

<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>	
<b>MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS</b>		REPORT FOR:	YEAR
		MONTH <b>May</b>	<b>2018</b>
TO: Hydrometeorological Information Center, W/OH2 NOAA / National Weather Service 1325 East West Highway, Room 7230 Silver Spring, MD 20910-3283		SIGNATURE <b>Steven F. Piltz</b> (Meteorologist-in-Charge)	
		DATE <b>June 11, 2018</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.

Overall, May 2018 was a hot and dry month. This May was the warmest on record for the entire states of Oklahoma and Arkansas, as well as at Tulsa, Fort Smith, and Fayetteville. This follows near record cold in April 2018. Only a few locations received above normal rainfall this month. Normal precipitation values climatologically rank May as the wettest month of the year. These averages range from 5.0 - 5.5 inches across northeast Oklahoma to 5.5 - 6.0 inches across southeast Oklahoma. The Ozark region of northwest Arkansas averages 5.8 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 May 2018 ranged from around 2" to isolated amounts around 8" across eastern OK and northwest AR. This corresponds to 25-90% of the normal May rainfall for most of eastern OK and northwest AR (Fig. 1b). However, portions of McIntosh, Muskogee, Wagoner, Cherokee and northern Osage Counties, as well as small portions of other counties, received near normal to near 150% of the normal May rainfall.

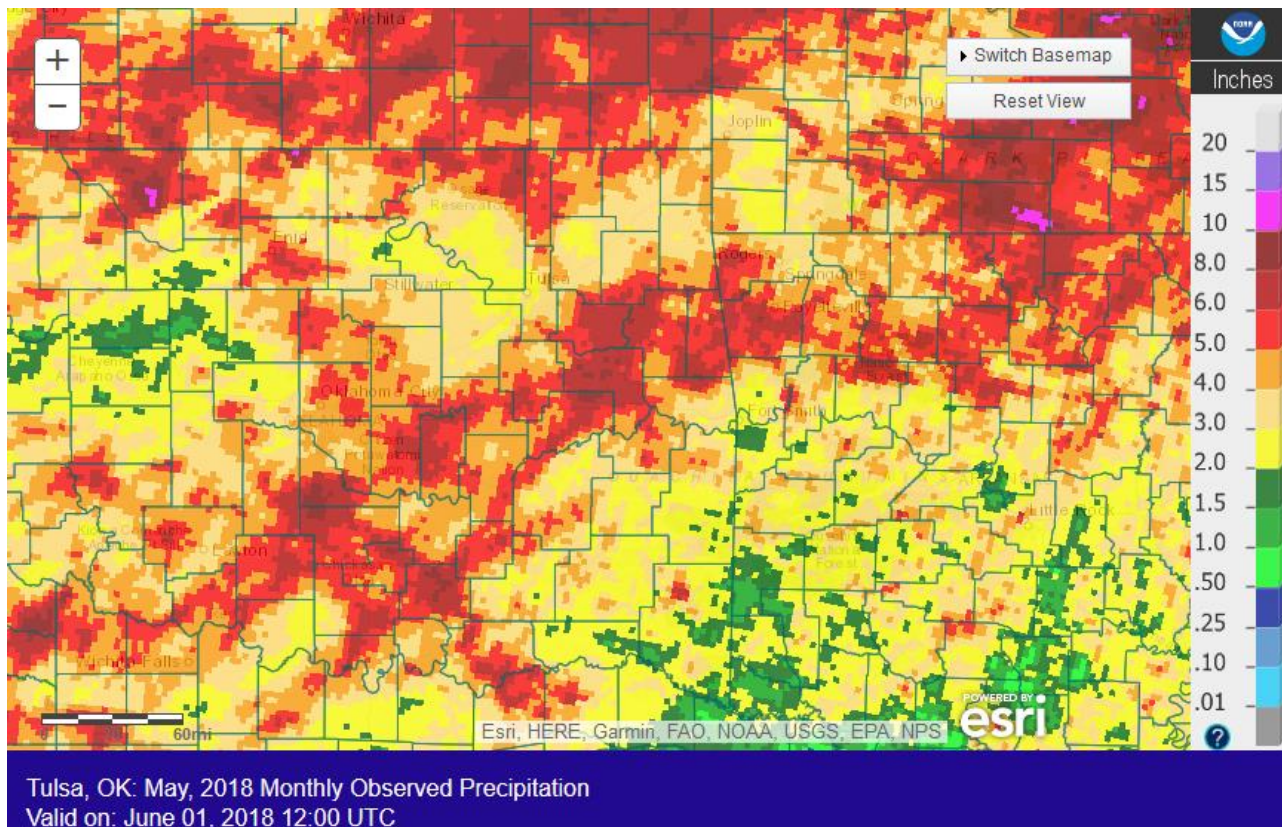


Fig. 1a. Estimated Observed Rainfall for May 2018

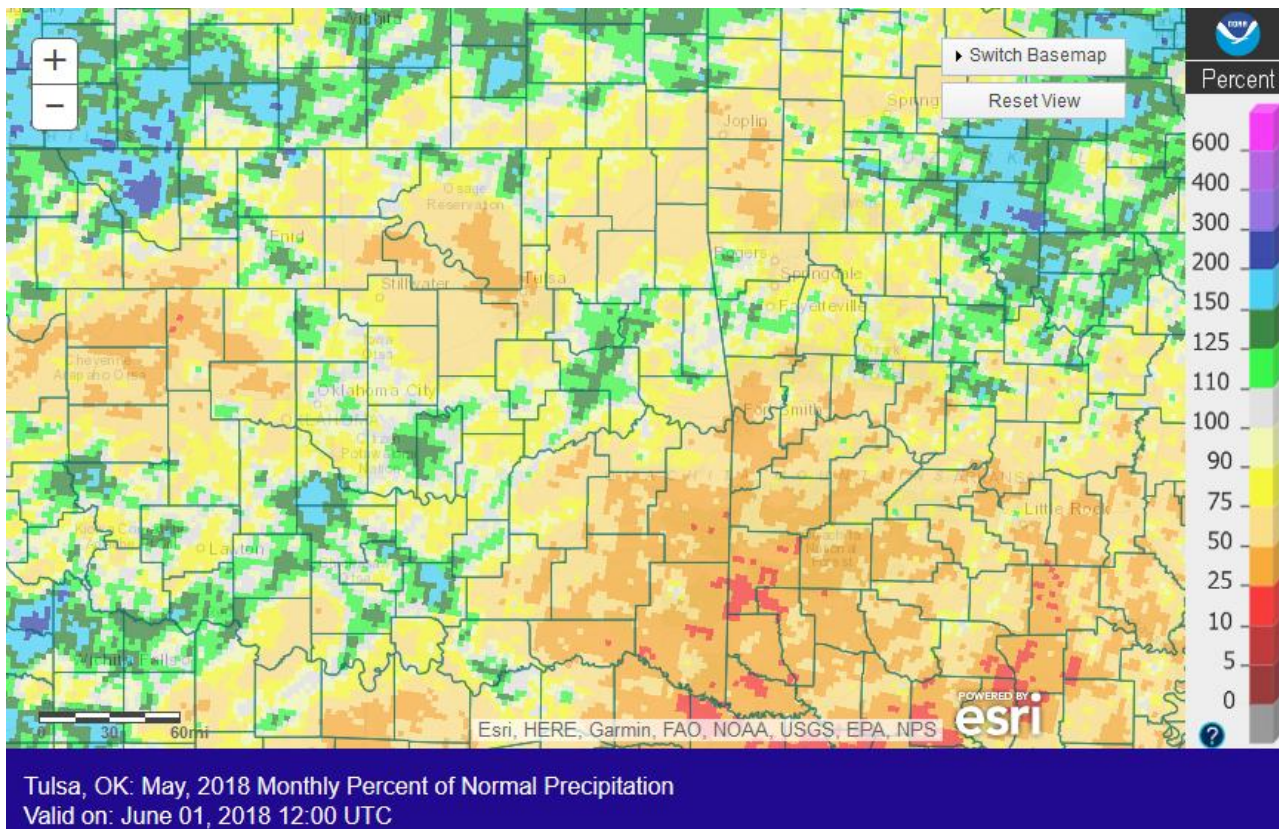


Fig. 1b. Estimated % of Normal Rainfall for May 2018

In Tulsa, OK, May 2018 ranked as the Record warmest May (76.7°F, previous record 75.3°F in 1962; since records began in 1905) and the 27<sup>th</sup> driest May (2.89"; since records began in 1888). Fort Smith, AR had the Record warmest May (76.8°F, previous record 75.8°F in 2012; since records began in 1883) and the 14<sup>th</sup> driest May (2.00"; since records began in 1883). Fayetteville, AR had the Record warmest (72.0°F; previous record 71.8°F in 1962) and the 31<sup>st</sup> wettest (5.82") May since records began in 1950. May 2018 was the warmest May on record for the State of Oklahoma (74.9°F, breaking the previous record of 74.0°F in 1962; this follows the second coldest April on record for Oklahoma), the State of Arkansas (74.8°F, breaking the previous record of 74.2°F in 1896), and for the CONUS (65.4°F, breaking the previous record of 64.7°F in 1934). Oklahoma set a record for the latest first tornado of the year. The first tornado in Oklahoma in 2018 occurred on May 1 near Buffalo, breaking the previous record of April 26, 1962 as the latest first date of a tornado in the state.

Some of the larger precipitation reports (in inches) for May 2018 included:

Farmington 0.4NNE, AR (coco)	7.70	Westville 0.2ENE, OK (coco)	7.60	Eufaula 4.6ENE, OK (coco)	7.41
Cookson, OK (meso)	7.12	Westville 3.0SSW, OK (coco)	7.01	Morris 2.4SW, OK (coco)	6.96
Siloam Springs 1.8N, AR (coco)	6.92	Decatur 2.6ESE, AR (coco)	6.79	Muskogee, OK (ASOS)	6.66

Some of the lowest precipitation reports (in inches) for May 2018 included:

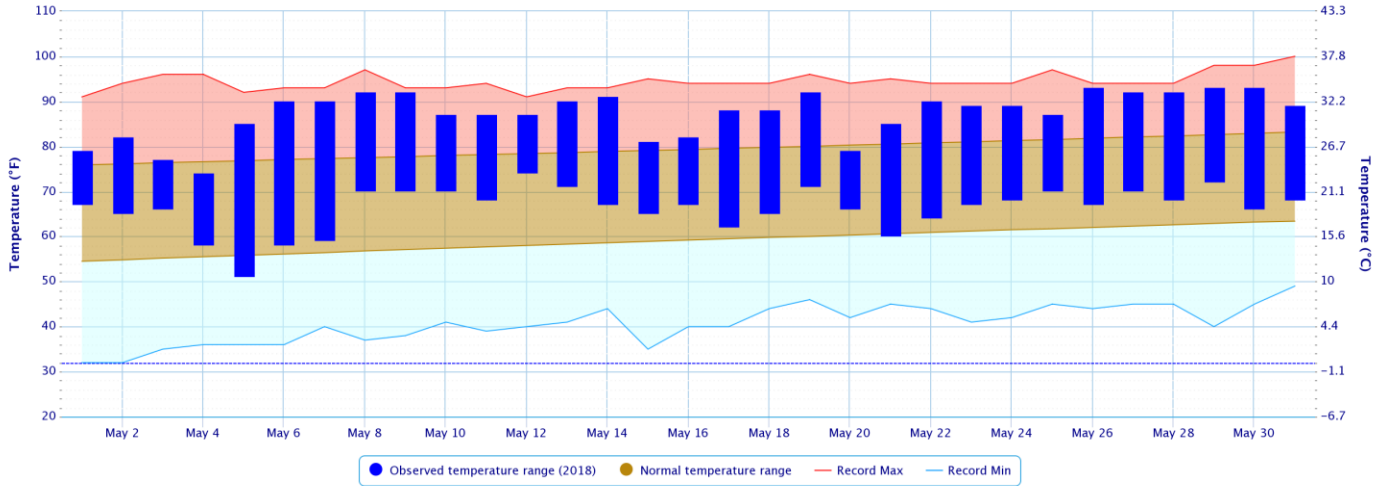
Sand Springs 4.6WNW, OK (coco)	1.77	Greenwood 1.4W, AR (coco)	1.83	Fort Smith, AR (ASOS)	2.00
Tulsa, OK (meso)	2.02	Sand Springs 2.1ENE, OK (coco)	2.25	Wynona, OK (meso)	2.40
Talihina, OK (meso)	2.40	Antlers, OK (coop)	2.45	Wilburton, OK (meso)	2.49

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

Rank since 1921	Last 30 Days (May 2 – 31, 2018)	Last 60 Days (Apr 2- May 31)	Spring 2018 (Mar 1 – May 31)	Last 120 Days (Feb 1 – May 31)	Year-to-Date (Jan 1 – May 31)	Last 180 Days (Dec 3 – May 31)	Water-Year-to-Date (Oct 1– May 31)	Last 365 Days (Jun 1, 2017 – May 31, 2018)
Northeast OK	41 <sup>st</sup> driest	14 <sup>th</sup> driest	14 <sup>th</sup> driest	41 <sup>st</sup> driest	31 <sup>st</sup> driest	23 <sup>rd</sup> driest	35 <sup>th</sup> driest	34 <sup>th</sup> driest
East Central OK	46 <sup>th</sup> driest	31 <sup>st</sup> driest	45 <sup>th</sup> driest	11 <sup>th</sup> wettest	16 <sup>th</sup> wettest	25 <sup>th</sup> wettest	43 <sup>rd</sup> wettest	30 <sup>th</sup> wettest
Southeast OK	15 <sup>th</sup> driest	12 <sup>th</sup> driest	11 <sup>th</sup> driest	18 <sup>th</sup> wettest	25 <sup>th</sup> wettest	25 <sup>th</sup> wettest	45 <sup>th</sup> driest	27 <sup>th</sup> wettest
Statewide	40 <sup>th</sup> driest	23 <sup>rd</sup> driest	15 <sup>th</sup> driest	49 <sup>th</sup> wettest	38 <sup>th</sup> driest	32 <sup>nd</sup> driest	23 <sup>rd</sup> driest	45 <sup>th</sup> driest

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

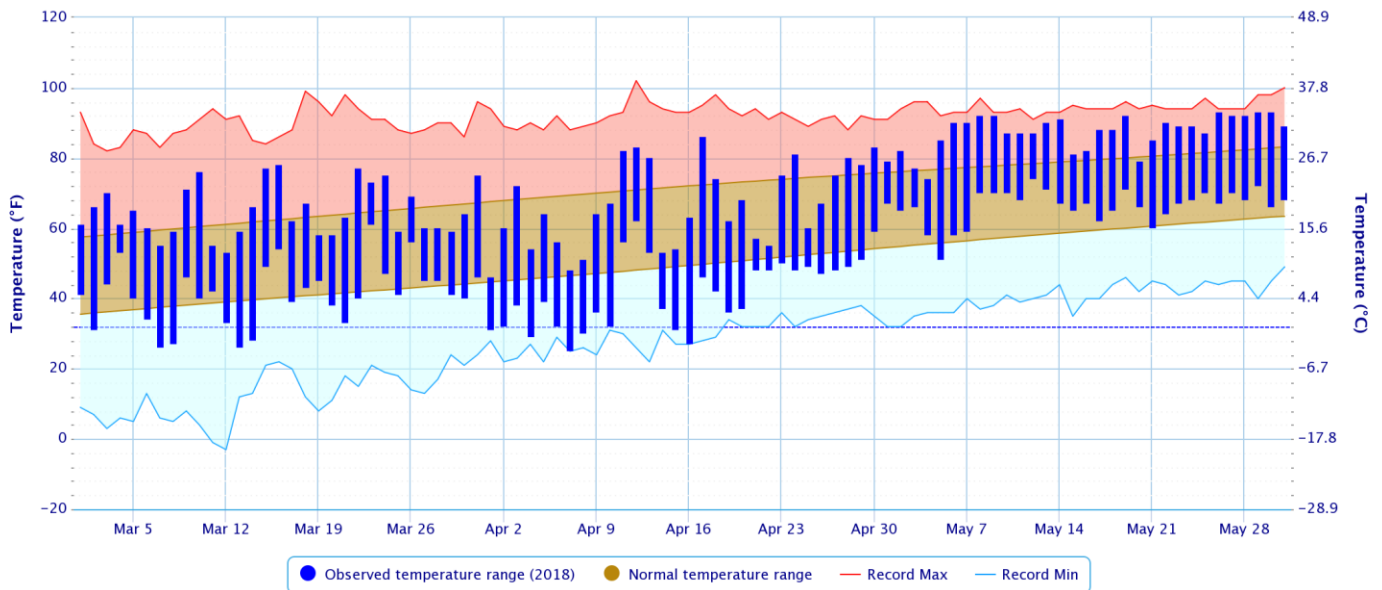
Period of Record – 1905-01-06 to 2018-05-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

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

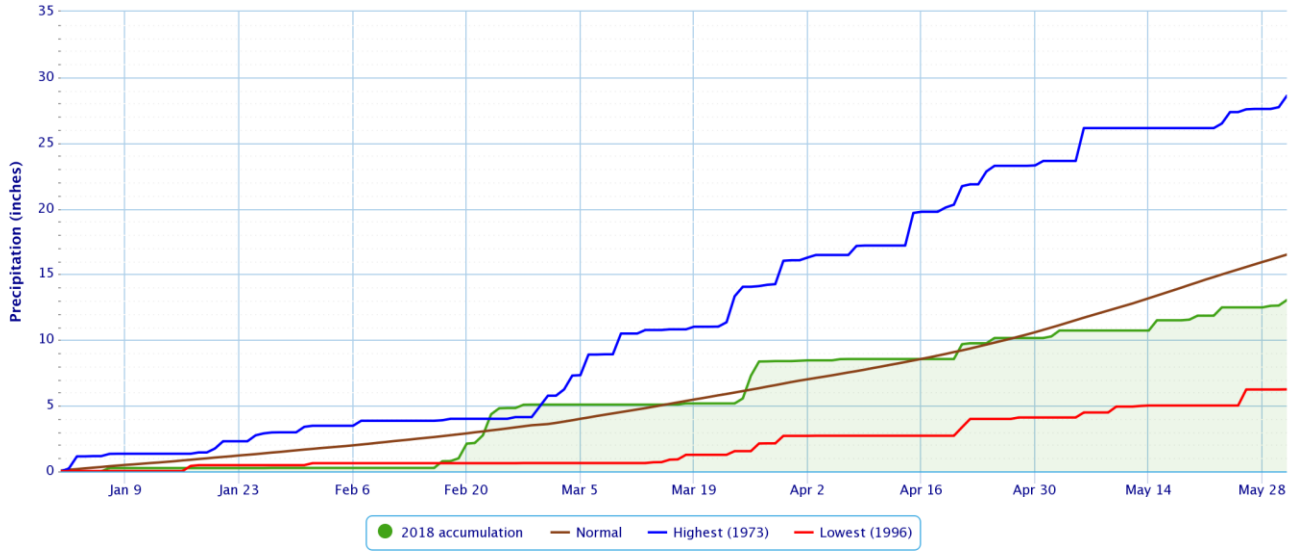
Period of Record – 1905-01-06 to 2018-05-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

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

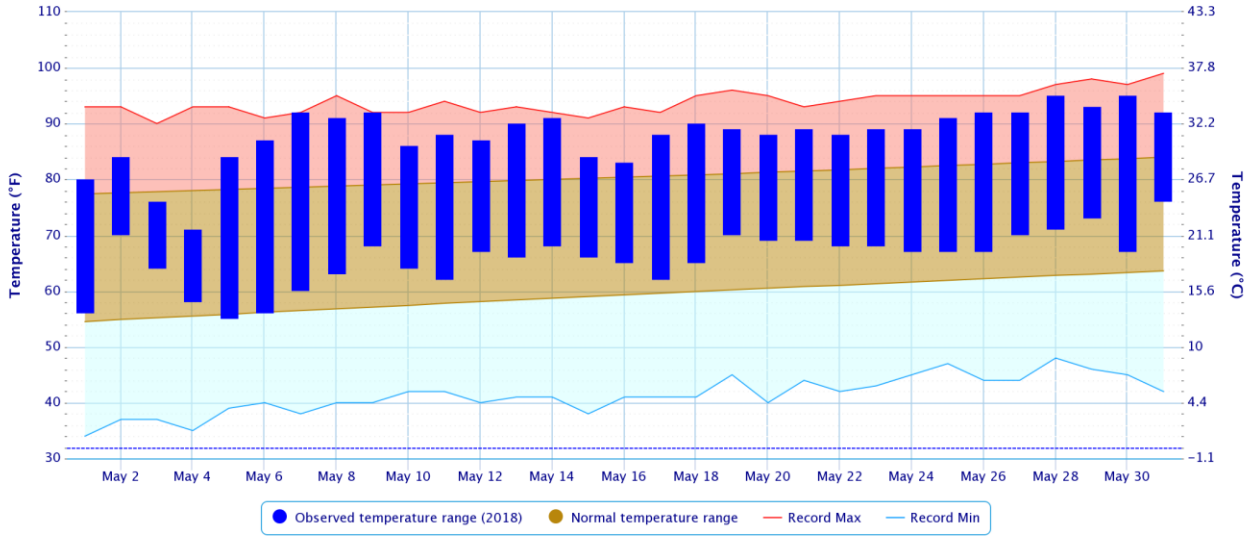
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

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

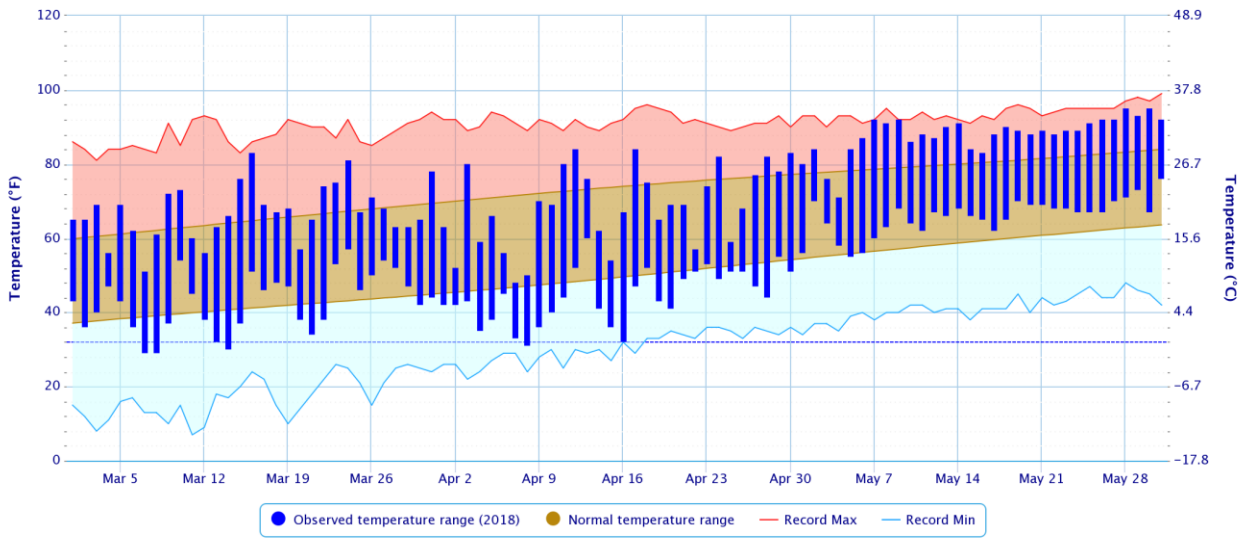
Period of Record – 1882-06-01 to 2018-05-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

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

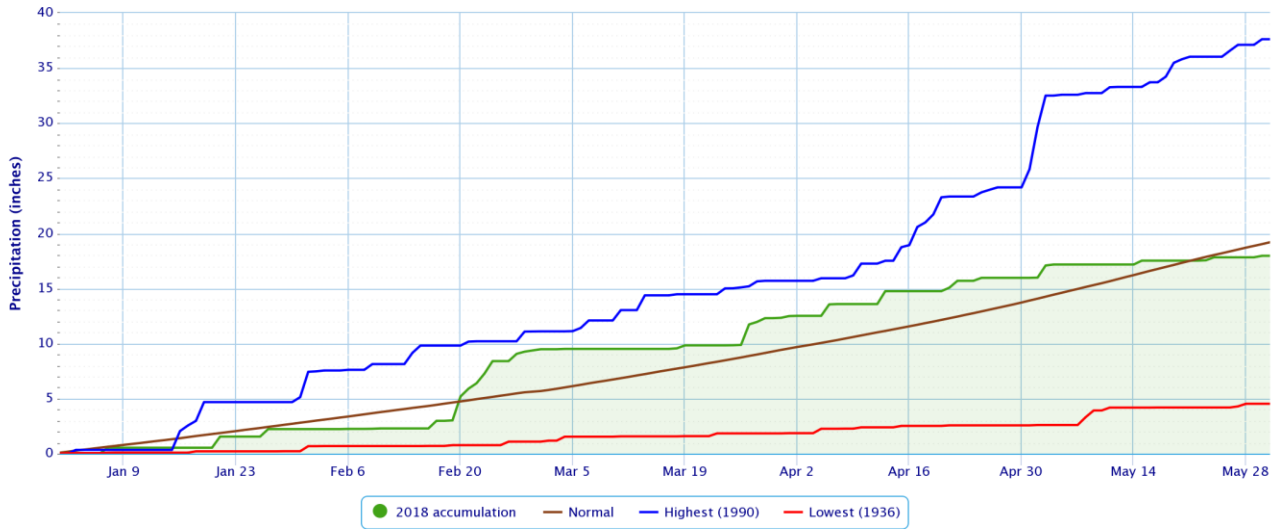
Period of Record – 1882-06-01 to 2018-05-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

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

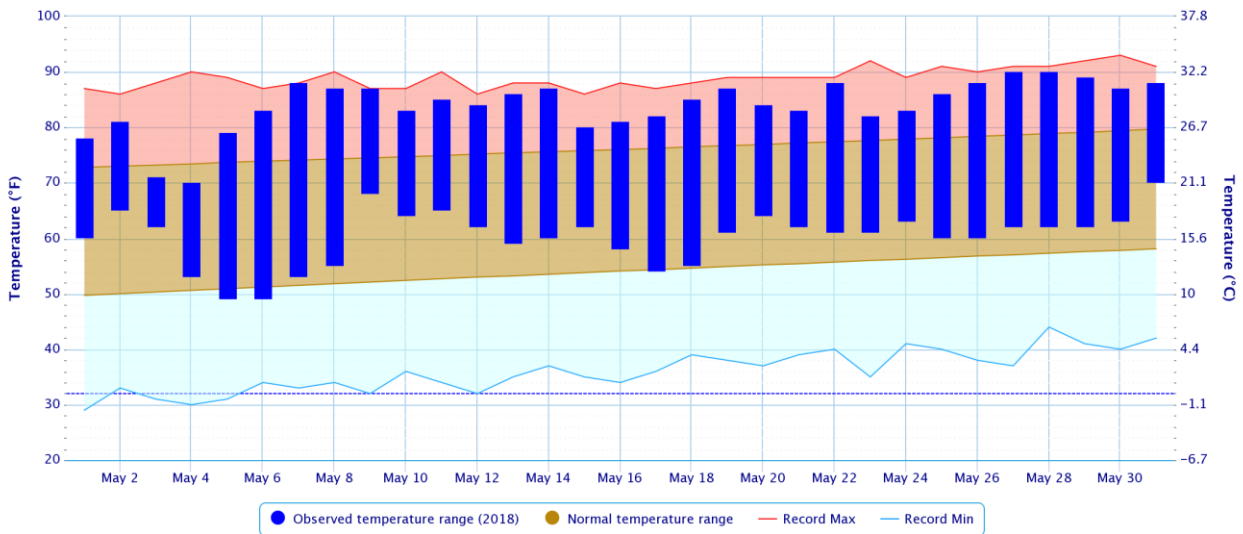
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

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

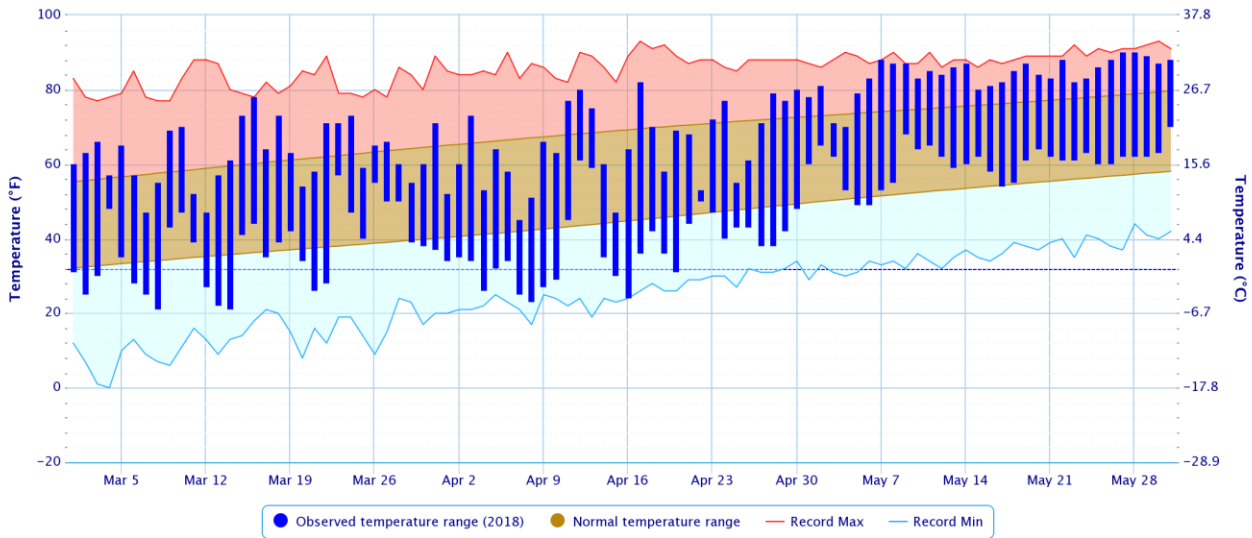
Period of Record – 1949-07-14 to 2018-05-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

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

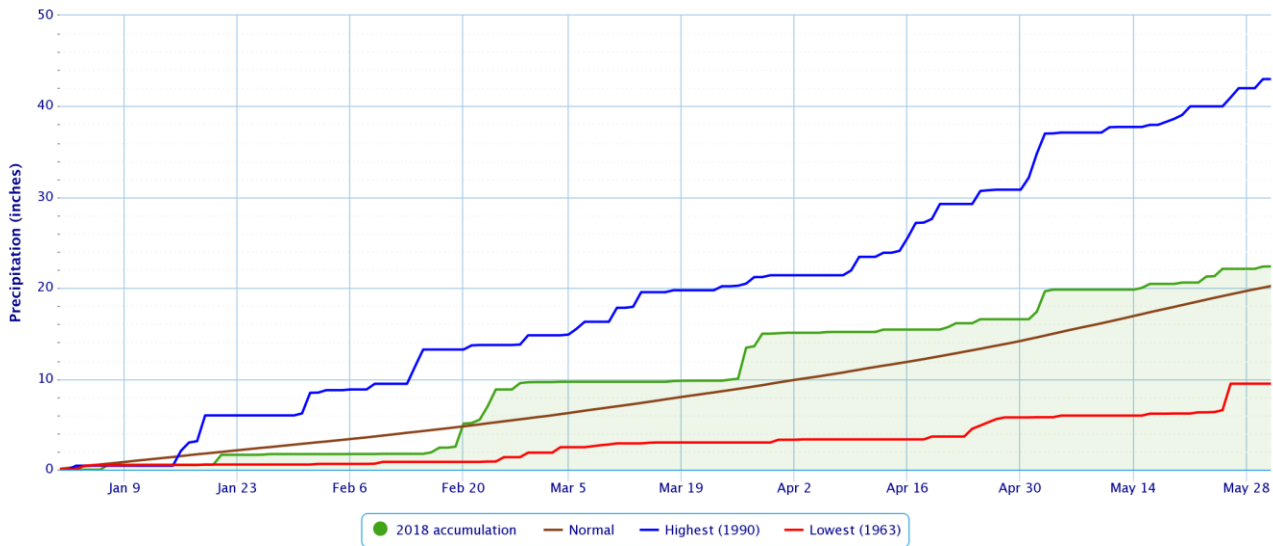
Period of Record – 1949-07-14 to 2018-05-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

### Accumulated Precipitation – FAYETTEVILLE DRAKE FIELD, AR

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



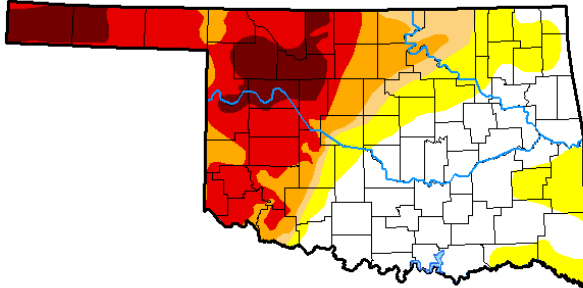
Powered by ACIS

## Drought

According to the [U.S. Drought Monitor](https://www.drought.gov/) (USDM) from May 29, 2018 (Figs. 2, 3), Severe (D2) Drought conditions were impacting western Osage and far northwest Pawnee Counties in eastern OK. Moderate (D1) drought conditions were present across portions of Osage, Pawnee, and eastern Kay Counties in eastern OK. Abnormally Dry (D0) but not in drought conditions encompassed portions of Pawnee, Creek, Osage, Washington, Tulsa, Rogers, Nowata, Ottawa, Delaware, Mayes, Craig, Latimer, Le Flore, and Choctaw Counties in eastern Oklahoma and far western Sebastian County in west central Arkansas.

# U.S. Drought Monitor Oklahoma

**May 29, 2018**  
(Released Thursday, May 31, 2018)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	37.27	62.73	45.53	40.54	29.71	9.81
<b>Last Week</b> 05-22-2018	46.24	53.76	45.55	40.54	31.09	14.25
<b>3 Months Ago</b> 02-27-2018	7.72	92.28	66.20	43.87	32.91	0.00
<b>Start of Calendar Year</b> 01-02-2018	0.00	100.00	77.15	38.76	0.00	0.00
<b>Start of Water Year</b> 09-26-2017	64.46	35.54	0.77	0.00	0.00	0.00
<b>One Year Ago</b> 05-30-2017	97.17	2.83	0.00	0.00	0.00	0.00

**Intensity:**  
■ D0 Abnormally Dry    ■ D3 Extreme Drought  
■ D1 Moderate Drought    ■ D4 Exceptional Drought  
■ D2 Severe Drought

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

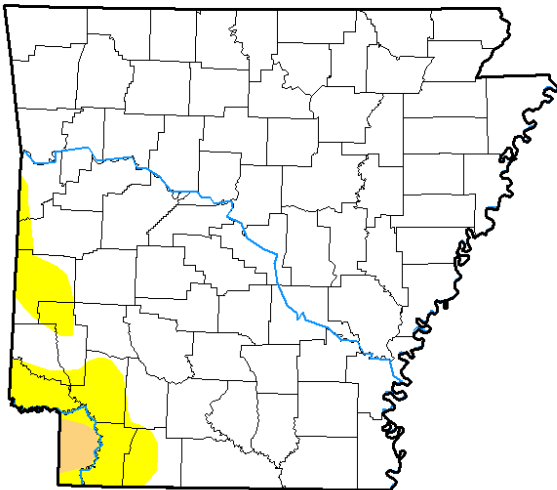


<http://droughtmonitor.unl.edu/>

Fig. 2. Drought Monitor for Oklahoma

# U.S. Drought Monitor Arkansas

**May 29, 2018**  
(Released Thursday, May 31, 2018)  
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	92.22	7.78	0.80	0.00	0.00	0.00
<b>Last Week</b> 05-22-2018	96.20	3.80	0.00	0.00	0.00	0.00
<b>3 Months Ago</b> 02-27-2018	68.86	31.14	1.91	0.00	0.00	0.00
<b>Start of Calendar Year</b> 01-02-2018	8.22	91.78	71.27	32.01	2.37	0.00
<b>Start of Water Year</b> 09-26-2017	39.57	60.43	0.46	0.00	0.00	0.00
<b>One Year Ago</b> 05-30-2017	99.14	0.86	0.00	0.00	0.00	0.00

**Intensity:**  
■ D0 Abnormally Dry    ■ D3 Extreme Drought  
■ D1 Moderate Drought    ■ D4 Exceptional Drought  
■ D2 Severe Drought

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

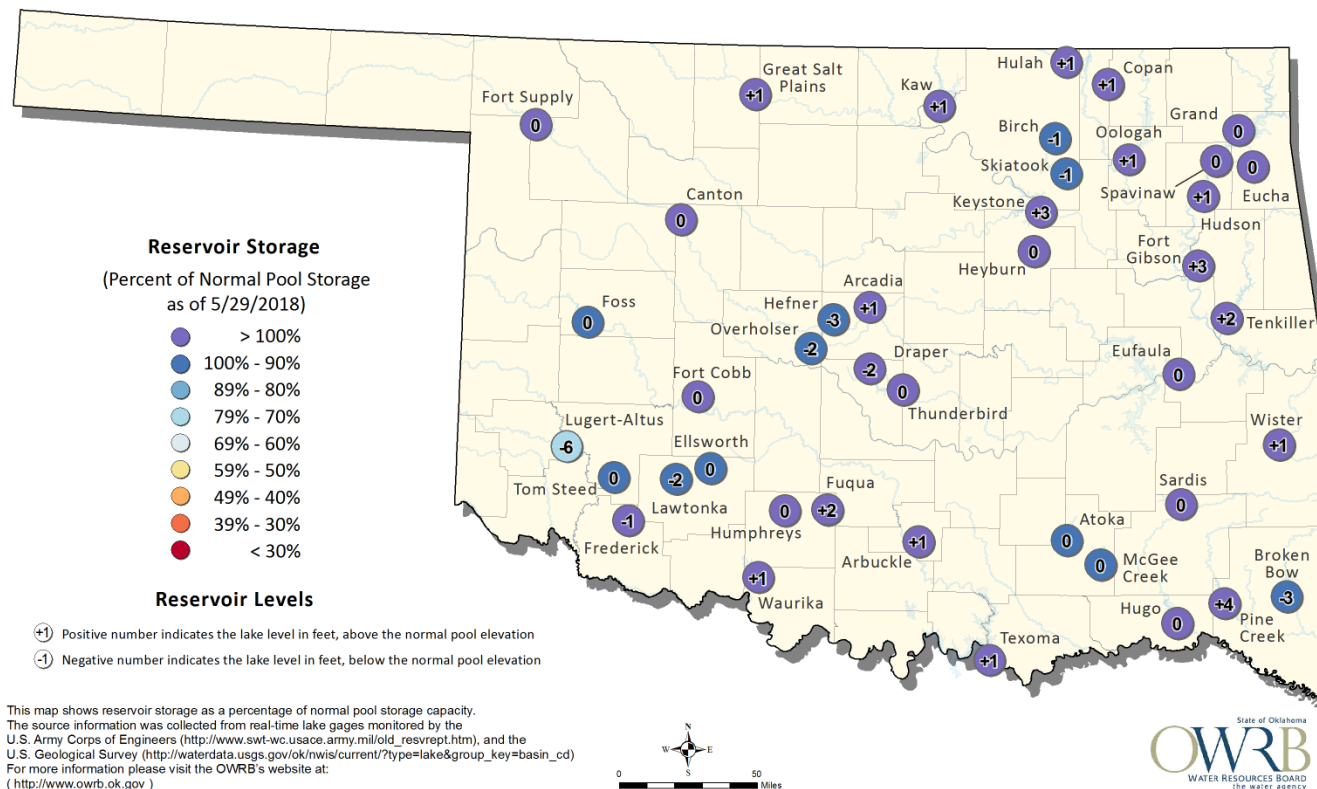


<http://droughtmonitor.unl.edu/>

Fig.3. Drought Monitor for Arkansas  
Reservoirs

# Oklahoma Surface Water Resources

## Reservoir Levels and Storage as of 5/29/2018



According to the USACE, most lakes in the HSA were within  $\pm 3\%$  of their conservation pool level. Reservoirs below 3% of their conservation pool storage as of 6/01/2018: Birch Lake 91%. Reservoirs above 3% of their conservation pool storage as of 6/01/2018: Beaver Lake 159%, Keystone Lake 106%, and Fort Gibson Lake 105%.

### Spring (March-April-May) 2018

In Tulsa, OK, Spring 2018 ranked as the 33<sup>rd</sup> warmest Spring (61.3°F, tied 2001, 1972, 1908; since records began in 1905) and the 19<sup>th</sup> driest Spring (7.96"; since records began in 1888). Fort Smith, AR had the 28<sup>th</sup> warmest Spring (62.8°F, tied 2016; since records began in 1883) and the 23<sup>rd</sup> driest Spring (8.70"; since records began in 1883). Fayetteville, AR had the 21<sup>st</sup> warmest (57.8°F; tied 2000, 1990) and the 30<sup>th</sup> driest (12.76") Spring since records began in 1950.

### Outlooks

The [Climate Prediction Center](#) (CPC) outlook for June 2018 (issued May 31, 2018) indicates a significantly enhanced chance for above normal temperatures and a slightly enhanced chance for 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, soil moisture conditions, and sub-seasonal climate signals, including the Madden-Julian Oscillation (MJO).



For the 3-month period June-July-August 2018, CPC is forecasting an enhanced chance for above normal temperatures and an equal chance for above, near, and below median precipitation across all of eastern OK and northwest AR (outlook issued May 17, 2018). This outlook is based on both statistical and dynamical forecast tools and decadal timescale climate trends, as well as impacts from the ENSO state and the MJO. According to CPC, ENSO neutral conditions were present in May, though some lingering La Niña conditions remained in the atmosphere. ENSO neutral conditions are favored to persist through the summer, with a growing chance of El Niño by fall and winter 2018-19.

**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)

Several rounds of showers and thunderstorms, some of which were severe, affected eastern OK and northwest AR from the evening of the 2<sup>nd</sup> through the late afternoon of the 3<sup>rd</sup>. The first line of storms moved into the area from the west during the evening of the 2<sup>nd</sup> and continued to progress eastward through the overnight hours. This activity moved out of western AR during the early morning hours of the 3<sup>rd</sup>, while additional storms moved into eastern OK from the west. By mid-morning of the 3<sup>rd</sup>, the 3<sup>rd</sup> line of storms pushed into eastern OK. By afternoon, this line moved into western AR. Part of the line began to accelerate forward as a bow echo as the storms moved into west central Arkansas. An EF-1 tornado developed within this bow echo segment near Peter Pender in Franklin County Arkansas (for more information on this event: <https://arcg.is/1f5Ob4>). All of this activity came to an end by late afternoon. The three rounds of storms brought 0.75" to 3.5" to most of eastern OK and northwest AR, with some isolated totals to around 4" (Figs. 4-6). However, far northwest Osage County only received 0.10"-0.30" of rain. This rainfall resulted in some flooding of roadways, as well as minor flooding along the Illinois River (see preliminary hydrographs at the end of this report; see E3 Report for details).

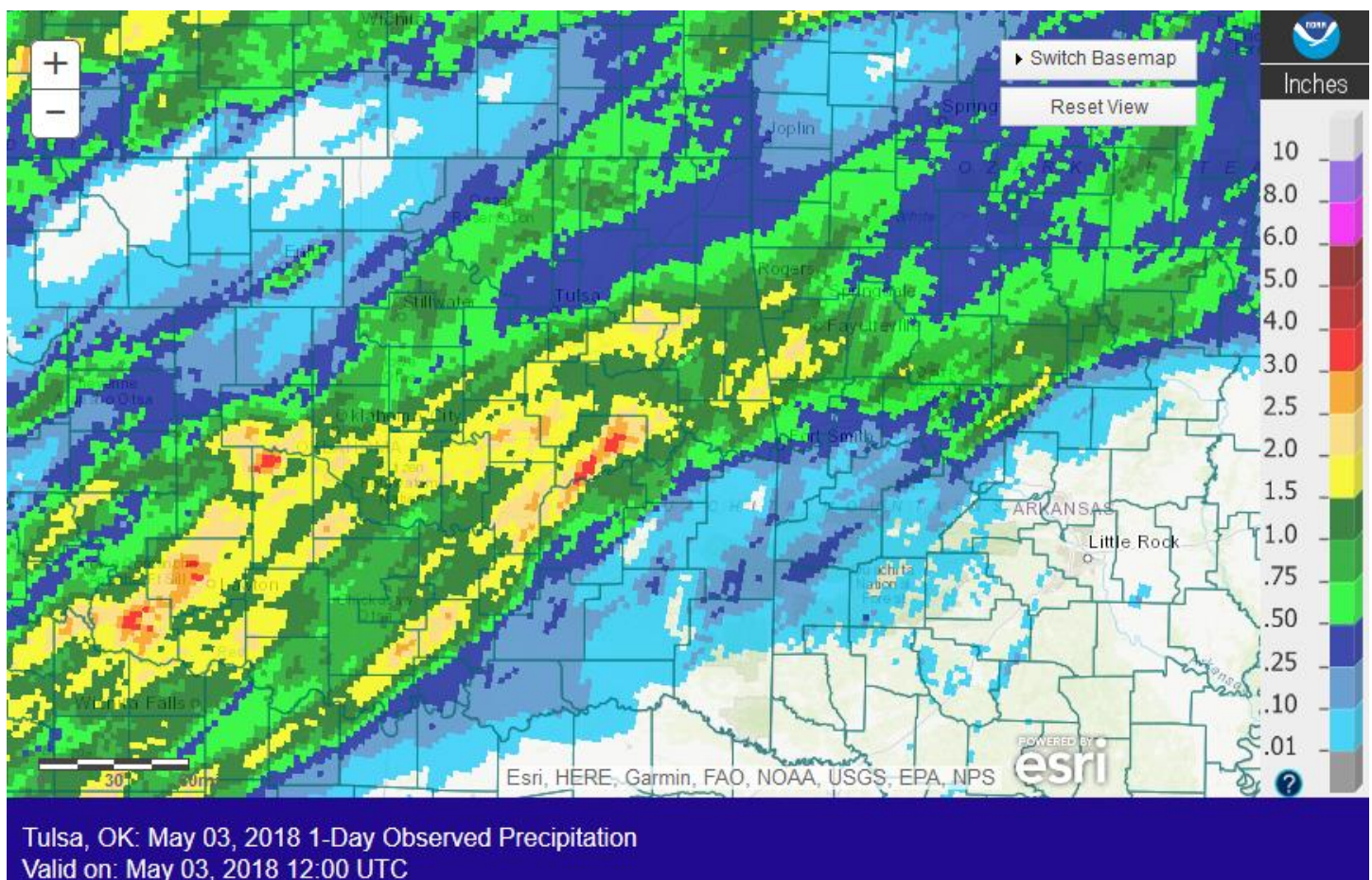
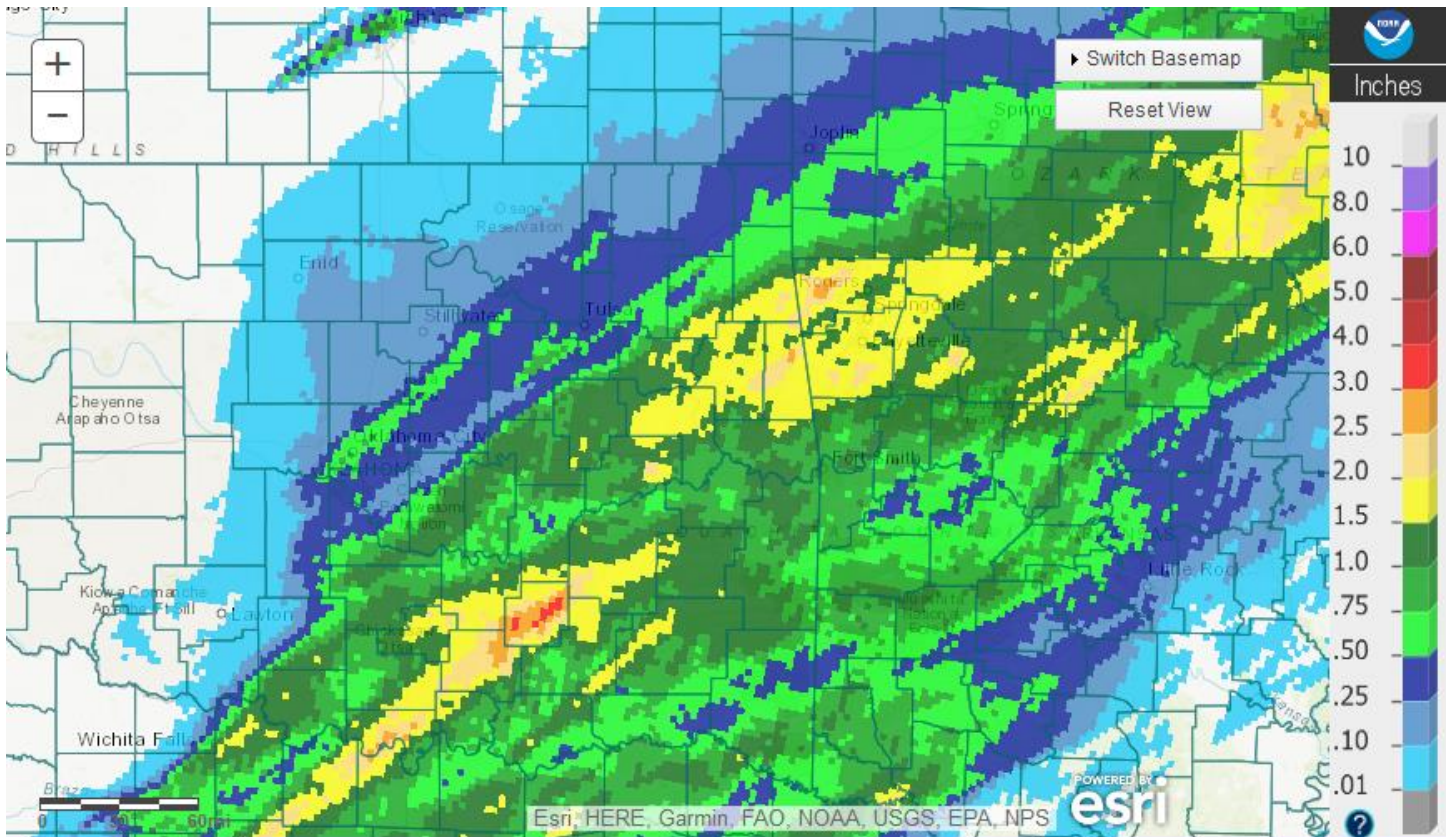
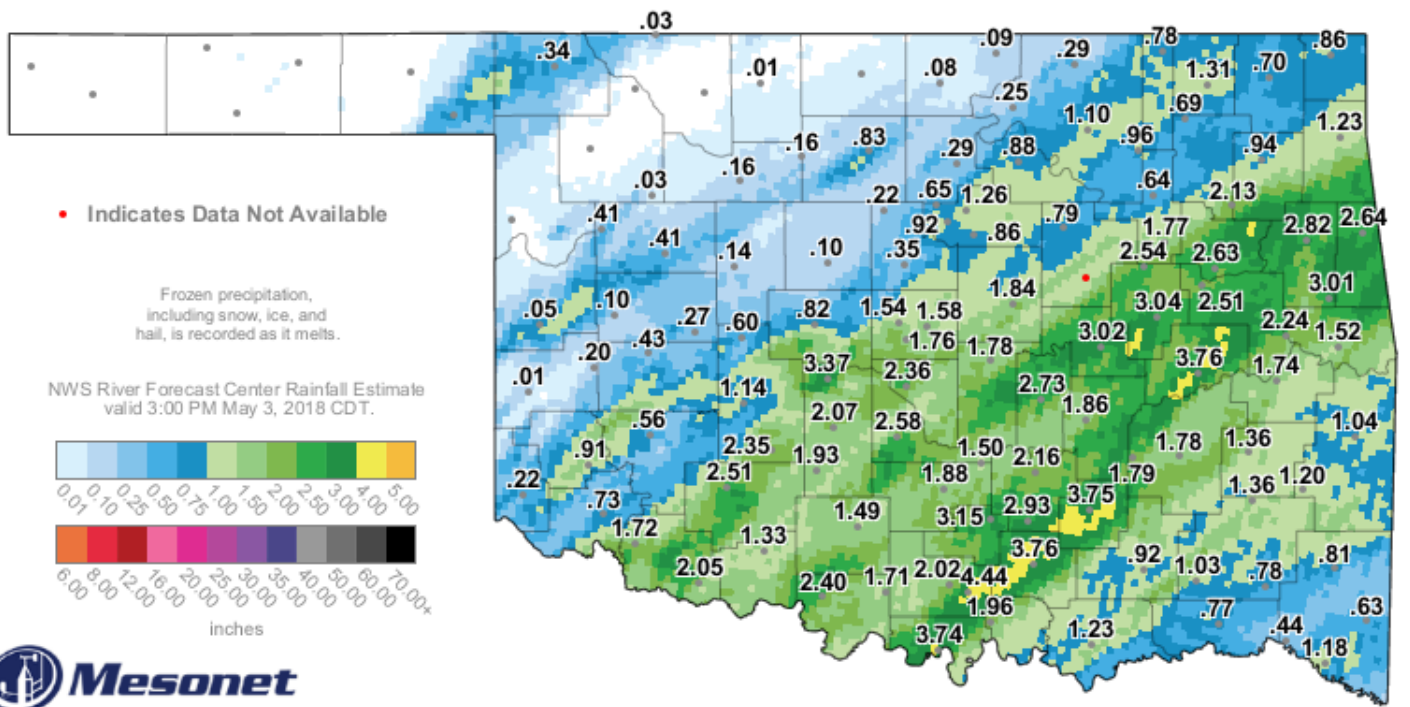


Fig. 4. 24-hour Estimated Observed Rainfall ending at 7am CDT 5/03/2018.



Tulsa, OK: May 04, 2018 1-Day Observed Precipitation  
Valid on: May 04, 2018 12:00 UTC

Fig. 5. 24-hour Estimated Observed Rainfall ending at 7am CDT 5/04/2018.



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

4:20 PM May 3, 2018 CDT

Created 4:24:27 PM May 3, 2018 CDT. © Copyright 2018

Fig. 6. 24-hour Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 4:20 pm CDT 5/03/2018.

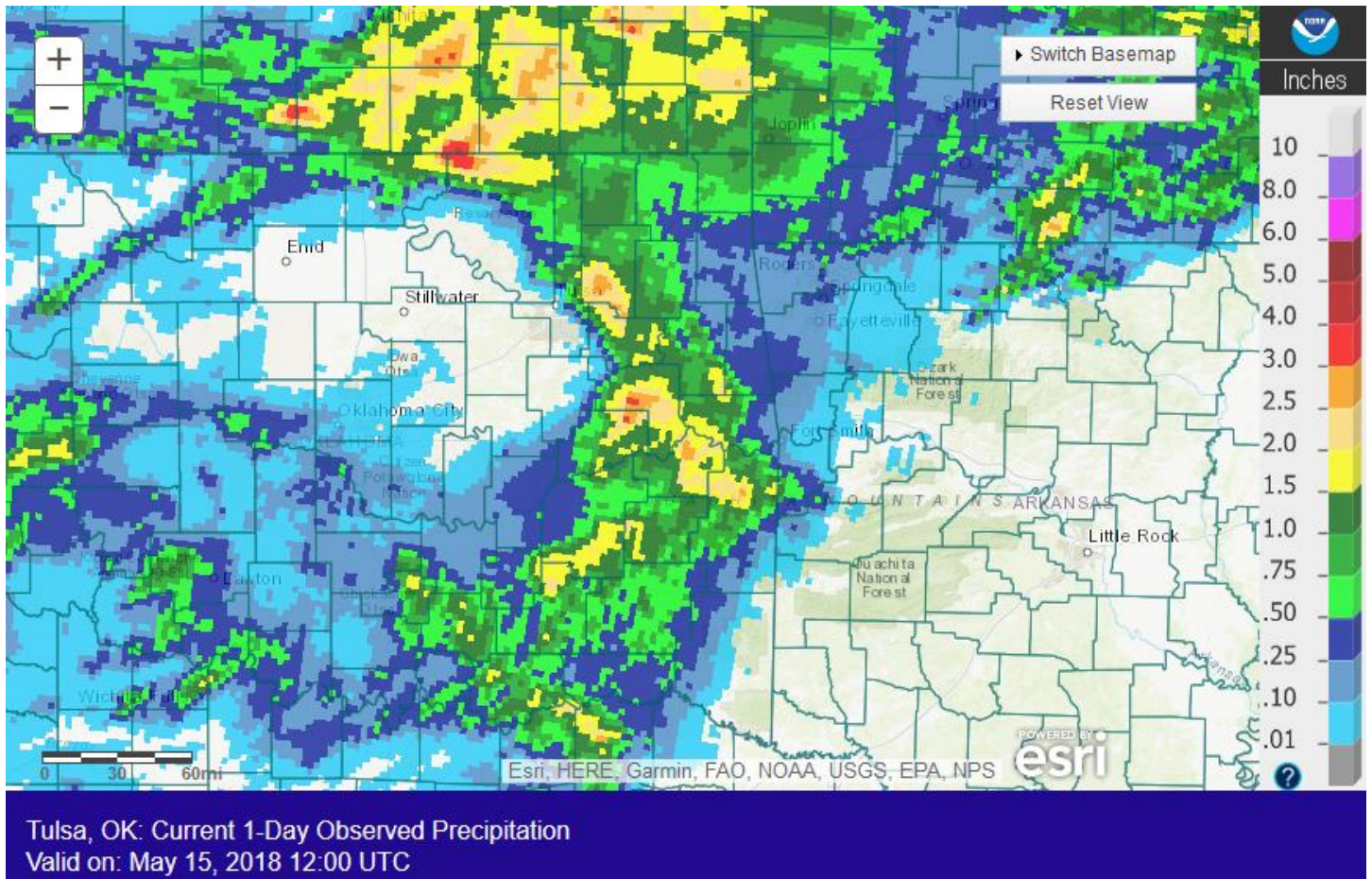


Fig. 7. 24-hour Estimated Observed Rainfall ending at 7am CDT 5/15/2018.

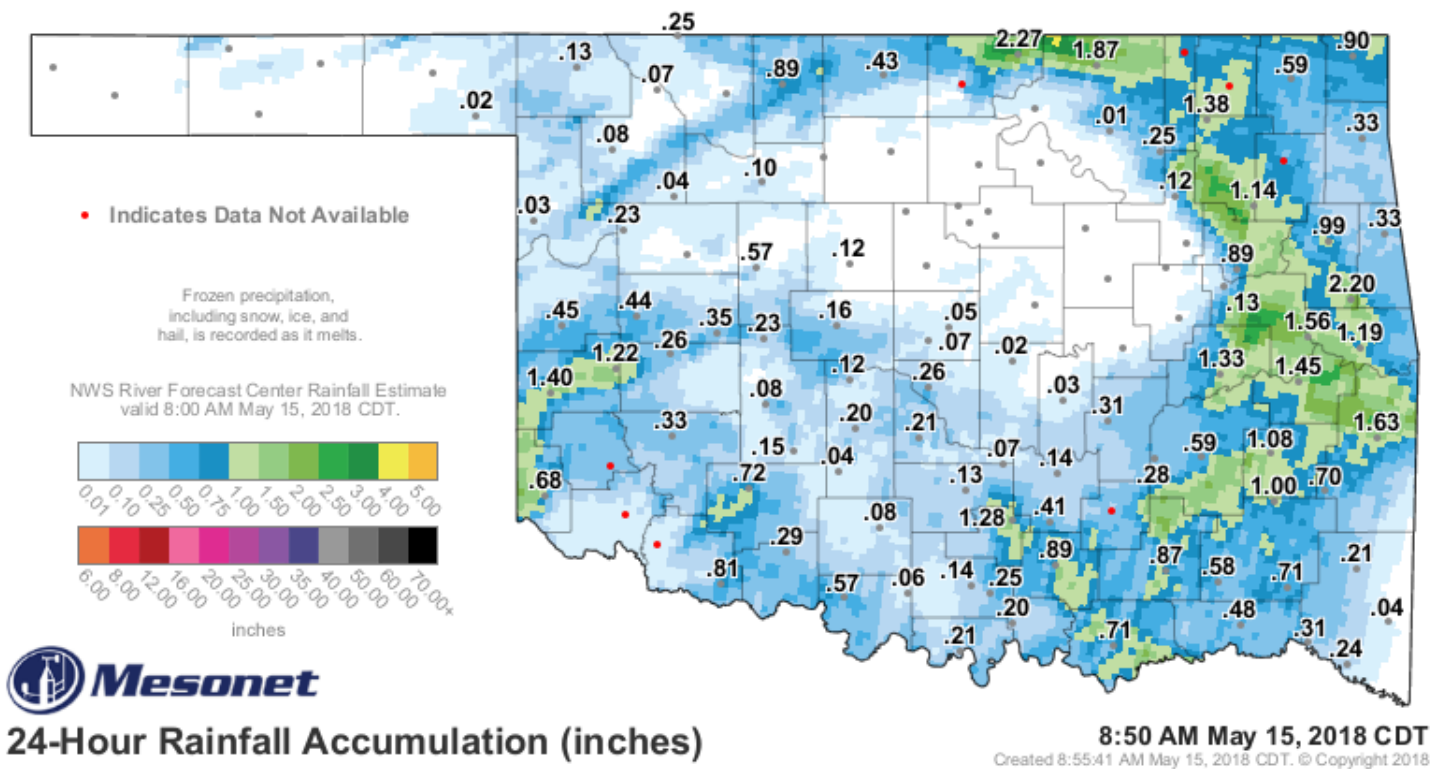


Fig. 8. 24-hour Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 8:50 am CDT 5/15/2018.

A supercell impacted far northwest Osage County during the evening of the 14<sup>th</sup>, bringing a small area of 2"-4" of rain (Fig. 7). Additional storms moved south out of KS during the overnight hours, developing into a southeastward propagating MCS. The MCS weakened as it moved into western AR during the morning hours of the 15<sup>th</sup>. Convection also occurred over southeast OK during the early morning hours in response to an MCV (mesoscale convective vortex) from earlier storms in southwest OK. Rainfall totals generally ranged from 0.25" to 2", with isolated pockets of 2"-3" (Figs. 7, 8).

Another MCV moved across eastern OK and northwest AR on the 16<sup>th</sup>, centered along an Okmulgee to Muskogee to Sallisaw path. Showers and thunderstorms rapidly developed during the late morning hours along and ahead of this feature and continued through the afternoon as the MCV shifted east. Some minor flooding was reported in the Muskogee and Bentonville areas. Additional thunderstorms affected Osage, Pawnee, Washington, and northern Tulsa Counties during the afternoon as well. All of the rain dissipated by mid evening. Rainfall totals were generally 0.25"-2", with localized totals of 2"-3" (Fig. 9).

Scattered showers and thunderstorms affected northeast OK, primarily along and north of I-44, during the morning hours of the 19<sup>th</sup>. This activity dissipated by around noon. Additional showers and thunderstorms developed along a cold front during the early afternoon across north central OK, which again moved across northeast OK affecting locations along and north of a Pawnee to Miami line. Damaging straight-line winds of 80-90 mph occurred near Fairfax in Osage County and Ralston in Pawnee County, and two brief EF-0 tornadoes occurred in Osage County (for more information on this event: <https://arqg.is/1f5Ob4>). Shortly after midnight on the 20<sup>th</sup>, a third round of more widespread shower and thunderstorm activity in central OK moved east into eastern OK. These storms moved quickly northeast, exiting the region during the morning hours. All of this rainfall resulted in rainfall totals of 0.25" to 2" for most of the affected area, with higher totals of 2" to 4" falling over portions of Osage, Washington (OK), Nowata, and Craig Counties (Fig. 10). These higher totals also occurred across the Neosho River basin in southeast KS, resulting in the Neosho River rising to about half a foot below flood stage (see preliminary hydrograph at the end of this report).

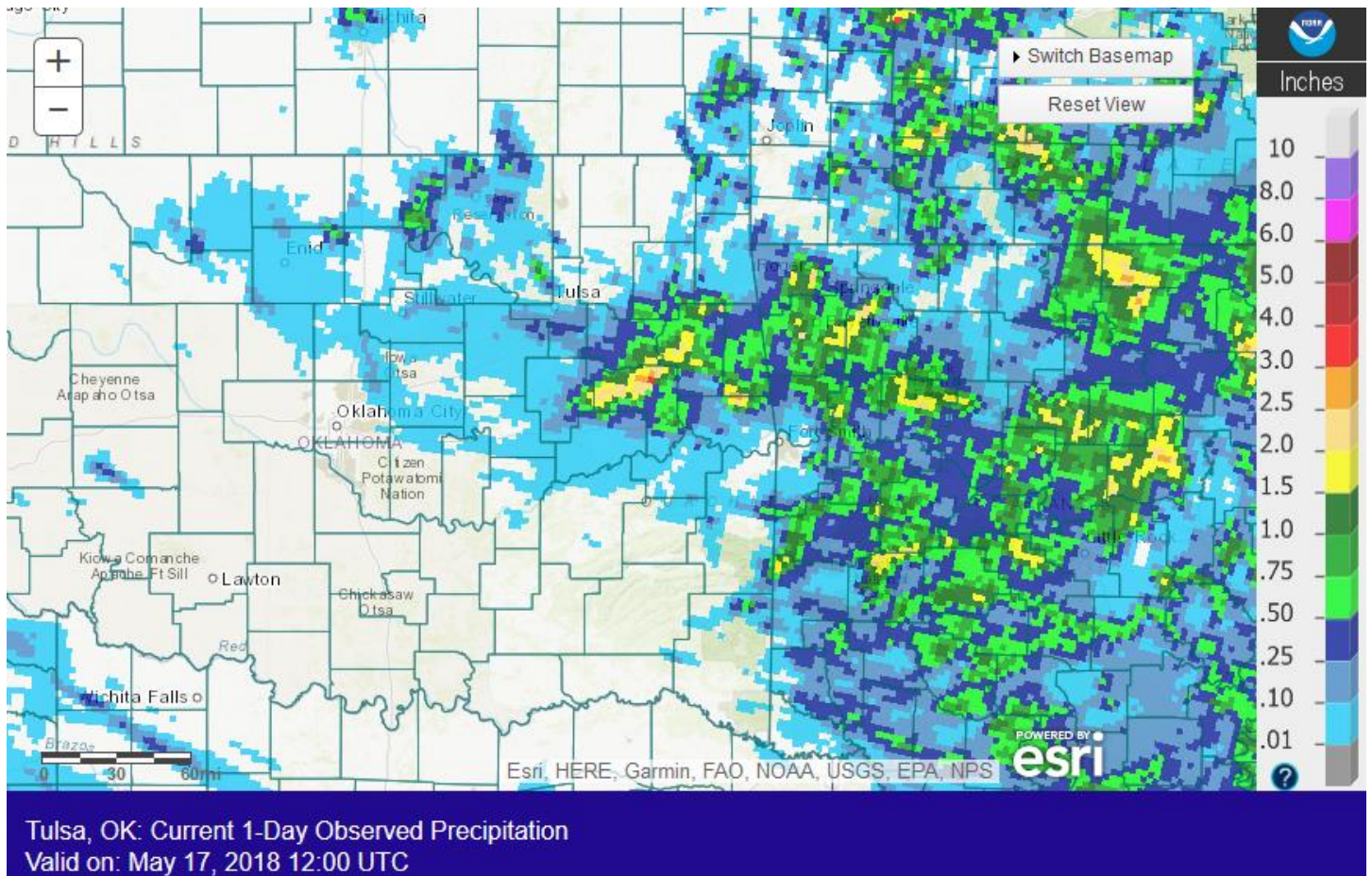


Fig. 9. 24-hour Estimated Observed Rainfall ending at 7am CDT 5/17/2018.

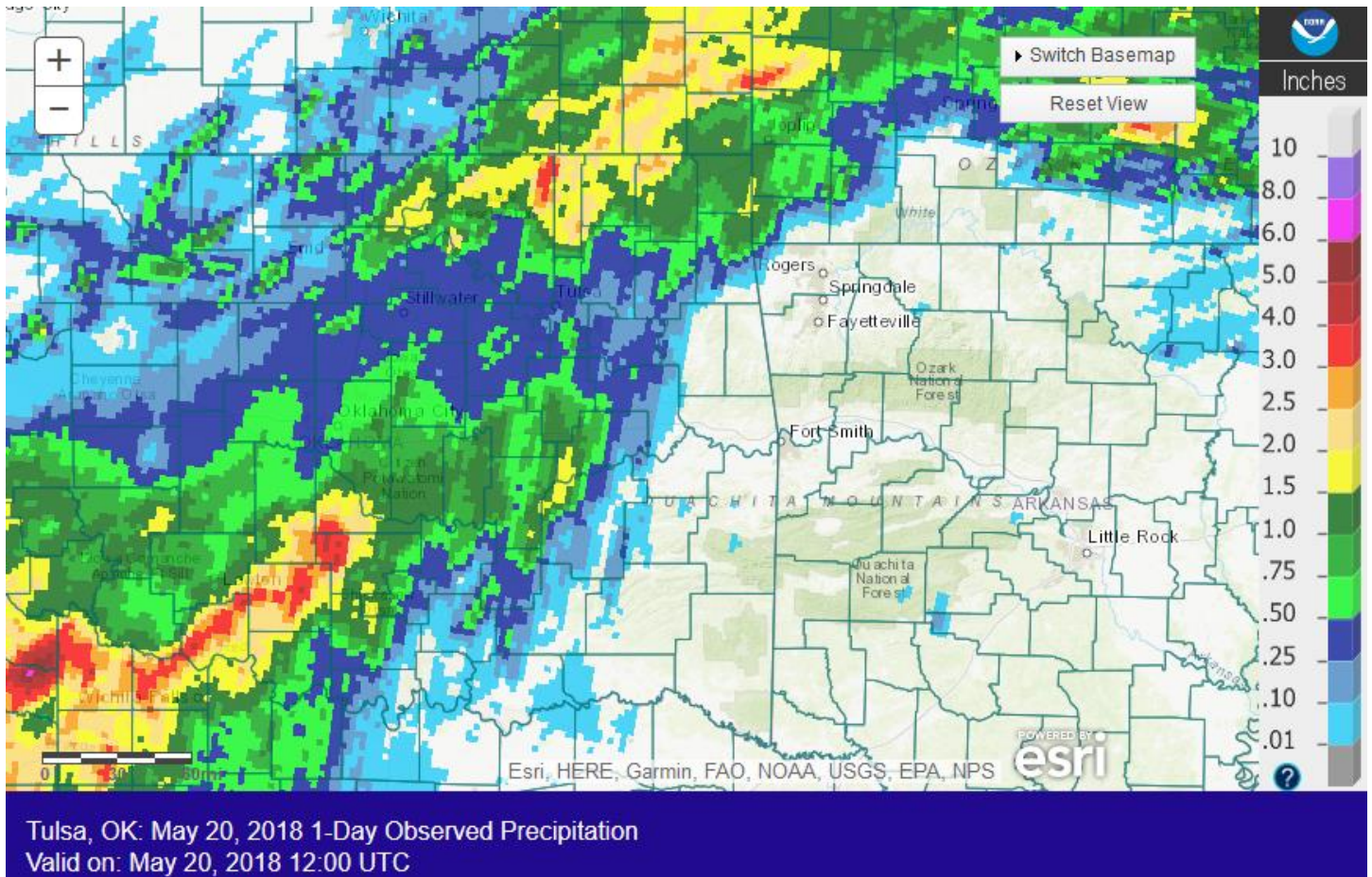


Fig. 10. 24-hour Estimated Observed Rainfall ending at 7am CDT 5/20/2018.

Written by:

Nicole McGavock  
Service Hydrologist  
WFO Tulsa

**Products issued in May 2018:**

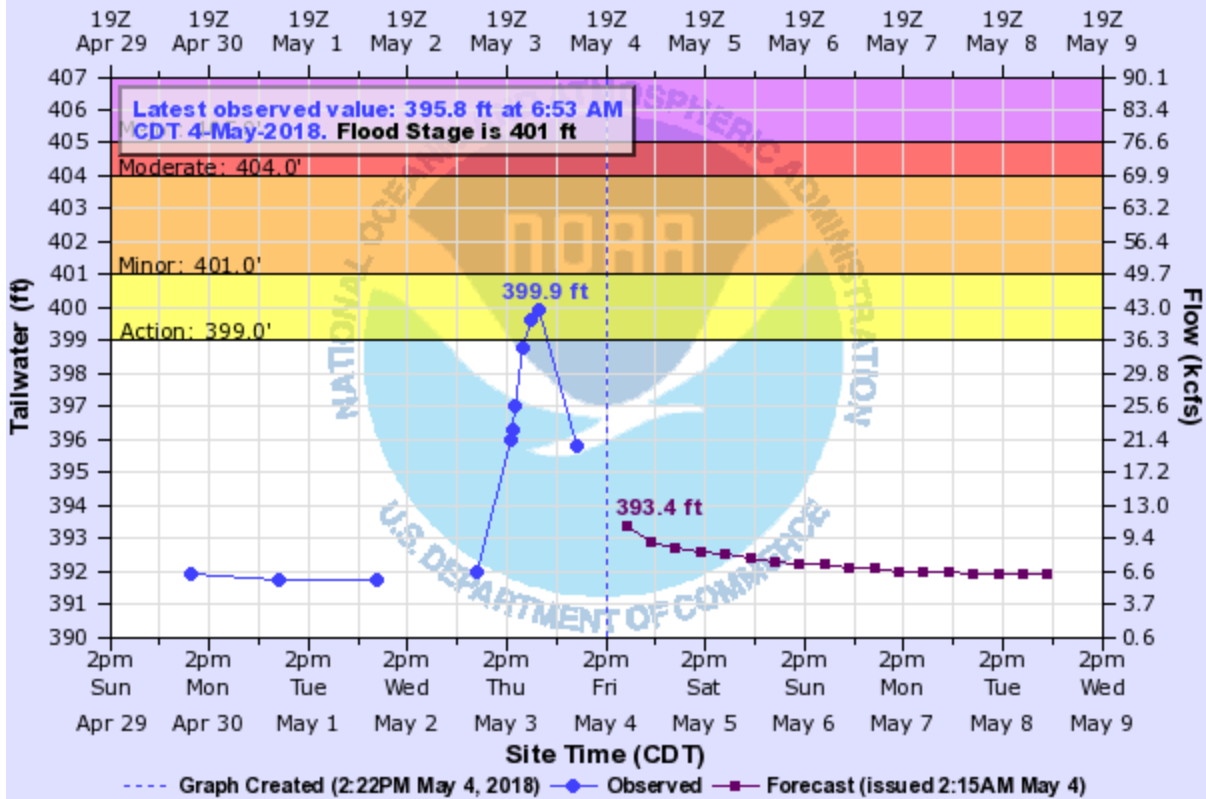
- \*CWYO2 became a daily river forecast point September 7, 2016
- \*MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014
- \*Mixed case River Flood products began July 31, 2013

- 1 Flash Flood Warnings (FFW)
- 0 Flash Flood Statements (FFS)
- 0 Flash/Areal Flood Watches (FFA) (0 Watch FFA CON/EXT/EXA/EXB/CAN)
- 18 Urban and Small Stream Advisories (FLS)
- 0 Areal Flood Warnings (FLW)
- 0 Areal Flood Statements (FLS)
- 5 River Flood Warnings (FLW) (includes category increases)
- 23 River Flood Statements (FLS)
- 3 River Flood Advisories (FLS) (6 Advisory FLS CON/EXT/CAN)
- 0 River Flood Watches (FFA) (0 Watch FFA CON/EXT/CAN)
- 0 River Statements (RVS)
- 0 Hydrologic Outlooks (ESF)
- 1 Drought Information Statements (DGT)

**Preliminary Hydrographs:**

## LEE CREEK NEAR VAN BUREN LCR

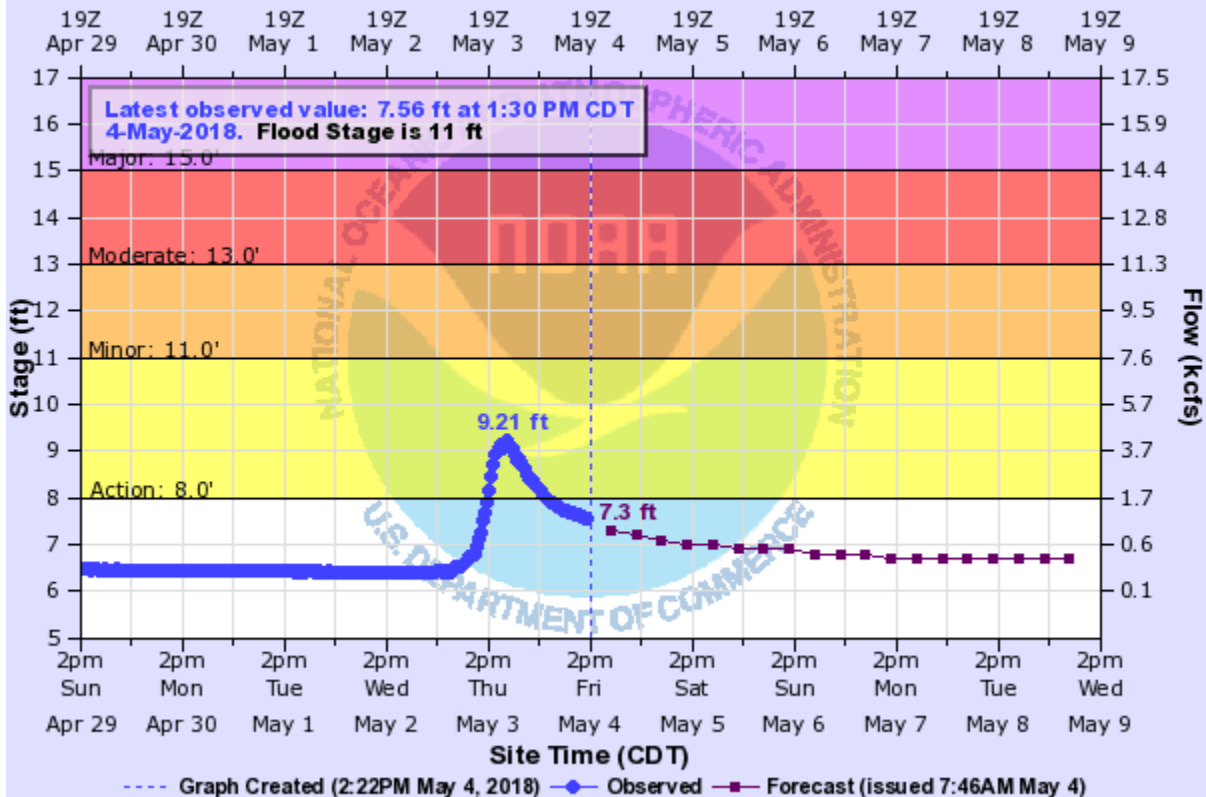
Universal Time (UTC)



VBRA4(plotting HTIRZ) "Gage 0" Datum: 0'

## FLINT CREEK (OK) NEAR KANSAS

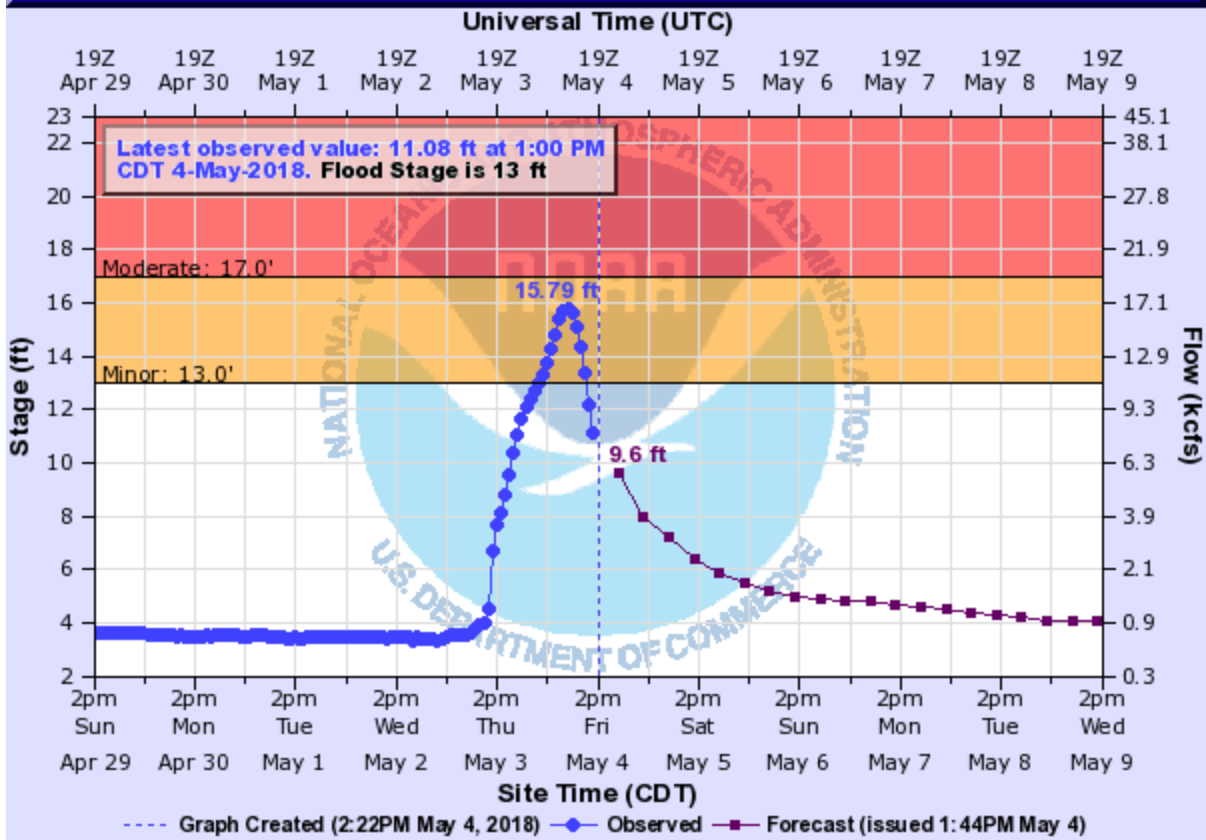
Universal Time (UTC)



KNSO2(plotting HGIRG) "Gage 0" Datum: 854.59'

Observations courtesy of US Geological Survey

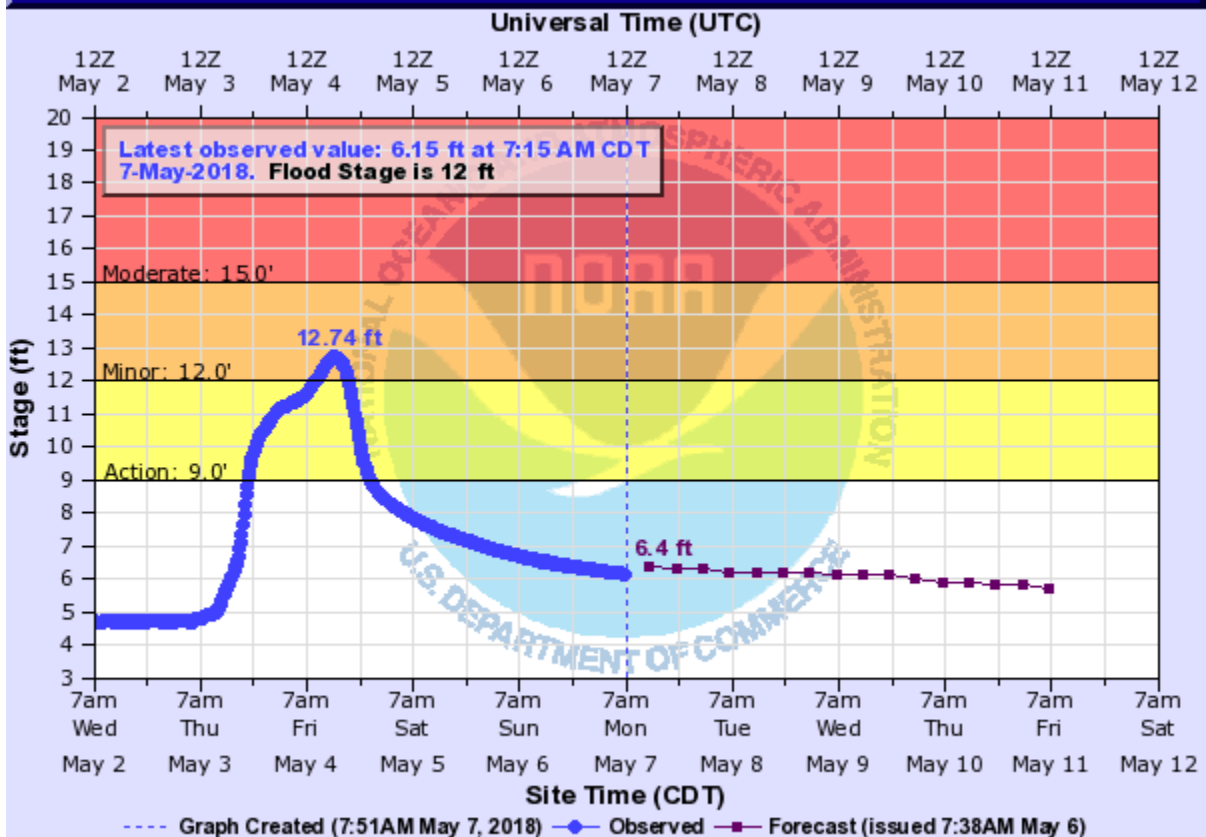
## ILLINOIS RIVER (AR OK) NEAR WATTS



WT02(plotting HGIRG) "Gage 0" Datum: 893.77'

Observations courtesy of US Geological Survey

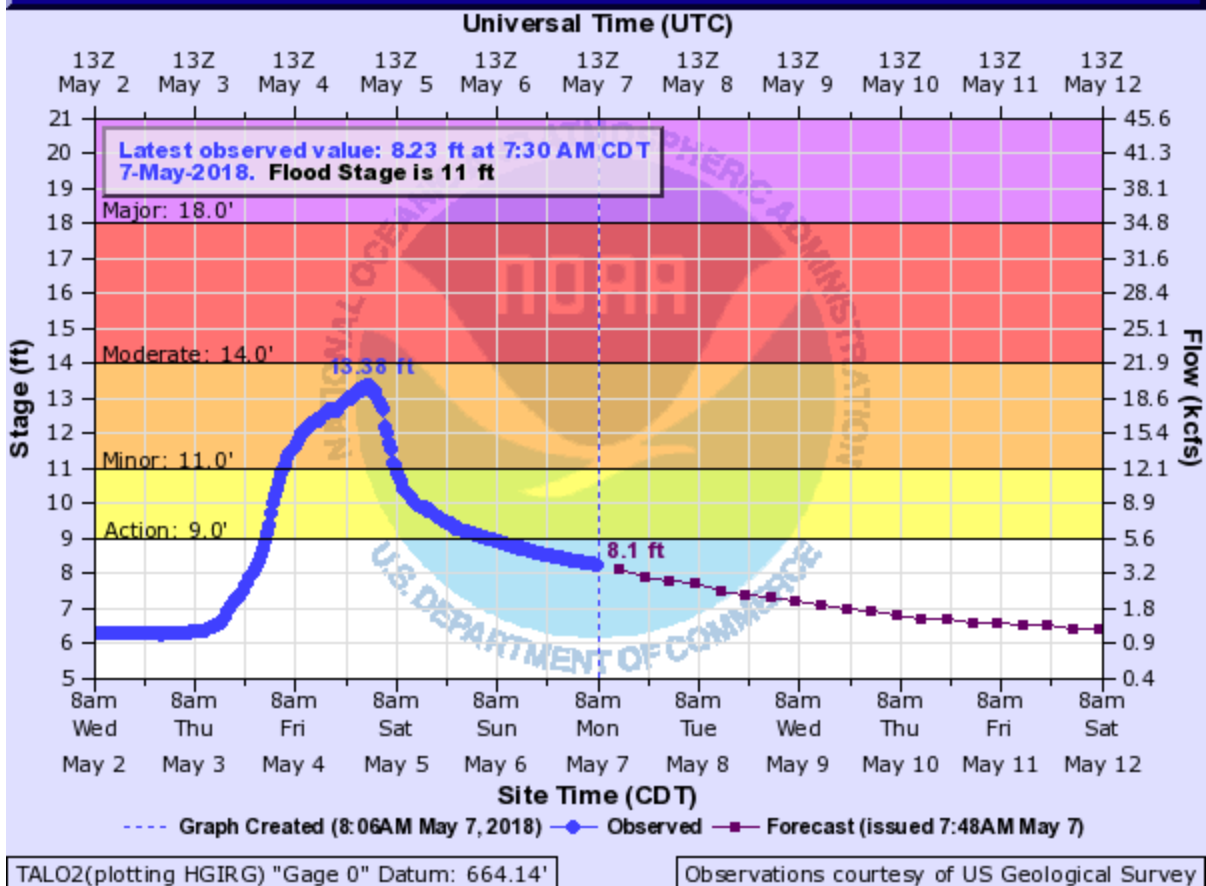
## ILLINOIS RIVER (AR OK) AT CHEWEY



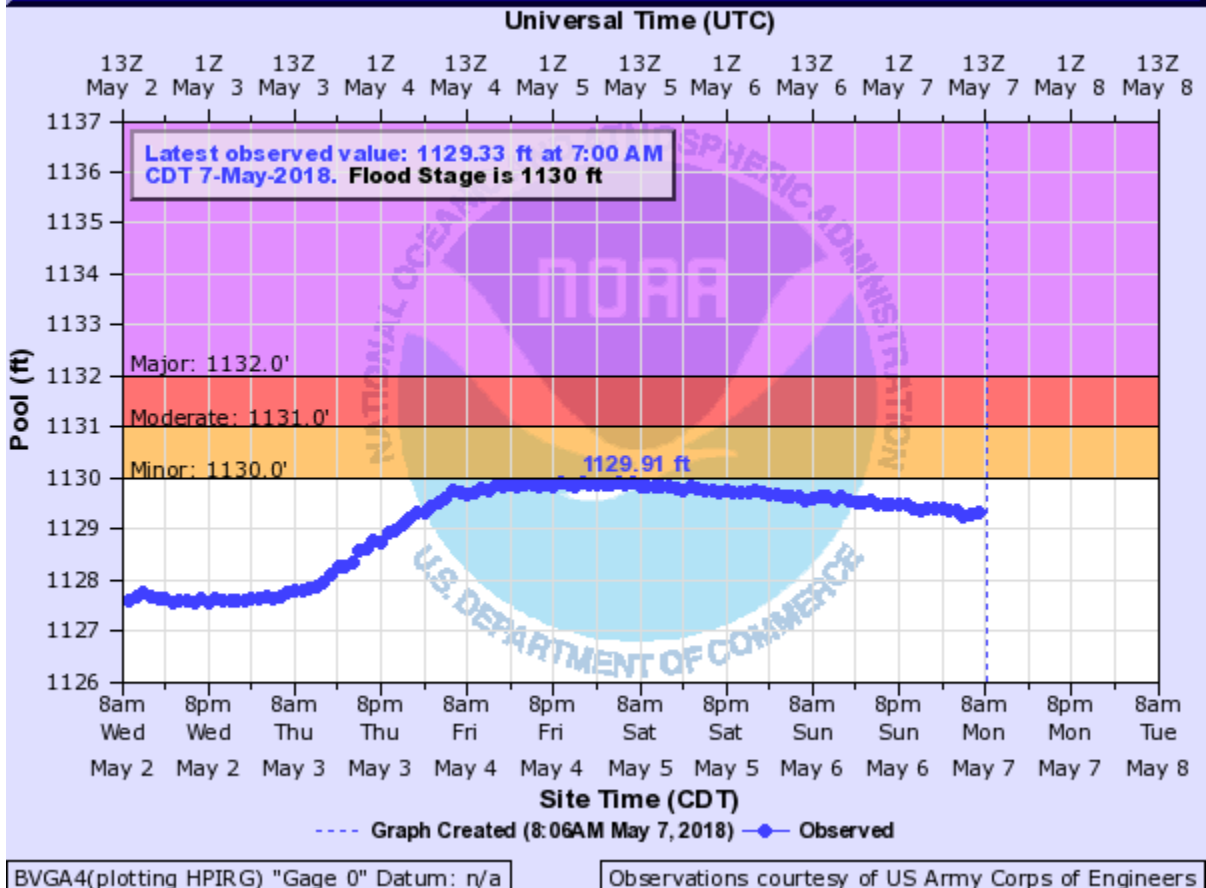
CWYO2(plotting HGIRG) "Gage 0" Datum: 800.88'

Observations courtesy of US Geological Survey

## ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH



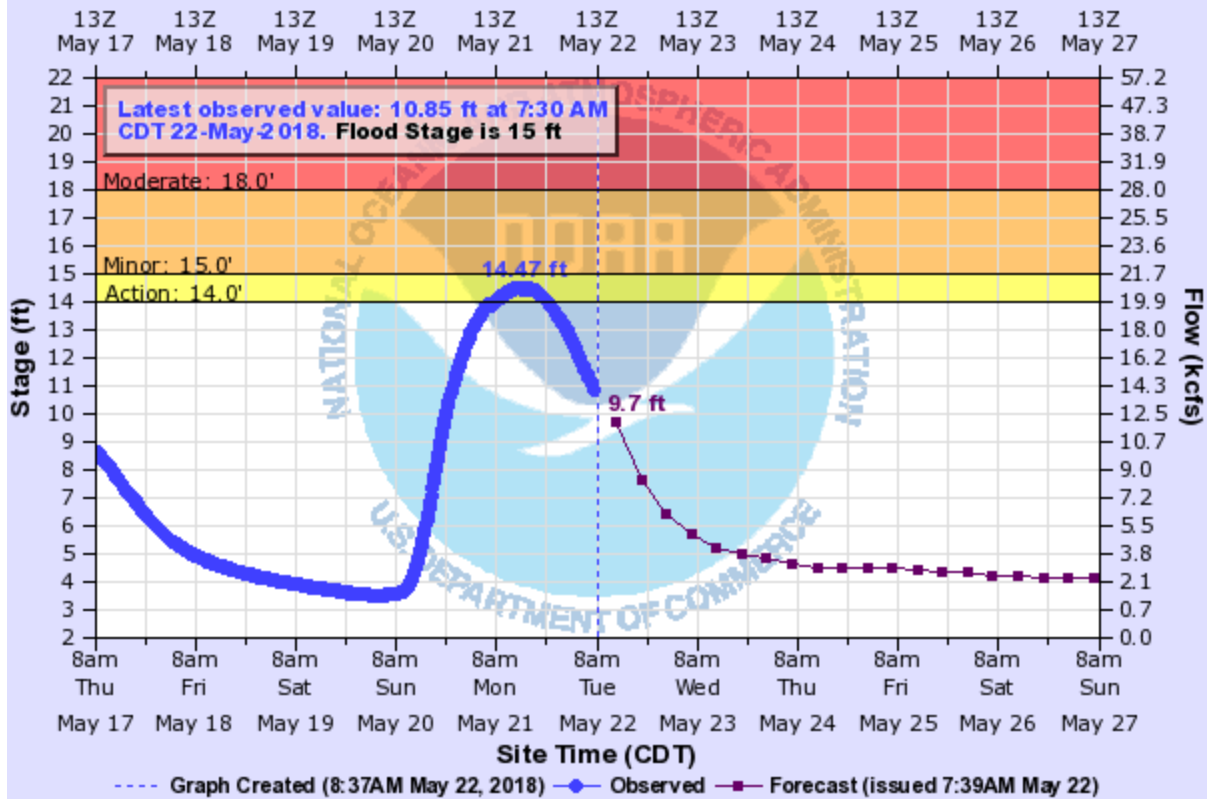
## NORTHWEST ARKANSAS LAKES AT BEAVER LAKE





# NEOSHO RIVER NEAR COMMERCE

Universal Time (UTC)



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

Observations courtesy of US Geological Survey