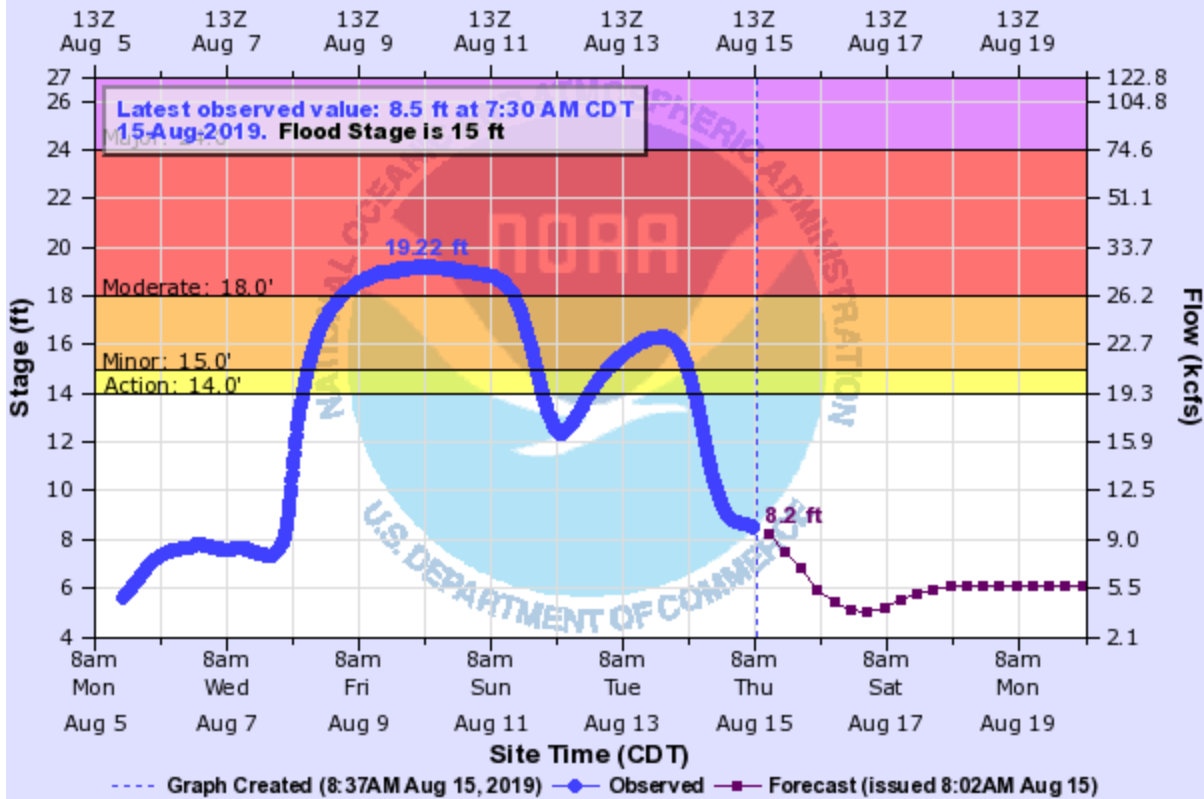
- 25 Flash Flood Warnings (FFW)
- 25 Flash Flood Statements (FFS)
- 5 Flash/Areal Flood Watches (FFA) (24 Watch FFA CON/EXT/EXA/EXB/CAN)
- 47 Urban and Small Stream Advisories (FLS)
- 9 Areal Flood Warnings (FLW)
- 0 Areal Flood Statements (FLS)
- 7 River Flood Warnings (FLW) (includes category increases)
- 44 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:**



## NEOSHO RIVER NEAR COMMERCE

Universal Time (UTC)

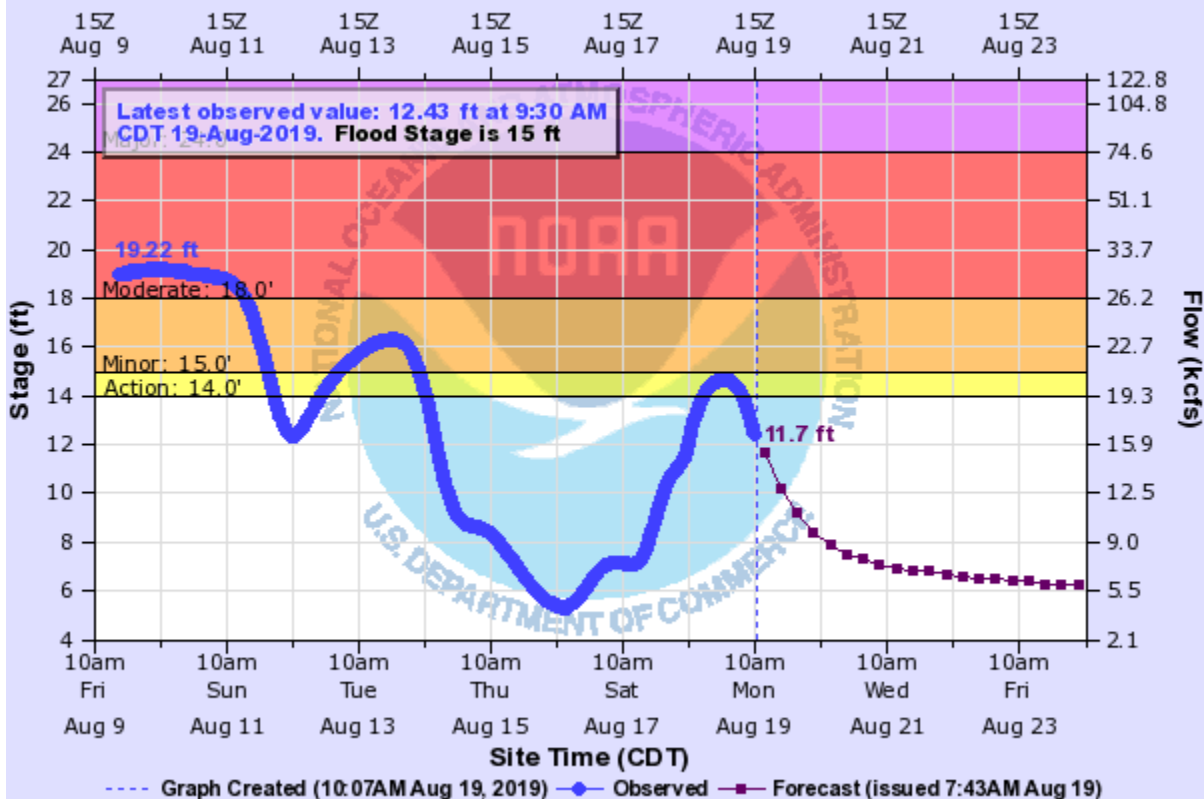


COMO2(plotting HGIRG) "Gage 0" Datum: 748.97'

Observations courtesy of US Geological Survey

## NEOSHO RIVER NEAR COMMERCE

Universal Time (UTC)



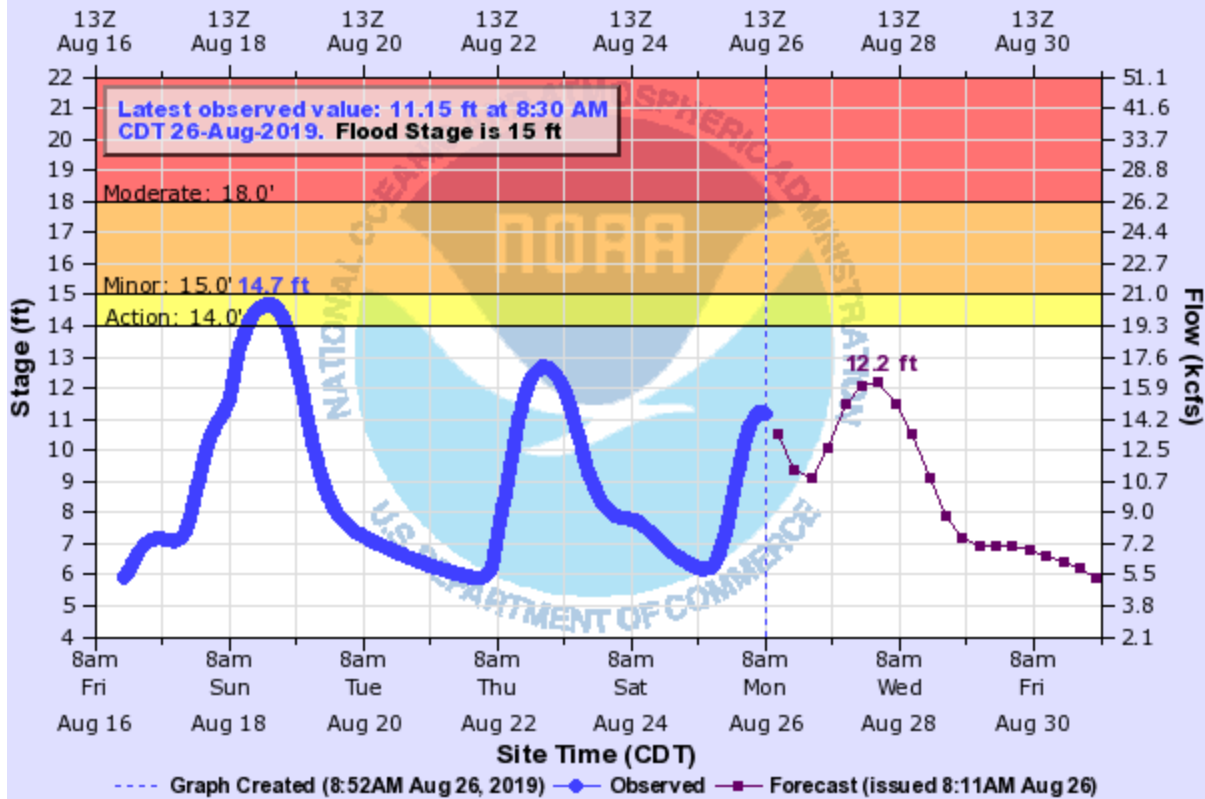
COMO2(plotting HGIRG) "Gage 0" Datum: 748.97'

Observations courtesy of US Geological Survey



## NEOSHO RIVER NEAR COMMERCE

Universal Time (UTC)

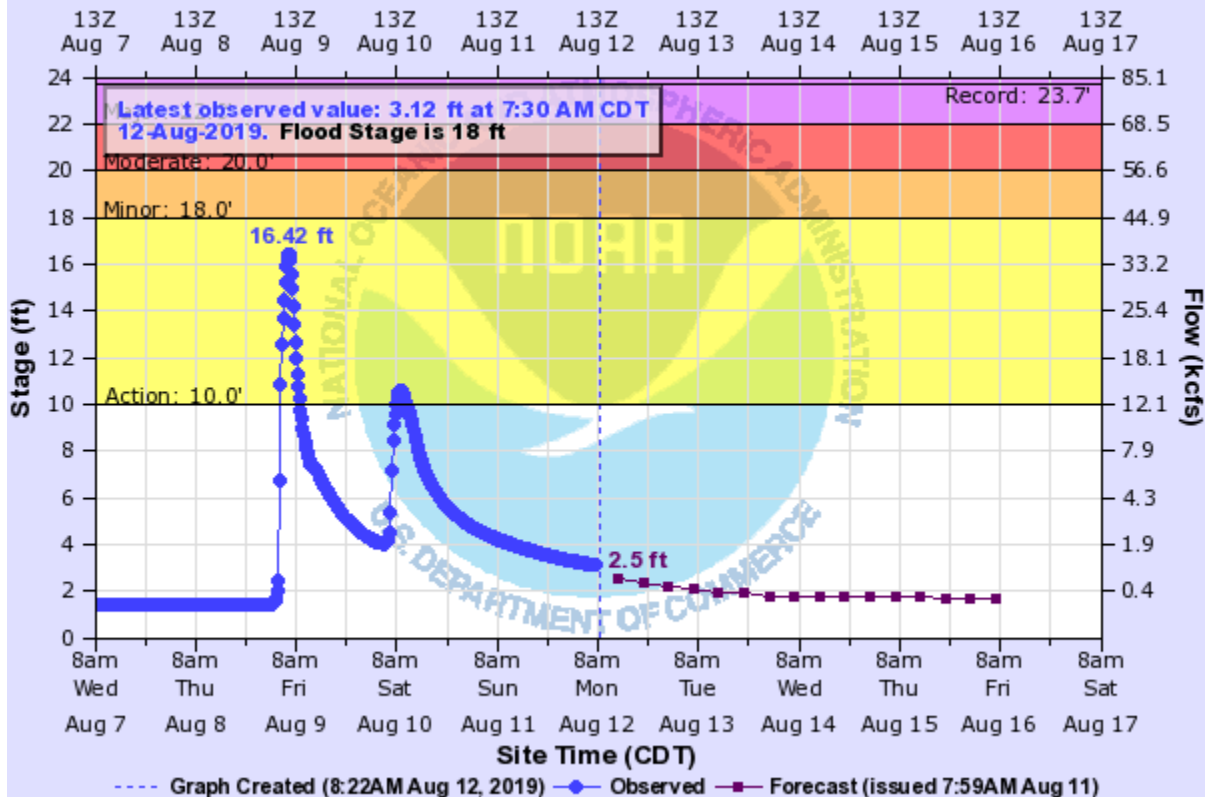


COMO2(plotting HGIRG) "Gage 0" Datum: 748.97'

Observations courtesy of US Geological Survey

## MULBERRY RIVER (AR) NEAR MULBERRY

Universal Time (UTC)

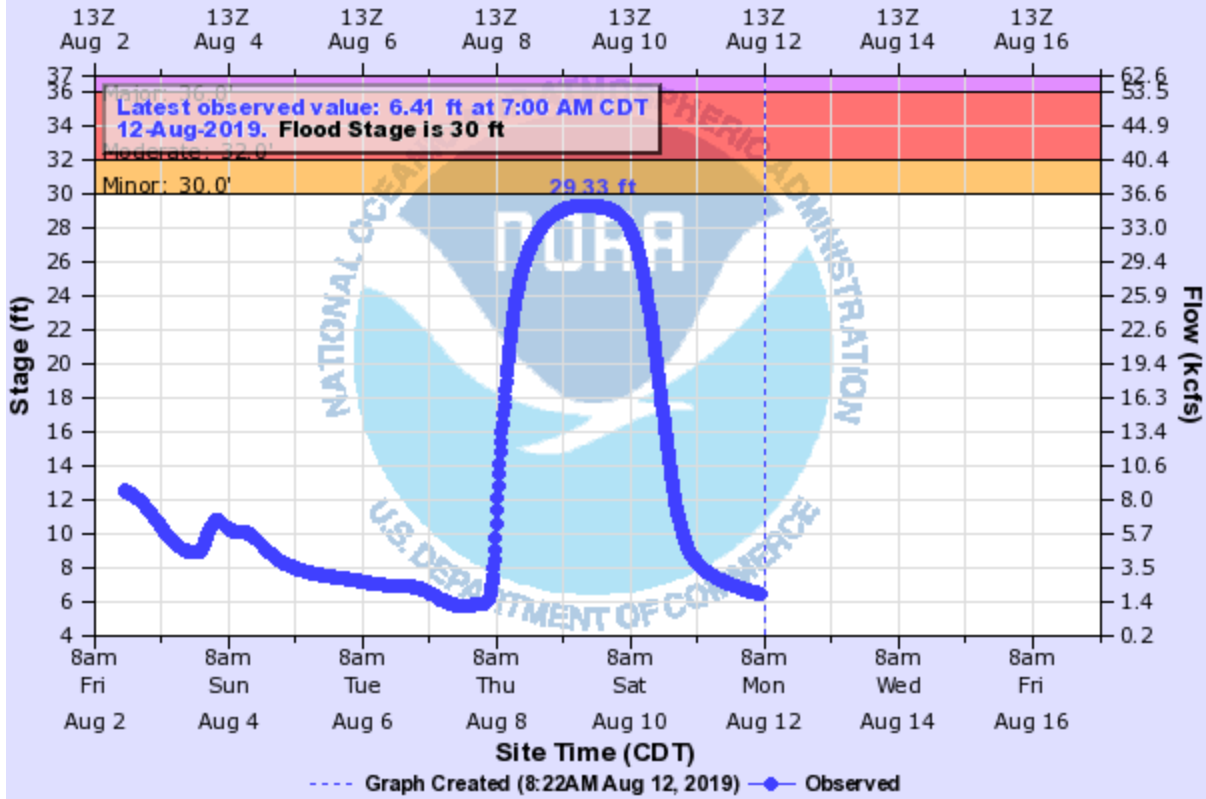


MLBA4(plotting HGIRG) "Gage 0" Datum: 432.75'

Observations courtesy of USGS/USACE/ADEQ

# VERDIGRIS RIVER NEAR LENAPAH

Universal Time (UTC)



LEPO2(plotting HGIRG) "Gage 0" Datum: 644.9'

Observations courtesy of US Geological Survey