

Tulsa, OK: August, 2015 Monthly Percent of Normal Precipitation

Fig. 1b. Estimated % of Normal Rainfall for August 2015

In Tulsa, OK, August 2015 ranked as the 24th coldest August (79.4°F, tied 2009, 1981; since records began in 1905) and the 21st wettest August (5.16"; since records began in 1888). Fort Smith, AR had the 52nd coldest August (80.2°F; since records began in 1882) and the 31st wettest August (4.43"; since records began in 1882). Fayetteville, AR had the 8th coldest (74.0°F, tied 1949, 1974, 2009) and the 20th wettest (4.41") August since records began in 1949.

In Tulsa, OK, Summer 2015 ranked as the 40th warmest Summer (81.5°F, tied 1999, 1986, 1982, 1957, 1932, 1931, 1929, 1921; since records began in 1905) and the 16th wettest Summer (16.65"; since records began in 1888). Fort Smith, AR had the 28th warmest Summer (81.8°F, tied 1956, 1933; since records began in 1882) and the 12th wettest Summer (16.35"; since records began in 1882). Fayetteville, AR had the 28th coldest (75.9°F, tied 2008, 2000) and the 3rd wettest (19.23") Summer since records began in 1950.

Some of the larger precipitation reports (in inches) for August 2015 included:

Miami, OK (meso)	8.51	Miami, OK (coop)	7.65	Van Buren 2.1NNW (coco)	7.41
Claremore 6.6W, OK (coco)	7.36	Stigler, OK (meso)	7.26	Copan, OK (meso)	6.89
Jay 3.3NNE, OK (coco)	6.80	Spavinaw, OK (coop)	6.77	Prairie Grove 0.5NE, AR (coco)	6.47

Some of the lowest precipitation reports (in inches) for August 2015 included:

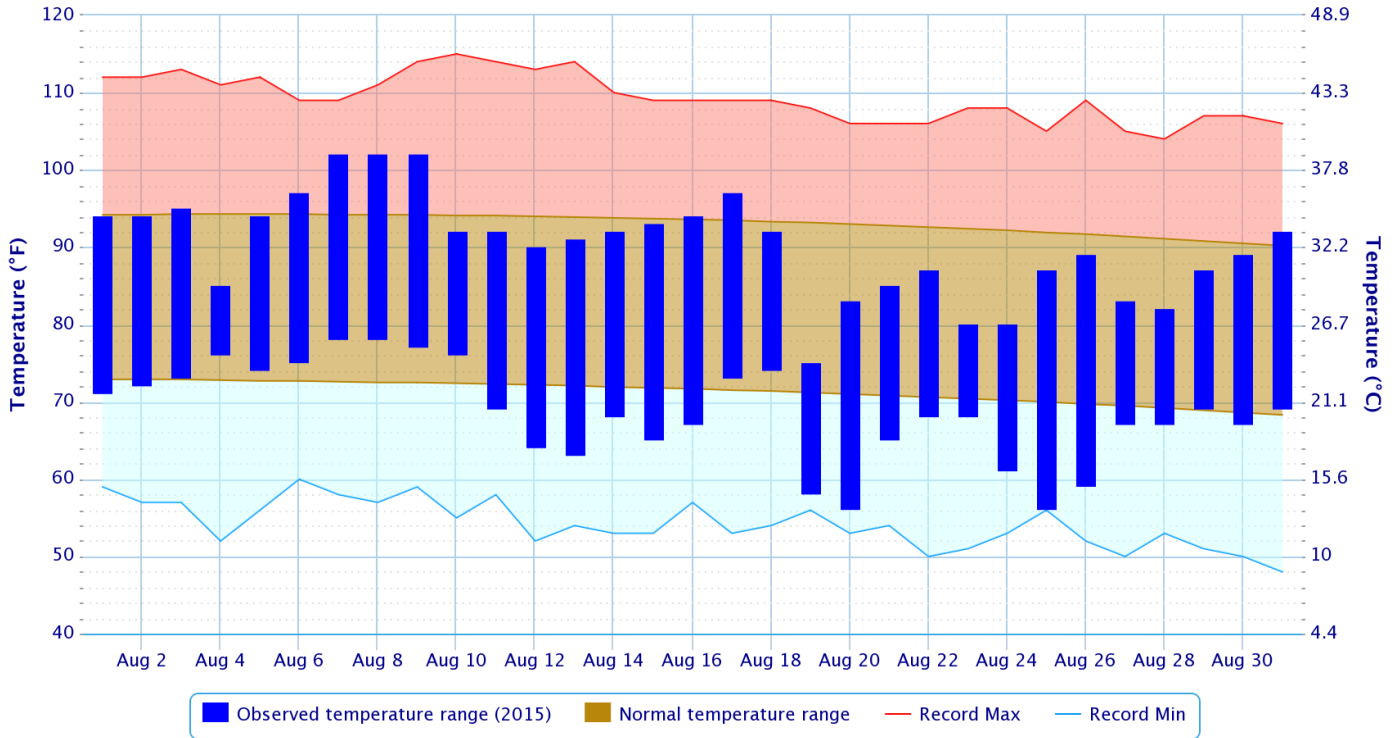
Hugo, OK (meso)	0.18	Antlers, OK (coop)	0.33	Antlers 5NW, OK (meso)	0.52
Cloudy, OK (meso)	0.86	Porter, OK (meso)	1.75	Okmulgee, OK (meso)	1.77
Oktaha 2NE, OK (coop)	1.80	Hectorville, OK (meso)	1.83	Clayton, OK (meso)	1.98

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

Rank since 1921	Last 30 Days (Aug 2-31)	Last 60 Days (Jul 3 – Aug 31)	Summer 2015 (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, 2014 – Aug 31, 2015)
Northeast OK	17 th wettest	8th wettest	11 th wettest	2nd wettest	5th wettest	7th wettest	10th wettest
East Central OK	37 th wettest	2nd wettest	3rd wettest	1st wettest	1st wettest	2nd wettest	1st wettest
Southeast OK	22 nd driest	21 st driest	21 st driest	3rd wettest	5th wettest	8th wettest	12 th wettest
Statewide	36 th driest	14 th wettest	13 th wettest	1st wettest	1st wettest	1st wettest	2nd wettest

Daily Temperature Data - Tulsa Area, OK (ThreadEx)

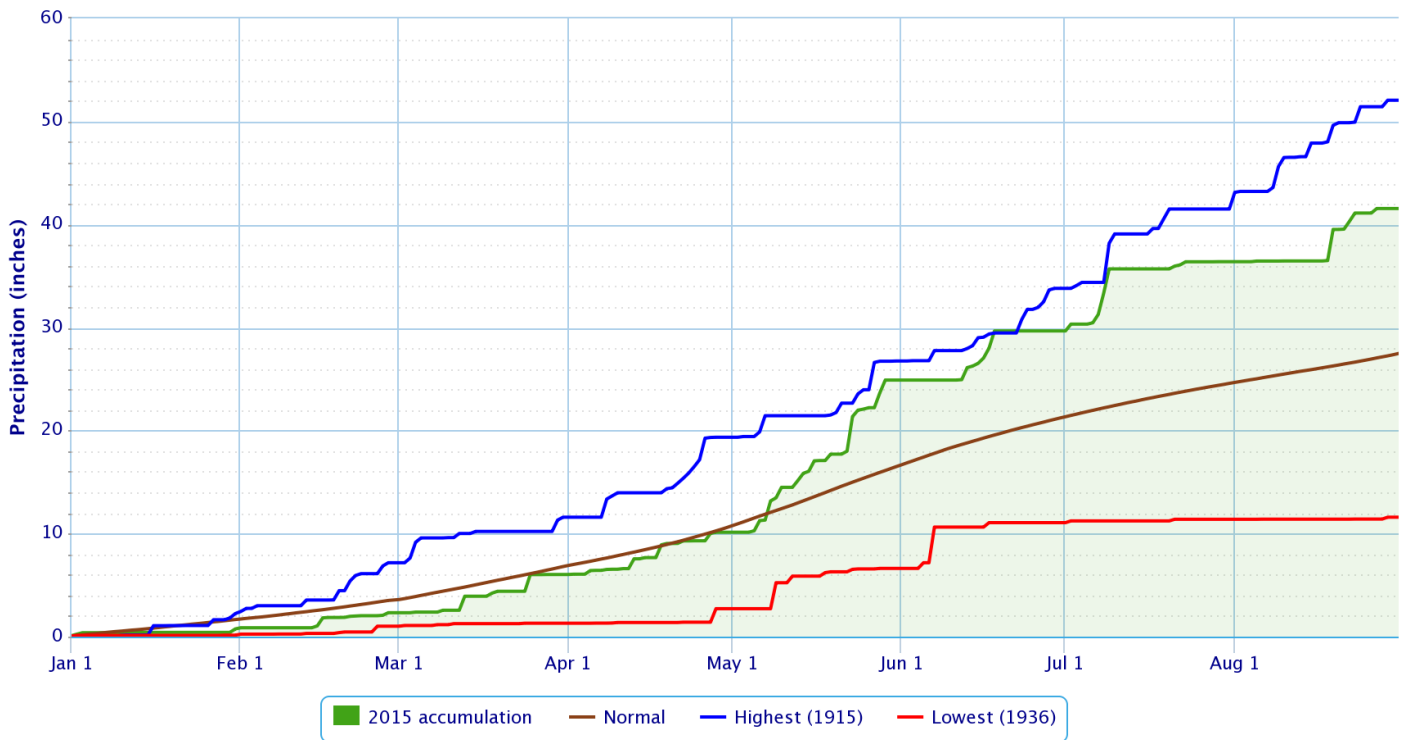
Period of Record - 1905-01-06 to 2015-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation - Tulsa Area, OK (ThreadEx)

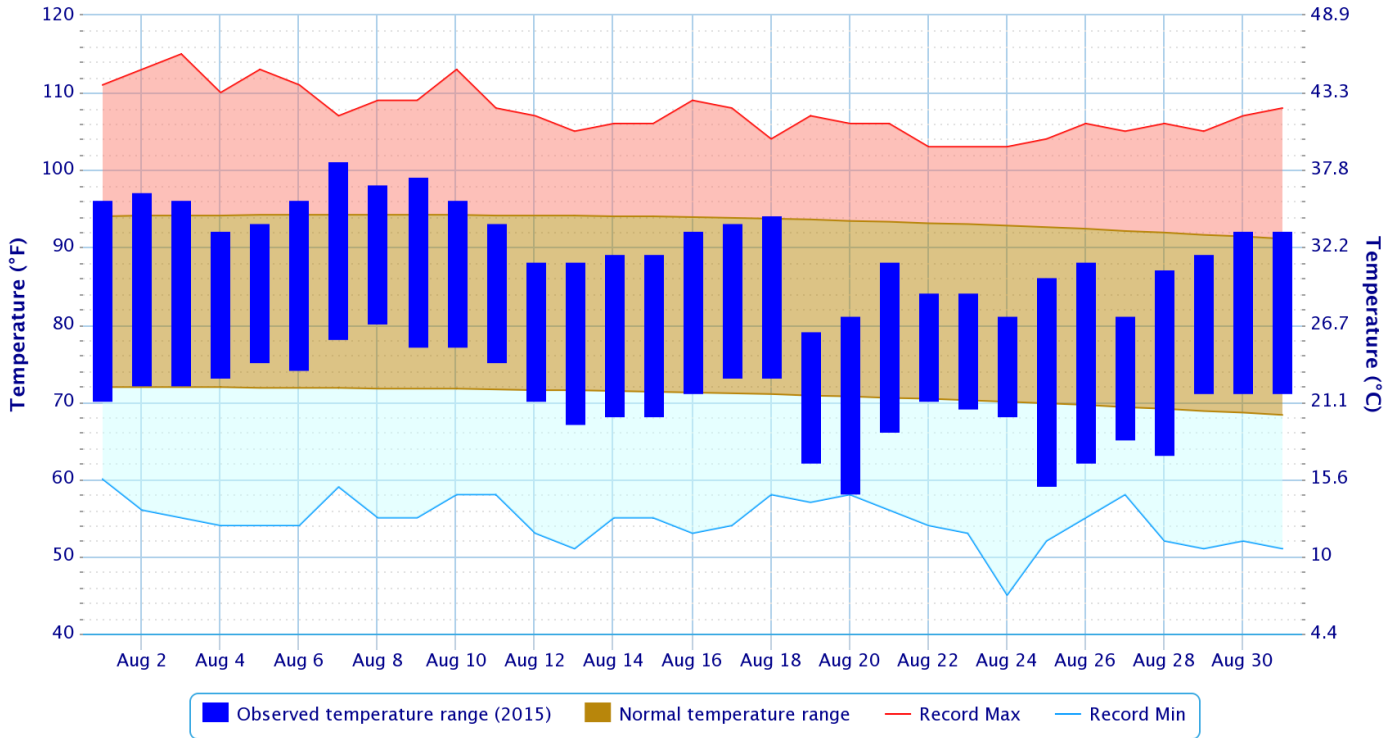
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

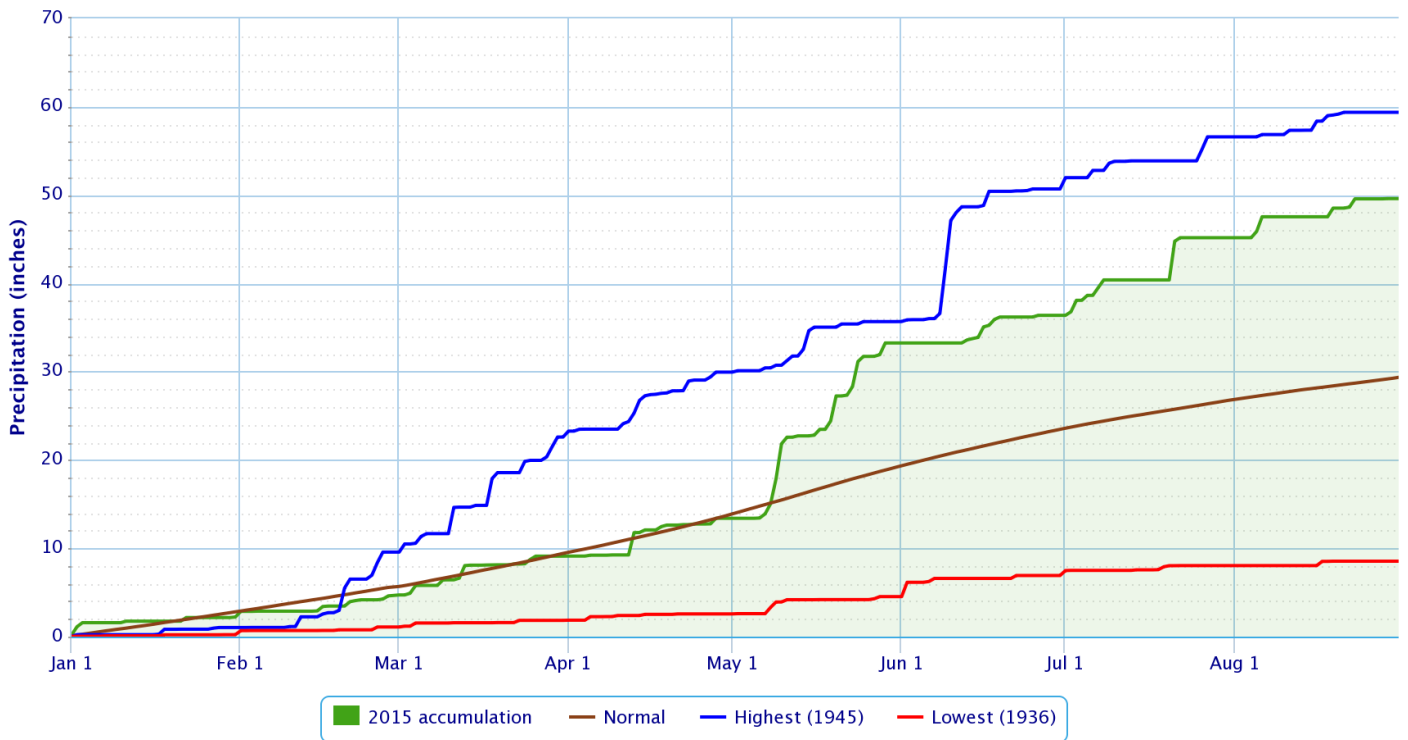
Period of Record – 1882-06-01 to 2015-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



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Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

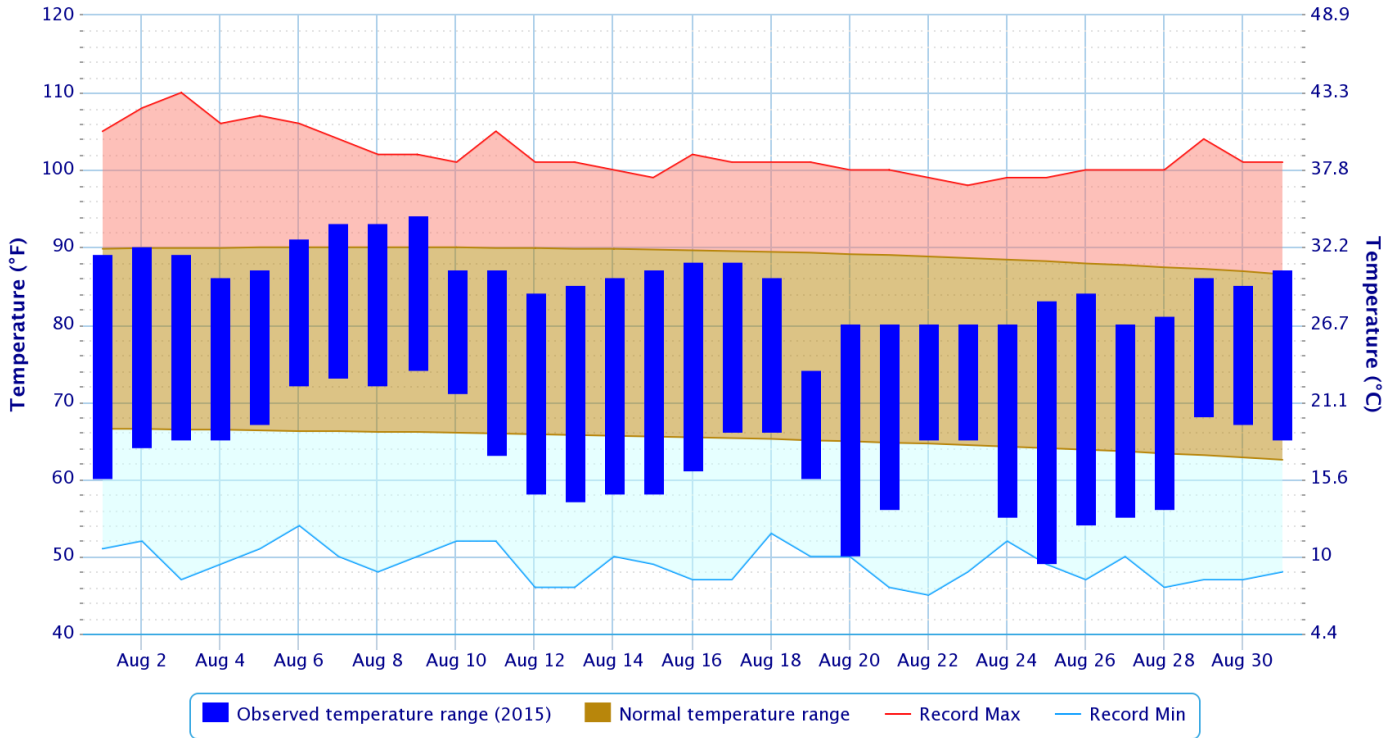
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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Daily Temperature Data – FAYETTEVILLE DRAKE FLD, AR

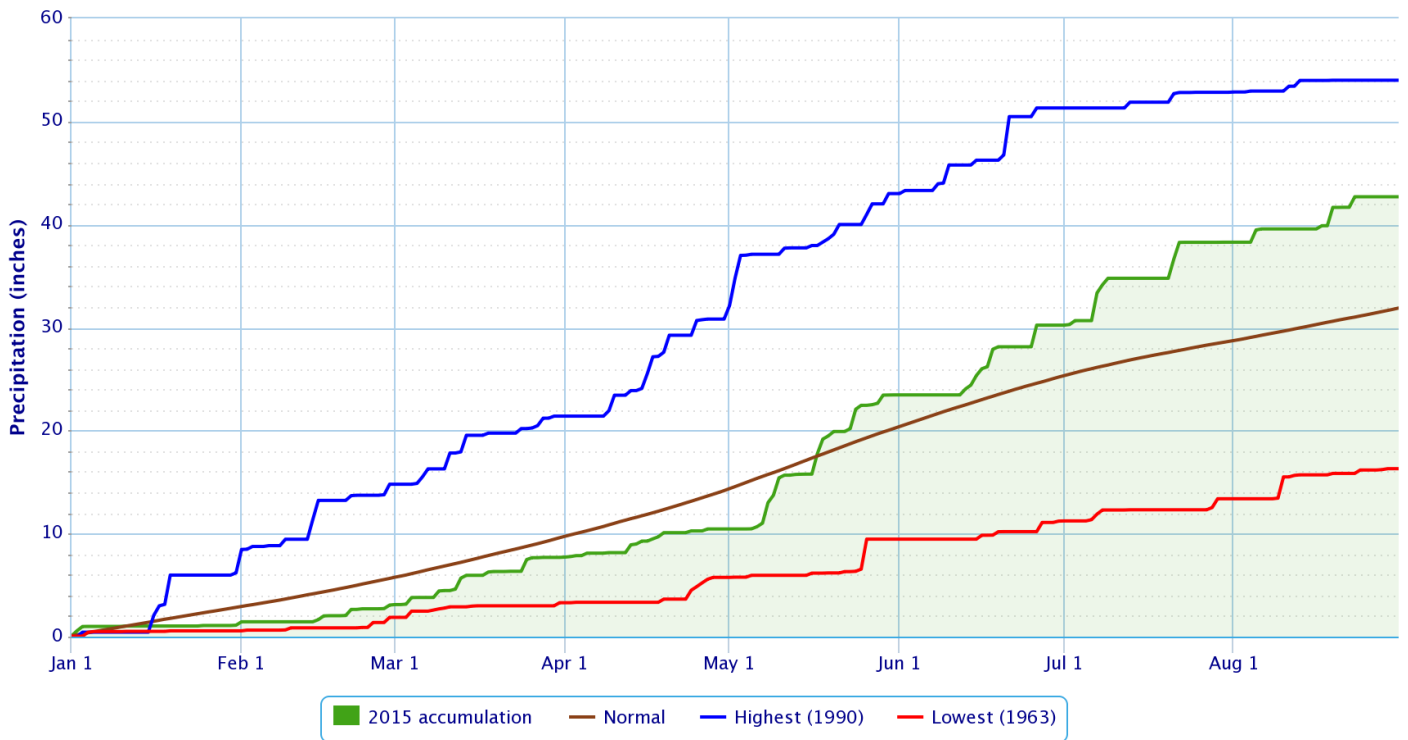
Period of Record – 1949-07-14 to 2015-09-02. Normals period: 1981-2010. Click and drag to zoom chart.



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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

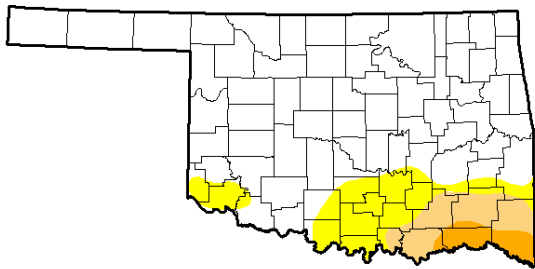


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Drought

According to the [U.S. Drought Monitor](#) (USDM) from September 1, 2015 (Figs 2a, 2b), Severe (D2) drought emerged across Choctaw and far southern Pushmataha Counties in southeast OK. Moderate (D1) drought was occurring over most of Pushmataha County. Abnormally dry (D0), but not in drought, conditions were located across the far southern portions of Pittsburg, Latimer, and Le Flore Co. Despite the extreme rainfall during the spring and early summer, from July 10th-Sep. 3, Choctaw and southern Pushmataha Counties received less than 20% of the normal rainfall (4"-6" below normal; 6th driest since 1921) for that time period (Fig. 3a). Much of the rain from the spring and early summer evaporated during July and August, hence the very high heat index values of 105°-115°. The lack of rainfall combined with the evaporation has depleted the soil moisture across southeast OK (Figs. 3b, 3c). This has resulted in the development of "flash drought."

U.S. Drought Monitor Oklahoma



September 1, 2015
(Released Thursday, Sep. 3, 2015)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	79.57	20.43	8.84	2.83	0.00	0.00
Last Week 8/25/2015	81.86	18.14	8.85	0.00	0.00	0.00
3 Months Ago 6/2/2015	88.91	11.09	0.00	0.00	0.00	0.00
Start of Calendar Year 12/31/2014	25.63	74.37	62.03	40.84	21.74	5.70
Start of Water Year 9/30/2014	8.55	91.45	73.31	58.13	20.92	4.64
One Year Ago 9/2/2014	19.50	80.50	70.40	46.15	16.51	2.25

Intensity:

 D0 Abnormally Dry	 D1 Moderate Drought	 D2 Severe Drought	 D3 Extreme Drought	 D4 Exceptional Drought
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The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

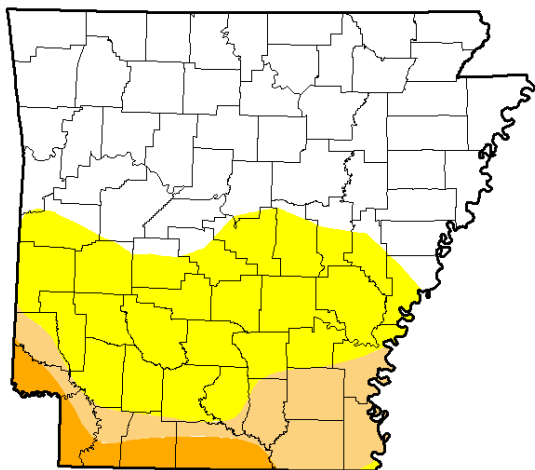
Author:
Anthony Artusa
NOAA/NWS/NCEP/CPC



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

Fig. 2a. Drought Monitor for Oklahoma

U.S. Drought Monitor Arkansas



September 1, 2015
(Released Thursday, Sep. 3, 2015)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	55.08	44.92	14.49	4.45	0.00	0.00
Last Week 8/25/2015	55.09	44.91	5.64	0.06	0.00	0.00
3 Months Ago 6/2/2015	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 12/31/2014	36.88	63.12	14.40	0.00	0.00	0.00
Start of Water Year 9/30/2014	54.54	45.46	9.13	0.00	0.00	0.00
One Year Ago 9/2/2014	86.17	13.83	2.36	0.00	0.00	0.00

Intensity:

 D0 Abnormally Dry	 D1 Moderate Drought	 D2 Severe Drought	 D3 Extreme Drought	 D4 Exceptional Drought
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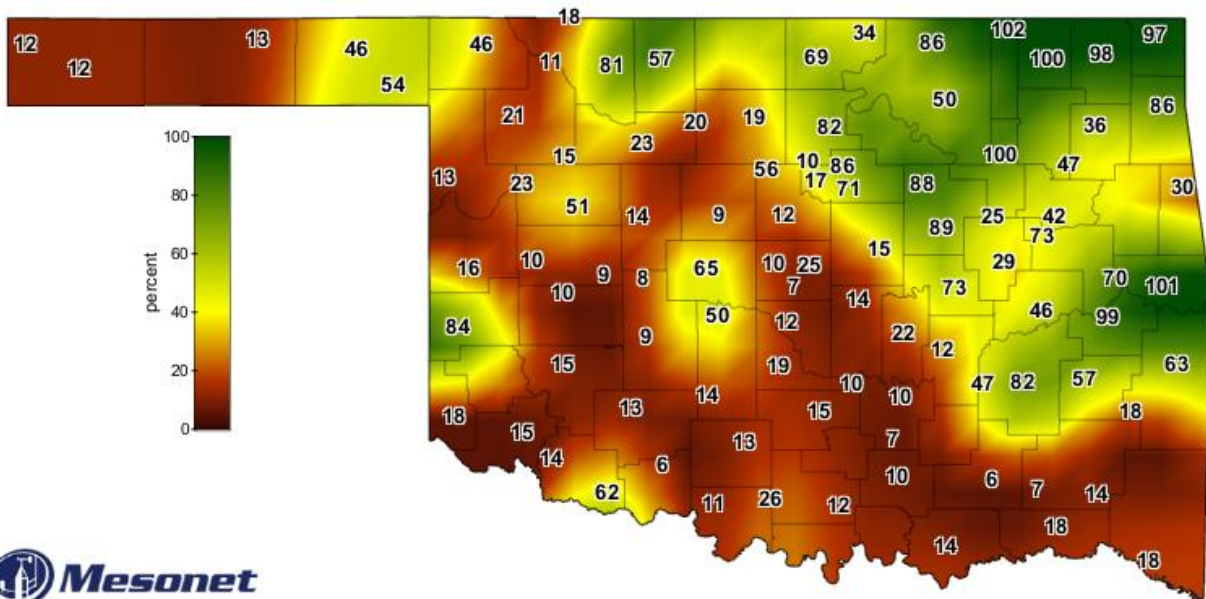
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Anthony Artusa
NOAA/NWS/NCEP/CPC



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

Fig. 2b. Drought Monitor for Arkansas



16-inch Percent Plant Available Water

September 2, 2015

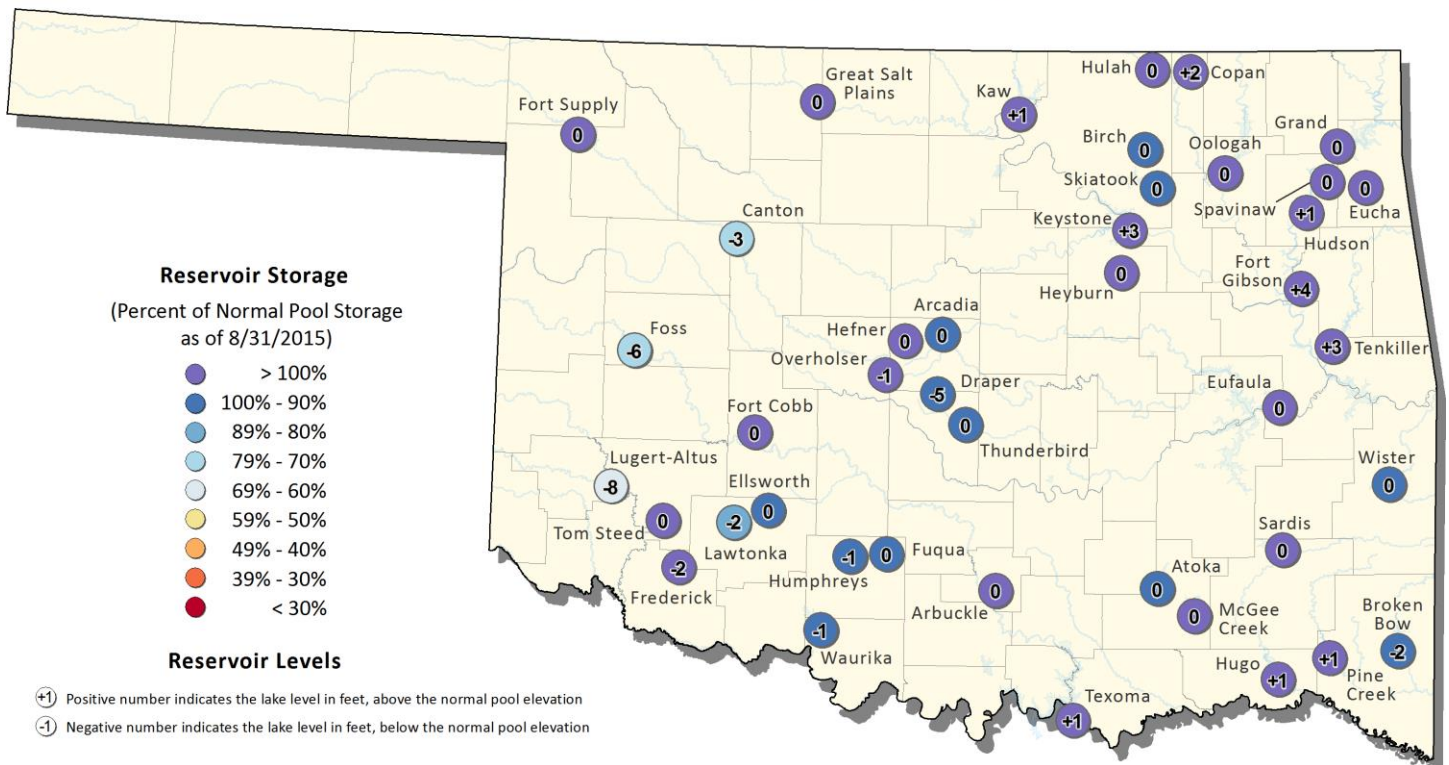
Created 7:30:12 AM September 3, 2015 CDT. © Copyright 2015

Fig. 3c. Oklahoma Mesonet 16" below ground percent plant available water for September 2, 2015.

Reservoirs

According to the USACE, most of the major reservoirs in the HSA had returned to normal levels and were operating within $\pm 5\%$ of the top of their conservation pools. The exception was Beaver Lake, which was still operating at 67% of its flood control pool as of 8/31/2015. Two other lakes remained in their flood control pools at the end of August: Ft. Gibson Lake 9% and Tenkiller Lake 6%.

Oklahoma Surface Water Resources Reservoir Levels and Storage as of 8/31/2015



This map shows reservoir storage as a percentage of normal pool storage capacity. The source information was collected from real-time lake gages monitored by the U.S. Army Corps of Engineers (http://www.swt-wc.usace.army.mil/old_resvrep.htm), and the U.S. Geological Survey (http://waterdata.usgs.gov/ok/nwis/current/?type=lake&group_key=basin_cd). For more information please visit the OWRB's website at (<http://www.owrb.ok.gov>)



Outlooks

The [Climate Prediction Center](#) (CPC) outlook for September 2015 (issued August 31, 2015) indicates a slightly enhanced chance for above normal temperatures across eastern OK and northwest AR. The outlook also calls for an equal chance of above, near, or below median rainfall across eastern OK and northwest AR. This outlook is based on both short- and extended range weather forecasts. The first third of the month is forecast to see anomalous troughing in the western U.S. and an amplified ridge over the eastern U.S., which is a pattern generally inconsistent with the ongoing El Niño conditions. However, by the end of the month, the pattern will become consistent with El Niño. The slightly enhanced chance for above normal temperatures is supported by short-, extended-, and month long dynamical models due to the anomalous ridge.

For the 3-month period September-October-November 2015, CPC is forecasting an enhanced chance for below normal temperatures and above median precipitation across all of eastern OK and northwest AR (outlook issued August 20, 2015). According to CPC, weekly El Niño conditions are currently of strong strength. The oceanic and atmospheric conditions reflect a significant and strengthening El Niño. There is a 90% chance for El Niño to continue through the upcoming winter and an 85% for it to persist into early spring 2016. Forecasting tools indicate El Niño will peak at strong intensity by late autumn. However, El Niño impacts are generally most significant in the Southern Plains during the cold seasons. Therefore, this outlook is based primarily on both statistical and dynamical forecast tools, but does consider El Niño conditions and possible impacts.

Summary of Precipitation Events Daily quality controlled rainfall maps can be found at:
http://water.weather.gov/precip/index.php?location_type=wfo&location_name=tsa

August 1-16

The first rain of August occurred on the 5th as a line of showers moved east across the area. Only light rain occurred, with most locations seeing a trace to around 0.25". Slightly higher totals of 0.25" to 0.75" occurred in eastern Kay, far northwest Osage, Delaware, and southern Crawford Co.

Scattered showers and thunderstorms developed over KS early on the 5th along an 850mb thermal boundary and north of a nearly stationary front that was situated over northeast OK and northwest AR. The convection moved southeast across northeast OK and northwest AR, generally along and east of a Pawhuska to Pryor to Poteau line, through the morning and was east of the HSA by early afternoon. Rainfall totals were around 0.25" to around 1" for most of the affected area, with a few isolated spots in northern Craig and Ottawa Counties getting near 1.5" (Fig. 4). Additional storms developed near the stationary front where moisture pooled during the evening, and affected east central OK and northwest and west central AR through the overnight and early morning hours. Rainfall totals from both rounds of rain were 1.5"-3.5" over portions of Sequoyah, Le Flore, Crawford, Sebastian, and Franklin Counties (Fig. 4).

Some of the larger 24-hr precipitation reports (in inches) ending 7am CDT 8/06/15 included:

Van Buren 2.1NNW, AR	3.49	Van Buren 0.7SSE, AR	3.24	Van Buren, AR	2.93
Riverdale 4.2E, AR	2.62	Fort Smith, AR	2.37		

Tulsa, OK (TSA): Current 1-Day Observed Precipitation
 Valid at 8/6/2015 1200 UTC- Created 8/6/15 18:30 UTC

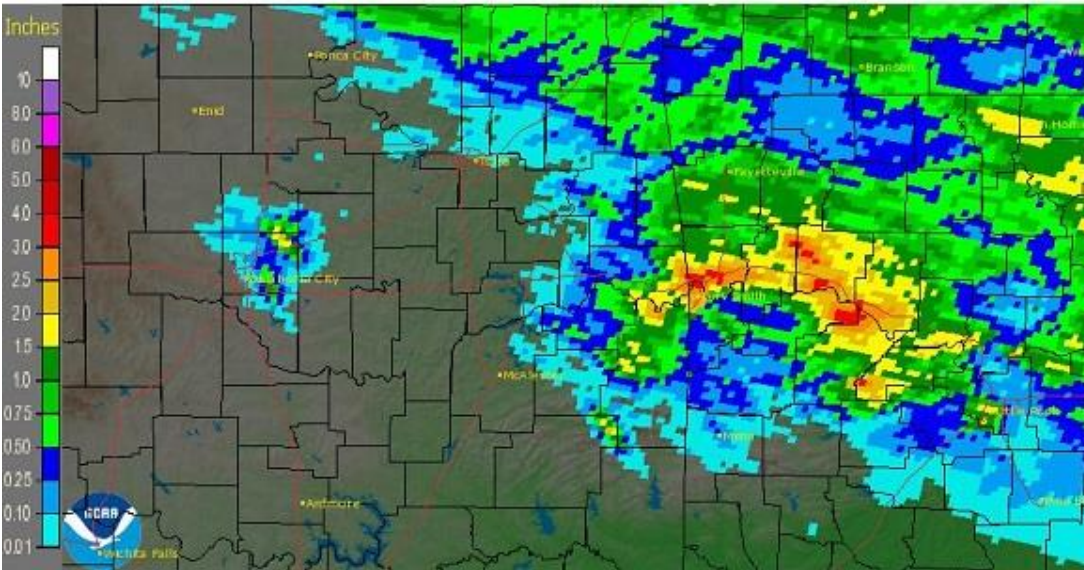


Fig. 4. 24-hr Estimated Observed Rainfall ending at 7am CDT 8/06/2015.

Showers and thunderstorms developed over southern KS and southern MO and moved south into northeast OK and northwest AR during the pre-dawn hours of the 10th. This activity slowly shifted south during the morning hours, bringing around 0.10" to around 0.4" inches of rain to locations along and north of Pawhuska, OK to Bentonville, AR line. A couple of additional isolated thunderstorms developed during the afternoon in Crawford Co., which brought around 0.25" of rain.

August 17-31

Scattered diurnal thunderstorms on the 17th brought around 0.10" to around 1.5" of rain to northwest AR and more isolated activity brought around 0.50" or less to some locations in southeast OK and far eastern OK.

A deepening upper-level low pressure system moved into the northern and central Plains on the 18th. Showers and thunderstorms moved eastward through the morning hours along and just south of the OK/KS state line. An increase in the northwest flow aloft then created lift for widespread showers and thunderstorms. The lower levels of the atmosphere were very moist, with precipitable water values near 1.75". An unseasonably strong cold front moved south into the HSA during the early evening, with convection developing along it. These initial storms affected primarily northeast OK and northwest AR. A line of thunderstorms developed along and behind the front during the overnight hours as the front moved southeast across the region. By early morning on the 19th, the line of storms had weakened and become more widespread, and by mid-day, shifted east of the HSA. These storms produced quite a bit of rain, with the northern half of Nowata and all of Craig and Ottawa Counties getting 2.5"-6" of rain on the 18th-19th (Fig. 5). Much of eastern OK and northwest AR received 1"-4" of rain (Figs. 5, 6). Due to a lack of rain and hot temperatures prior to these storms, there was no flooding. New daily rainfall records were set at several locations for the 19th: 3.02" Tulsa, OK (previous record 1.60" in 1915); 1.78" Fayetteville, AR (previous record 1.31" in 1987); and 2.22" McAlester, OK (previous record 0.81" in 1967). The cold front also brought record cold temperatures in its wake. Fort Smith, Fayetteville, Bartlesville, Muskogee, and McAlester all set or tied new record lows on the 20th, and Fayetteville also set a record cold maximum temperature on the 19th. Most sites recorded their high temperatures soon after midnight on the 19th, and therefore, most did not break any records despite very cool afternoon temperatures.

Some of the larger 24-hr precipitation reports (in inches) ending 7am CDT 8/19/15 included:

Quapaw 3SE, OK	4.33	Miami 1NNW, OK	4.29	Wyandotte 7.3NE, OK	3.65
Childers 2SSE, OK	3.62	Farmington 0.6WSW, AR	3.50	Tulsa 4.2NE, OK	3.47
Copan 3ENE, OK	3.43	Burbank, OK	3.36	Tulsa 1SW, OK	3.20

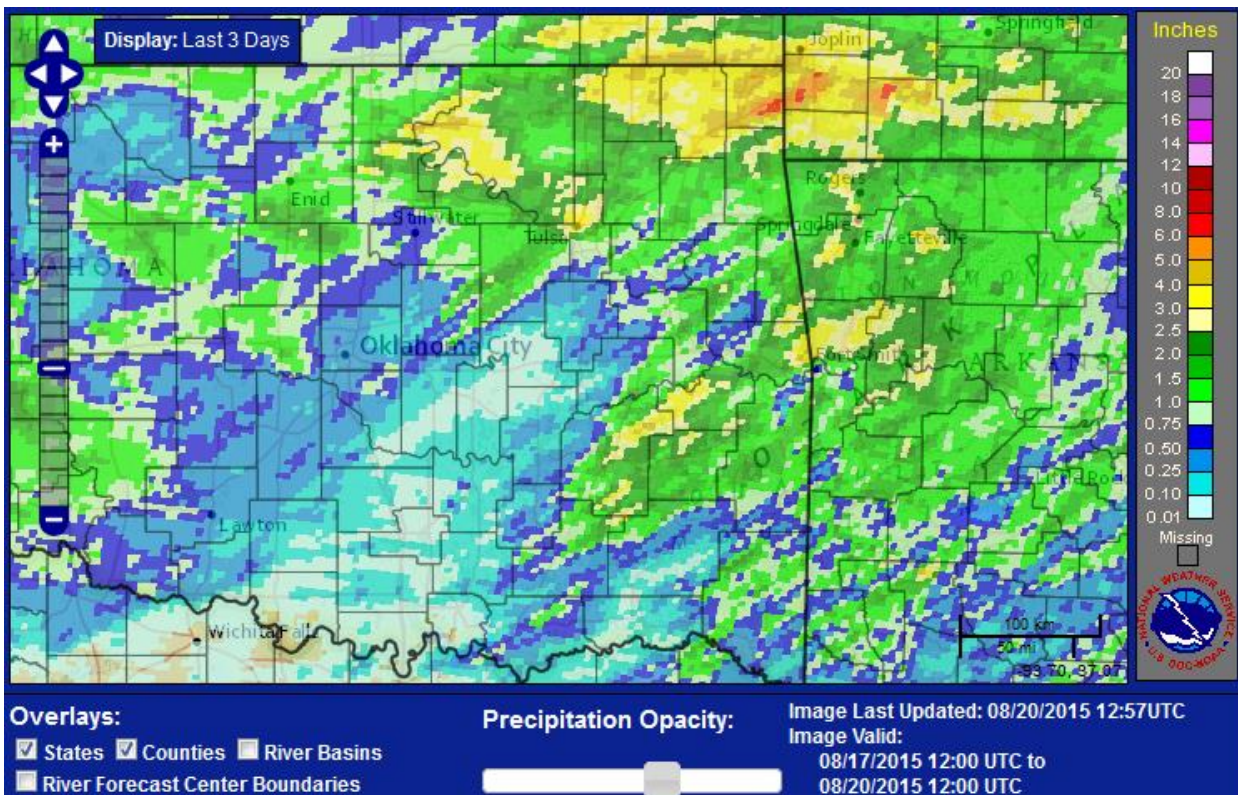


Fig. 5. 3-day Estimated Observed Rainfall ending at 7am CDT 8/20/2015.

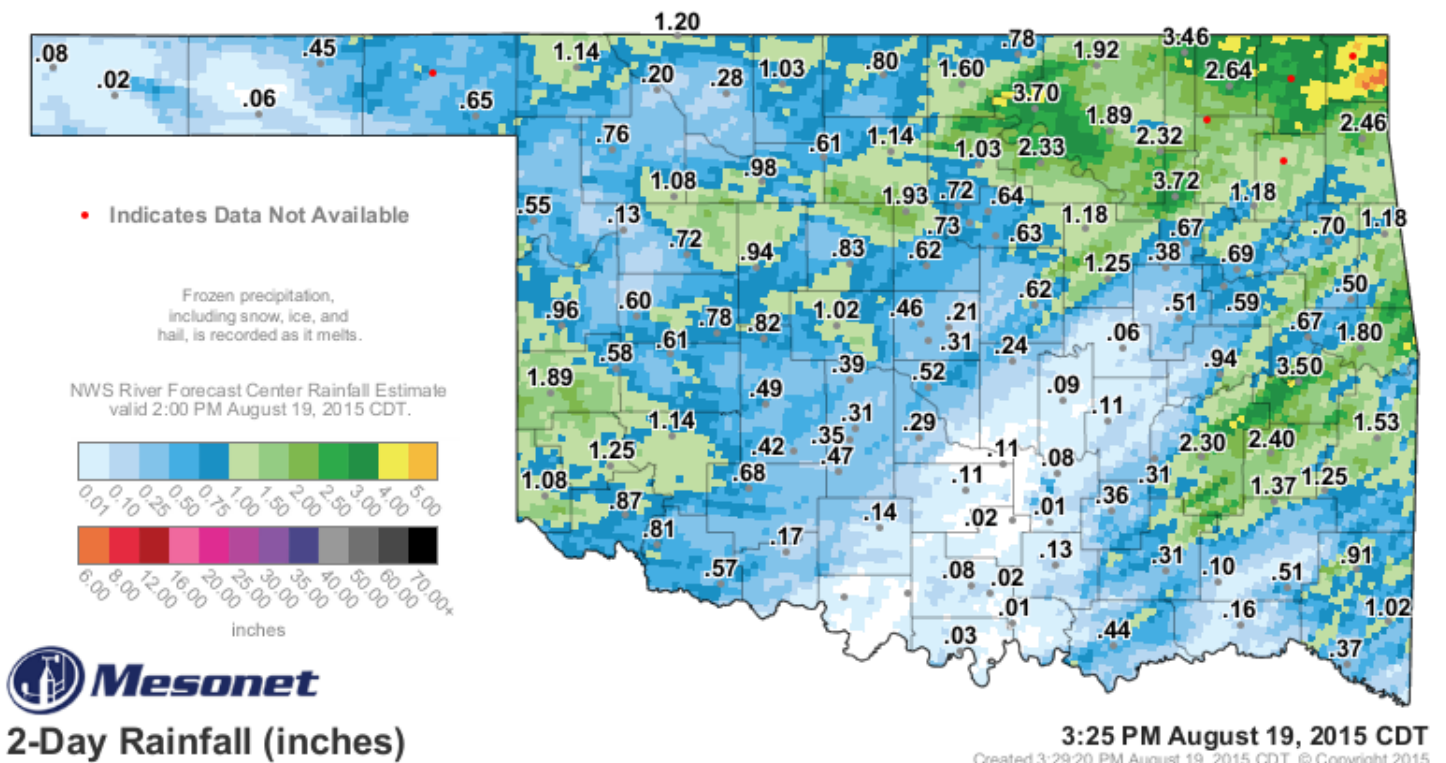


Fig. 6. 48-hr Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 3:25pm CDT 8/19/2015.

A mesoscale convective system (MCS) moved into northeast OK late on the 21st and continued to move southeast through the early morning and into the afternoon hours of the 22nd. The heaviest rainfall swath affected locations from Pawnee County through Pittsburg County, with locally 3"-4" in Pawnee County (Figs. 7, 8). A slow moving supercell also produced a narrow swath of 3"-4" of rain across portions of Ottawa Co., where localized flash flooding occurred (Fig. 8). A second MCS then moved south out of KS and MO during the early morning hours of the 23rd ahead of a cold front. This thunderstorm complex moved southward across

the HSA, with the rain ending during the afternoon (Figs. 8, 9). All of eastern OK and northwest AR received rainfall from these two events, with the exception of Choctaw Co., which only received a few hundredths of an inch of rain. Elsewhere, the two-storm rainfall total ranged from around 0.50" to around 4" (Figs. 10, 11).

The highest rainfall measurements included:

Ending 7am CDT 8/22/15: Pawnee 3ENE, OK 3.36"

Ending 7am CDT 8/23/15: Quapaw 3SE, OK 3.62" and Jay 3.3NNE, OK 2.80"

Ending 7am CDT 8/24/15: Stigler 4WNW, OK 2.67"

A few light showers and thunderstorms affected southeast OK near the boundary early on the 24th as a secondary upper-level disturbance moved out of the central Rockies. A line of scattered light showers and isolated thunderstorms developed near Hwy 412 at mid-morning, and drifted slowly southeast before dissipating during the afternoon. This activity only produced around 0.10" of rain or less.

Isentropic lift resulted in elevated showers and thunderstorms over southeast KS early on the 27th. This activity moved south into northeast OK during the morning and continued through the afternoon hours before dissipating as the low-level jet diminished. These storms produced moderate to heavy rain, and training of thunderstorms led to some flash flooding in Washington Co., OK. Affected areas were along and east of Hwy 75 to near the OK/AR state line and along and north of I-40. Most of this area received rainfall totals from around 0.10" to around 0.50". However, far eastern Osage, Washington, Nowata, northern Tulsa, and northwest Rogers Counties had 0.75" to around 3" of rain from this activity (Fig. 12). The highest rain gage measurement was 2.70" at Copan Dam.

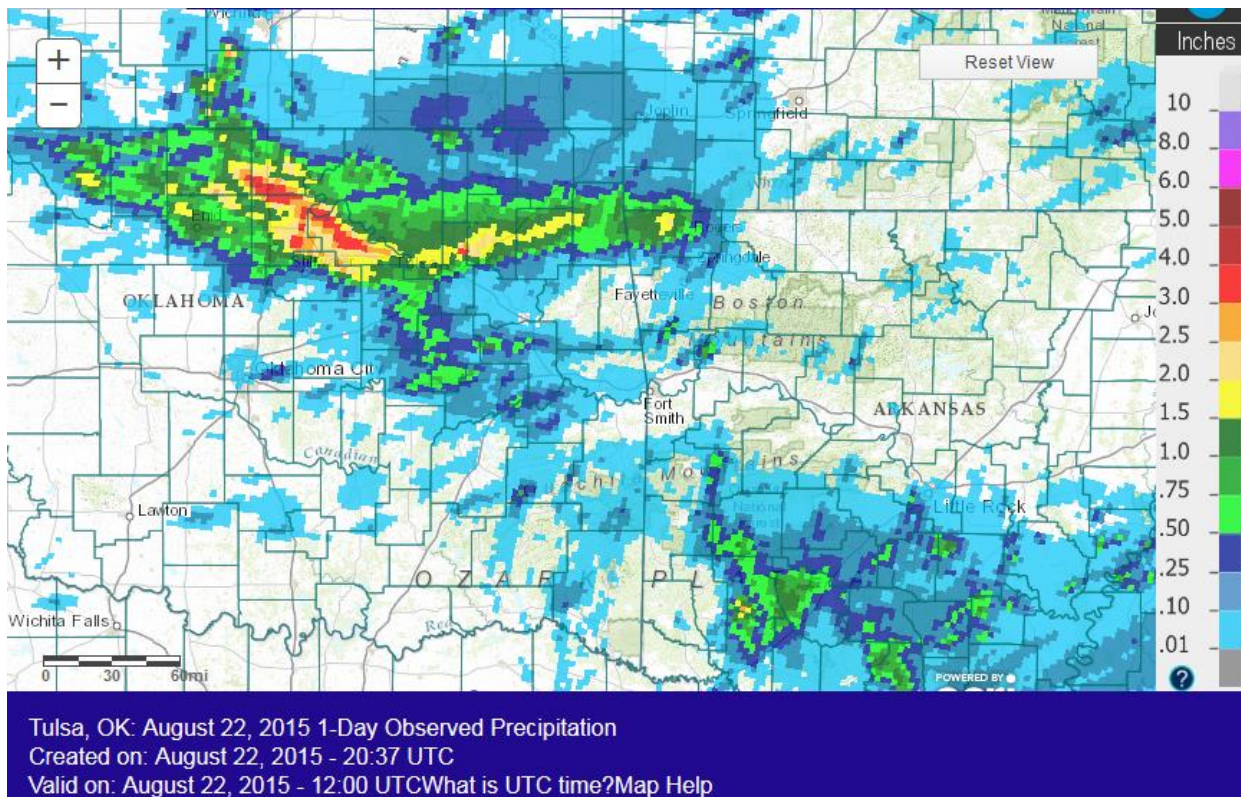


Fig. 7. 24-hr Estimated Observed Rainfall ending at 7am CDT 8/22/2015.

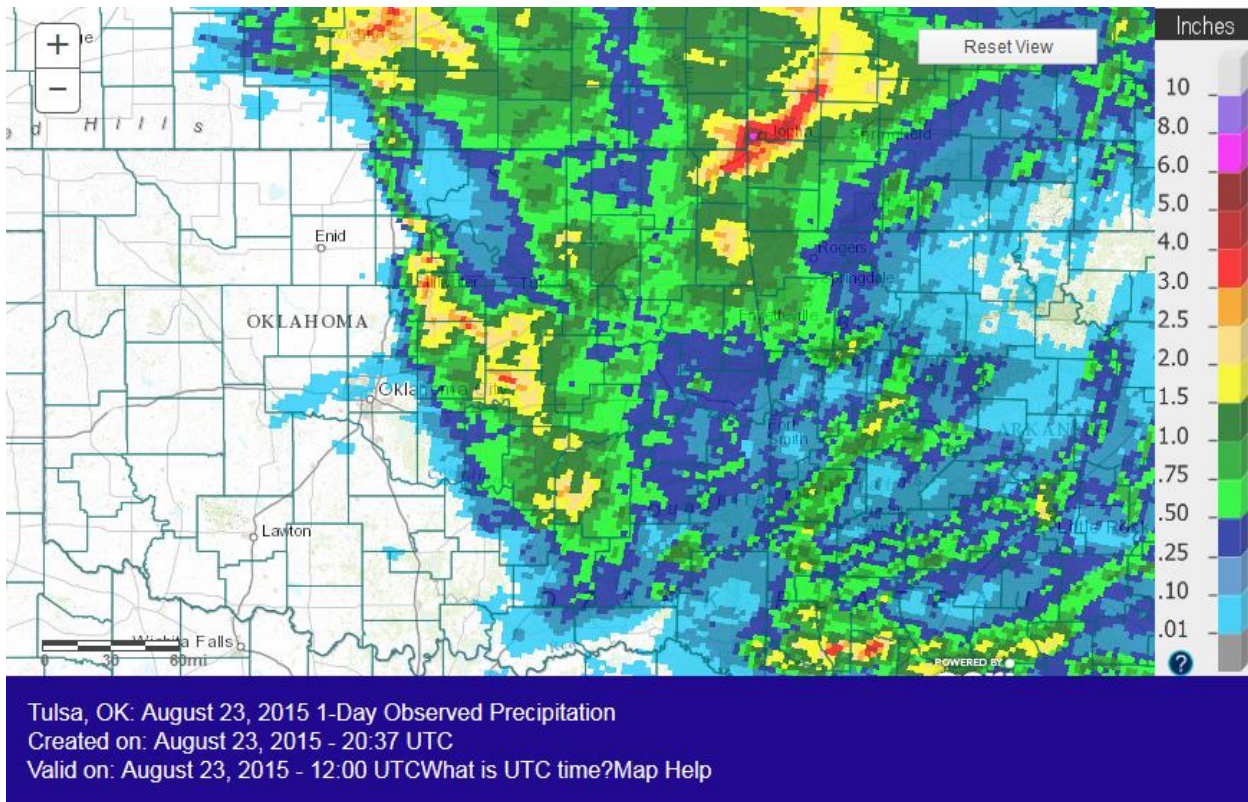


Fig. 8. 24-hr Estimated Observed Rainfall ending at 7am CDT 8/23/2015.

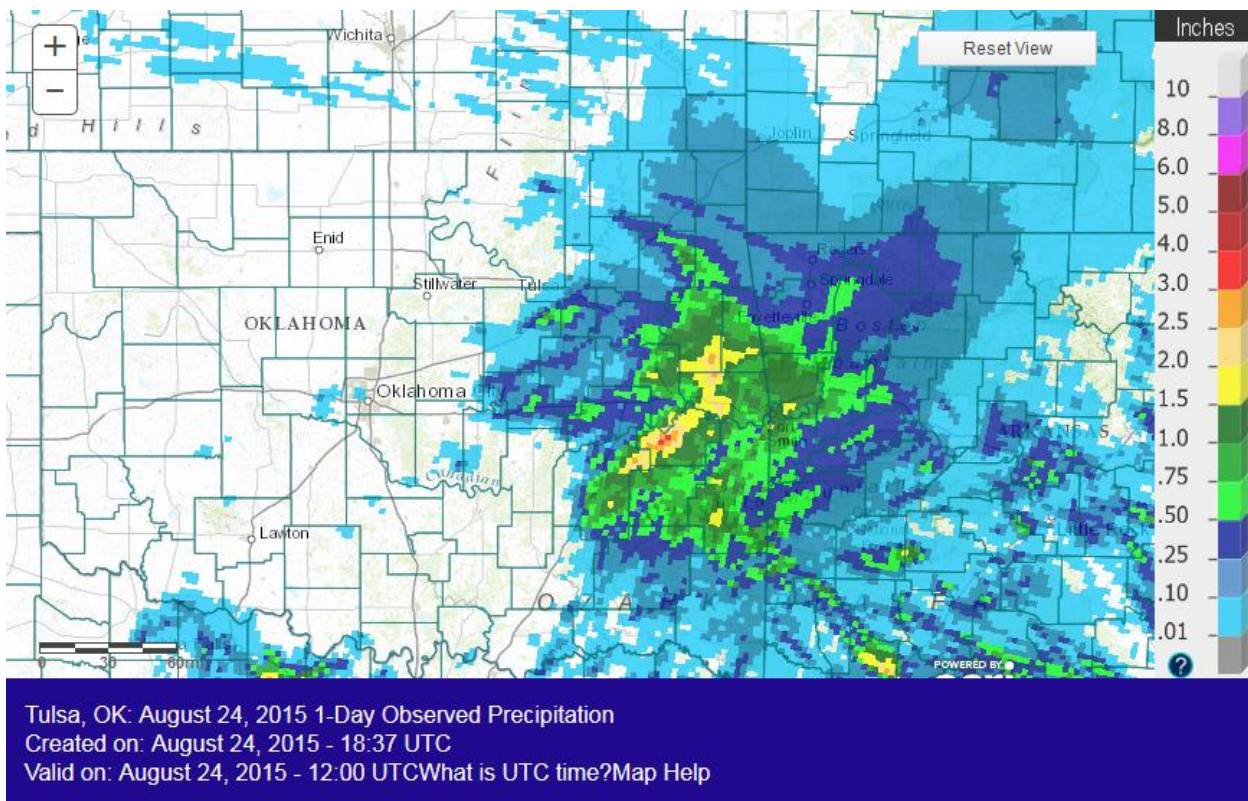


Fig. 9. 24-hr Estimated Observed Rainfall ending at 7am CDT 8/24/2015.

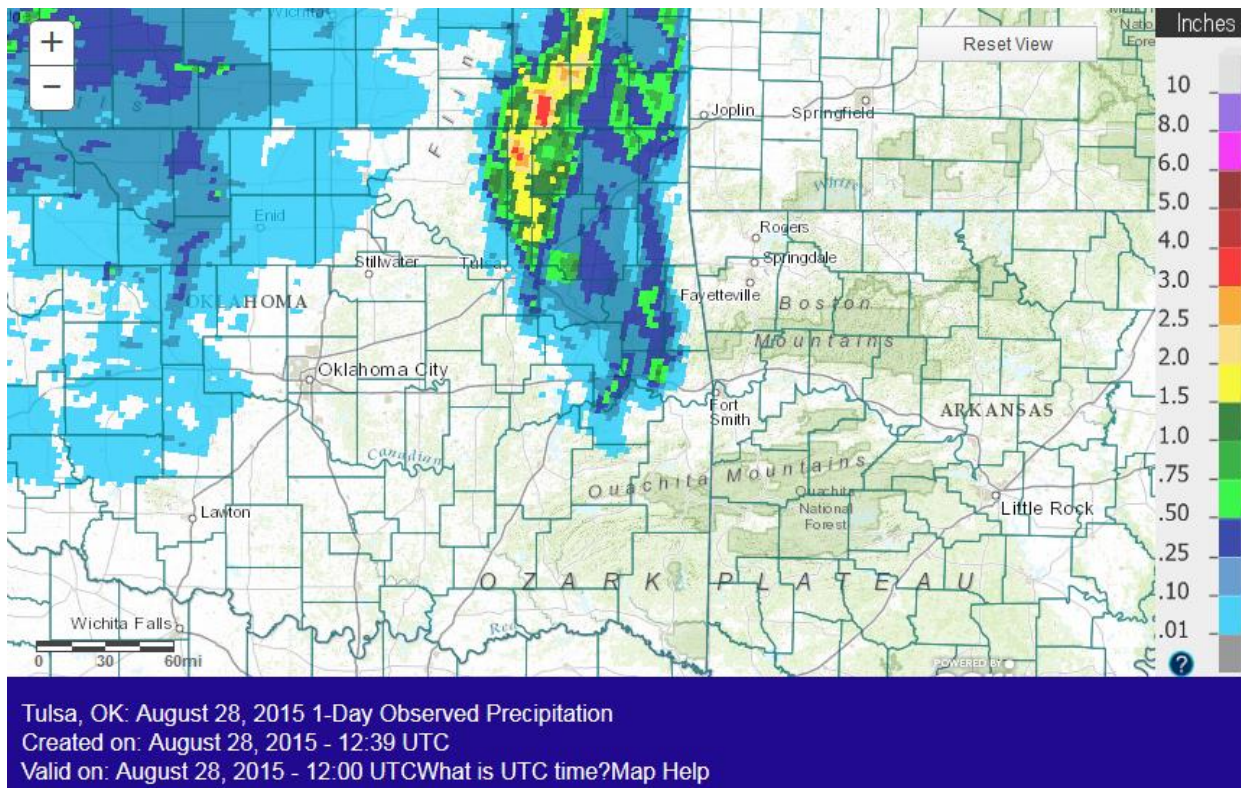


Fig. 12. 24-hr Estimated Observed Rainfall ending at 7am CDT 8/28/2015.

Showers and thunderstorms developed near a cold front across central KS into the OK panhandle and moved southeast. This activity led to scattered light rain moving into northeast OK from the west during the pre-dawn hours of the 28th. These showers weakened through the morning hours though light rain lingered into the afternoon. A second line of scattered light rain moved east across the HSA during the afternoon and early evening hours. Scattered light showers also developed during the late night hours of the 28th across southeast OK and northwest AR. Most affected locations received around 0.25" or less of rain, though southeast Latimer Co. received around 0.50". A few showers lingered across southeast OK during the morning of the 29th within a mid-level moisture axis. Isolated locations received around 0.25" or less once again. The weak front continued to push eastward, with additional rain developing in its vicinity during the evening hours southeast of I-44 and north of a Wagoner to Fayetteville to Berryville line. This activity also remained light, with around 0.50" or less of rain.

Isolated convection developed during the heat of the afternoon of the 30th as an upper-level circulation moved over the region. This activity brought 0.10" to around 1.5" to isolated locations across southeast and east central OK, as well as northwest and west central AR.

Isolated diurnal thunderstorms developed during the afternoon of the 31st across the higher terrain of Carroll and Le Flore Counties. Most affected locations received around 0.75" or less of rain, with one small area in west central Carroll County getting around 1.5".

Written by:
 Nicole McGavock
 Service Hydrologist
 WFO Tulsa

Products issued in August 2015:

- *MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014
- *Mixed case River Flood products began July 31, 2013

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

None