

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 August	YEAR 2017
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 September 11, 2017	

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.

August 2017 was unusually wet and mild, with much of the region receiving above normal rainfall and temperatures near to below normal on average this month. The State of Oklahoma preliminarily had the 2nd wettest and 6th coolest August on record. A near total solar eclipse also happened this month. 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 2017 ranged from around 2" to around 15". Several areas, especially across east central OK and west central AR, received 8"-15" of rain this month. This corresponds from around 150% to near 600% of the normal August rainfall for a majority of the area (Fig. 1b). However, a portion of northeast OK only received 75%-100% of the normal August rainfall.

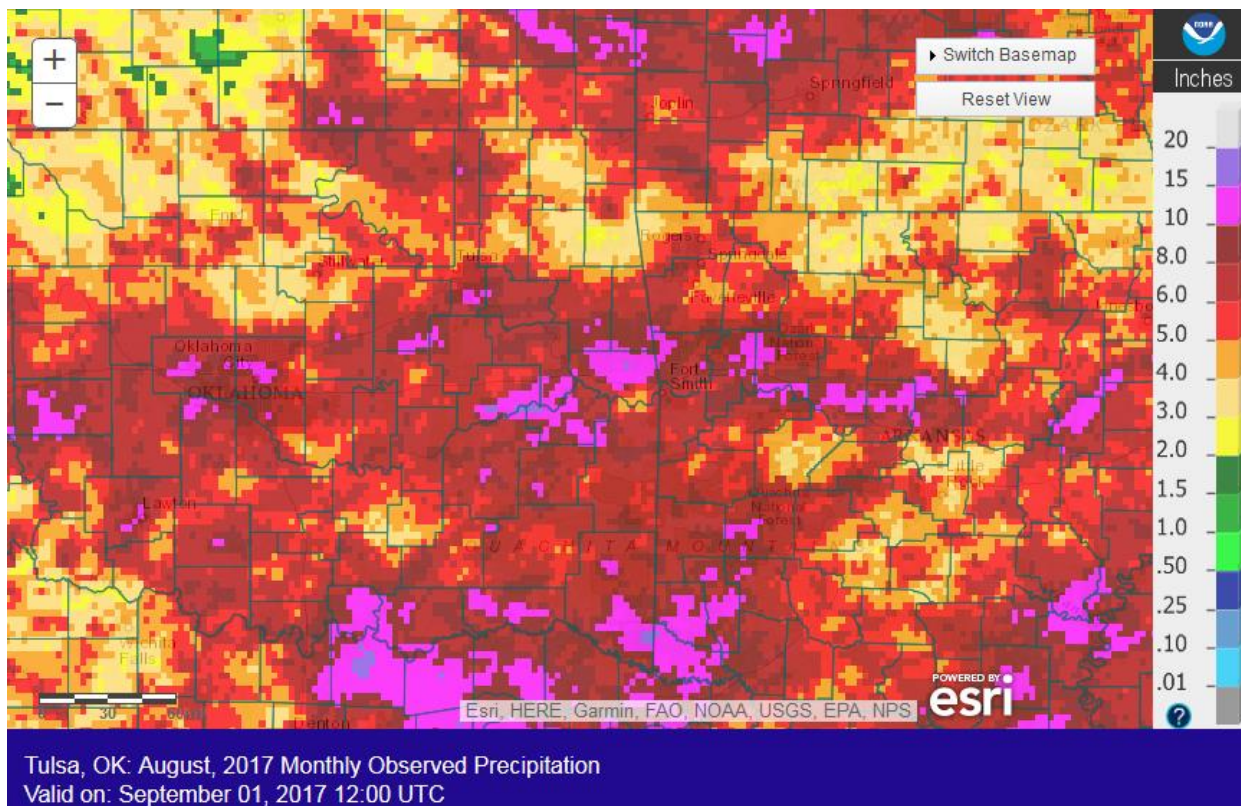


Fig. 1a. Estimated Observed Rainfall for August 2017

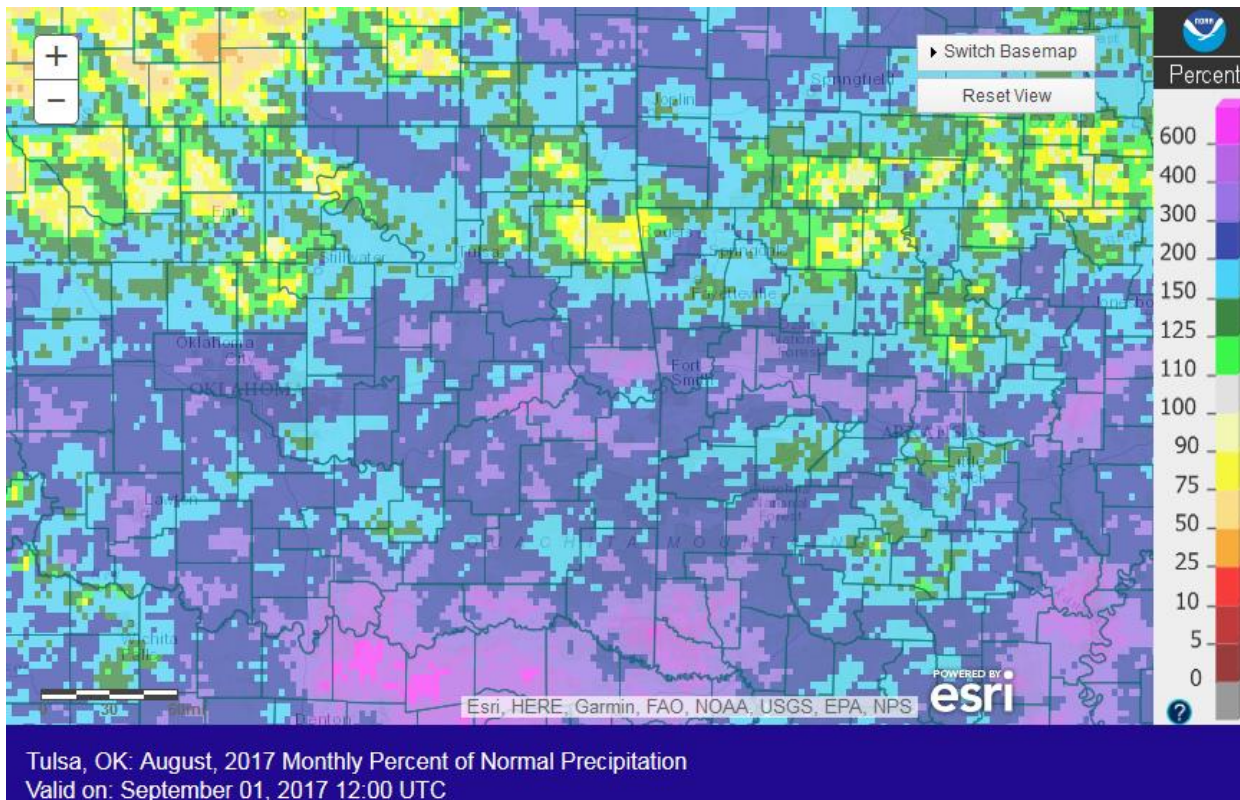


Fig. 1b. Estimated % of Normal Rainfall for August 2017

In Tulsa, OK, August 2017 ranked as the 17th coldest August (78.5°F, tied 1966, 1948; since records began in 1905) and the 13th wettest August (6.07"; since records began in 1888). Fort Smith, AR had the 47th coldest August (79.7°F; since records began in 1882) and the 7th wettest August (7.00"; since records began in 1882). Fayetteville, AR had the 6th coldest (73.4°F, tied 1966) and the 15th wettest (5.66") August since records began in 1949.

Some of the larger precipitation reports (in inches) for August 2017 included:

Vian 5.3ENE, OK (coco)	13.00	Eufaula, OK (meso)	12.01	Bunch 0.8N, OK (coco)	11.28
Wilburton 9.4N, OK (coco)	11.27	Stigler, OK (meso)	11.25	Sallisaw, OK (meso)	11.24
Sallisaw 1.0SE, OK (coco)	11.06	Bixby, OK (meso)	11.01	Hugo, OK (meso)	10.85

Some of the lowest precipitation reports (in inches) for August 2017 included:

Vinita, OK (meso)	3.43	Upper Spavinaw Port, OK (coop)	3.71	Pryor, OK (meso)	4.11
Claremore 2ENE, OK (coop)	4.12	Burbank, OK (meso)	4.13	Berryville 0.8SSW, AR (coco)	4.23
Ralston, OK (coop)	4.35	Spavinaw, OK (coop)	4.41	Okemah, OK (meso)	4.74

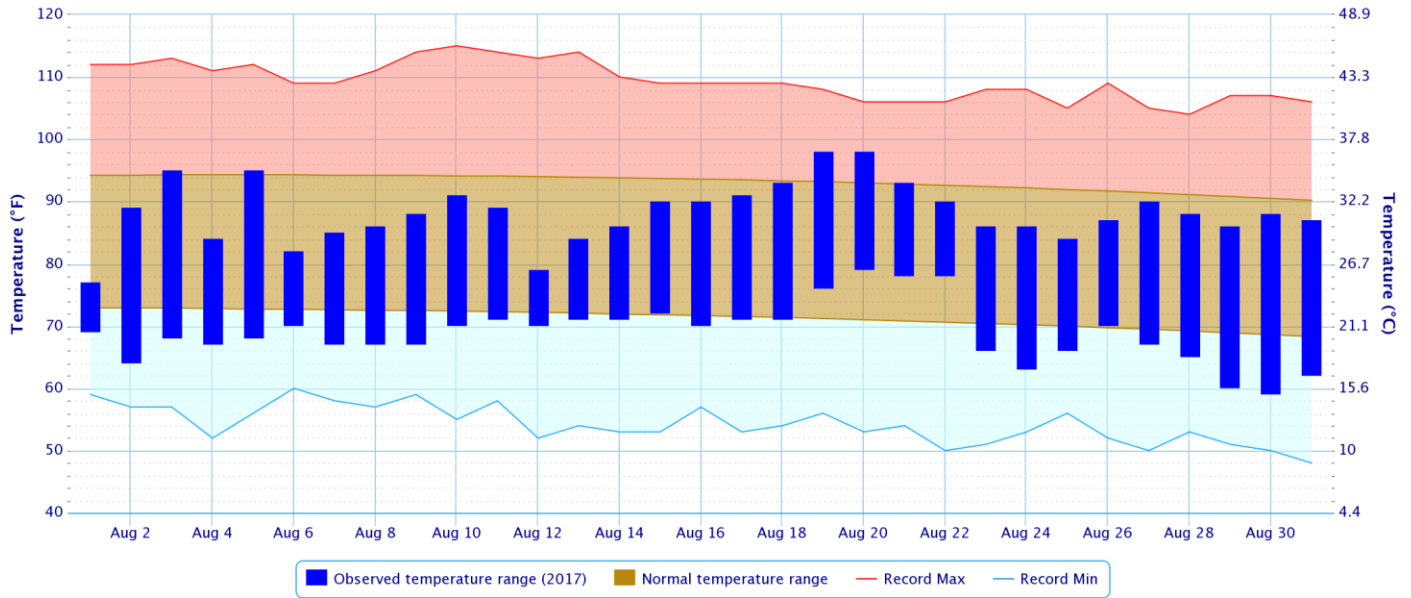
According to mesonet station only statistics from the [Oklahoma Climatological Survey \(OCS\) Mesonet](#):

Rank since 1921	August 2017	Last 60 Days (Jul 3 – Aug 31)	Summer 2017 (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, 2016–Aug 31, 2017)
Northeast OK	9th wettest	17 th wettest	39 th wettest	28 th wettest	7th wettest	5th wettest	13 th wettest	20 th wettest
East Central OK	1st wettest	5th wettest	7th wettest	7th wettest	4th wettest	6th wettest	18 th wettest	30 th wettest
Southeast OK	1st wettest	4th wettest	2nd wettest	7th wettest	11 th wettest	14 th wettest	45 th wettest	47 th driest
Statewide	2nd wettest	5th wettest	14 th wettest	20 th wettest	7th wettest	6th wettest	22 nd wettest	28 th wettest

In Tulsa, OK, Summer (June-July-August) 2017 ranked as the 35th coldest Summer (80.1°F, tied 1951, 1907, 1912, 1938; since records began in 1905) and the 56th wettest Summer (11.07"; since records began in 1888). Fort Smith, AR had the 67th coldest Summer (80.4°F, tied 1991; since records began in 1882) and the 4th wettest Summer (20.03"; since records began in 1882). Fayetteville, AR had the 10th coldest (74.6°F) and the 16th wettest (14.29", tied 1964) Summer since records began in 1950.

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

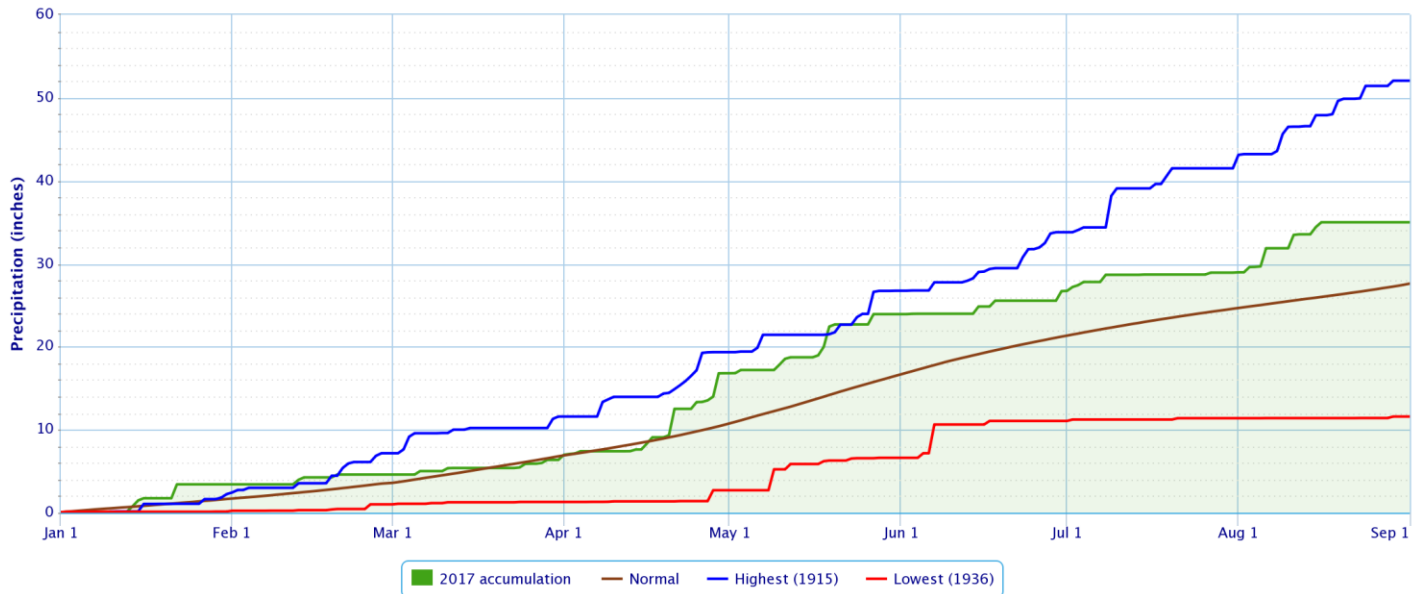
Period of Record – 1905-01-06 to 2017-09-10. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

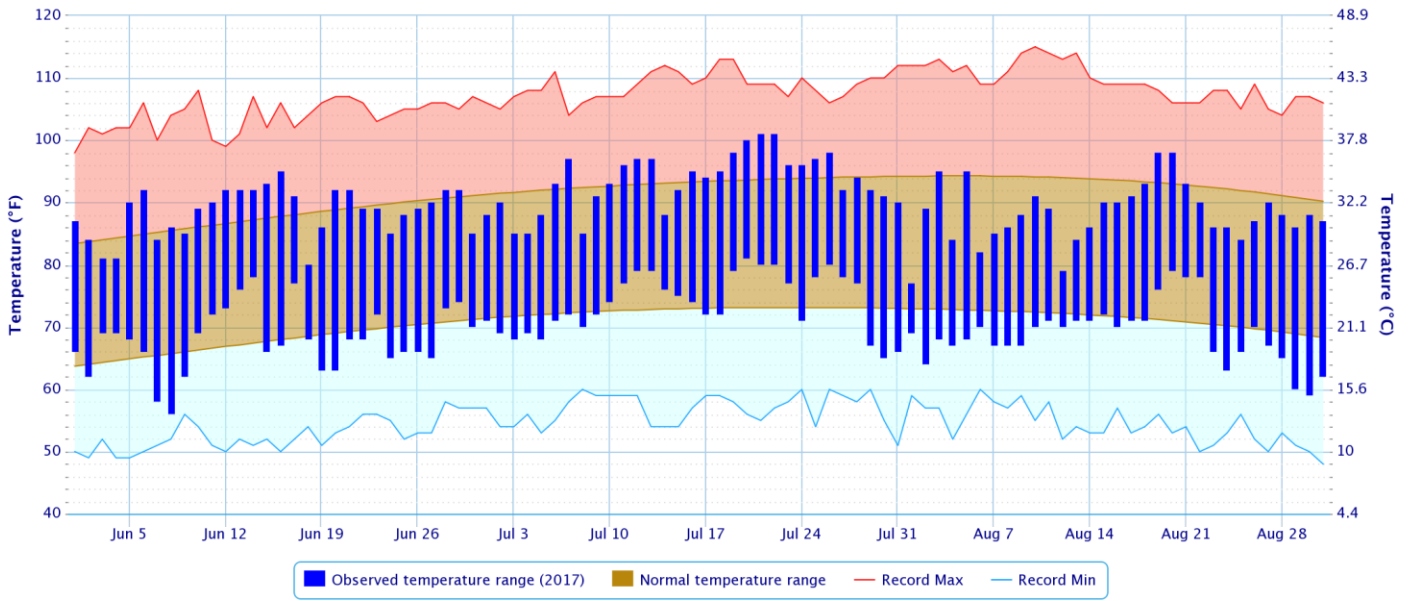
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Daily Temperature Data – Tulsa Area, OK (ThreadEx)

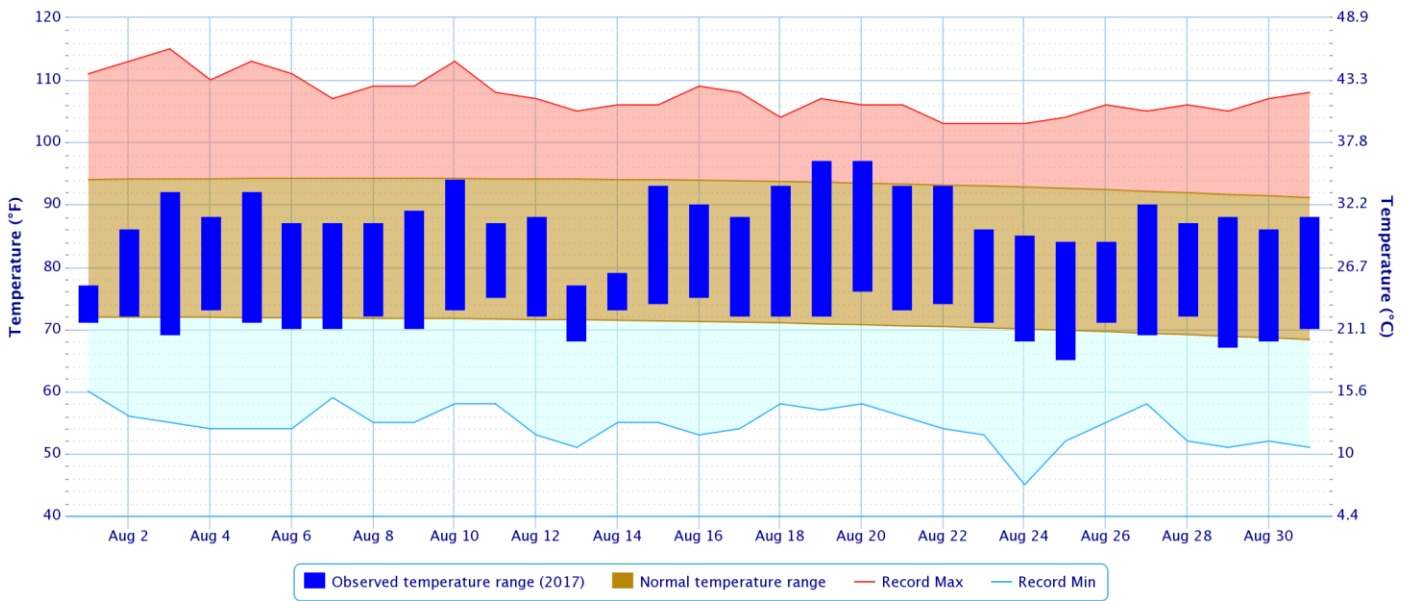
Period of Record – 1905-01-06 to 2017-09-10. Normals period: 1981-2010. Click and drag to zoom chart.



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

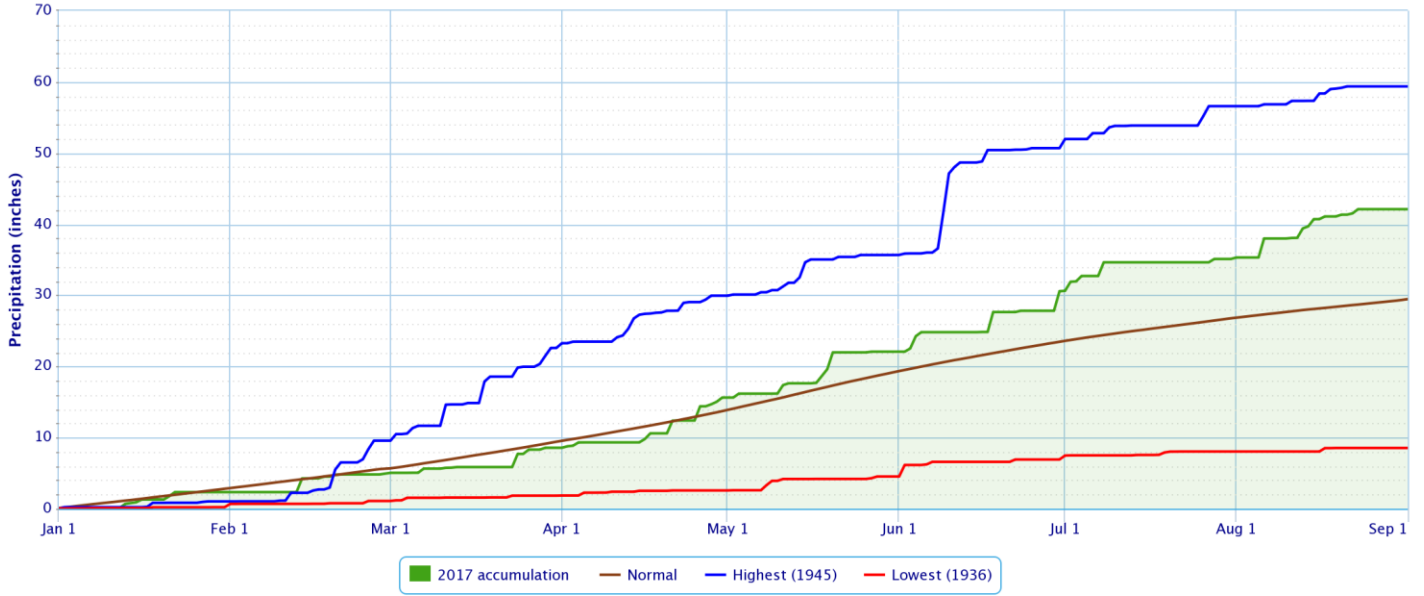
Period of Record – 1882-06-01 to 2017-09-10. Normals period: 1981-2010. Click and drag to zoom chart.



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Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

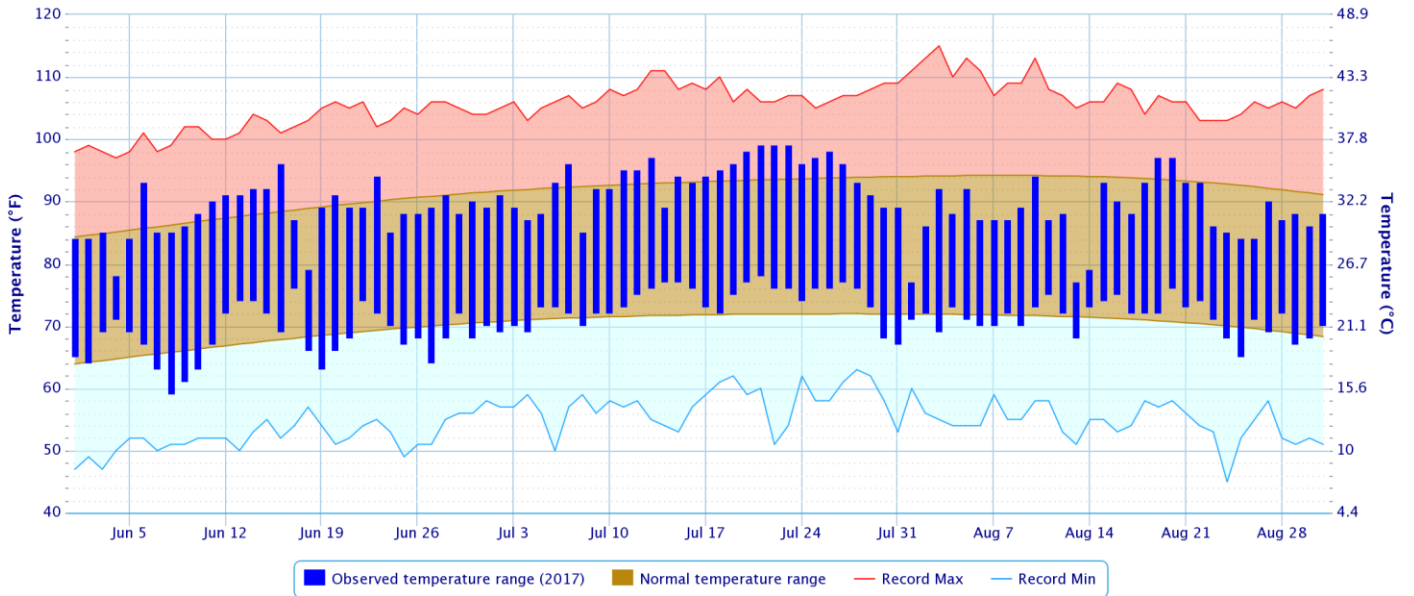
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

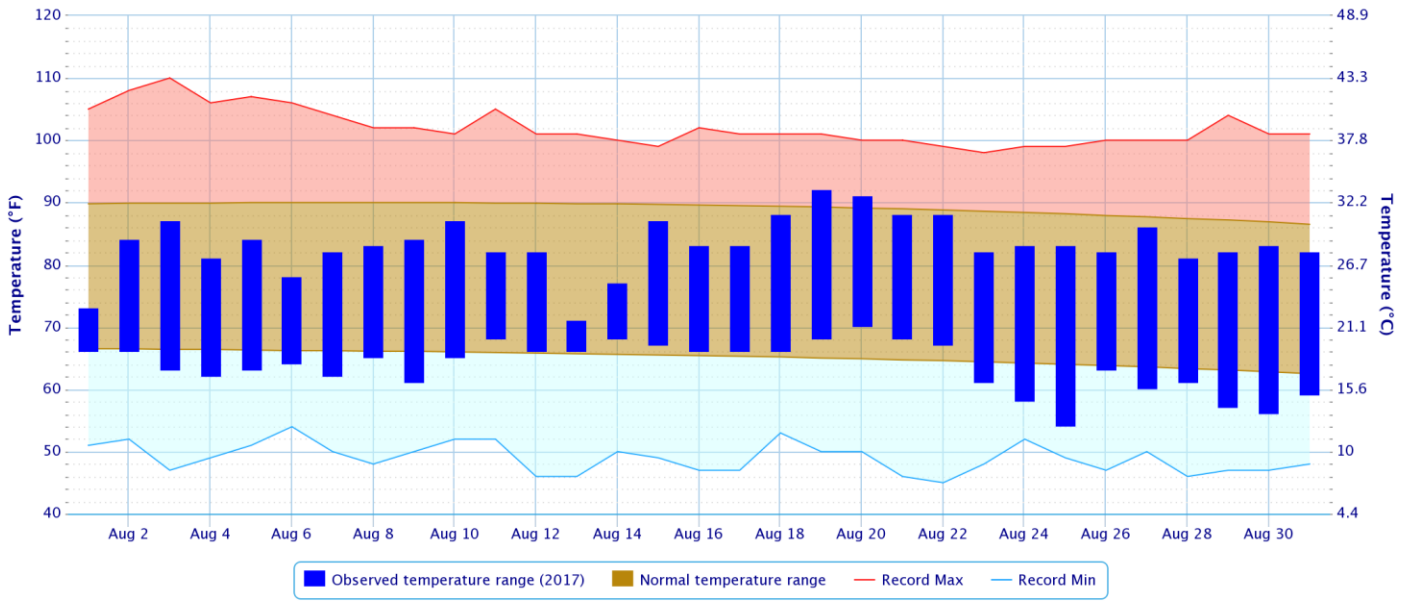
Period of Record – 1882-06-01 to 2017-09-10. Normals period: 1981-2010. Click and drag to zoom chart.



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Daily Temperature Data – FAYETTEVILLE DRAKE FLD, AR

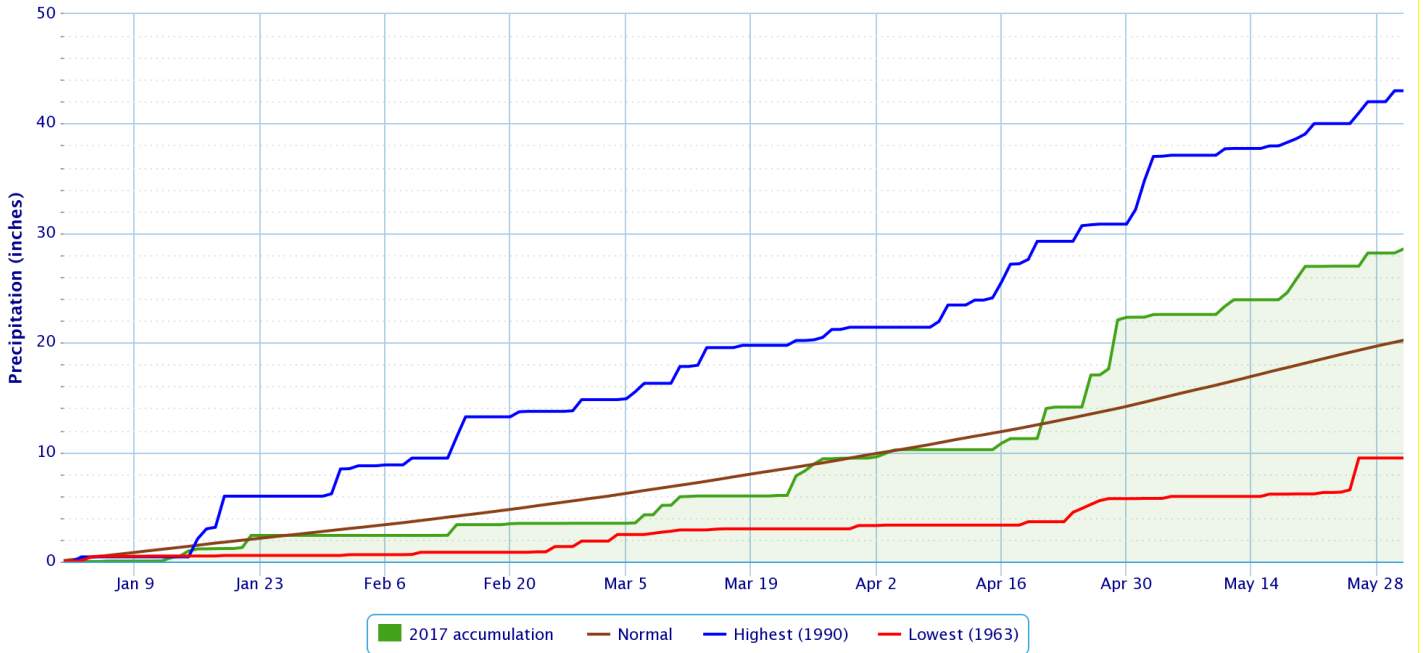
Period of Record – 1949-07-14 to 2017-09-10. Normals period: 1981-2010. Click and drag to zoom chart.



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Accumulated Precipitation – FAYETTEVILLE DRAKE FLD, AR

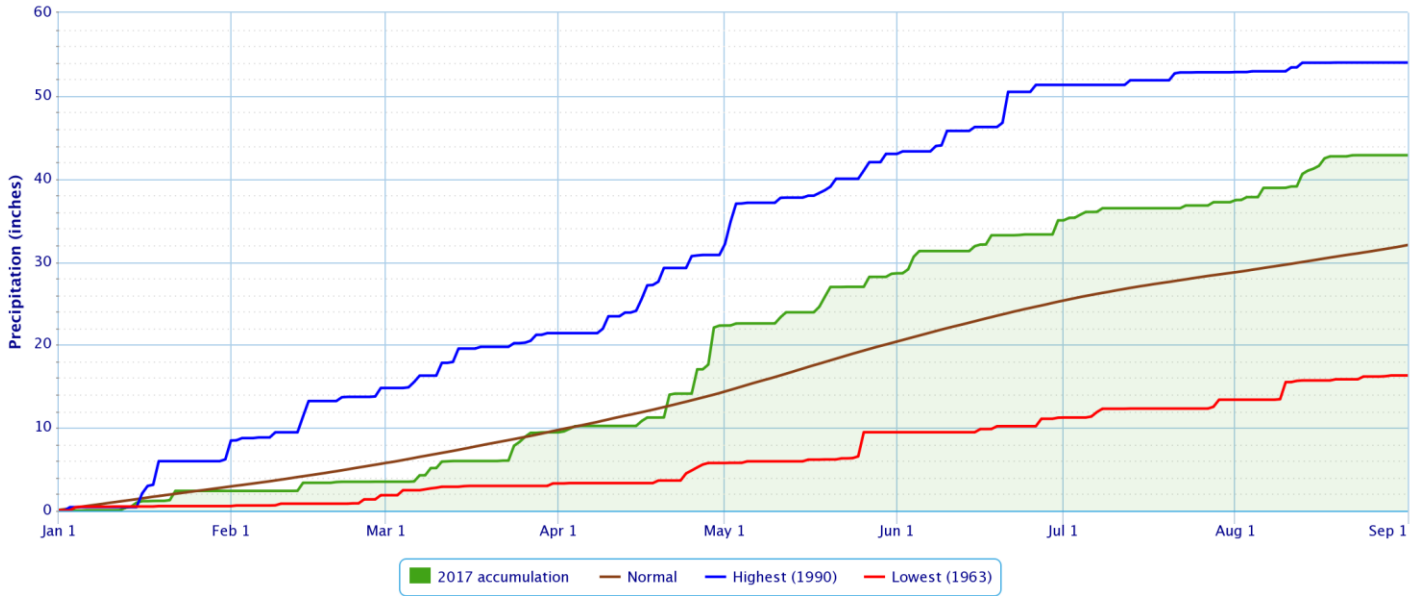
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Accumulated Precipitation – FAYETTEVILLE DRAKE FLD, AR

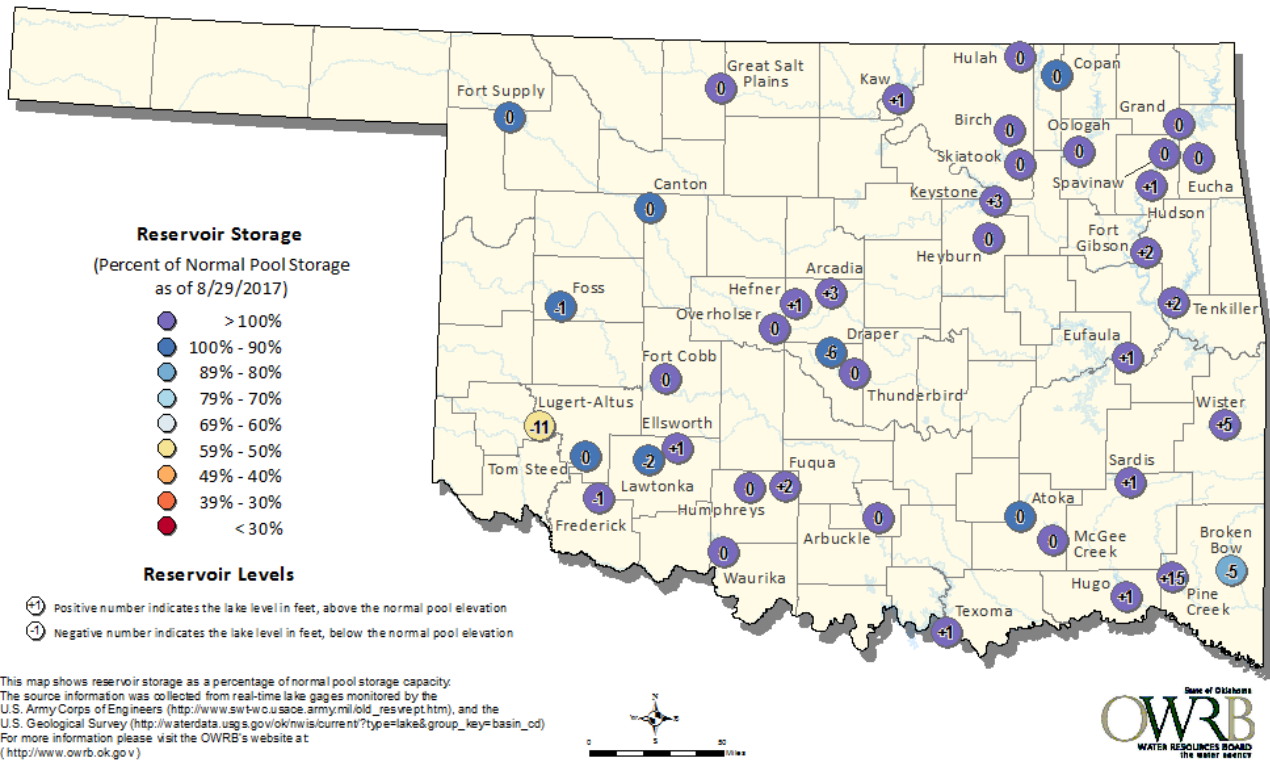
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Reservoirs

Oklahoma Surface Water Resources Reservoir Levels and Storage as of 8/29/2017



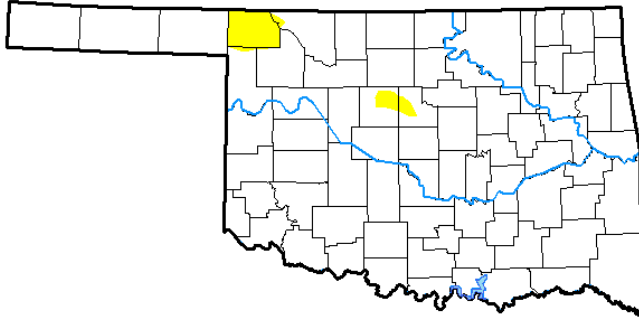
According to the USACE, the most of the lakes in the HSA were at near normal levels as of 8/31/2017. Beaver Lake remained in its flood control pool and operating at 160% of its conservation pool, while Copan Lake was the only reservoir with below normal conditions, at 94% of its conservation pool.

Drought

According to the [U.S. Drought Monitor](#) (USDM) from August 29, 2017 (Figs. 2, 3), no drought conditions were present across eastern OK and northwest AR.

**U.S. Drought Monitor
Oklahoma**

August 29, 2017
(Released Thursday, Aug. 31, 2017)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	97.84	2.16	0.00	0.00	0.00	0.00
Last Week 08-22-2017	96.03	3.97	0.00	0.00	0.00	0.00
3 Months Ago 05-30-2017	97.17	2.83	0.00	0.00	0.00	0.00
Start of Calendar Year 01-03-2017	5.61	94.39	83.21	55.75	5.55	0.00
Start of Water Year 09-27-2016	57.82	42.18	19.04	3.05	0.00	0.00
One Year Ago 08-30-2016	52.00	48.00	14.06	0.30	0.00	0.00

Intensity:

- 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:

Chris Fenimore
NCEI/NESDIS/NOAA

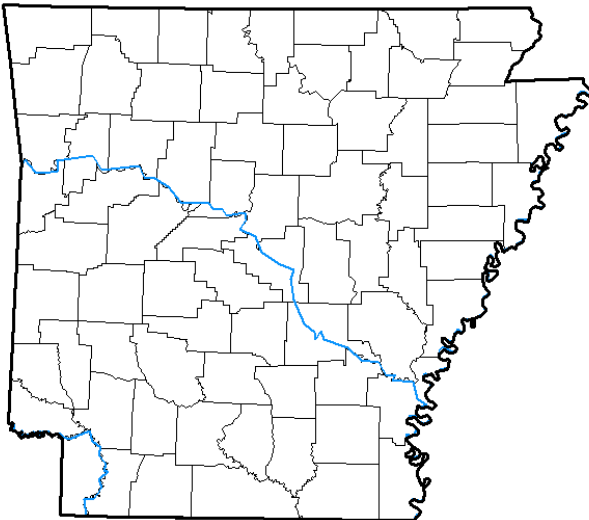


<http://droughtmonitor.unl.edu/>

Fig. 2. Drought Monitor for Oklahoma

**U.S. Drought Monitor
Arkansas**

August 29, 2017
(Released Thursday, Aug. 31, 2017)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	100.00	0.00	0.00	0.00	0.00	0.00
Last Week 08-22-2017	100.00	0.00	0.00	0.00	0.00	0.00
3 Months Ago 05-30-2017	99.14	0.86	0.00	0.00	0.00	0.00
Start of Calendar Year 01-03-2017	27.05	72.95	39.03	7.99	2.02	0.00
Start of Water Year 09-27-2016	71.02	28.98	0.00	0.00	0.00	0.00
One Year Ago 08-30-2016	99.96	0.04	0.00	0.00	0.00	0.00

Intensity:

- 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:

Chris Fenimore
NCEI/NESDIS/NOAA



<http://droughtmonitor.unl.edu/>

Fig. 3. Drought Monitor for Arkansas

Outlooks

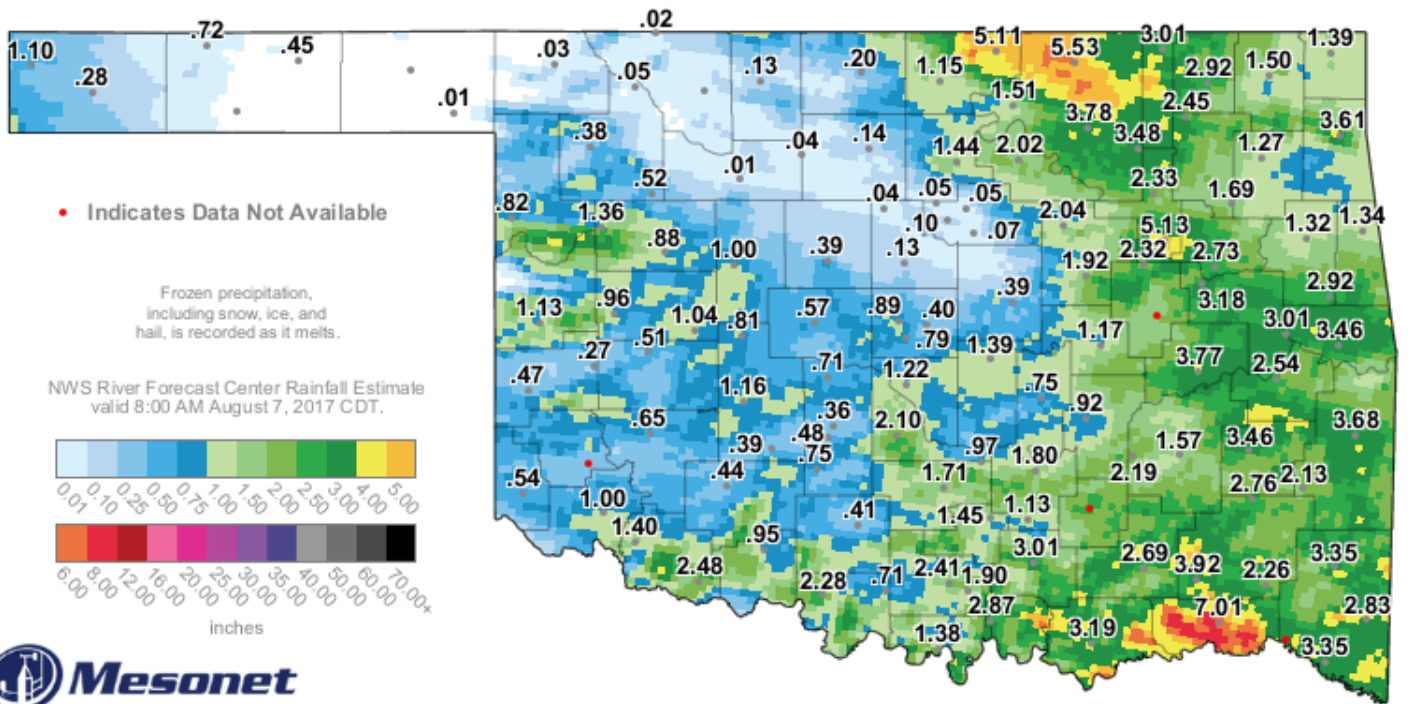
The [Climate Prediction Center](#) (CPC) outlook for September 2017 (issued August 31, 2017) indicates an enhanced chance for below normal temperatures and below median precipitation across all of eastern OK and northwest AR. This outlook takes into account weather conditions forecast over the next 1-2 weeks and subseasonal climate signals in the weeks 3-4 time frame.

For the 3-month period September-October-November 2017, CPC is forecasting an enhanced chance for above normal temperatures and above median rainfall across all of eastern OK and northwest AR (outlook issued August 17, 2017). This outlook is based on both statistical and dynamical forecast tools and decadal timescale climate trends. According to CPC, Pacific sea surface temperatures along the equator continue to indicate ENSO-neutral conditions. ENSO-neutral is expected to persist at least into early winter, as the chance of El Niño development during the next few months have decreased. ENSO-neutral is slightly favored during winter 2017-18, though the odds of a weak wintertime La Niña have increased significantly.

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

On the evening of the 5th, thunderstorms moved into northeast OK and expanded in coverage through the evening hours. A bow echo developed within the thunderstorm complex, bringing several quasi-linear convective system (QLCS) tornadoes to northeast OK, including an EF-2 in midtown Tulsa (more information at <https://arcg.is/0LuGH1>). The line of storms continued to push southeast and into southeast OK and west central AR by the pre-dawn hours of the 6th. All of the rain then moved south and out of the area by noon. In addition to the tornadoes, this activity brought heavy rain due to a deep moisture axis over the region. Rainfall totals ranged from 0.75" to around 6" across all of eastern OK and northwest AR, with many areas receiving 2"-4" (Figs. 4, 5). The highest totals of 5"-6" occurred over northern Osage County. Later in the evening, thunderstorms redeveloped near the Red River along a boundary. This activity continued through the overnight hours before finally coming to an end around sunrise on the 7th. The 24-hour rainfall total from both rounds of precipitation over southeast OK was 1.5"-8", with all of Choctaw County receiving 2.5"-8" of rain (Figs. 4, 6). In the 24 hours ending at 7am CDT August 7, 7.01" was measured 2 miles northwest of Hugo, OK. Numerous roads were reported closed in Hugo. 3.38" was measured 5 miles west of Antlers, OK.

Scattered thunderstorms moved south out of KS on the evening of the 10th, affecting northeast OK and northwest AR north of I-40. There were numerous reports of wind damage associated with these storms. A large complex of storms tracking east across OK then began to affect eastern OK a couple hours after midnight on the 11th and reached western AR near sunrise. Rainfall totals ranged from around 0.50" to around 3" for much of eastern OK and northwest AR (Fig. 7), with the exception of far southeast OK which remained mostly dry. Portions of the Neosho River basin in southeast KS received 1.5"-4" of rain. As this water flowed south, it caused the Neosho River near Commerce to rise to just below flood stage (preliminary hydrograph at the end of this report).



2-Day Rainfall Accumulation (inches)

9:40 AM August 7, 2017 CDT

Created 9:45:48 AM August 7, 2017 CDT. © Copyright 2017

Fig. 4. 2-day Estimated observed rainfall (image) and OK Mesonet measurements ending at 9:40 am CDT 08/07/2017.

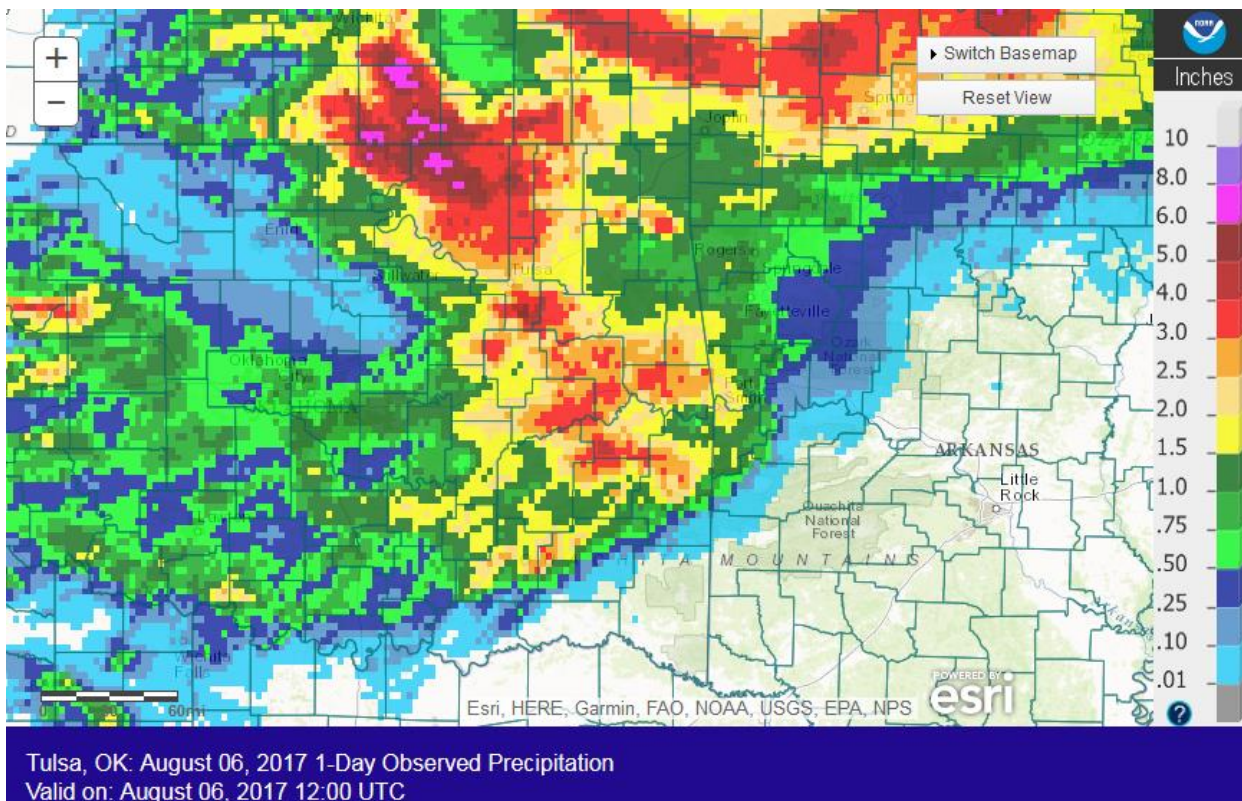


Fig. 5. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/06/2017.

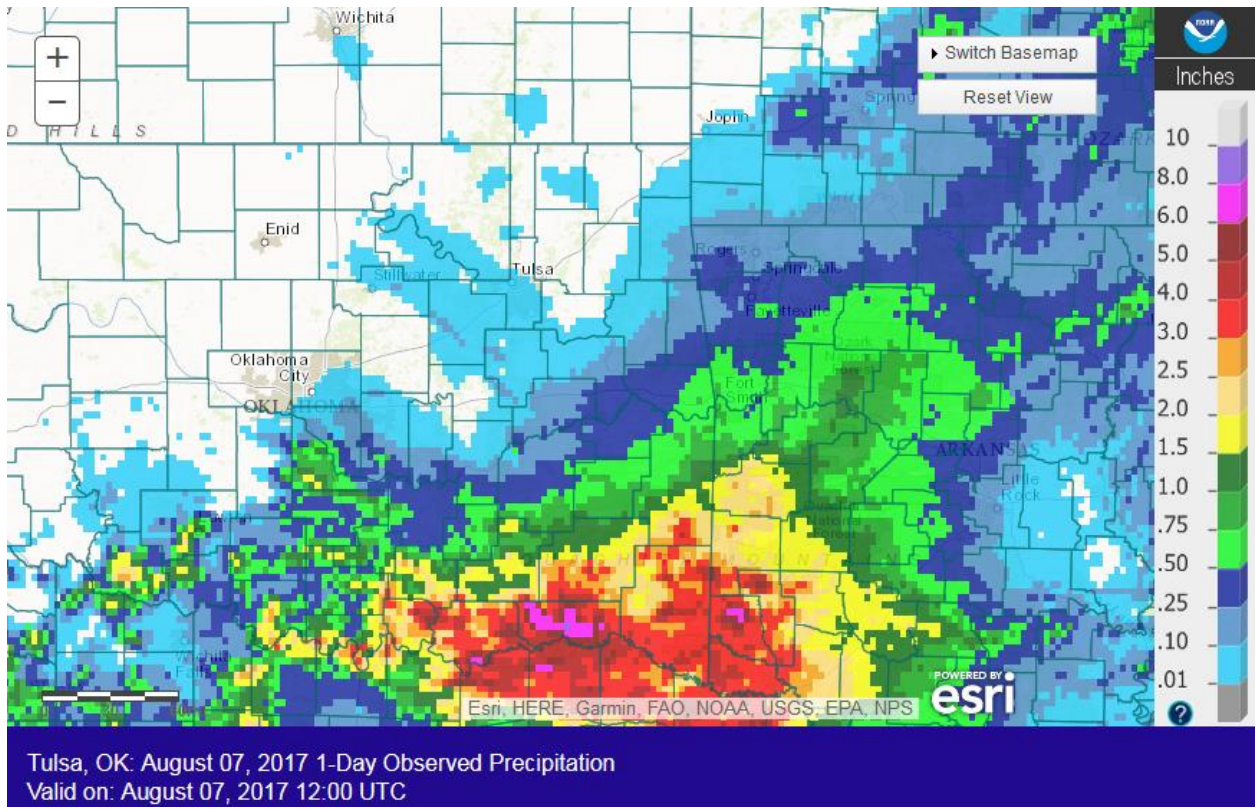


Fig. 6. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/07/2017.

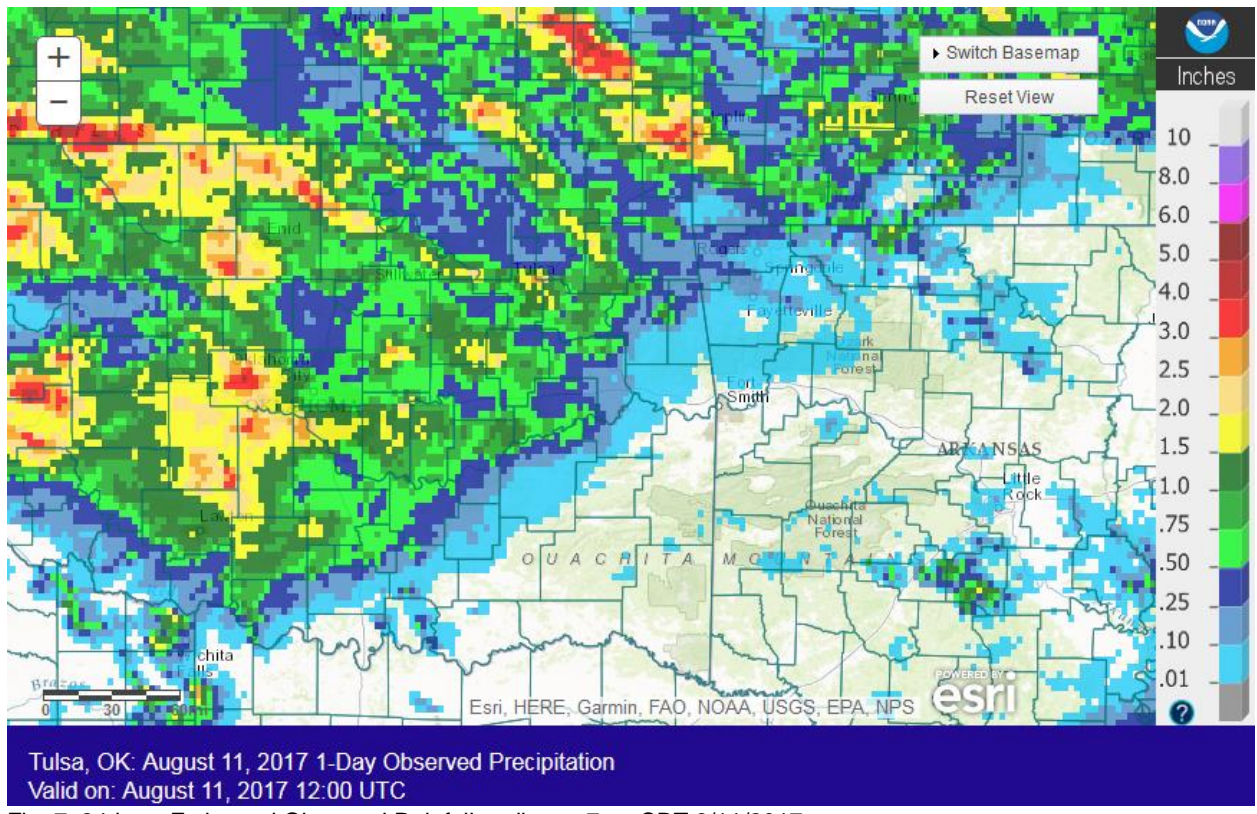


Fig. 7. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/11/2017.

An impulse emanating from the Southwest monsoon activity slid over the southern Plains on the 12th, resulting in widespread showers moving east into the area from central OK. This activity affected east central and northeast OK through northwest AR during the morning and afternoon hours, with additional convection spreading into southeast OK and west central AR during the evening. Around midnight on the 13th, elevated showers and thunderstorms began to develop along the I-40 corridor and near the Red River, north of a stalled front over northern TX. An intense band of convection affected locations along the Canadian and Arkansas Rivers in east central OK for several hours during the night. Portions of McIntosh, Haskell, Muskogee, and Sequoyah Counties received 3"-8" of rain (Figs. 8-10). Elsewhere, rainfall totals ranged from a few hundredths to around 3". The rain finally came to an end by noon on the 13th. Flash flooding occurred across Sequoyah County, with a swift water rescue reported several miles east of Sallisaw, OK, and numerous roads impassable, especially in the Gans and Sallisaw areas. Sequoyah County Emergency Management said a train derailment occurred in Sequoyah County on the 13th, and the derailment was likely due to heavy rain washing away the ground under the tracks (Figs. 11a-d). Around 10 cars went off the rails in the morning on Central High Road east of Sallisaw and north of Highway 64, but the two crew members on board were not injured. Six cars reportedly contained liquid petroleum gas, but officials say there were no leaks. Around five area homes were evacuated, and families were soon allowed to return home. Union Pacific estimates 2 weeks for track repairs, though the timeline could be longer due to more rain.

Some of the larger 24-hour precipitation reports (in inches) ending at 7am CDT 8/13/2017 included:

Eufaula 5W, OK	5.91	Sallisaw 2SSW, OK	5.82	Vian 5.3ENE, OK	5.38
Sallisaw 0.3SE, OK	5.36	Stigler 6SSE, OK	4.81	Webbers Falls 1.5S, OK	4.15

An MCS developed over the high Plains and eventually merged with other convection lifting north from the TX southern Plains during the evening of the 13th. This system generated an MCV over southwest OK. As the MCV moved east, it enhanced upglide over a surface boundary near the Red River and showers with embedded thunderstorms progressed northeast through the morning hours of the 14th, affecting eastern OK and western AR generally along and south I-44. An upper-level disturbance sliding east over the region fueled another cluster of storms from southeast OK into northwest AR during the evening of the 14th and into the early morning hours of the 15th. Along and south of I-44, rainfall totals were 0.25" to 2", with isolated areas of 2" to 3". However, heavier rain during the early morning hours brought 2"-6" of rain to most of Franklin County in west central AR (Figs. 12, 13). 5.15" was measured in 24 hours at Ratcliff, AR, 4.90" was measured in Ozark, AR, and 3.42" was measured 1.7 miles east of Charleston, AR. There were reports of water in several homes along AR Highway 23 north of Ozark, AR and a couple of bridges out outside of Branch, AR. The Mulberry River near Mulberry rose quickly above Action Stage, but remained below flood stage (preliminary hydrograph at the end of this report).

A line of thunderstorms develop near I-35 during the afternoon of the 15th, expanding in coverage as it traversed northeast OK and northwest AR, generally along and north of I-40, during the evening hours. The heaviest rainfall of 0.50" to 3" fell in a band from Creek County to Franklin County (Fig. 14). AR Highway 59 was flooded near Natural Dam, AR, with the worst flooding near Cedarville, AR. Sand Springs, OK measured 2.71" in just 40 minutes. A swift water rescue was needed near Krebs, OK. Lee Creek near Van Buren rose above Action Stage, but remained below flood stage (preliminary hydrograph at the end of this report).

At mid-morning of the 16th, a cold front was positioned from the TX panhandle to central KS, with an ongoing MCS moving eastward across eastern KS into MO. The southern flank of this activity shifted south into northeast OK along an outflow boundary. Additionally, scattered showers developed during the morning and afternoon from southeast OK into northwest AR within an axis of deep layer moisture ahead of the cold front. By mid-evening, a line of thunderstorms had developed along the front from eastern KS into north central OK. This line move southeast across the entire area during the evening and overnight hours, before moving out of southeast OK by mid-morning on the 17th. Rainfall totals were around 0.50" to around 2.5" (Fig. 15). The rain over southeast KS and far northeast OK led to minor flooding along the Neosho River near Commerce (preliminary hydrograph at the end of this report). The Mulberry River near Mulberry in west central AR rose above Action Stage, but remained below Flood Stage.

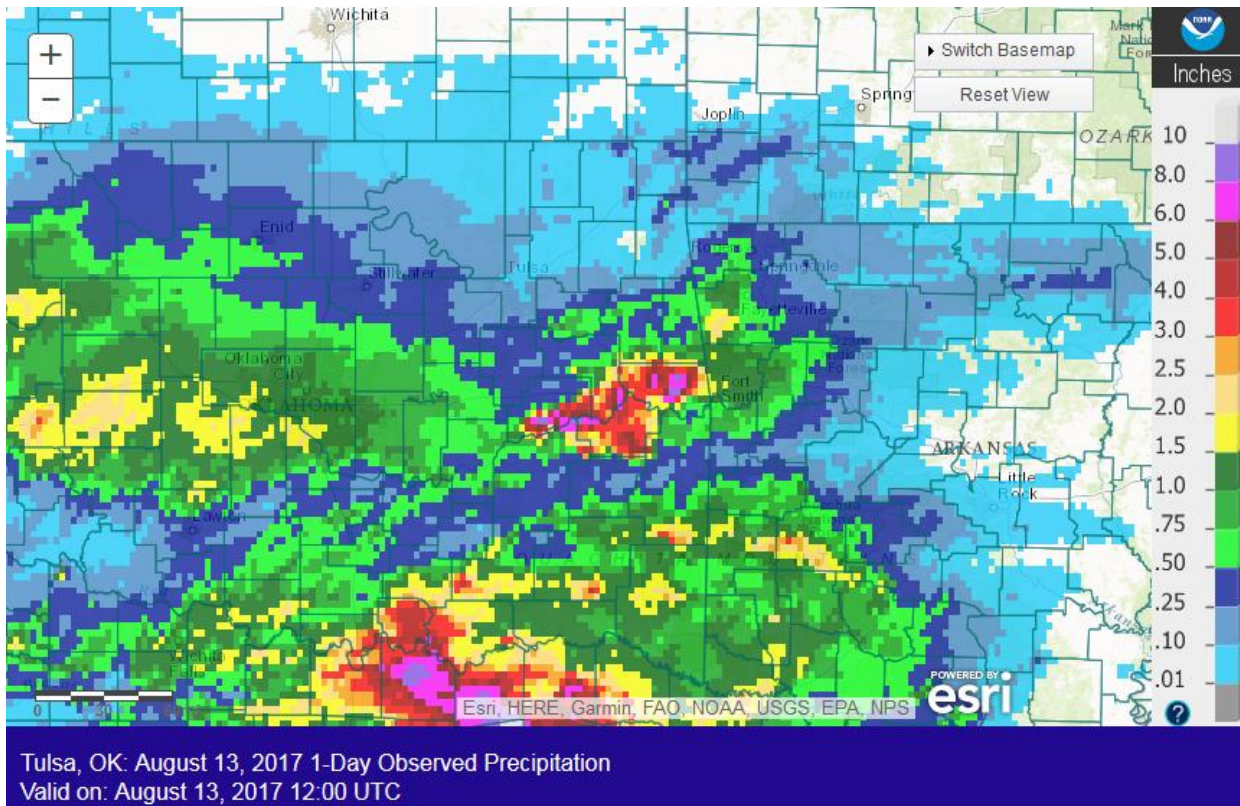


Fig. 8. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/13/2017.

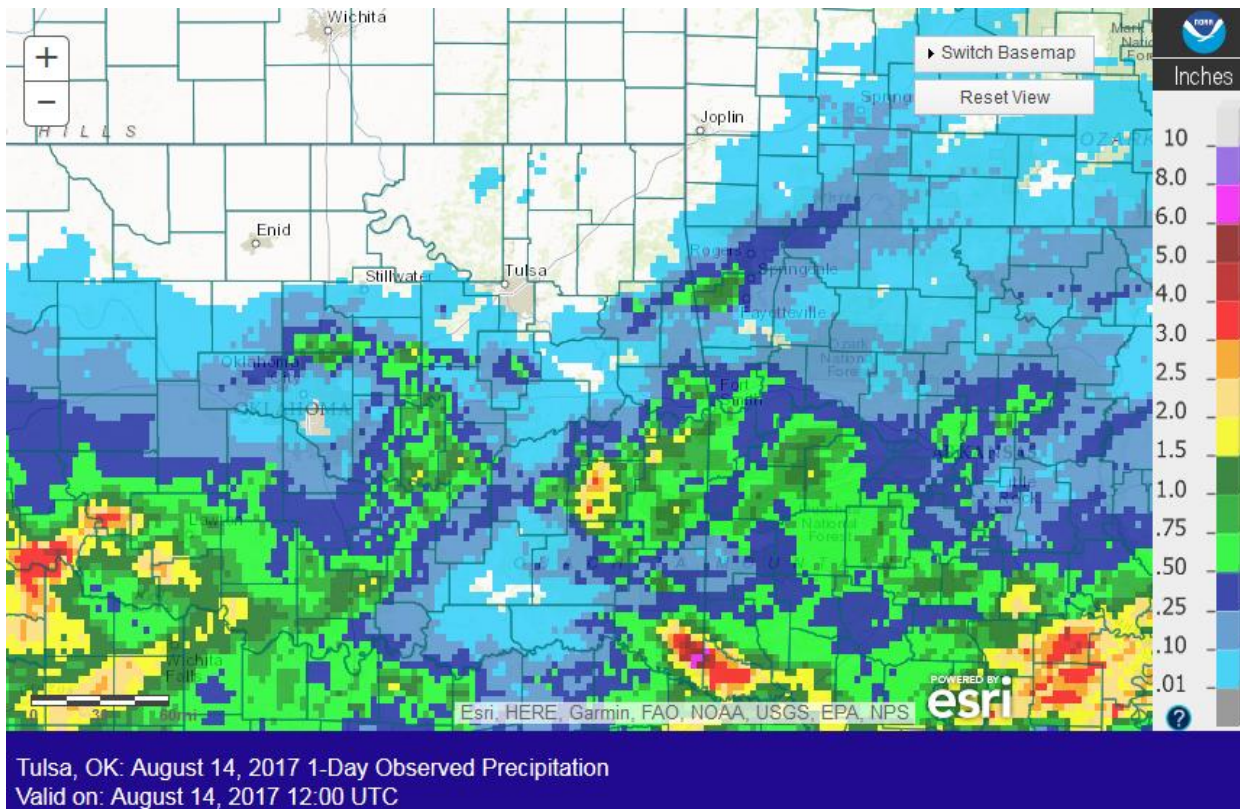
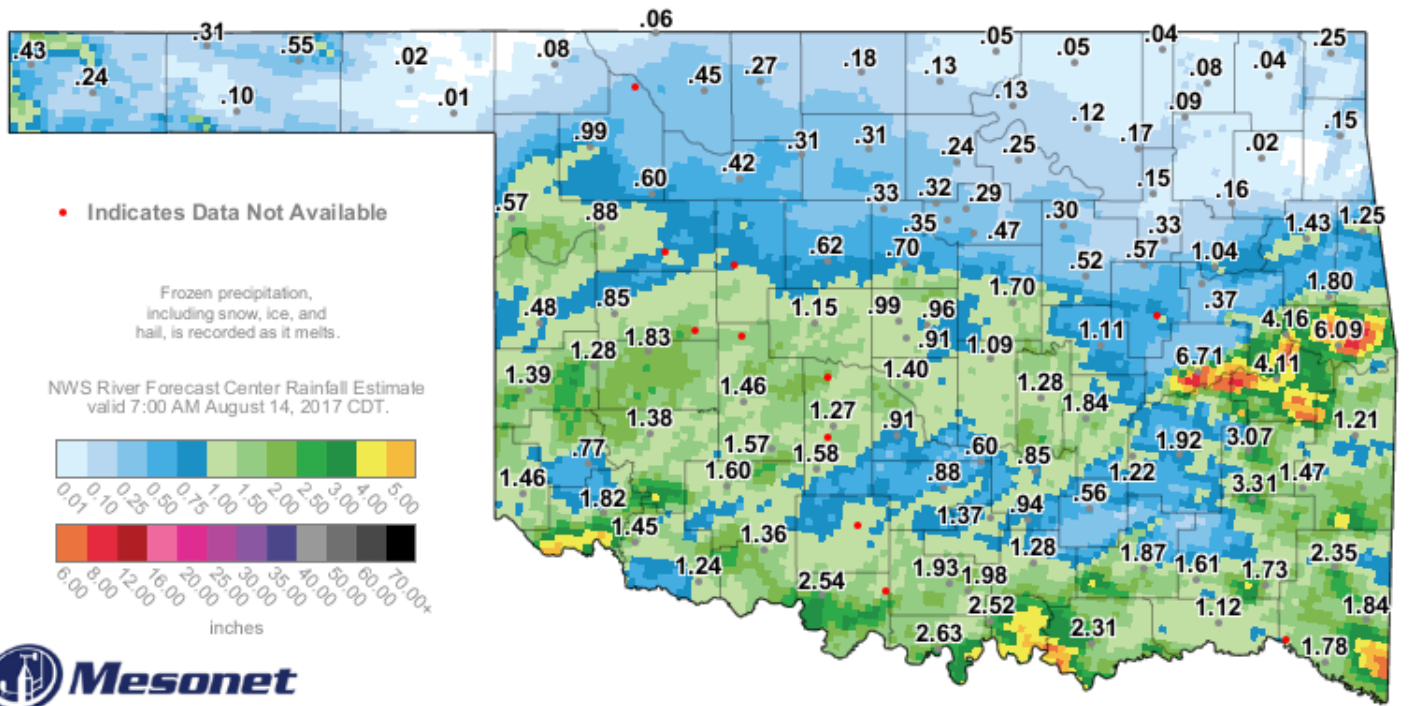


Fig. 9. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/14/2017.



2-Day Rainfall Accumulation (inches)

8:20 AM August 14, 2017 CDT

Created 8:25:47 AM August 14, 2017 CDT. © Copyright 2017

Fig. 10. 2-day Estimated observed rainfall (image) and OK Mesonet measurements ending at 8:20 am CDT 08/14/2017.

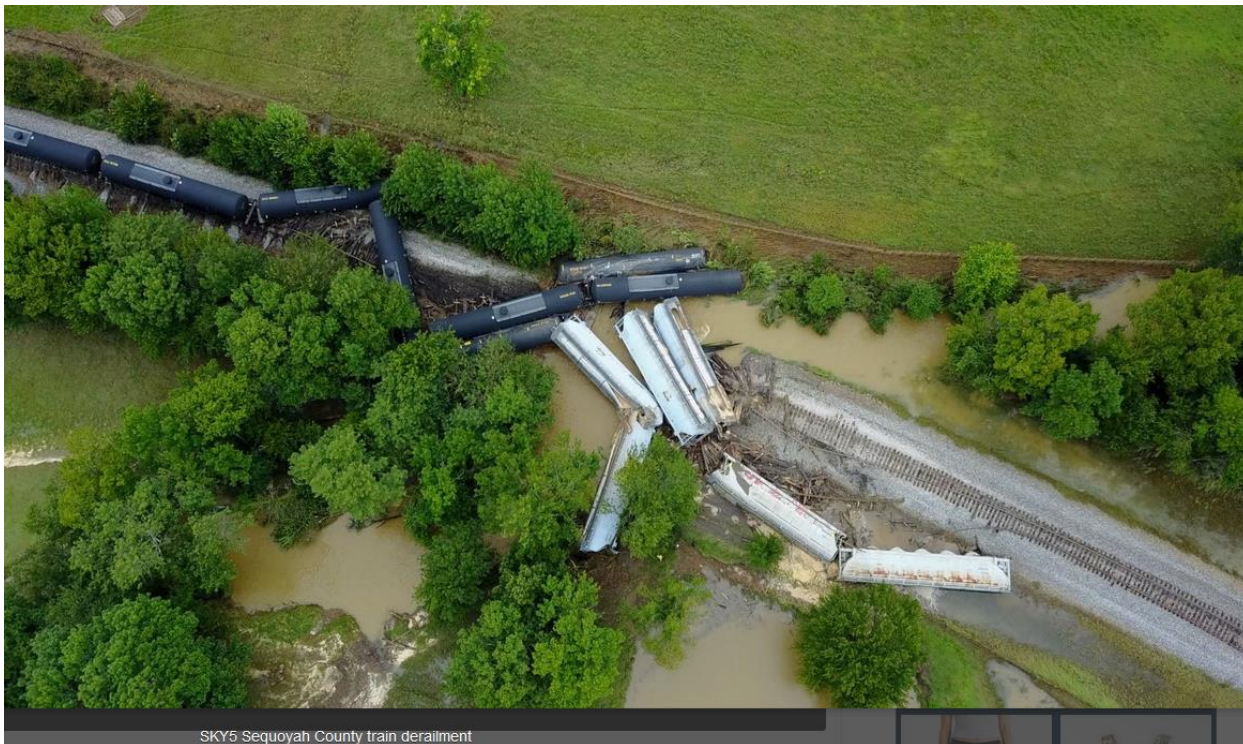


Fig. 11a. Train derailment on 8/13/2017. Image from KFSM 5News



Fig. 11b. Train derailment on 8/13/2017. Image from KFSM 5News

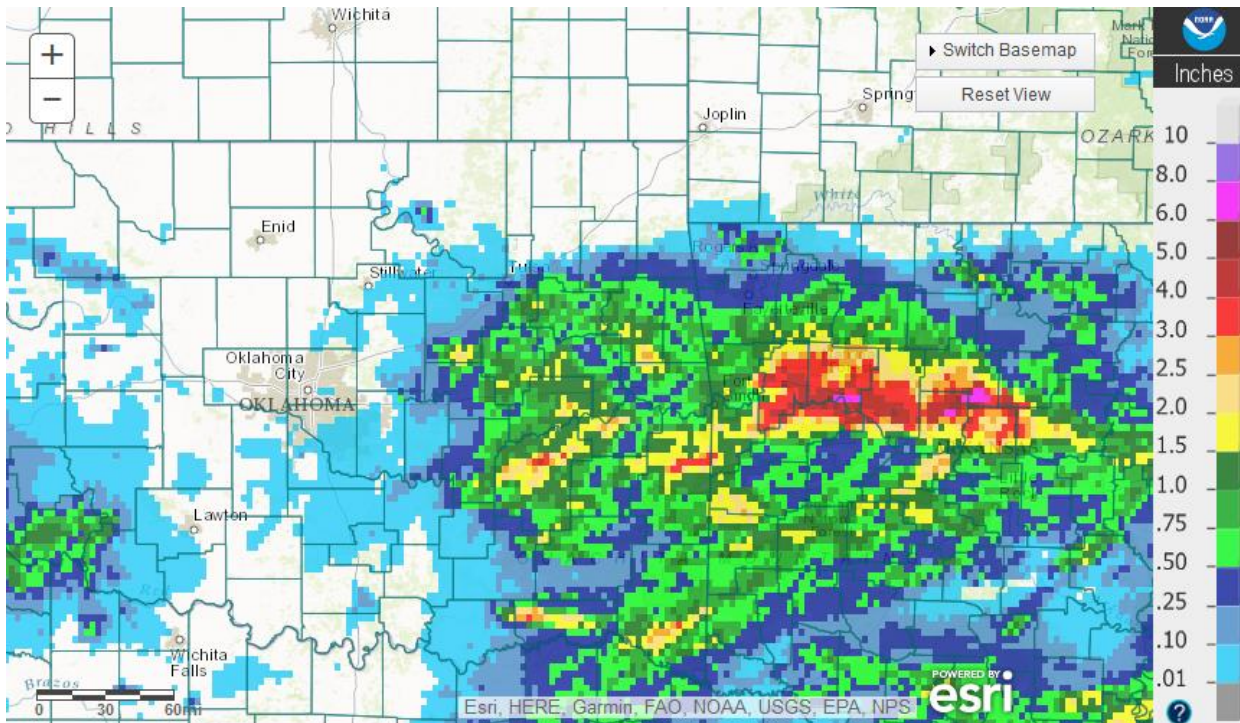


Fig. 11c. Train derailment on 8/13/2017. Image from KFSM 5News



Photo courtesy of Sequoyah County Emergency Management.

Fig. 11d. Train derailment on 8/13/2017. Image from Sequoyah County Emergency Management.



Tulsa, OK: August 15, 2017 1-Day Observed Precipitation
Valid on: August 15, 2017 12:00 UTC

Fig. 12. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/15/2017.

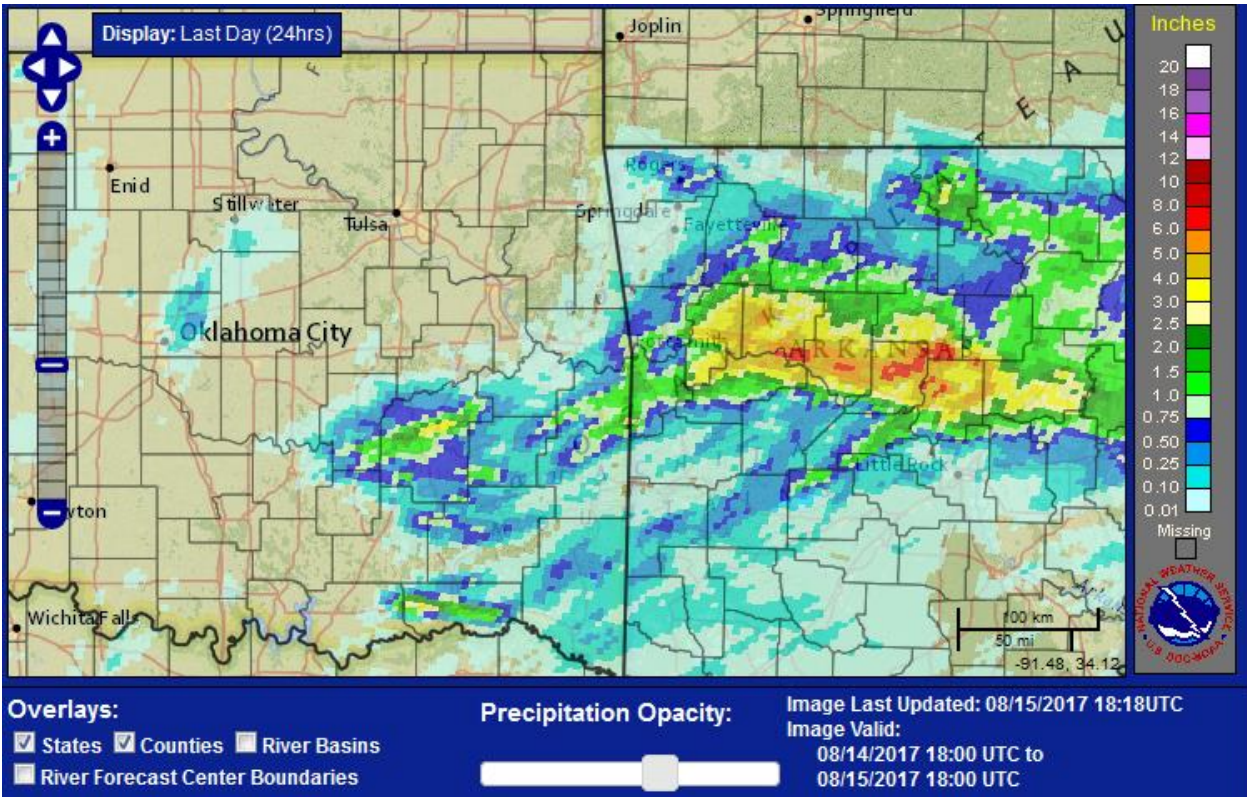


Fig. 13. 24-hour Estimated Observed Rainfall ending at 1pm CDT 8/15/2017.

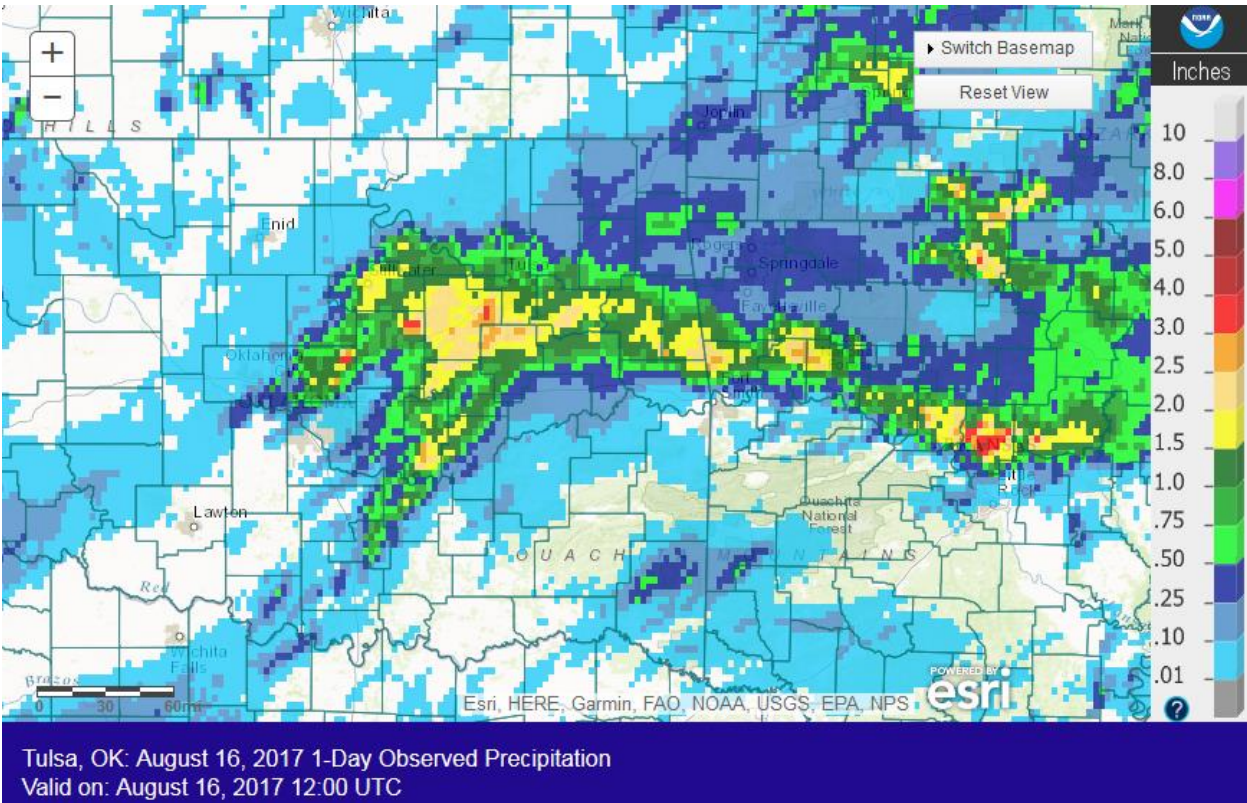


Fig. 14. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/16/2017.

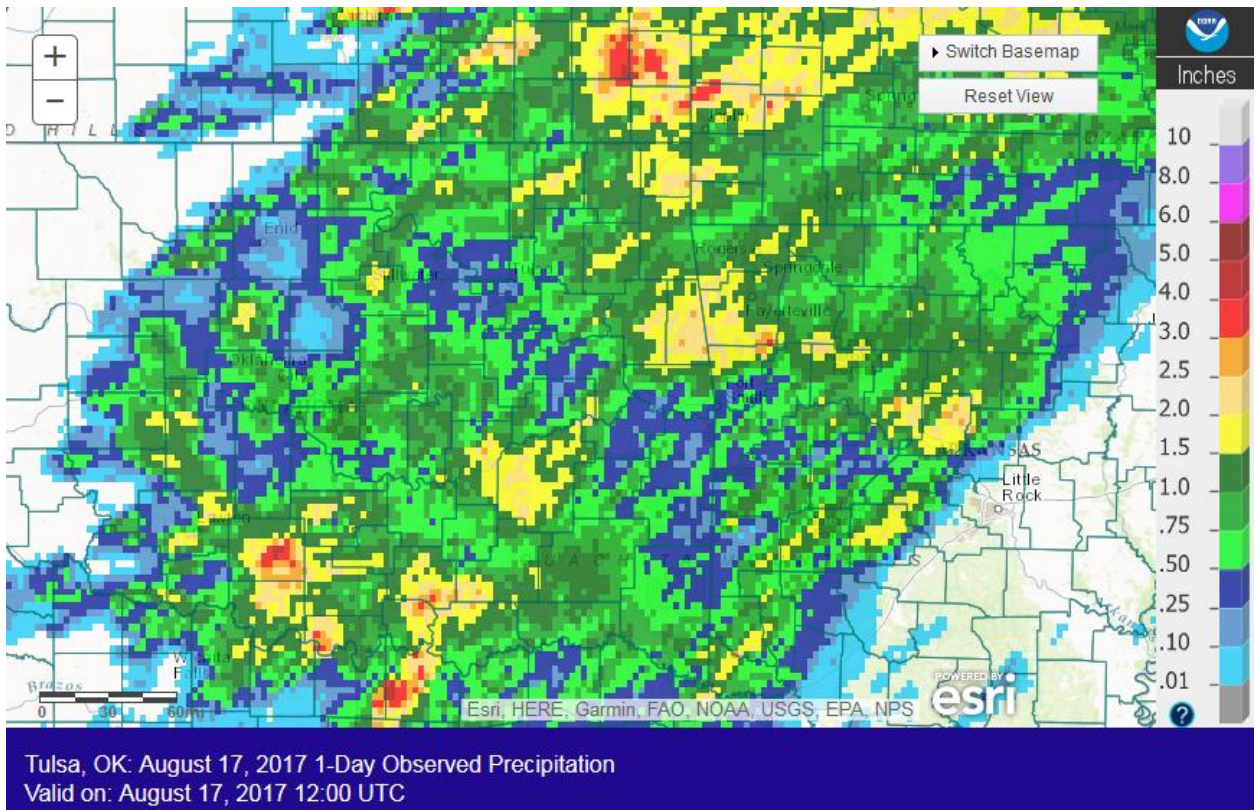


Fig. 15. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/17/2017.

August 21, 2017 was the first total solar eclipse in the U.S. since Feb. 1979. In Tulsa, the sun was 89% eclipsed during the peak at 1:08pm CDT (Fig. 16). The eclipse occurred from 11:39 am CDT – 2:37 pm CDT. There was a noticeable drop in temperature, wind, and solar radiation during the time of the eclipse, as seen in plots of meteorological parameters from three Oklahoma Mesonet stations, Figs. 17-19.

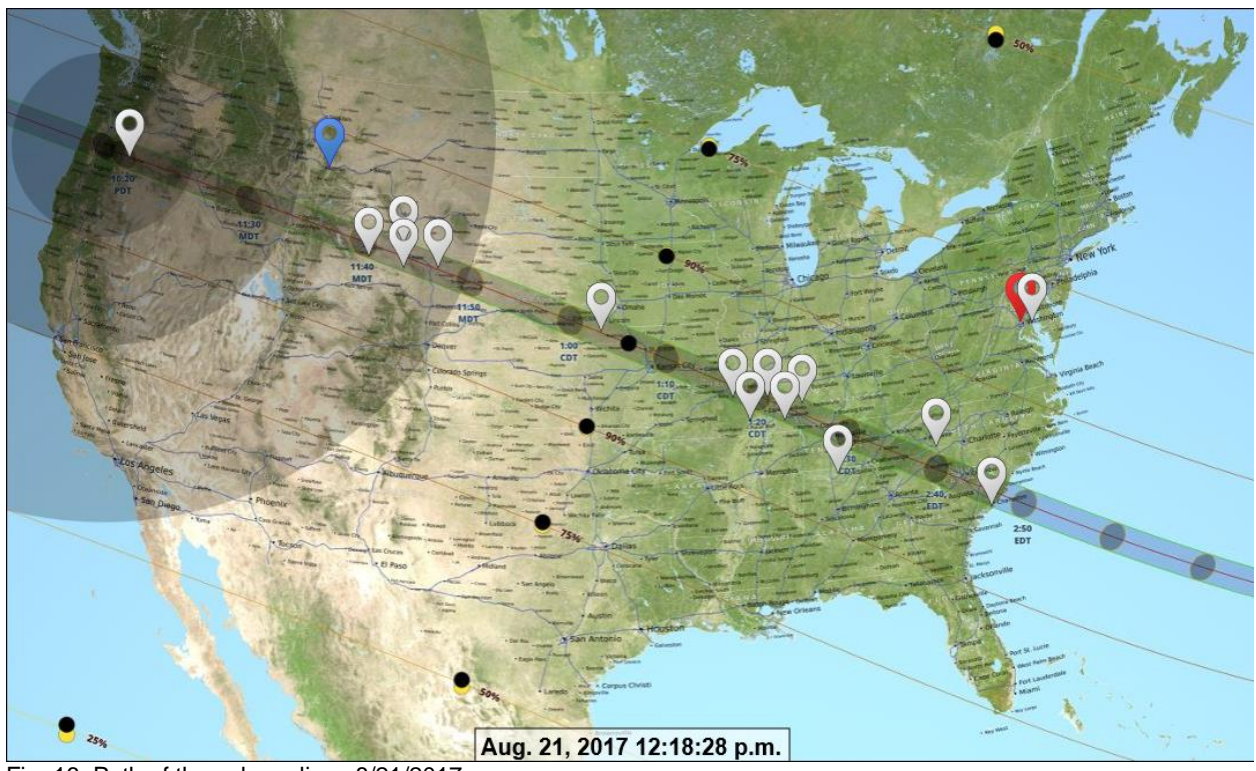


Fig. 16. Path of the solar eclipse 8/21/2017.

Tulsa International Airport observation: METAR KTUL 211753Z 17011KT 10SM FEW250 31/23 A3004 RMK AO2 SLP161
 SOLAR ECLIPSE IN PROGRESS T03110233 10322 20256 58008

Date	Time (cdt)	Wind (mph)	Vis. (mi.)	Weather	Sky Cond.	Temperature (°F)			Relative Humidity	Wind Chill (°F)	Heat Index (°F)		Pressure	
						Air	Dwpt	6 hour					altimeter (in)	sea level (mb)
21	13:53	S 12	10.00	A Few Clouds	FEW250	89	75			63%	NA	99	30.03	1015.9
21	12:53	S 13	10.00	A Few Clouds	FEW250	88	74	90	78	63%	NA	97	30.04	1016.1
21	11:53	S 9	10.00	A Few Clouds	FEW032 FEW250	90	75			62%	NA	101	30.06	1016.7

Table of observations at Tulsa International Airport during the eclipse on August 21, 2017.

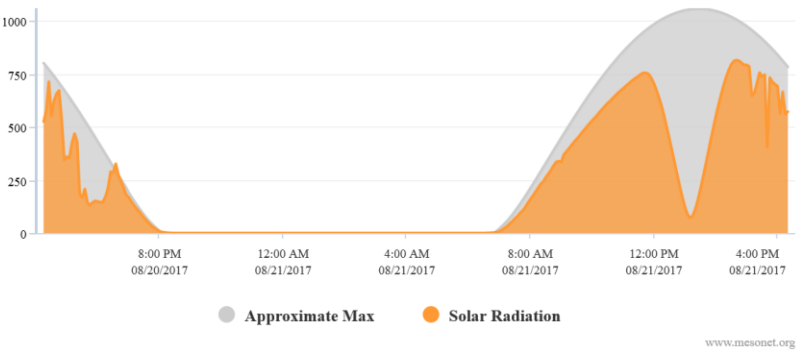
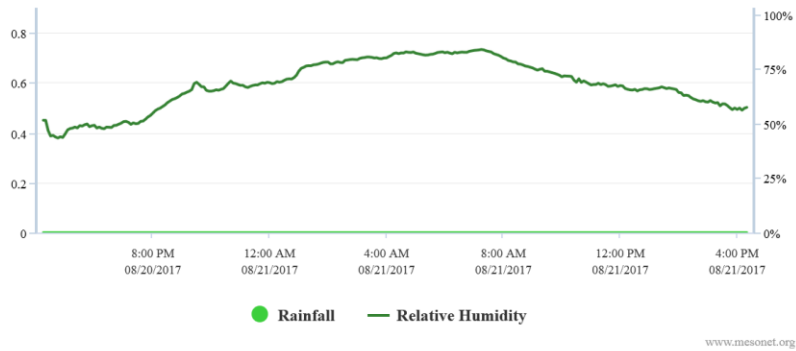
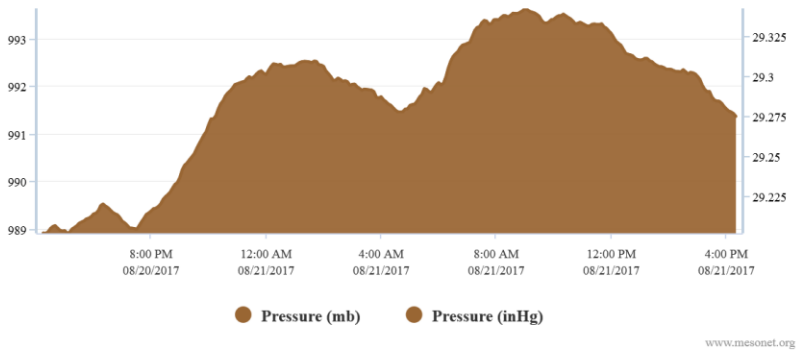
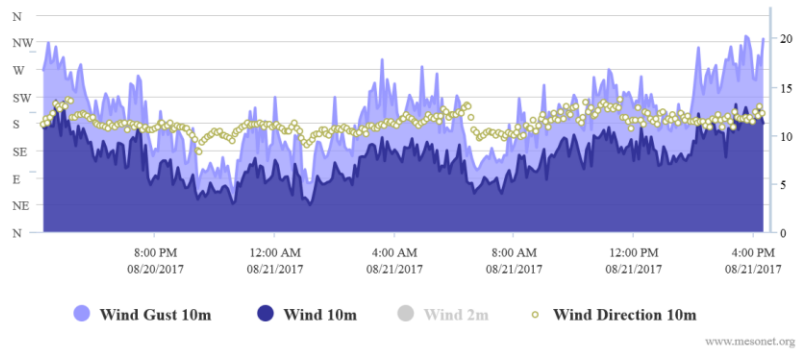
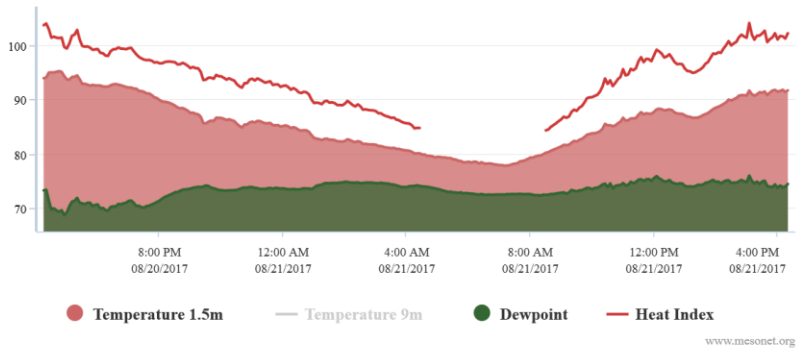


Fig. 17. Data from the Oklahoma Mesonet observation station in Tulsa, OK 8/21/2017.

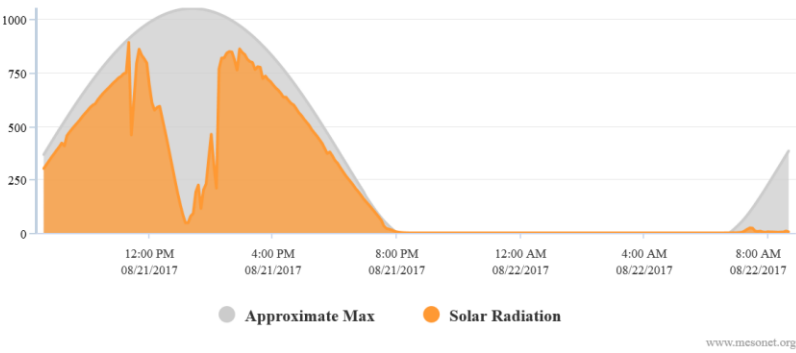
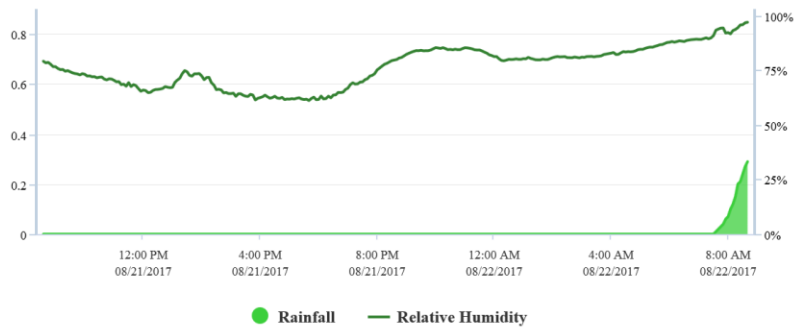
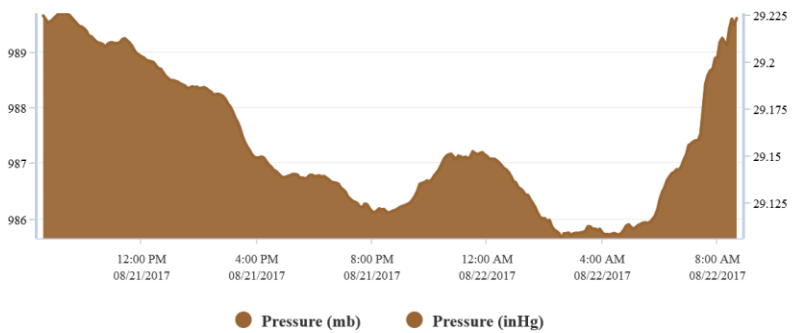
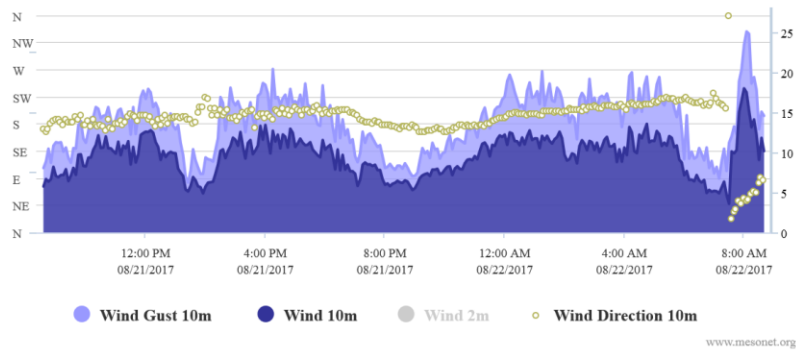
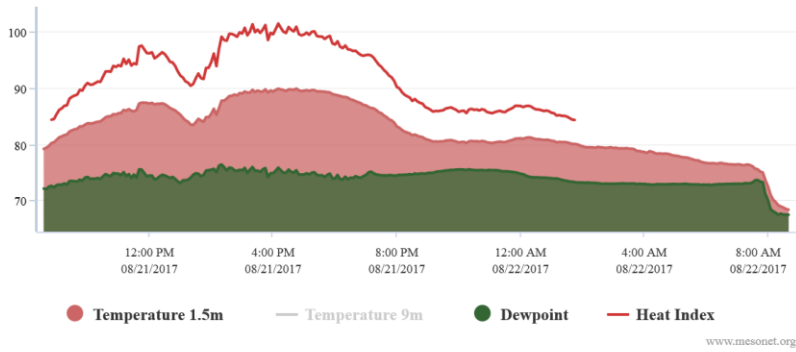


Fig. 18. Data from the Oklahoma Mesonet observation station in Miami, OK 8/21/2017.

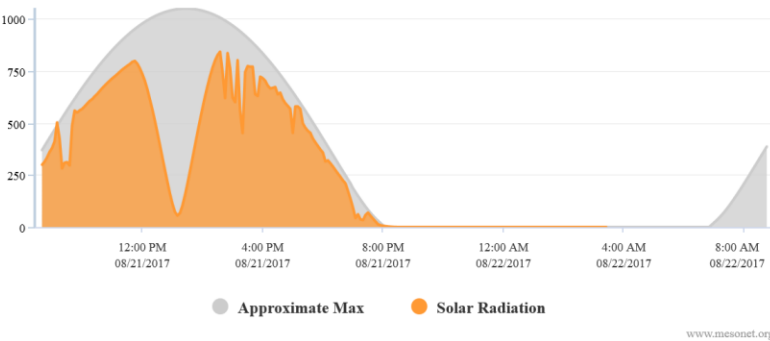
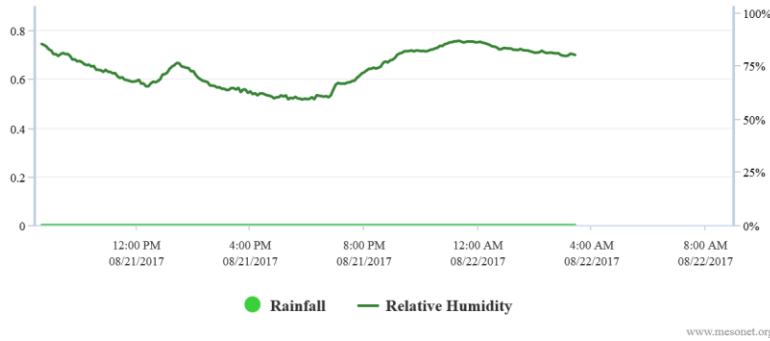
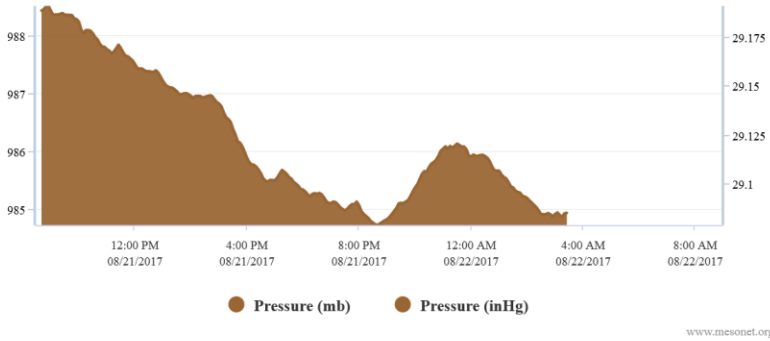
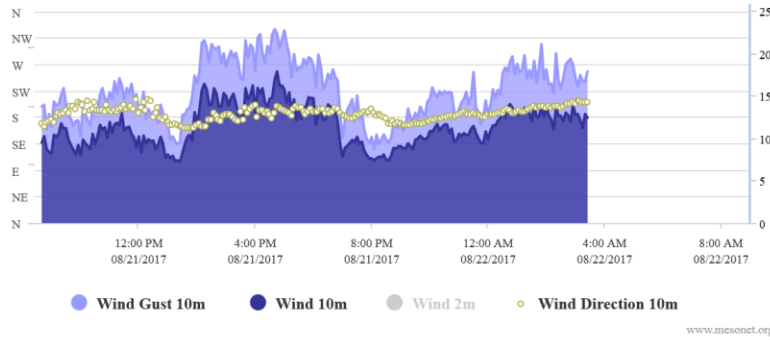
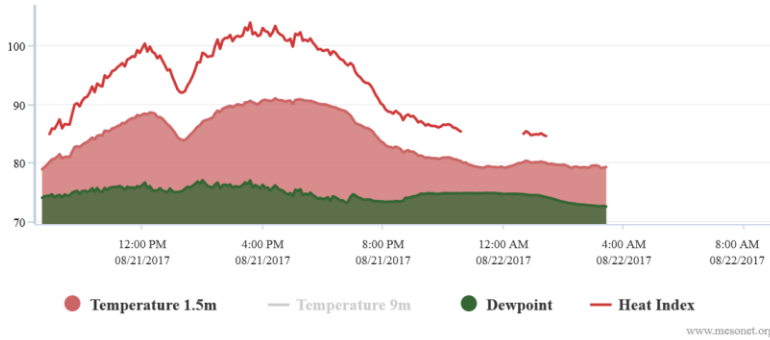


Fig. 19. Data from the Oklahoma Mesonet observation station in Copan, OK 8/21/2017.

A thunderstorm complex moving southeast across eastern KS and western MO clipped far northeast OK and northwest AR during the morning hours of the 22nd, bringing around 0.50" to around 1" of rain. During the afternoon and evening, thunderstorms developed along a cold front as it moved south across the area. Scattered showers and thunderstorms lingered through the overnight hours, before dissipating by mid-morning on the 23rd. Rainfall totals over east central and southeast OK and west central AR were 0.25" to around 2.5", with some localized 3"-4" totals in Pittsburg and Latimer Counties (Fig. 20). 3.60" was measured 4 miles ENE of Daisy, OK.

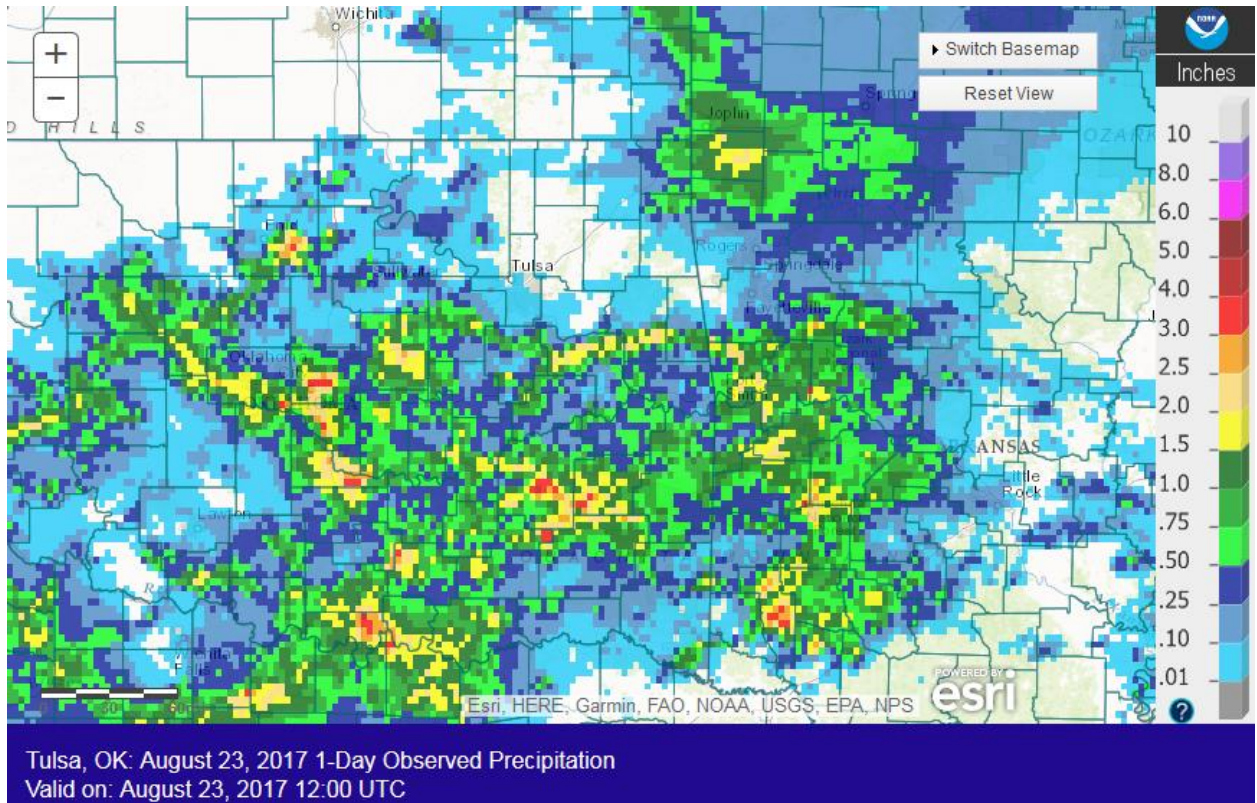


Fig. 20. 24-hour Estimated Observed Rainfall ending at 7am CDT 8/23/2017.

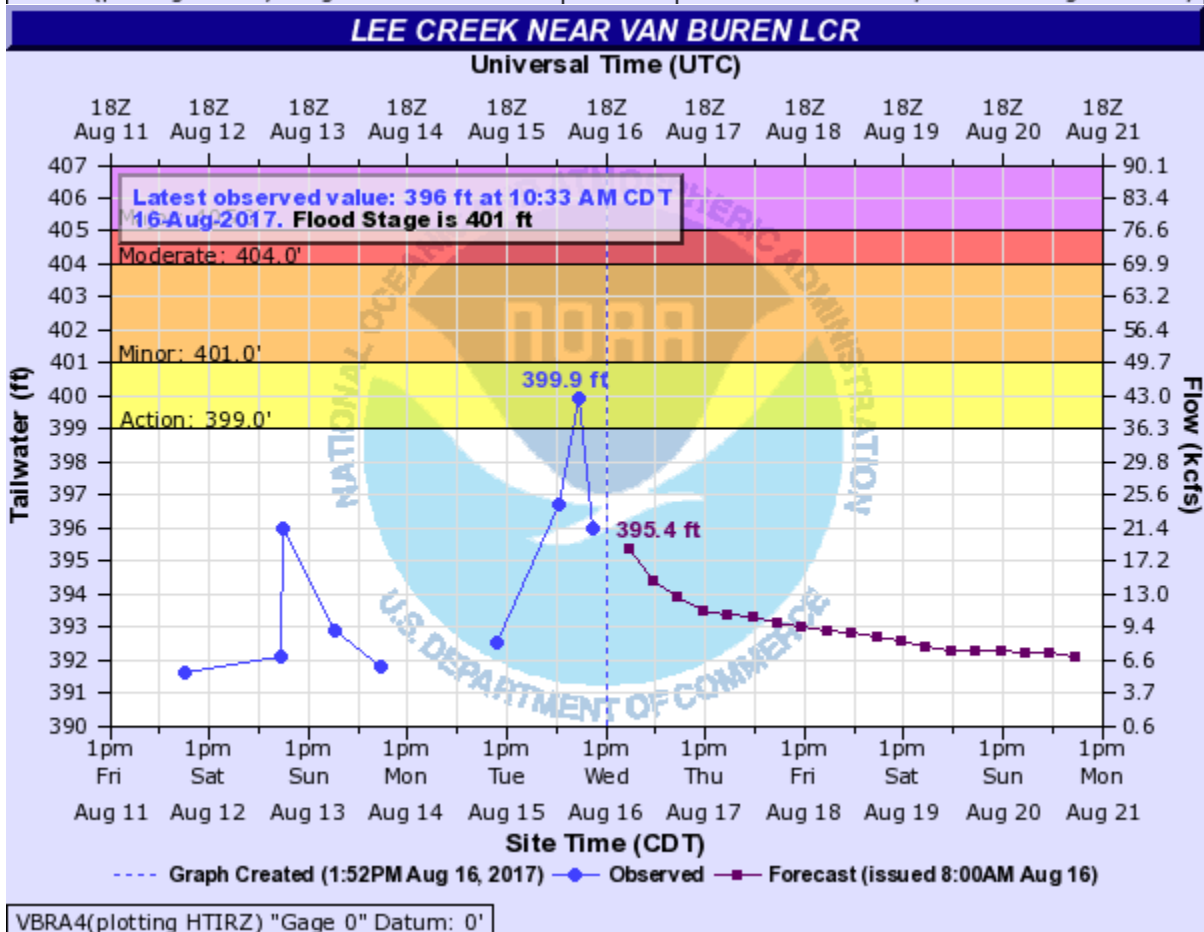
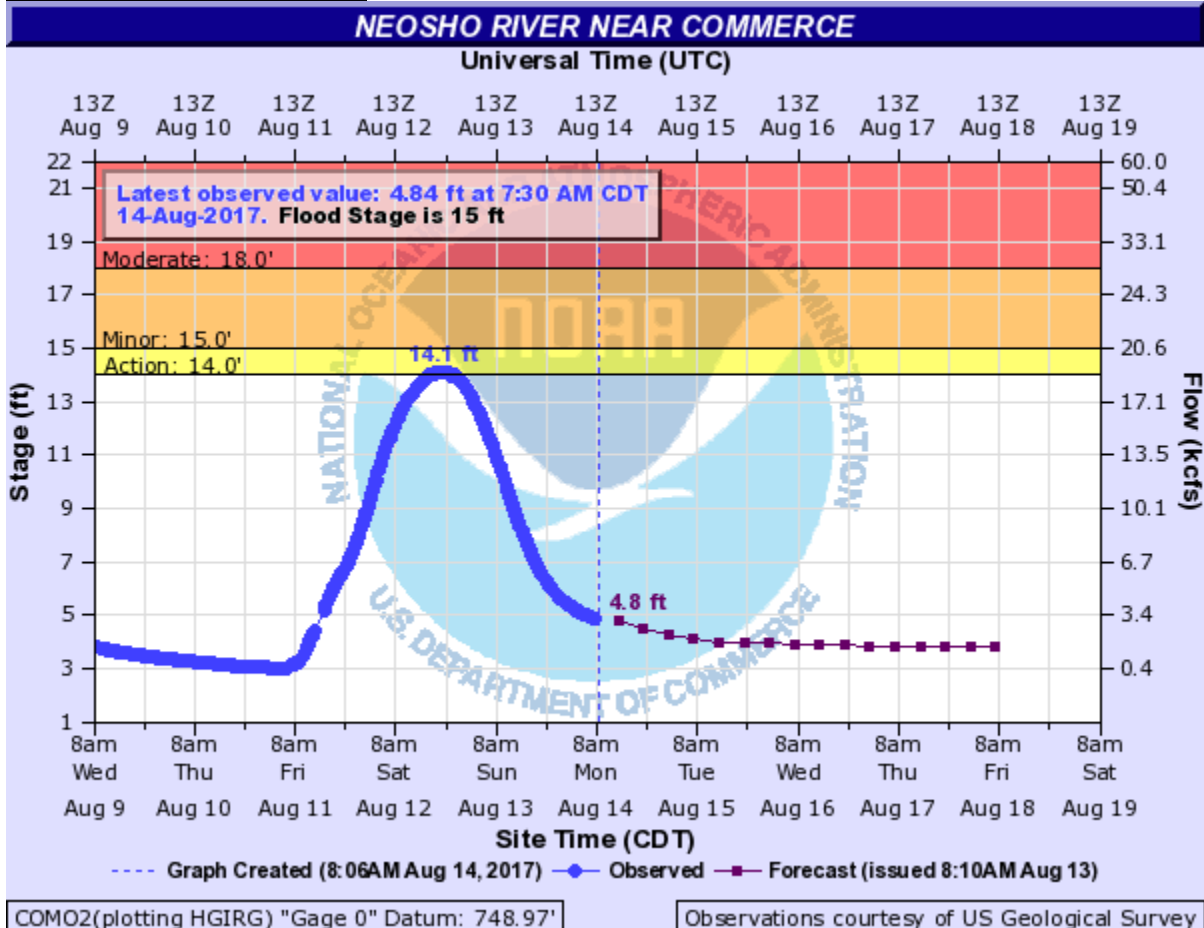
Written by:
Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in August 2017:

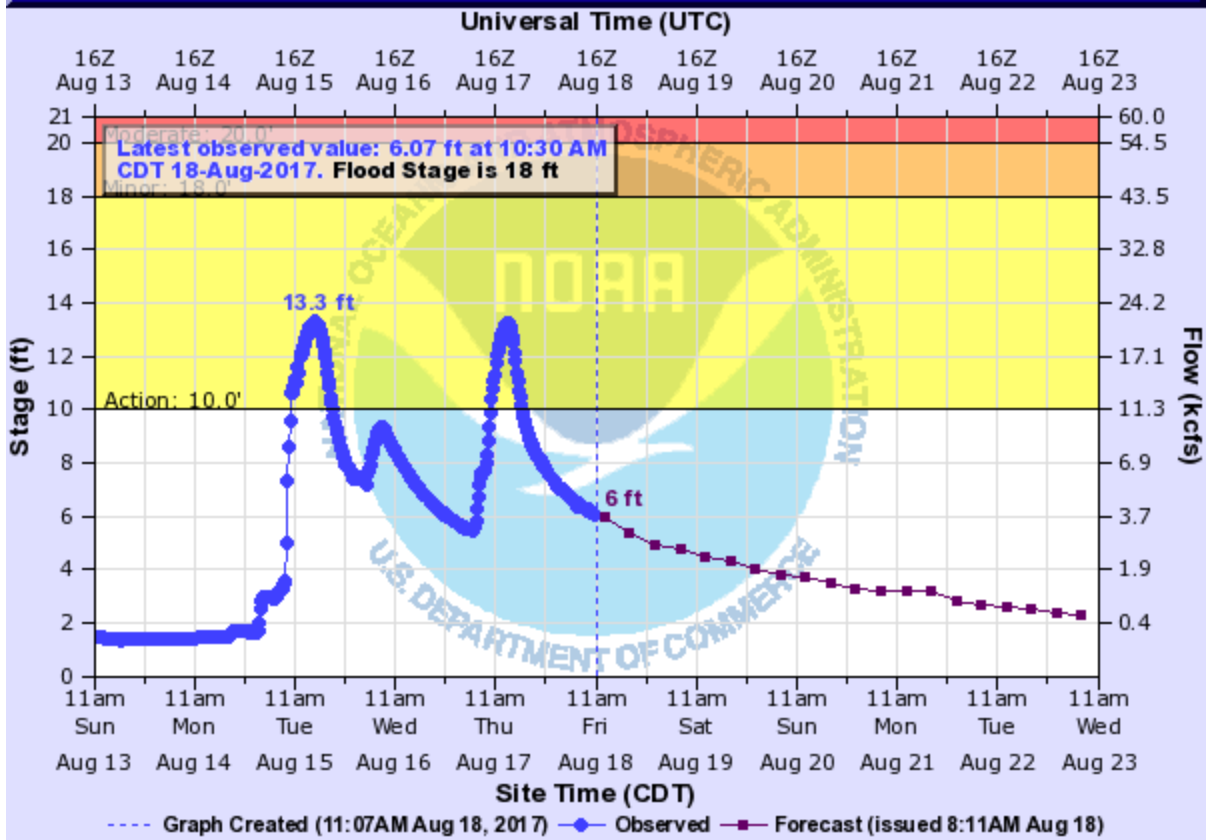
- *CWYO2 became a daily river forecast point September 7, 2016
- *MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014
- *Mixed case River Flood products began July 31, 2013

- 10 Flash Flood Warnings (FFW)
- 6 Flash Flood Statements (FFS)
- 4 Flash/Areal Flood Watches (FFA) (13 Watch FFA CON/EXT/EXA/EXB/CAN)
- 22 Urban and Small Stream Advisories (FLS)
- 7 Areal Flood Warnings (FLW)
- 5 Areal Flood Statements (FLS)
- 2 River Flood Warnings (FLW) (includes category increases)
- 12 River Flood Statements (FLS)
- 5 River Flood Advisories (FLS) (8 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:



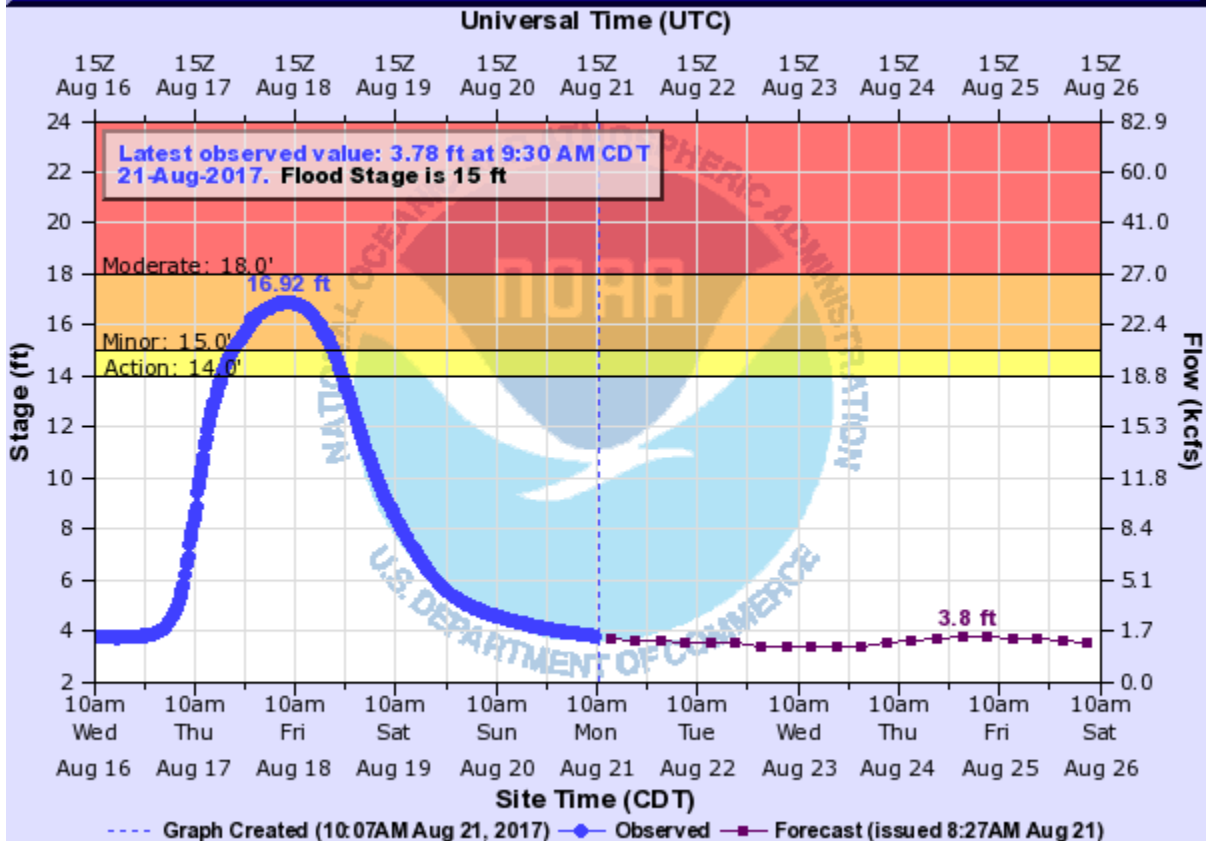
MULBERRY RIVER (AR) NEAR MULBERRY



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

Observations courtesy of USGS/USACE/ADEQ

NEOSHO RIVER NEAR COMMERCE



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

Observations courtesy of US Geological Survey