

<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>June</b> YEAR <b>2017</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>July 12, 2017</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.

Temperatures for June 2017 were near normal across the area. Rainfall was above normal across east central OK and portions of west central AR, with near to below normal rainfall elsewhere. Normal rainfall in the month of June ranges from 3.9 inches in McIntosh County to 5.9 inches in Wagoner County. The Ozark region of northwest Arkansas averages 5.1 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 June 2017 ranged from around 1" to around 10". The highest totals were across east central OK, portions of northwest AR, and Choctaw Co. in southeast OK. This corresponds from around 25% (over Creek Co.) to around 200% (in east central OK) of the normal June rainfall (Fig. 1b).

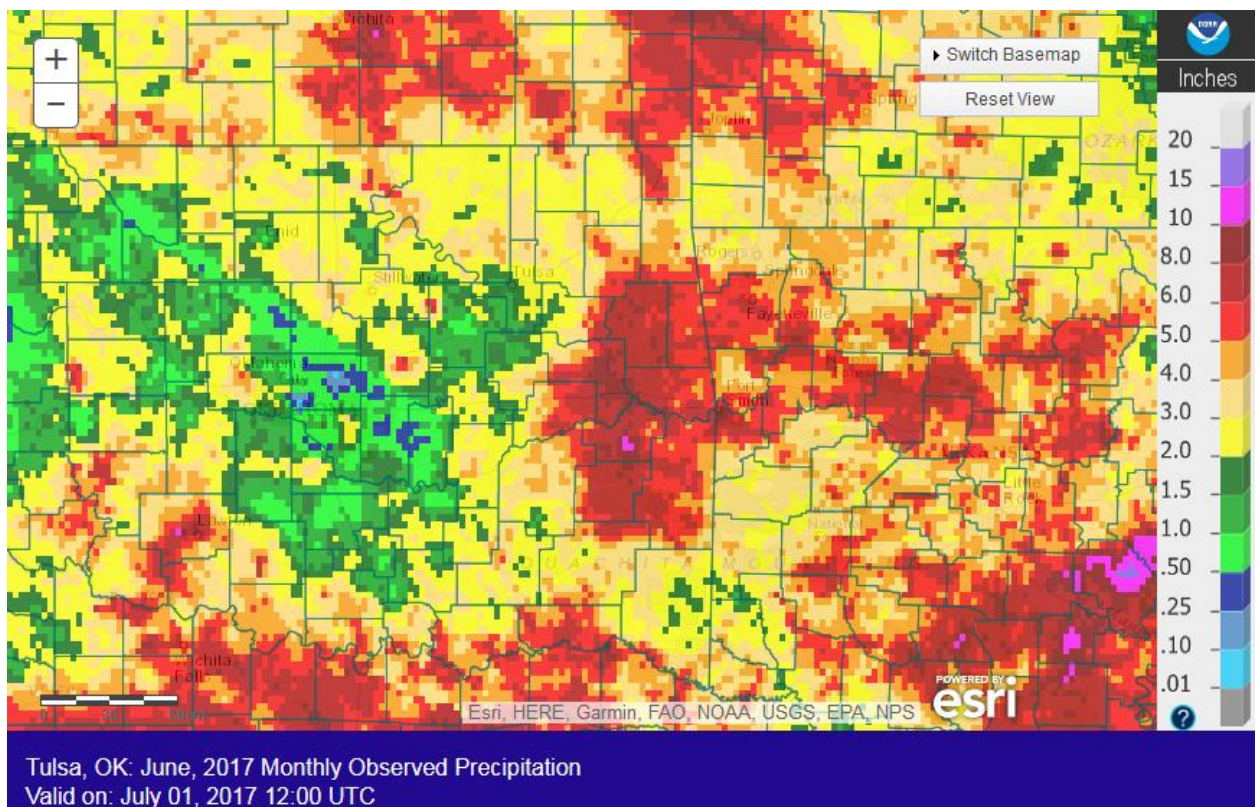


Fig. 1a. Estimated Observed Rainfall for June 2017

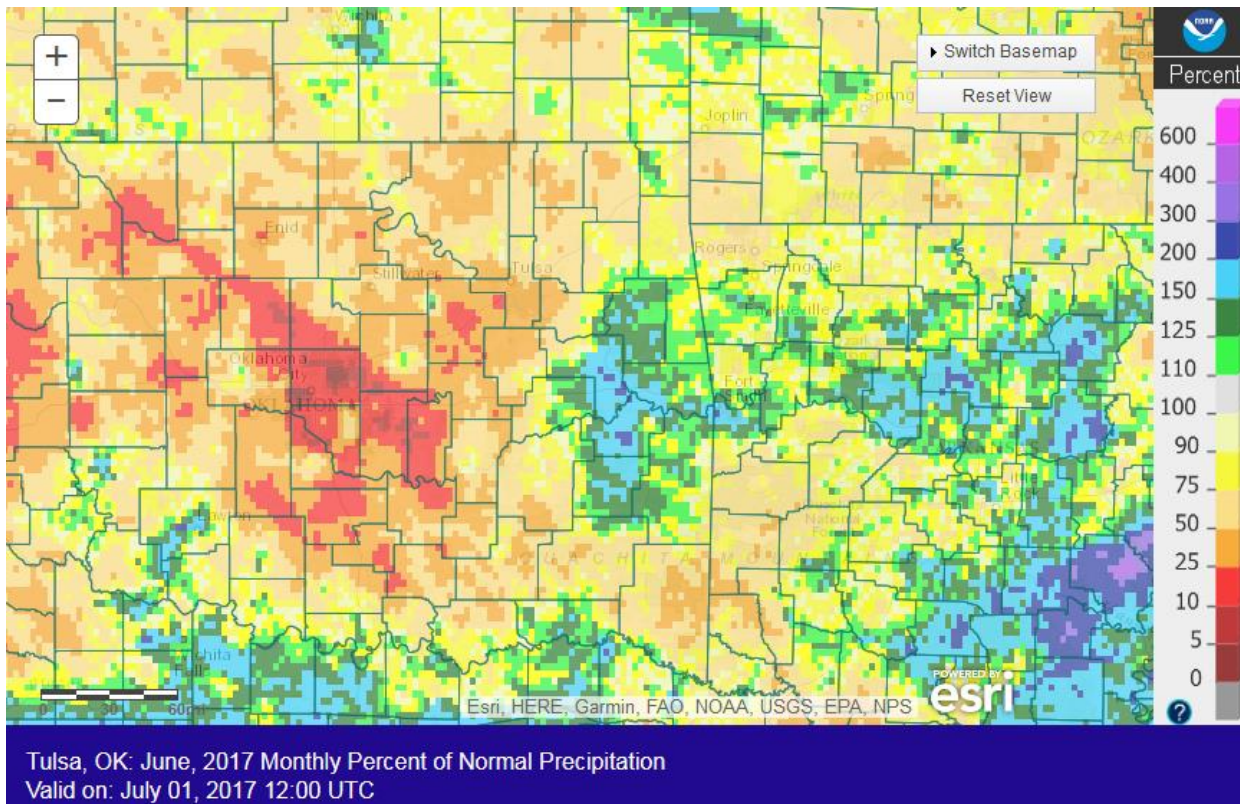


Fig. 1b. Estimated % of Normal Rainfall for June 2017

In Tulsa, OK, May 2017 ranked as the 52<sup>nd</sup> warmest June (78.1°F; since records began in 1905) and the 38<sup>th</sup> driest June (2.77", tied 1931; since records began in 1888). Fort Smith, AR had the 64<sup>th</sup> warmest June (78.0°F, tied 1987; since records began in 1882) and the 6<sup>th</sup> wettest June (8.50"; since records began in 1882). Fayetteville, AR had the 22<sup>nd</sup> coldest (72.7°F, tied 1999, 1970, 1962, 1959) and the 15<sup>th</sup> wettest (6.44", tied 1956) June since records began in 1950.

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

Fort Smith, AR (ASOS)	8.50	Muskogee, OK (ASOS)	7.91	Tahlequah 3.5 SSW, OK (coco)	7.01
Webbers Falls, OK (meso)	6.51	Drumright 0.6SW, OK (coco)	6.45	Fayetteville, AR (ASOS)	6.44
Siloam Springs 1.8N, AR (coco)	6.32	Tahlequah, OK (meso)	6.28	Farmington 0.4NNE, AR (coco)	6.19

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

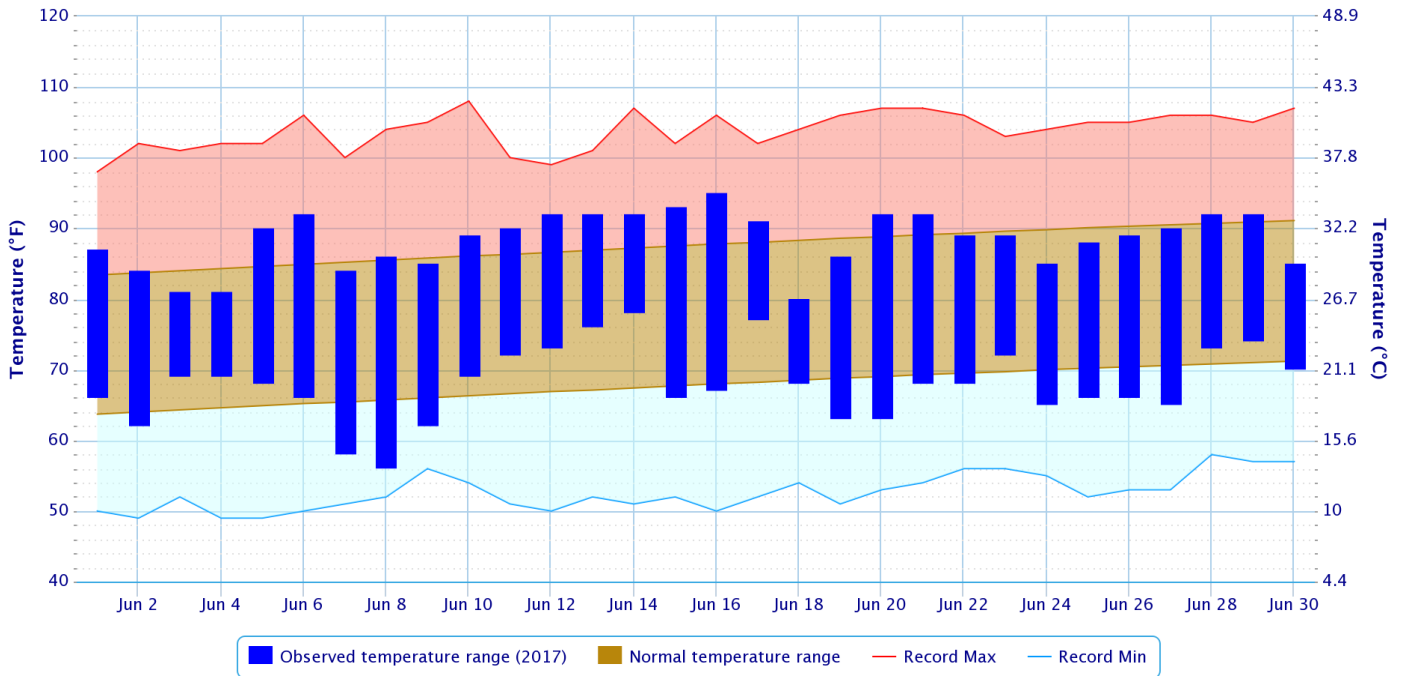
Bristow, OK (meso)	0.25	Hectorville, OK (meso)	0.64	Oilton, OK (meso)	0.83
Glenpool 0.6S, OK (coco)	0.93	Bixby, OK (meso)	1.19	Stuart, OK (meso)	1.34
Vinita, OK (meso)	1.36	Jenks Riverside Arpt, OK (ASOS)	1.39	Tulsa, OK (meso)	1.50

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

Rank since 1921	June 1 – June 29	Last 60 Days (May 1 – Jun 29)	Last 90 Days (Apr 1 – Jun 29)	Warm Growing Season (Mar 1 – Jun 29)	Year-to-Date (Jan 1 – June 29)	Water Year-to-Date (Oct 1 – Jun 29)	Last 365 Days (Jun 30, 2016–Jun 29, 2017)
Northeast OK	14 <sup>th</sup> driest	47 <sup>th</sup> driest	<b>10<sup>th</sup> wettest</b>	12 <sup>th</sup> wettest	14 <sup>th</sup> wettest	18 <sup>th</sup> wettest	26 <sup>th</sup> wettest
East Central OK	32 <sup>nd</sup> driest	48 <sup>th</sup> wettest	<b>9<sup>th</sup> wettest</b>	15 <sup>th</sup> wettest	18 <sup>th</sup> wettest	48 <sup>th</sup> wettest	45 <sup>th</sup> driest
Southeast OK	49 <sup>th</sup> wettest	25 <sup>th</sup> driest	40 <sup>th</sup> driest	37 <sup>th</sup> driest	37 <sup>th</sup> driest	17 <sup>th</sup> driest	21 <sup>st</sup> driest
Statewide	18 <sup>th</sup> driest	24 <sup>th</sup> driest	24 <sup>th</sup> wettest	32 <sup>nd</sup> wettest	22 <sup>nd</sup> wettest	48 <sup>th</sup> wettest	43 <sup>rd</sup> wettest

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

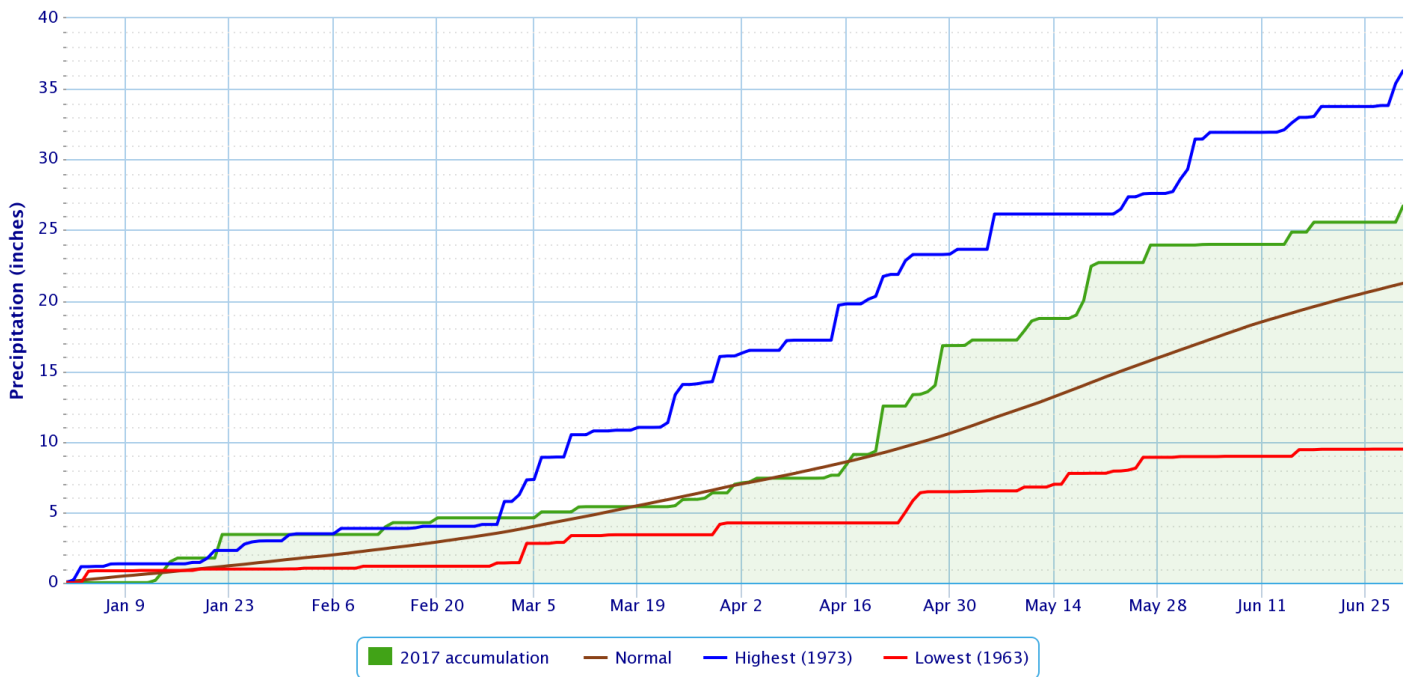
Period of Record – 1905-01-06 to 2017-07-10. Normals period: 1981-2010. Click and drag to zoom chart.



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

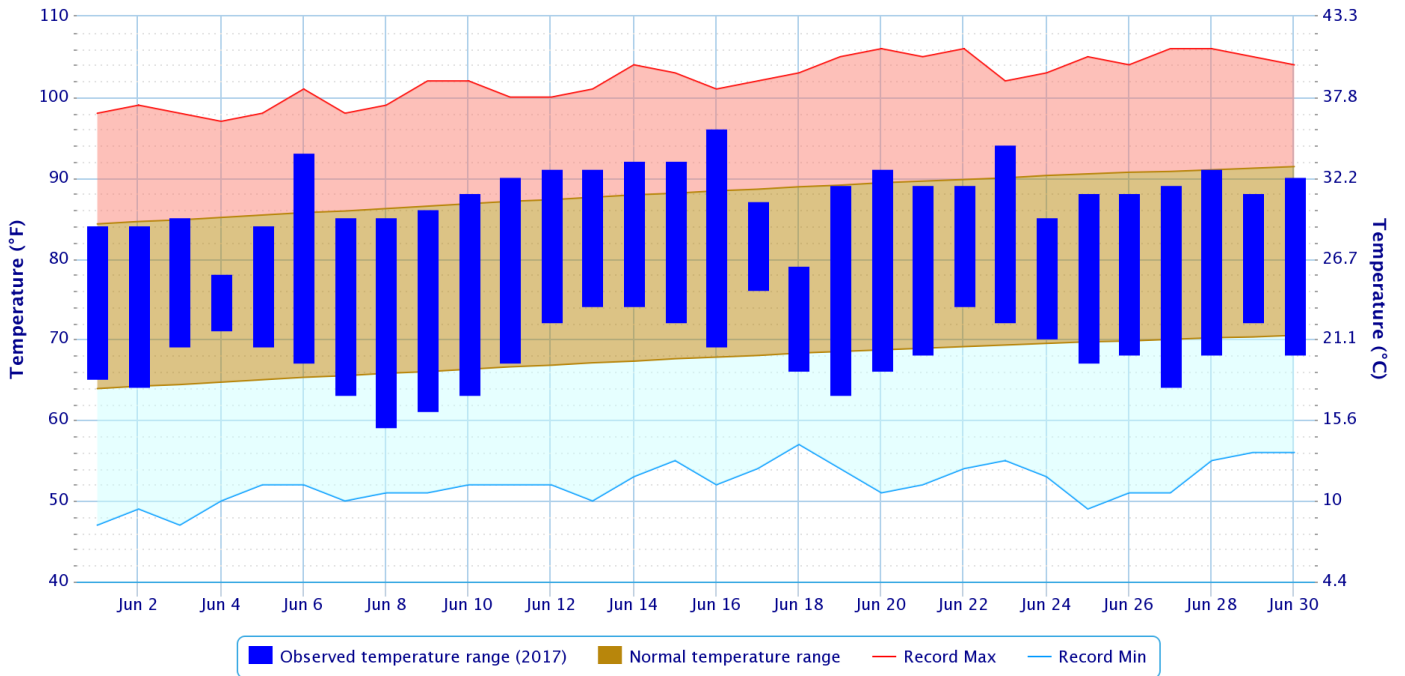
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

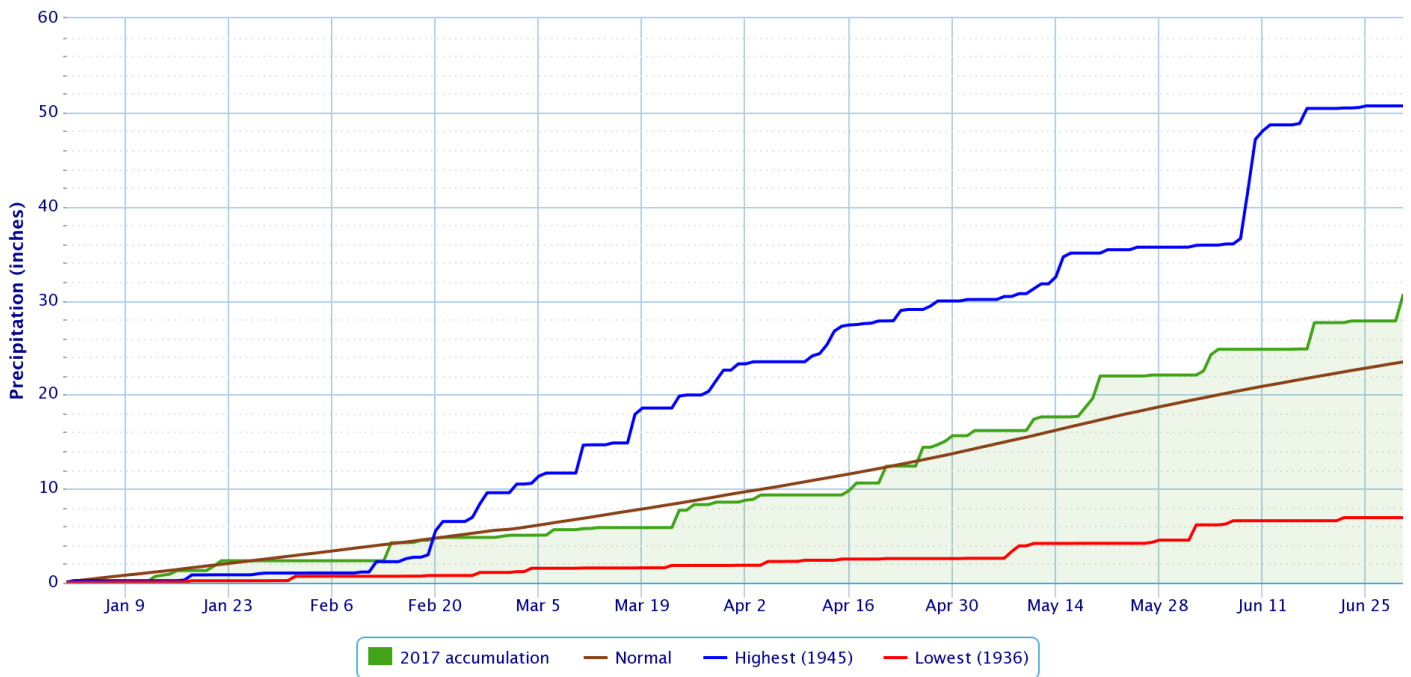
Period of Record – 1882-06-01 to 2017-07-10. Normals period: 1981-2010. Click and drag to zoom chart.



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

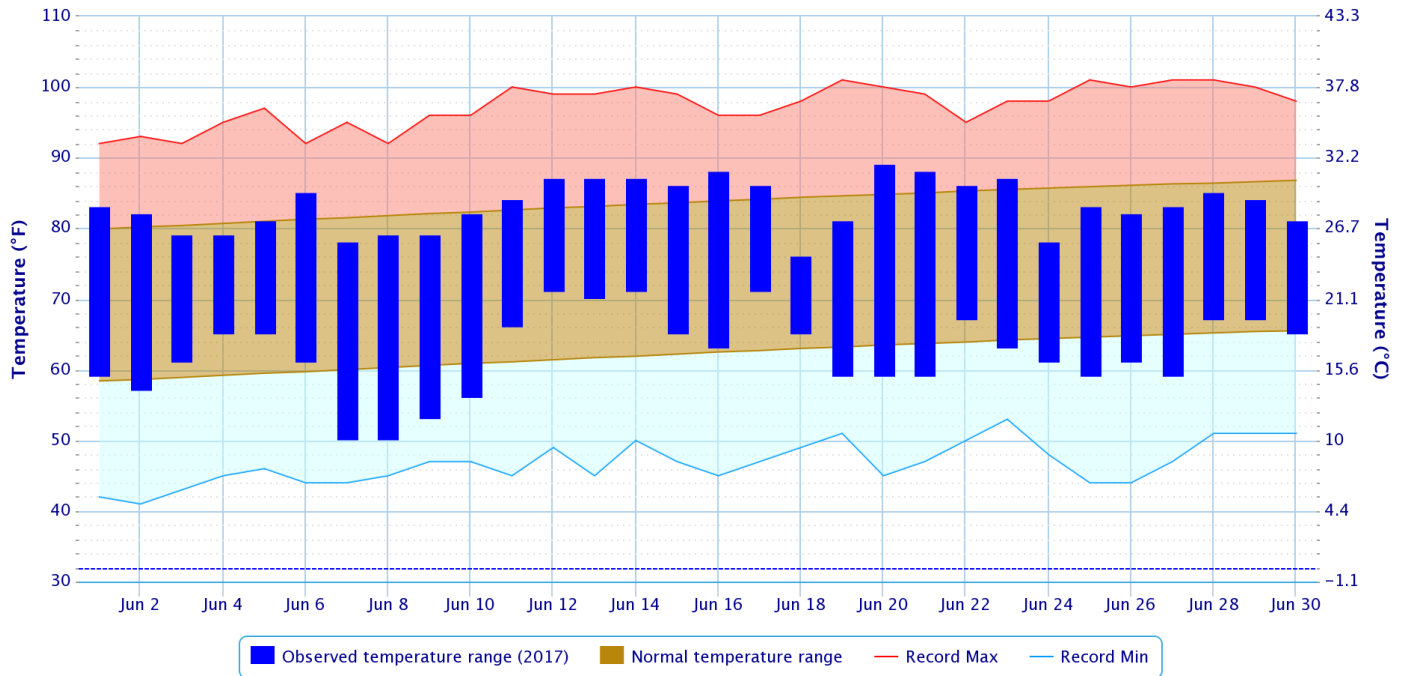
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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

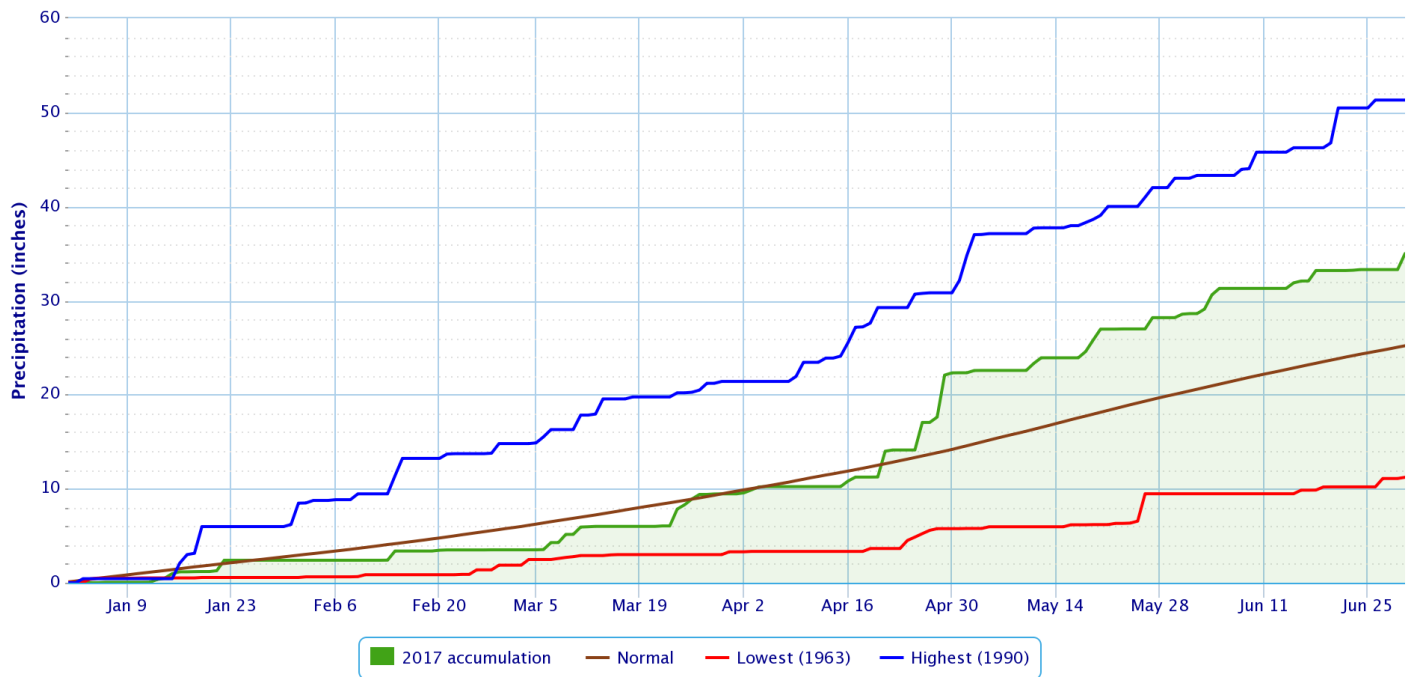
Period of Record – 1949-07-14 to 2017-07-10. Normals period: 1981-2010. Click and drag to zoom chart.



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### Accumulated Precipitation – FAYETTEVILLE DRAKE FLD, AR

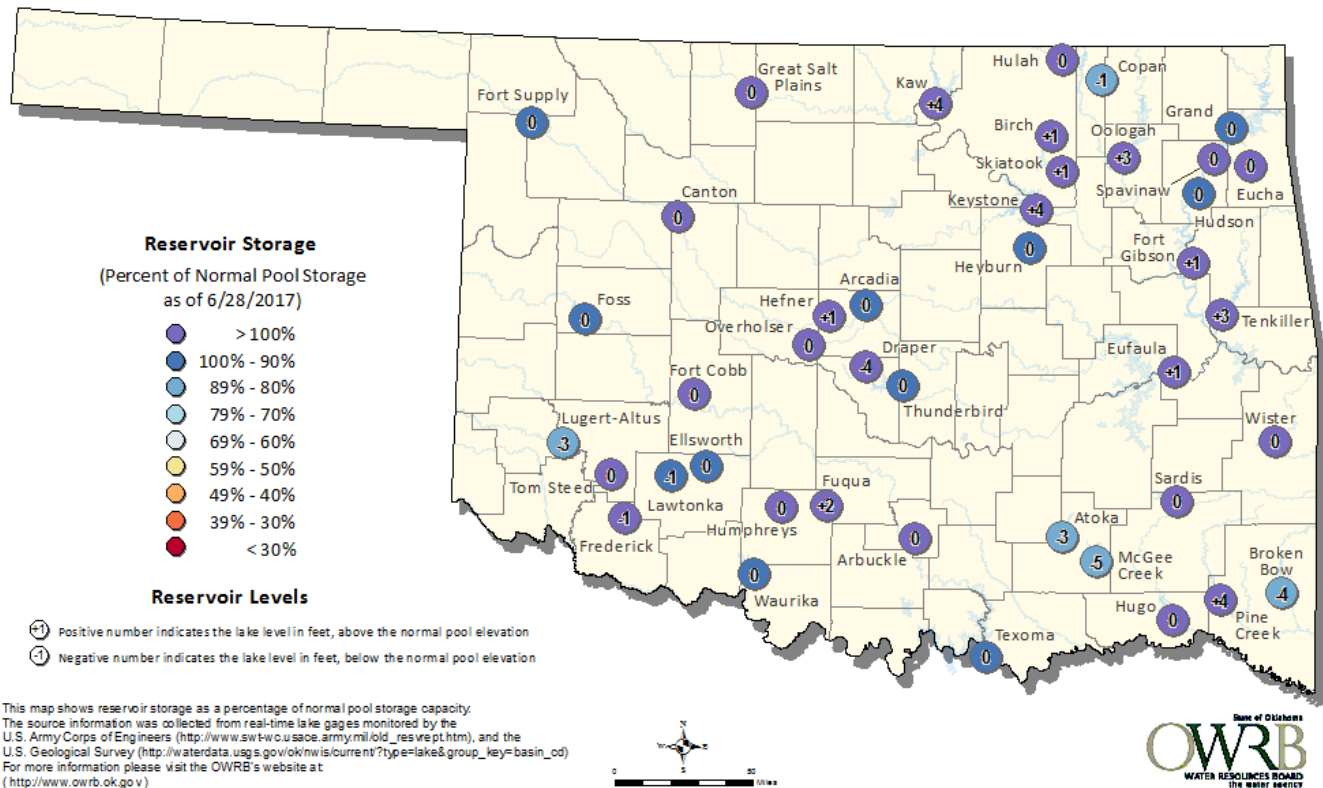
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



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## Reservoirs

### Oklahoma Surface Water Resources Reservoir Levels and Storage as of 6/28/2017



According to the USACE, the most of the lakes in the HSA had returned to near normal levels as of 6/30/2017. Reservoirs continuing to operate more than 5% above the top of their conservation level include: Beaver Lake 176%, Oologah Lake 108%, Kaw Lake 107%, Keystone Lake, 106%, Skiatook Lake 106%, and Hudson Lake 106%. Copan Lake was the only reservoir with below normal conditions, at 85% of its conservation pool.

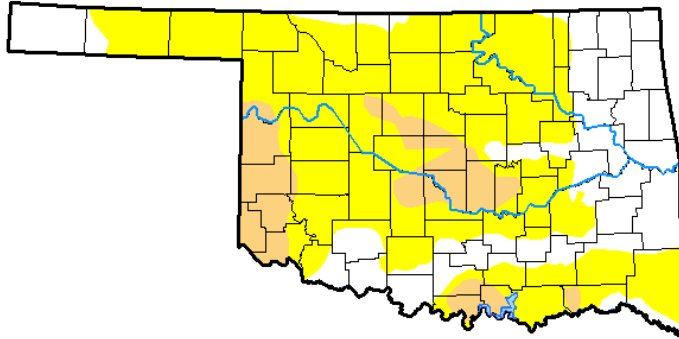
Flooding in April and May resulted high lake levels. Releases were required to evacuate the water in the flood control pools across northeast OK and these releases resulted in the Arkansas River near Muskogee remaining near regulating stage for an extended time. It took until June 10, 2017 for the releases out of the dams to be scaled back significantly and allow the Arkansas River levels to fall. This greatly impacted commerce along the McClellan-Kerr Arkansas River Navigation System since river flows during and following the floods were too high for barge operations.

## Drought

According to the [U.S. Drought Monitor](#) (USDM) from June 27, 2017 (Figs. 2, 3), Moderate Drought (D1) conditions had reemerged across western Choctaw County. D0 (abnormally dry conditions but not in drought) were present across portions of Pushmataha, Choctaw, Pittsburg, Haskell, Okfuskee, Okmulgee, Creek, Tulsa, Pawnee, Osage, eastern Kay, and Washington Counties in eastern OK.

# U.S. Drought Monitor Oklahoma

**June 27, 2017**  
(Released Thursday, Jun. 29, 2017)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	30.33	69.67	12.25	0.00	0.00	0.00
<b>Last Week</b> 06-20-2017	73.11	26.89	3.18	0.00	0.00	0.00
<b>3 Months Ago</b> 03-28-2017	7.24	92.76	77.80	36.07	2.99	0.00
<b>Start of Calendar Year</b> 01-03-2017	5.61	94.39	83.21	55.75	5.55	0.00
<b>Start of Water Year</b> 09-27-2016	57.82	42.18	19.04	3.05	0.00	0.00
<b>One Year Ago</b> 06-28-2016	77.65	22.35	5.86	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:

Jessica Blunden  
NCEI/NOAA

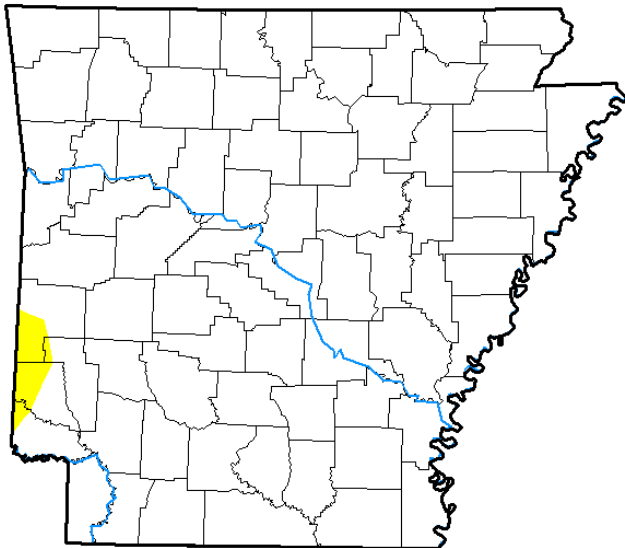


<http://droughtmonitor.unl.edu/>

Fig. 2. Drought Monitor for Oklahoma

# U.S. Drought Monitor Arkansas

**June 27, 2017**  
(Released Thursday, Jun. 29, 2017)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	98.86	1.14	0.00	0.00	0.00	0.00
<b>Last Week</b> 06-20-2017	99.58	0.42	0.00	0.00	0.00	0.00
<b>3 Months Ago</b> 03-28-2017	44.88	55.12	18.87	2.00	0.00	0.00
<b>Start of Calendar Year</b> 01-03-2017	27.05	72.95	39.03	7.99	2.02	0.00
<b>Start of Water Year</b> 09-27-2016	71.02	28.98	0.00	0.00	0.00	0.00
<b>One Year Ago</b> 06-28-2016	94.91	5.09	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:

Jessica Blunden  
NCEI/NOAA



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

Fig. 3. Drought Monitor for Arkansas

## **Outlooks**

The [Climate Prediction Center](#) (CPC) outlook for July 2017 (issued June 30, 2017) indicates a slightly enhanced chance for above median precipitation and equal chances for above, near, and below normal temperatures across all of eastern OK and northwest AR. This outlook takes into account weather conditions forecast over the next 1-2 weeks and sub-seasonal climate signals in the weeks 3-4 time frame. Equal chances of above, near, and below normal temperatures is indicated for much of the Mississippi and Ohio Valleys, where troughing is predicted for much of the month by available models.

For the 3-month period July-August-September 2017, CPC is forecasting a slightly enhanced chance for above normal temperatures and an equal chance for above, near, and below median rainfall across all of eastern OK and northwest AR (outlook issued June 15, 2017). This outlook is based on both statistical and dynamical forecast tools, decadal timescale climate trends, and to a limited extent, soil moisture. According to CPC, Pacific sea surface temperatures along the equator, as well as the atmospheric response, continue to indicate ENSO-neutral conditions, which are favored to persist through the fall. For the Winter, ENSO neutral conditions are favored (50-55% chance), with only a 35% chance for El Niño conditions developing.

**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](http://water.weather.gov/precip/index.php?location_type=wfo&location_name=tsa)

### **June 1-15**

During the morning and afternoon of the 1<sup>st</sup>, showers and thunderstorms moved north out of TX and into southeast OK as a weak upper-level wave lifted northeast out of TX. Additional scattered showers and thunderstorms developed over northwest AR during the heat of the afternoon and propagated northeast into northeast OK. All of this activity dissipated by mid-evening. Rainfall totals were generally around 1" or less, though a couple of locations received 1.5"-2" of rain.

Showers and thunderstorms developed over eastern OK before dawn on the 3<sup>rd</sup> in advance of an upper-level low over western OK. This activity spread into northwest AR around noon. With the weak forcing remaining nearby and a weakly capped tropical airmass over the area, scattered convection continued across eastern OK and northwest AR through the evening and overnight hours. The upper-level wave moved closer on the 4<sup>th</sup>, with showers and thunderstorms continuing across the region all day and into early on the 5<sup>th</sup>. The remnants of the upper-level low was situated from northwest AR to southeast OK on the morning of the 5<sup>th</sup>. Showers and isolated thunderstorms continued over this area through early afternoon as the trough shifted further southeast. Then, diurnally driven scattered convection developed during the afternoon and ended shortly after sunset. Due to the convective nature of the rainfall on the 3<sup>rd</sup>-5<sup>th</sup>, rainfall totals ranged from 0.25" to around 4" (Figs. 4-6). However, a large portion of Tulsa and Okmulgee Counties received less than 0.10" of rain during this time.

A small cluster of thunderstorms moved out of north central OK and affected northeast OK northwest of I-44 from around sunrise through the morning hours of the 14<sup>th</sup>. Rainfall totals ranged from a few hundredths to around 1" in Pawnee County.

A couple of storms developed over Creek County on the morning of the 15<sup>th</sup>, and expanded in size as they propagated east and south. At about the same time, showers and isolated thunderstorms were moving southwest into northwest AR from an MCS in Missouri. All of this activity dissipated shortly after noon. Another MCS developed over KS during the afternoon of the 15<sup>th</sup>. This storm complex then moved southeast into northeast OK and northwest AR during the late evening, continuing through the overnight hours, and finally dissipated a few hours before sunrise on the 16<sup>th</sup>. There were numerous reports of 40-60 mph winds and wind damage across much of eastern OK and northwest AR from the line of storms (Figs. 9, 10). Rainfall totals were generally 0.10" to around 1.25" north of I-40, with 0.50" or less of rain south of I-40 (Figs. 7, 8).



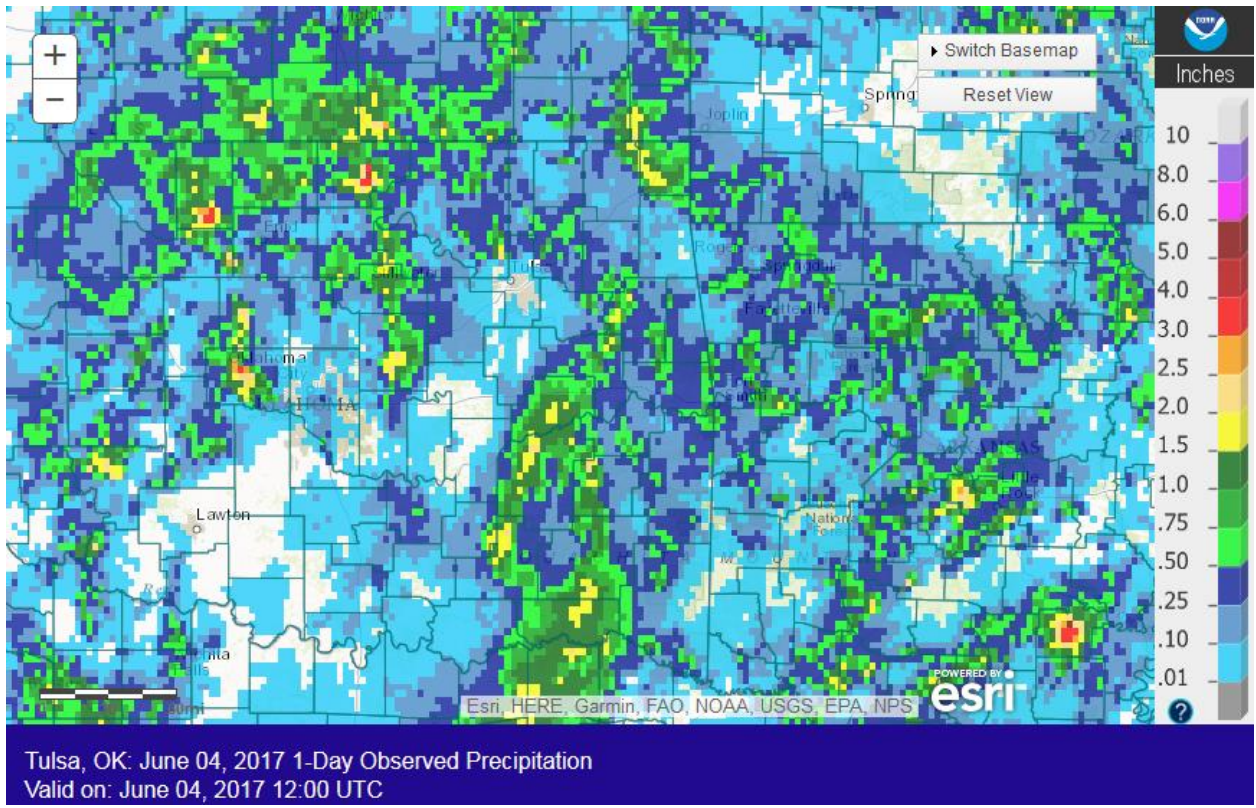


Fig. 4. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/04/2017.

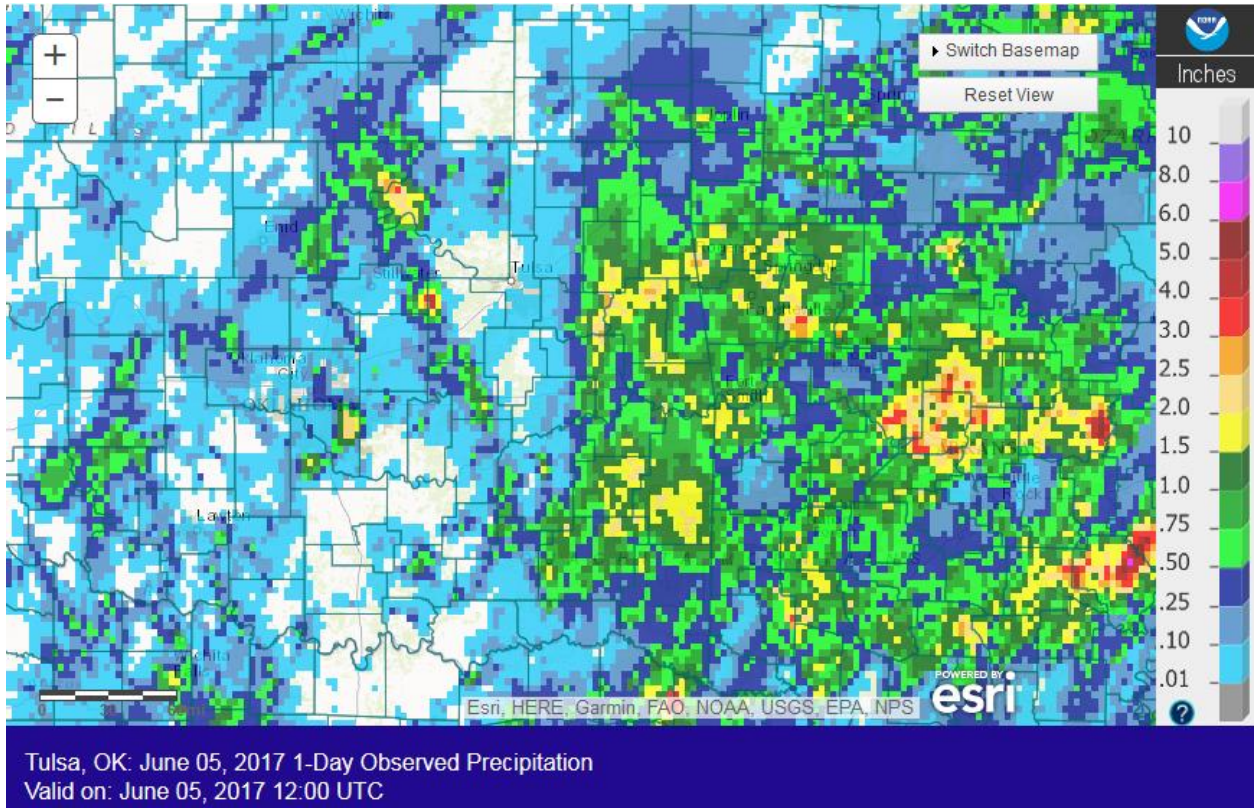


Fig. 5. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/05/2017.

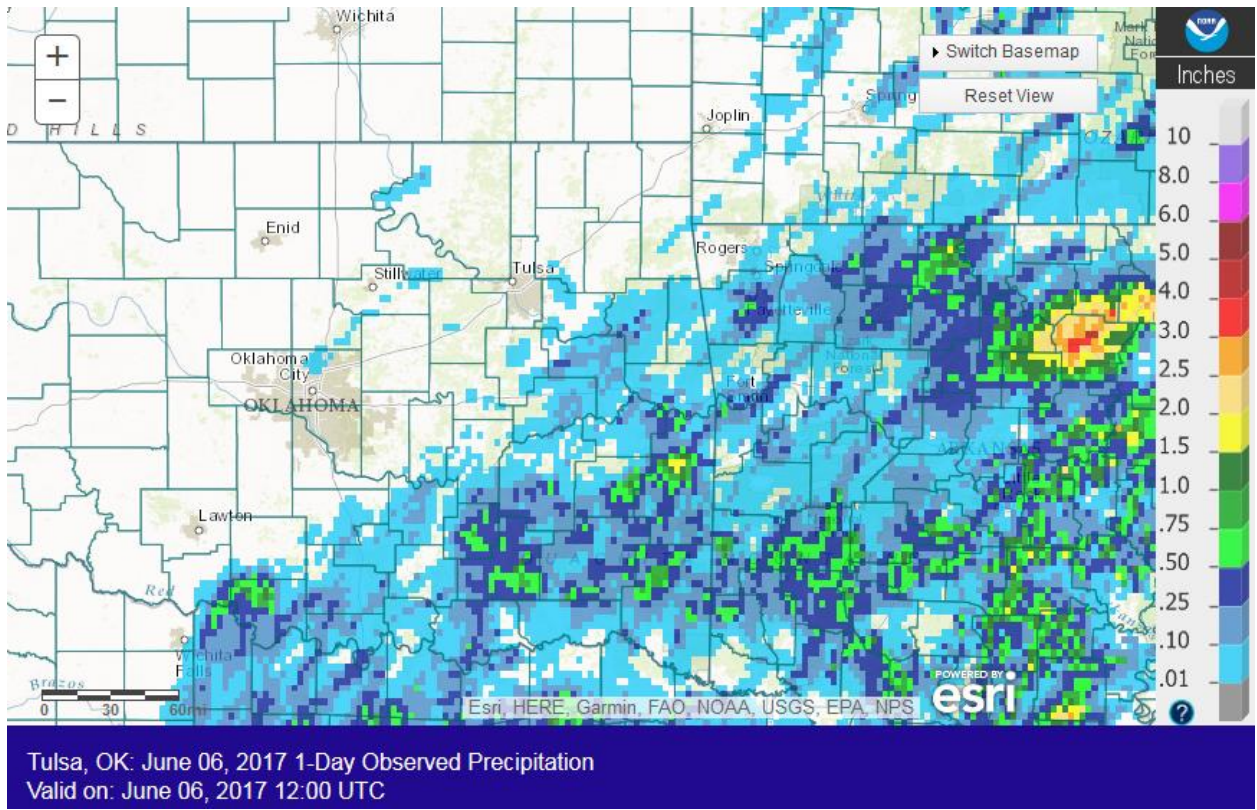


Fig. 6. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/06/2017.

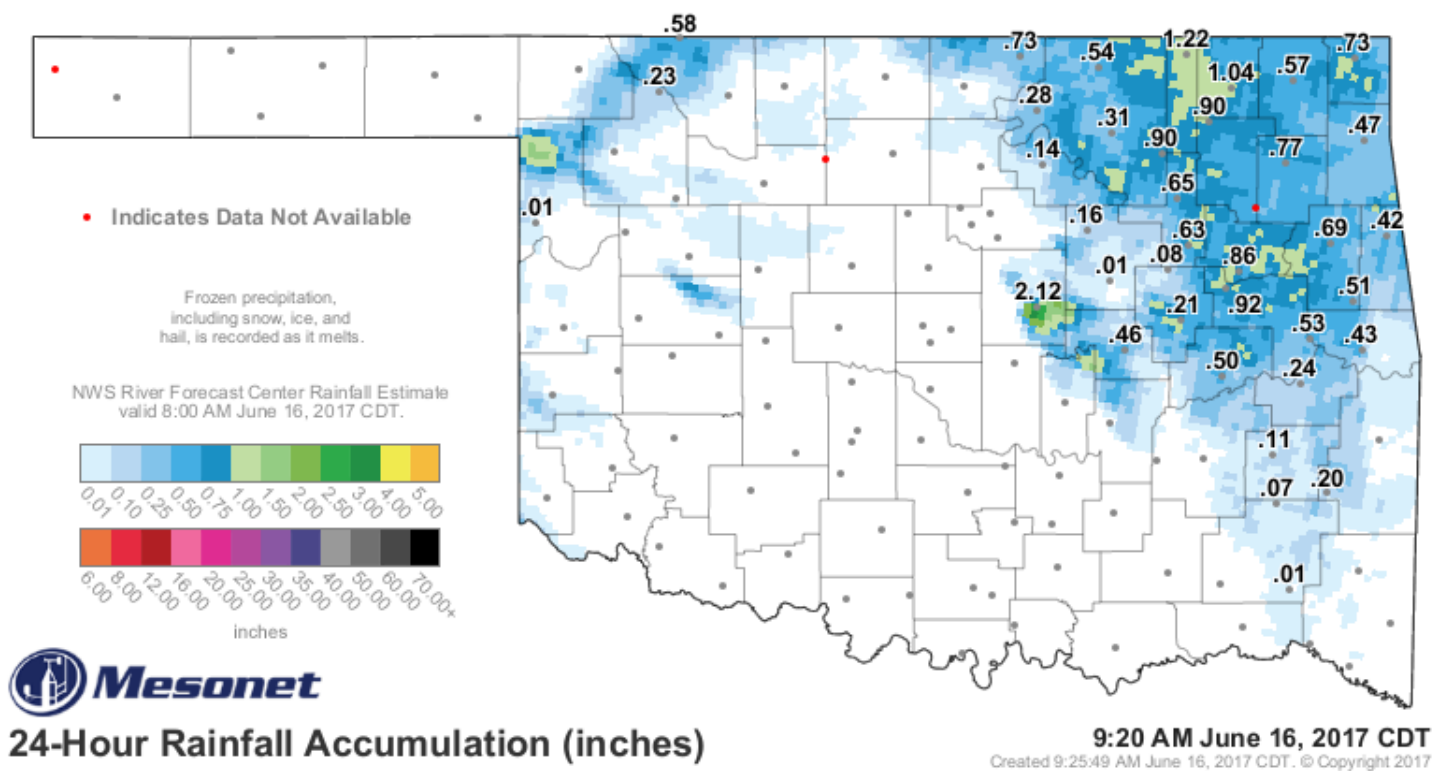


Fig. 7. 24-hour Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 9:20 am CDT 06/16/2017.

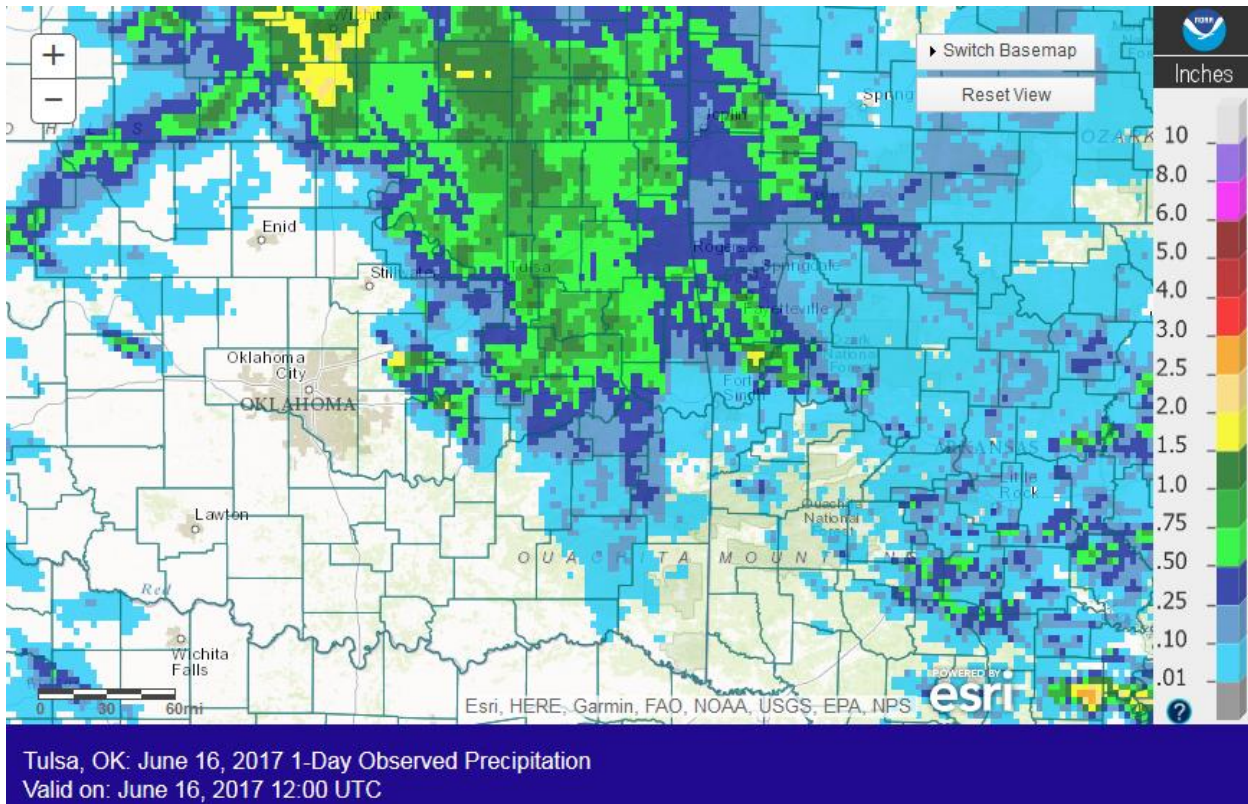


Fig. 8. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/16/2017.

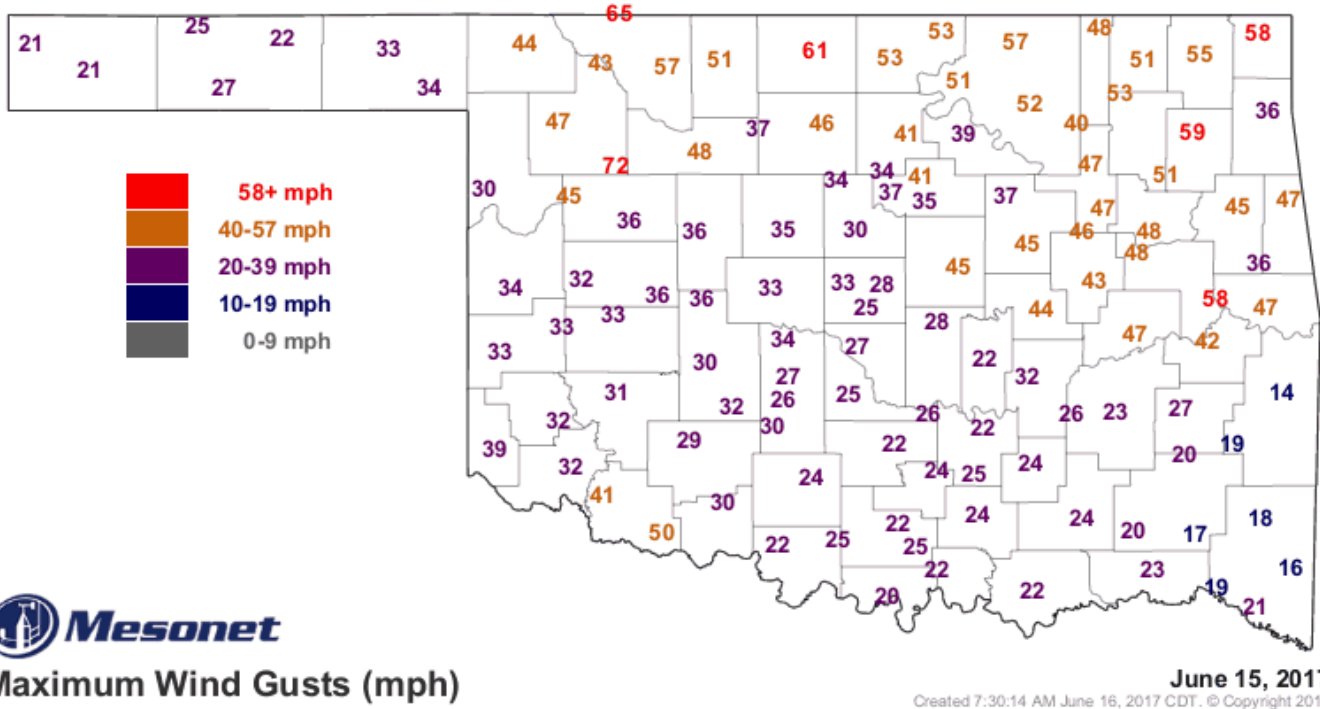


Fig. 9. Maximum wind gusts (mph) from the Oklahoma Mesonet for June 15, 2017.

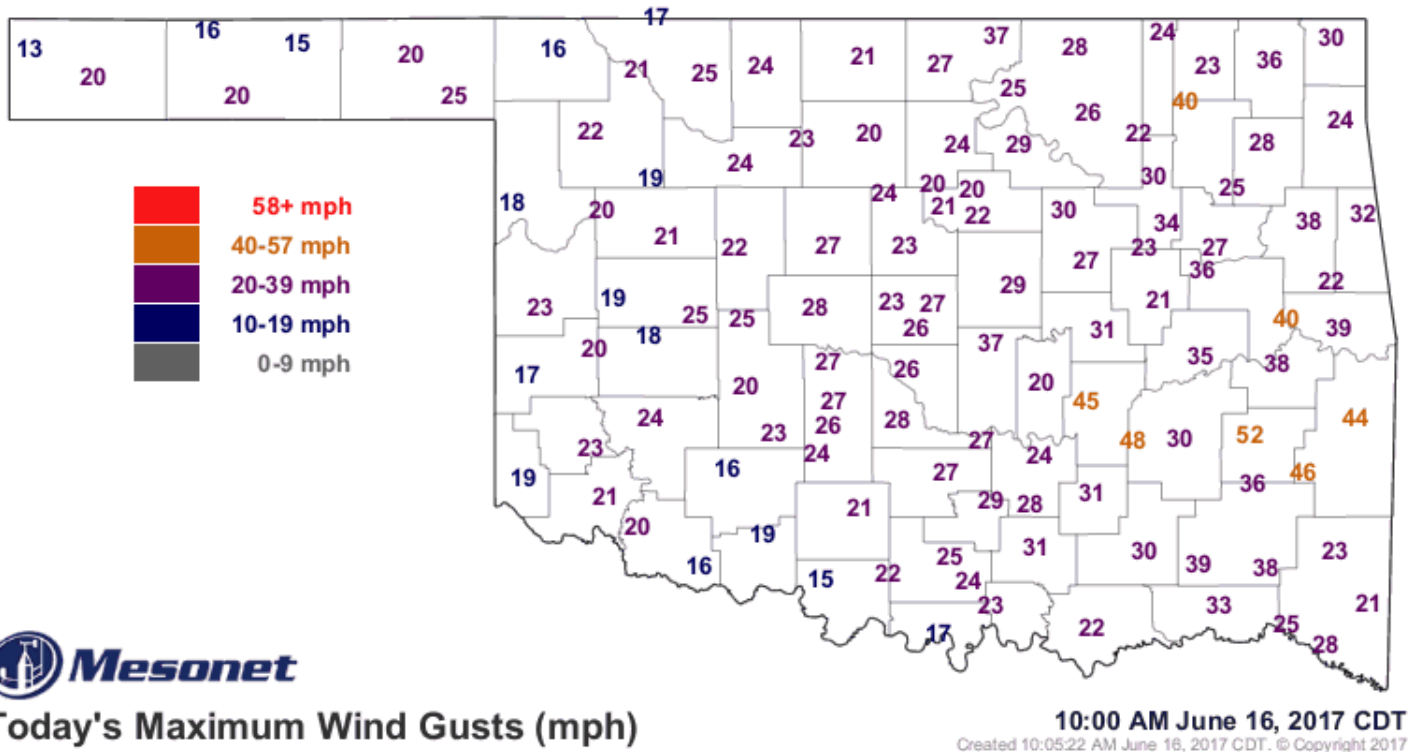


Fig. 10. Maximum wind gusts (mph) from the Oklahoma Mesonet for June 16, 2017.

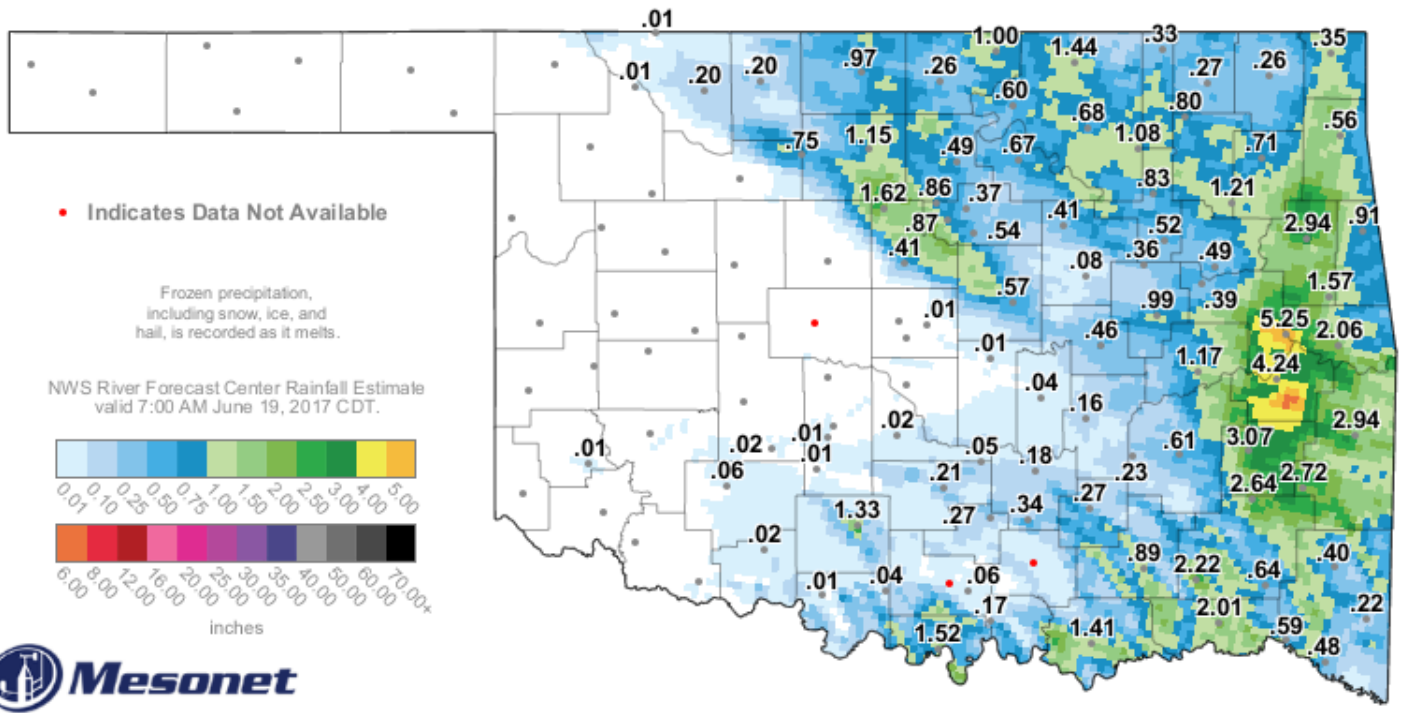
### June 16-30

An MCS over eastern KS/western MO moved south into northeast OK and northwest AR shortly after sunrise on the 17<sup>th</sup>. These storms continued to move south through the morning and early afternoon hours, bringing damaging winds and hail to far eastern OK and western AR. Thunderstorms redeveloped along a cold front over southern KS during the evening and moved into northeast OK at midnight on the 18<sup>th</sup>. This activity slowly moved southeast, affecting most of eastern OK and northwest AR through noon. Golf ball size (1.75") hail was reported near Pawnee. Once the main area of storms cleared the area, additional scattered showers and thunderstorms lingered southeast of I-44 during the afternoon. A nearly stationary boundary set up along the I-40 corridor during the evening. Storms trained over this area for several hours before the line of storms finally started to shift south around midnight. Convection continued through the overnight hours over southeast OK, before moving south of the Red River at sunrise on the 19<sup>th</sup>. Rainfall totals from the several rounds of storms ranged from around 0.50" to 2" for most of eastern OK and northwest AR. However, east central and southeast OK received 2" to near 6" of rain (Figs. 11-14).

Just after noon on the 23<sup>rd</sup>, showers and thunderstorms moved south out of MO into northwest AR. These storms continued southward through the afternoon and early evening hours, and spread west into southeast OK. This activity moved south of the area by mid-evening. Rainfall totals were around 0.25" to around 1.5". Isolated showers developed over northeast OK around midnight on the 24<sup>th</sup> and affected locations in northeast OK and northwest AR through the overnight hours. This activity only brought an additional few hundredths of an inch of rain to the affected areas.

An MCS developed over KS and moved southeast into eastern Kay, western Osage, and western Pawnee Counties a little after midnight on the 30<sup>th</sup>. The line of storms continued to advance southeast across all of eastern OK and western AR through the morning hours. The convection moved south of the area by noon. Rainfall totals from this round of convection ranged from around 0.3" to 2.25", except for southern Pushmataha and Choctaw Counties where less than 0.1" of rain fell (Figs. 15, 16). A secondary line of elevated convection developed near Highway 412 in east central OK and northwest AR mid-morning and moved east southeast through mid-afternoon. Steep lapse rates over central OK and TX advected into eastern OK and northwest AR during the afternoon, allowing for destabilization despite the morning MCS. Additional convection developed along a line from Okemah, OK to Fayetteville, AR during the early evening hours and swept southeast.

Scattered showers and thunderstorms also developed further north over northeast OK during the overnight hours. All of the convection came to an end by sunrise on July 1<sup>st</sup>. Rainfall totals were 1.5" to around 4" over much of east central OK and west central AR, with lesser amounts of around 0.25" to around 1" elsewhere (Fig. 17).



## 2-Day Rainfall Accumulation (inches)

8:25 AM June 19, 2017 CDT

Created 8:30:41 AM June 19, 2017 CDT. © Copyright 2017

Fig. 11. 2-day Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 8:25 am CDT 06/19/2017.

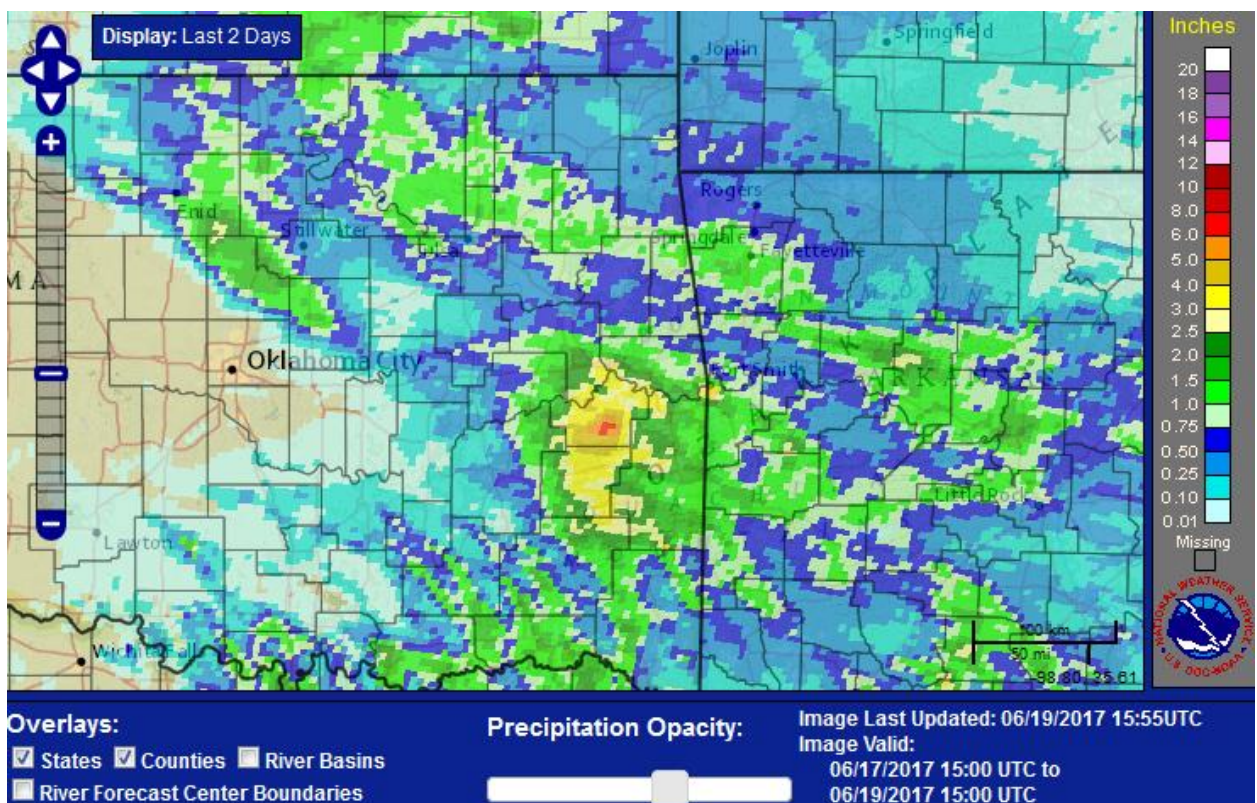
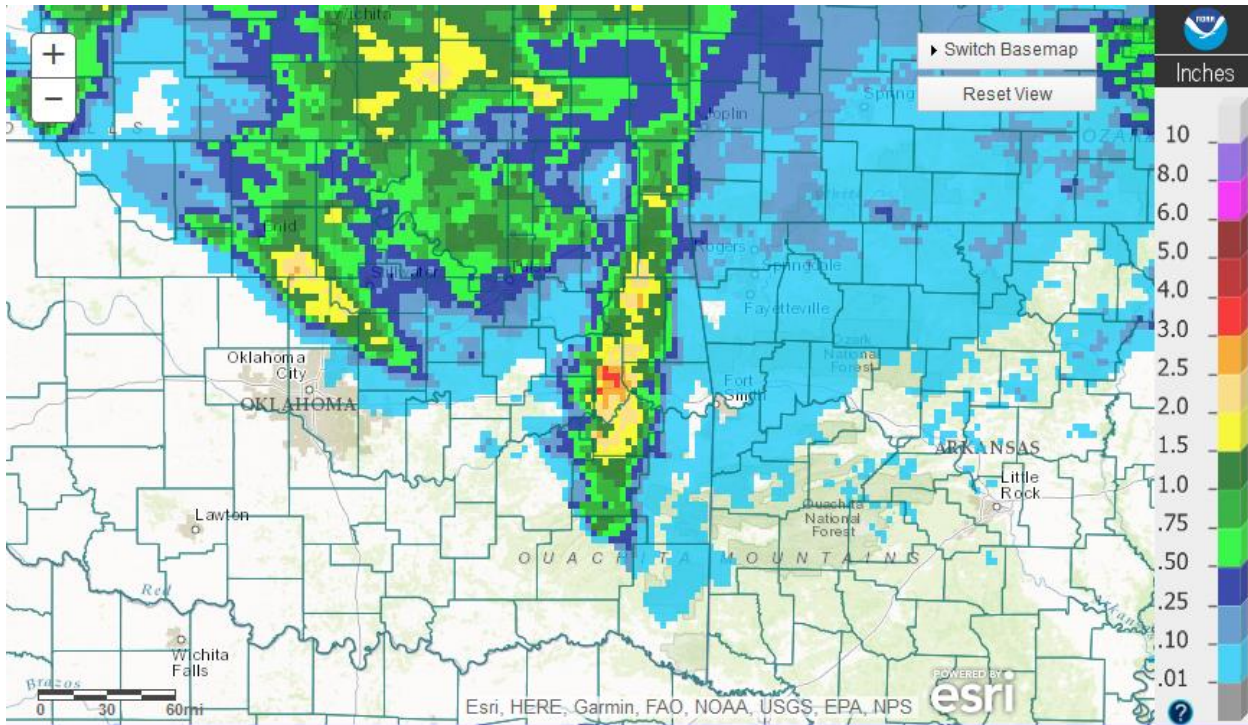
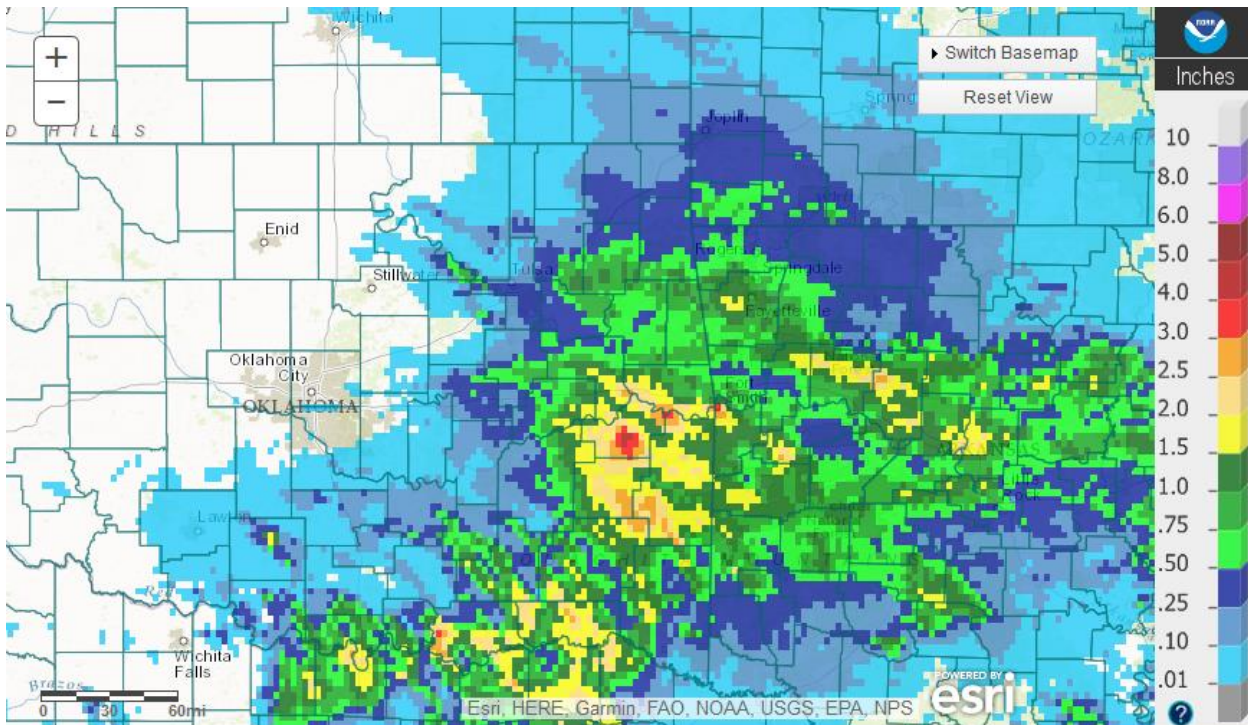


Fig. 12. 48-hour Estimated Observed Rainfall ending at 10am CDT 6/19/2017.



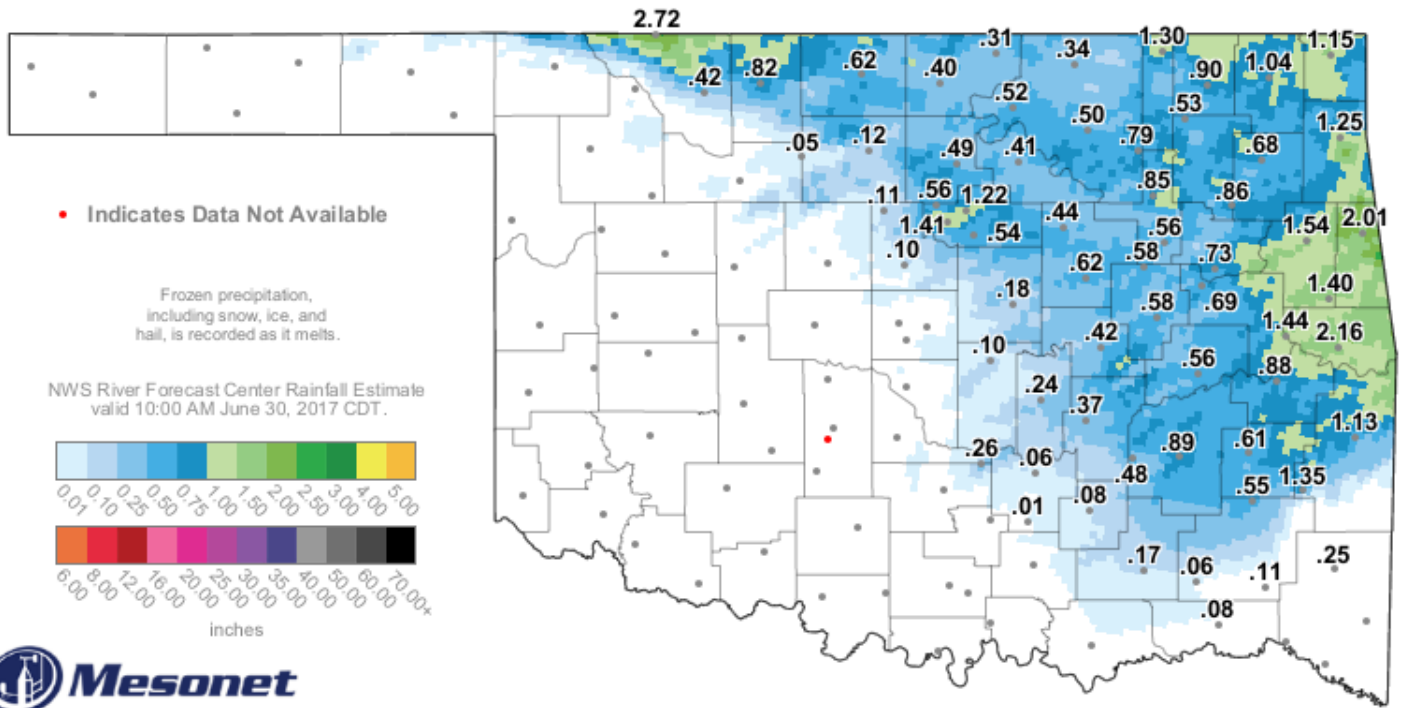
Tulsa, OK: June 18, 2017 1-Day Observed Precipitation  
 Valid on: June 18, 2017 12:00 UTC

Fig. 13. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/18/2017.



Tulsa, OK: June 19, 2017 1-Day Observed Precipitation  
 Valid on: June 19, 2017 12:00 UTC

Fig. 14. 24-hour Estimated Observed Rainfall ending at 7am CDT 6/19/2017.



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

11:25 AM June 30, 2017 CDT

Created 11:30:36 AM June 30, 2017 CDT. © Copyright 2017

Fig. 15. 24-hour Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 11:25 am CDT 06/30/2017.

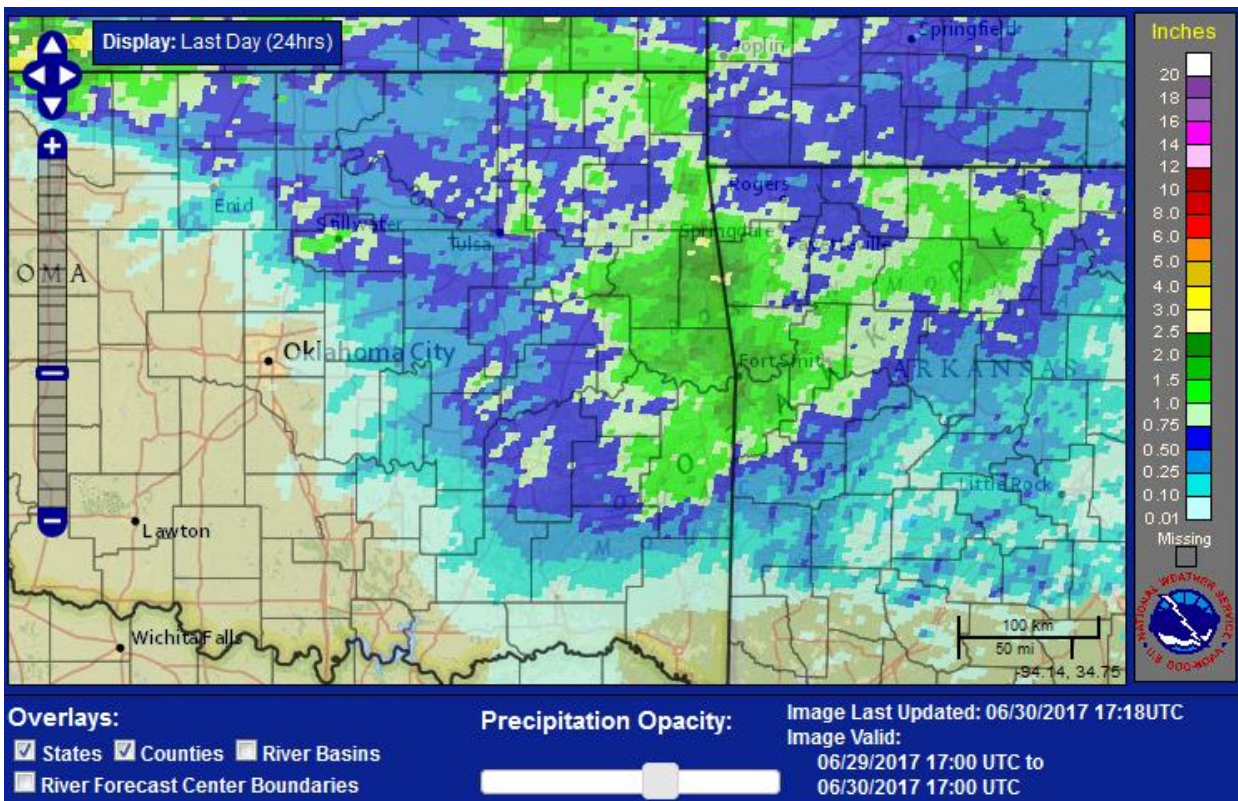


Fig. 16. 24-hour Estimated Observed Rainfall ending at 12pm CDT 6/30/2017.

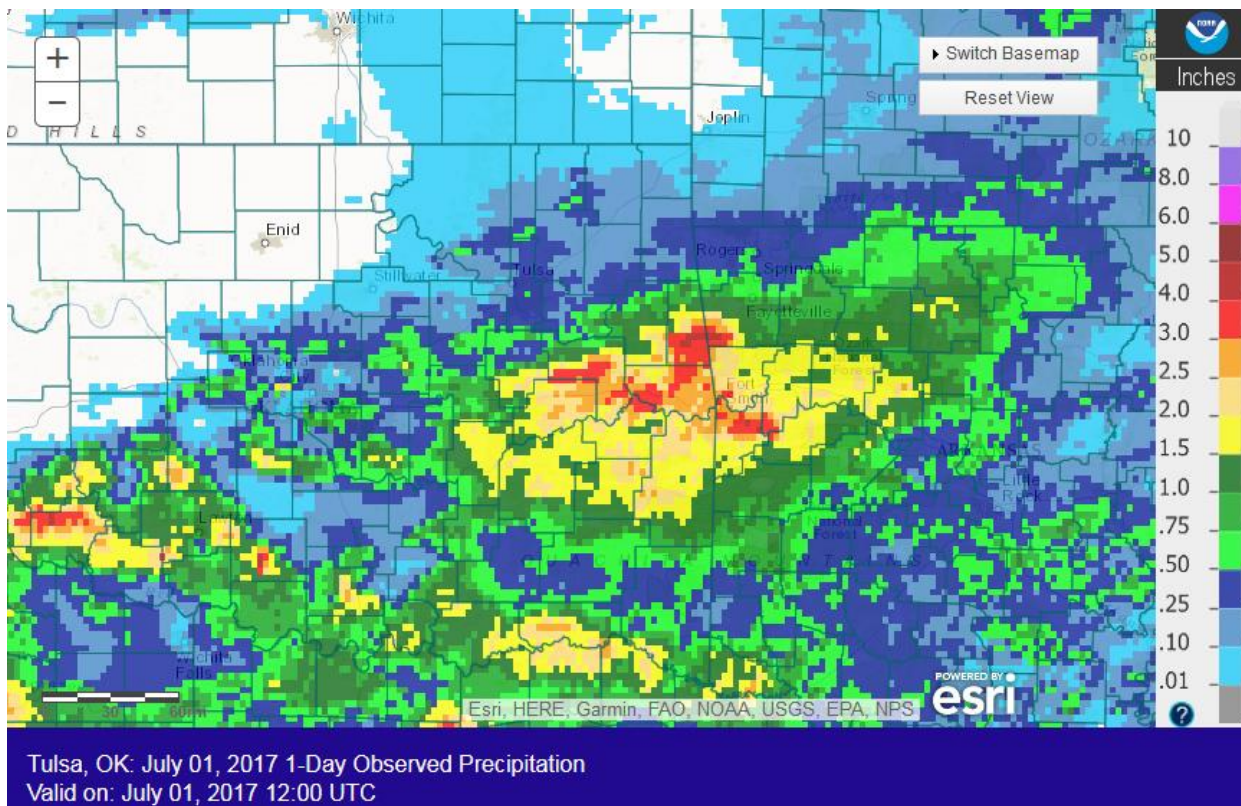


Fig. 17. 24-hour Estimated Observed Rainfall ending at 7am CDT 7/01/2017.

Written by:

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Service Hydrologist  
WFO Tulsa

**Products issued in June 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

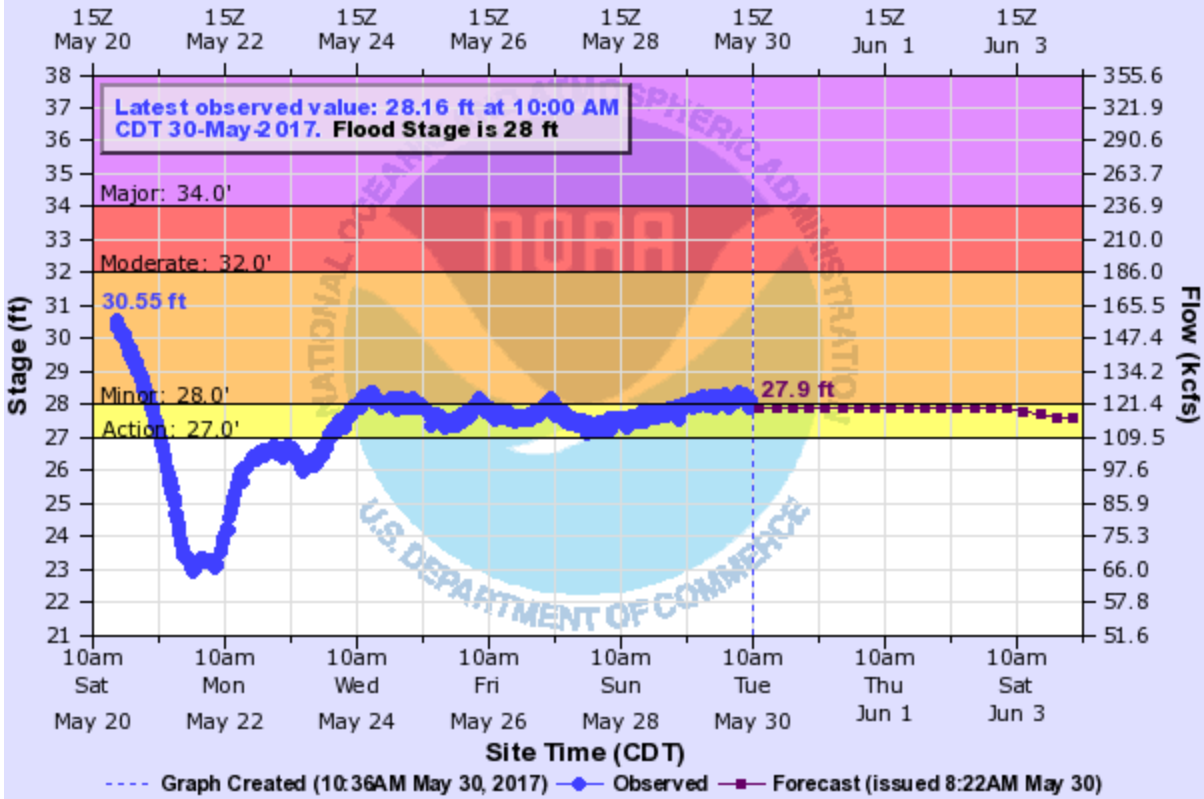
- 0 Flash Flood Warnings (FFW)
- 0 Flash Flood Statements (FFS)
- 0 Flash/Areal Flood Watches (FFA) (0 Watch FFA CON/EXT/EXA/EXB/CAN)
- 7 Urban and Small Stream Advisories (FLS)
- 0 Areal Flood Warnings (FLW)
- 0 Areal Flood Statements (FLS)
- 0 River Flood Warnings (FLW) (includes category increases)
- 0 River Flood Statements (FLS)
- 3 River Flood Advisories (FLS) (77 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:**



## ARKANSAS RIVER NEAR MUSKOGEE

Universal Time (UTC)

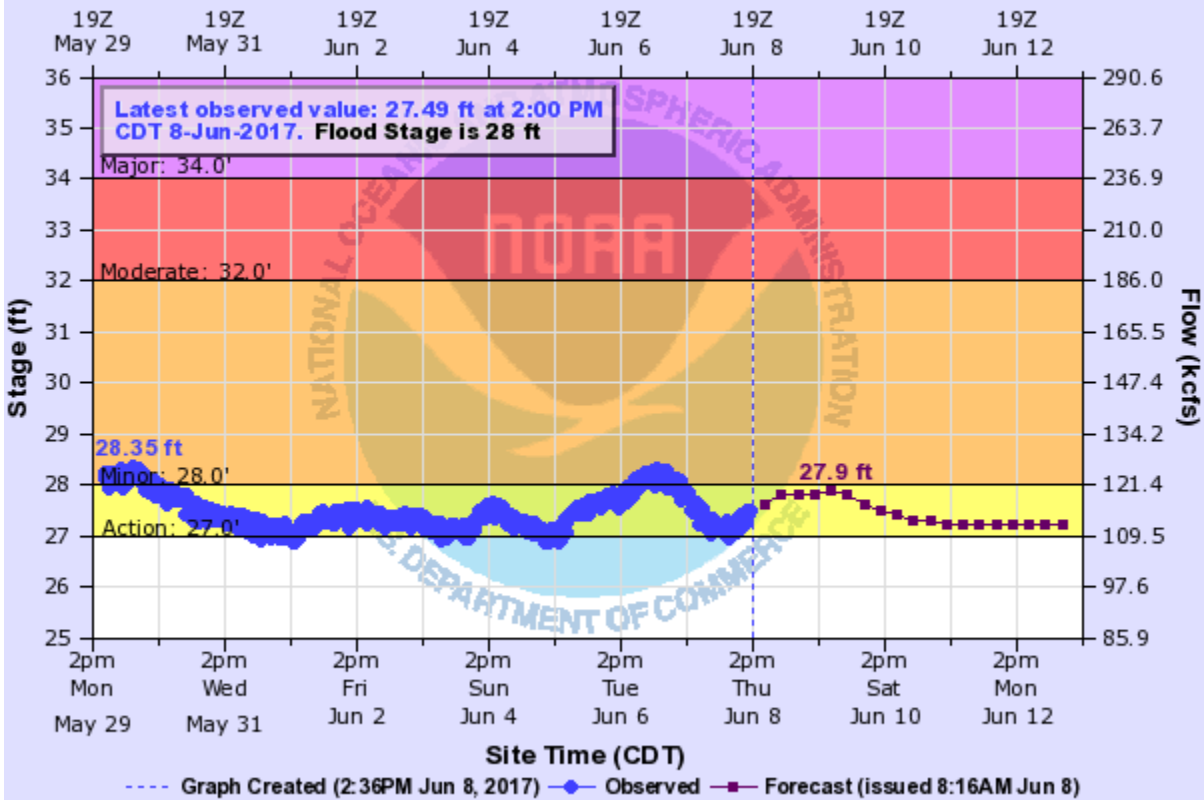


MKGO2(plotting HGIRG) "Gage 0" Datum: 471.38'

Observations courtesy of US Geological Survey

## ARKANSAS RIVER NEAR MUSKOGEE

Universal Time (UTC)

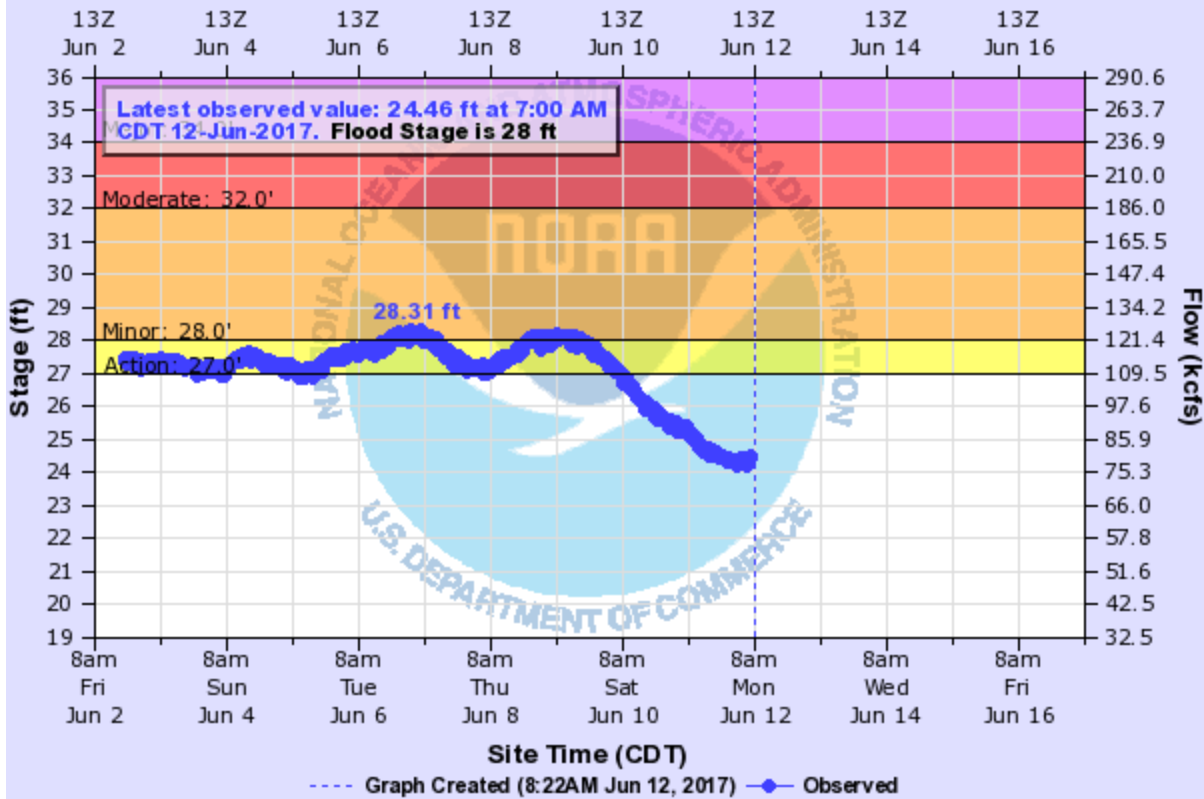


MKGO2(plotting HGIRG) "Gage 0" Datum: 471.38'

Observations courtesy of US Geological Survey

## ARKANSAS RIVER NEAR MUSKOGEE

Universal Time (UTC)

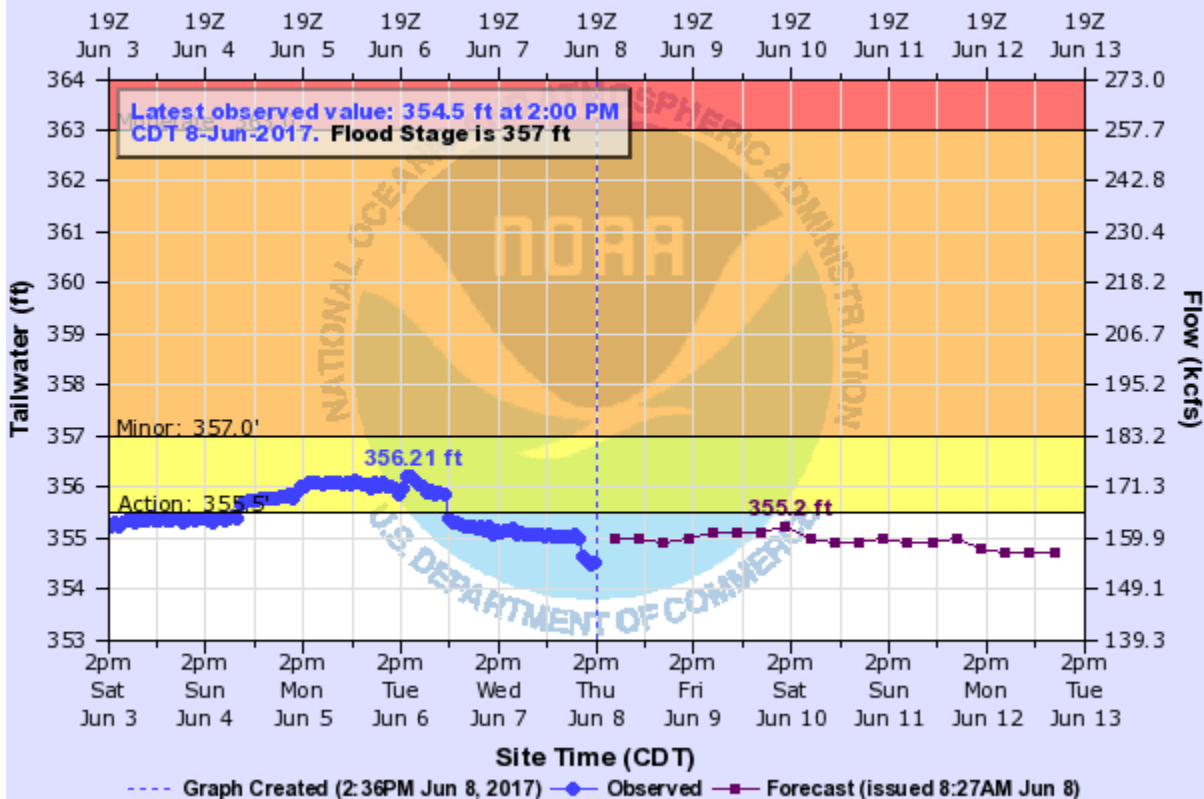


MKGO2(plotting HGIRG) "Gage 0" Datum: 471.38'

Observations courtesy of US Geological Survey

## ARKANSAS RIVER AT OZARK L/D TAILWATER

Universal Time (UTC)



OZGA4(plotting HTIRG) "Gage 0" Datum: 0'

Observations courtesy of US Army Corps of Engineers - LRD