| | |
|---|---|
| **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 |
| **MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS** | HYDROLOGIC SERVICE AREA (HSA): **Tulsa, Oklahoma (TSA)**<br>REPORT FOR: MONTH **September** YEAR **2018** |
| TO: Hydrometeorological Information Center, W/OH2<br>NOAA / National Weather Service<br>1325 East West Highway, Room 7230<br>Silver Spring, MD 20910-3283 | SIGNATURE **Steven F. Piltz**<br>(Meteorologist-in-Charge)<br>DATE **October 1, 2018** |

*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.**

There was a large rainfall gradient from north to south across eastern OK and northwest AR in September 2018. Rainfall in southeast KS resulted in river flooding along the Neosho River this month. Normal rainfall for September ranges from 4.2 inches in Okmulgee County to 5.4 inches in Delaware County. In the Ozark region of northwest Arkansas, rainfall averages 4.5 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 September 2018 ranged from 0.5" to isolated amounts around 12" across eastern OK and northwest AR. The highest rainfall totals of over 6" were primarily across eastern OK and west central AR southwest of a Tulsa to Fort Smith line. This corresponds to 10% to around 200% of the normal September rainfall across the area, with only 10%-25% of the September rainfall normal in the northeast corner of OK (Fig. 1b).

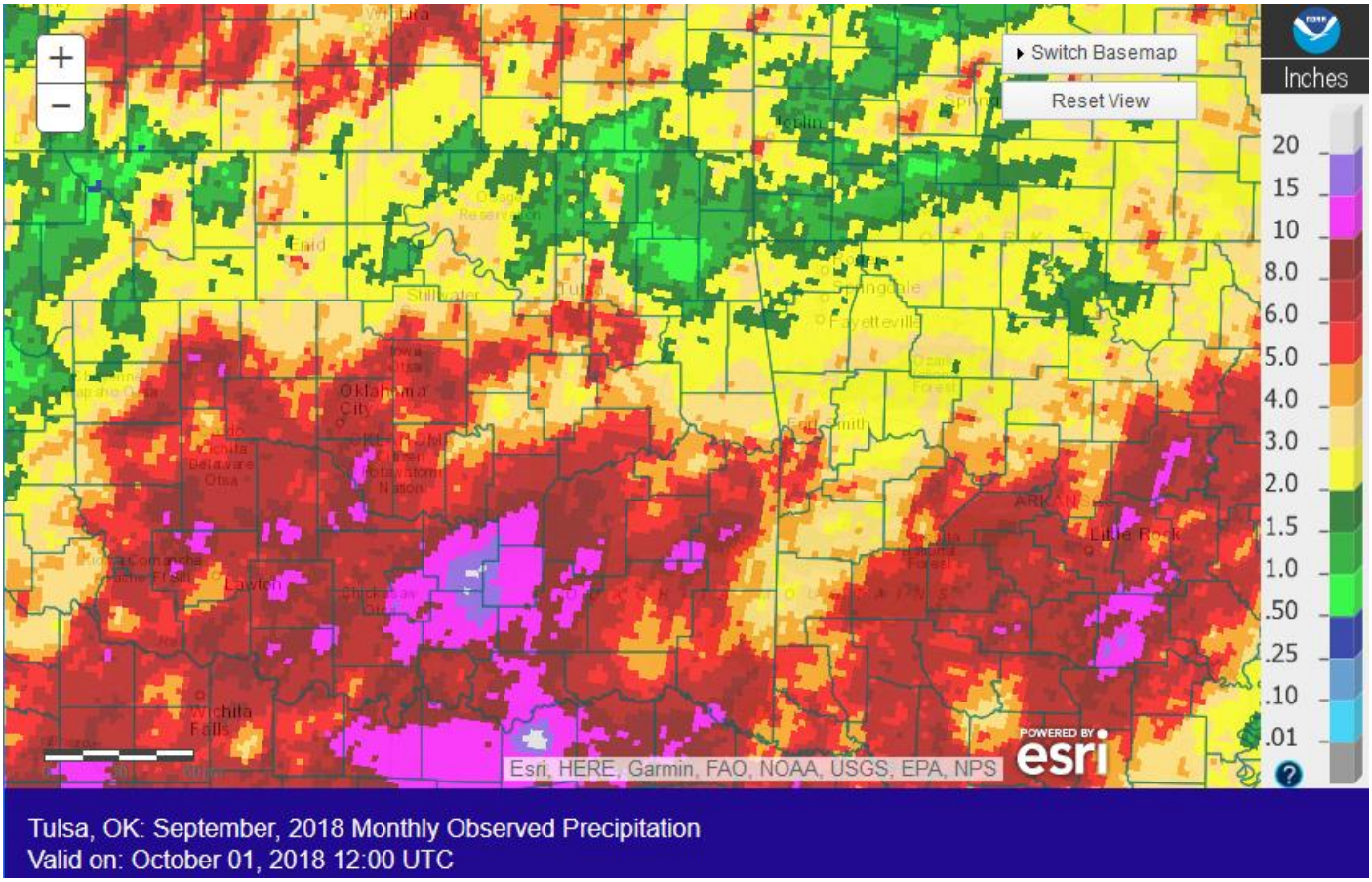



Fig. 1a. Estimated Observed Rainfall for September 2018

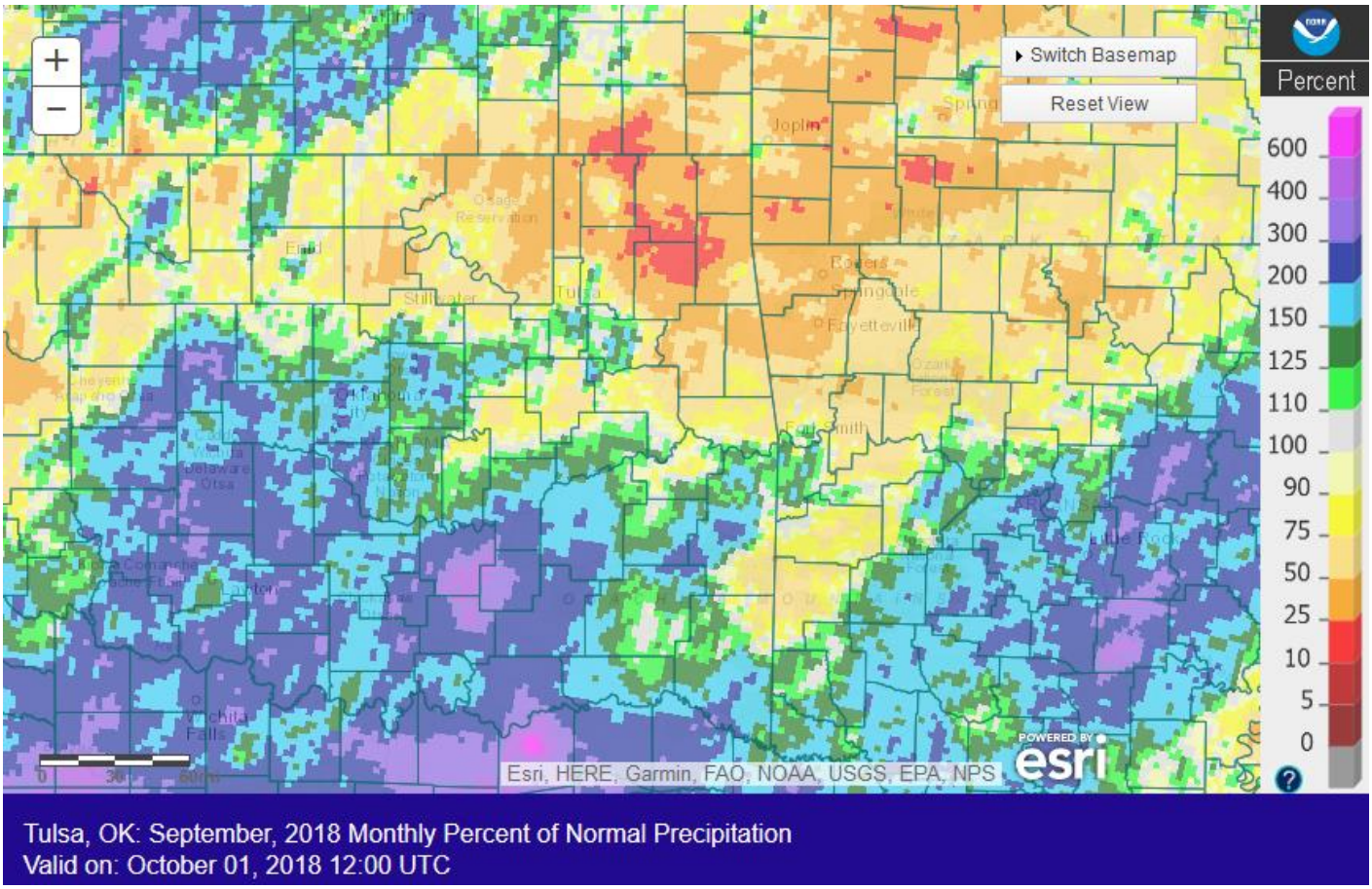


Fig. 1b. Estimated % of Normal Rainfall for September 2018

In Tulsa, OK, September 2018 ranked as the 30th warmest September (75.9°F, tied 2012, 1920; since records began in 1905) and the 63rd driest September (3.06", tied 1997; since records began in 1888). Fort Smith, AR had the 23rd warmest September (77.1°F, tied 1977, 1947; since records began in 1882) and the 23rd wettest September (5.75", tied 2007; since records began in 1882). Fayetteville, AR had the 13th warmest (71.8°F) and the 15th driest (2.05") September since records began in 1949.

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

| | | | | | |
|---|---|---|---|---|---|
| Talihina, OK (meso) | 10.75 | Stuart, OK (meso) | 9.45 | Krebs 0.3WNW, OK (coco) | 8.88 |
| McAlester, OK (meso) | 8.61 | Clayton, OK (meso) | 8.54 | McAlester, OK (ASOS) | 7.76 |
| Tulsa 5.4SSE, OK (coco) | 7.58 | Antlers, OK (coop) | 7.23 | Wister, OK (meso) | 7.05 |

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

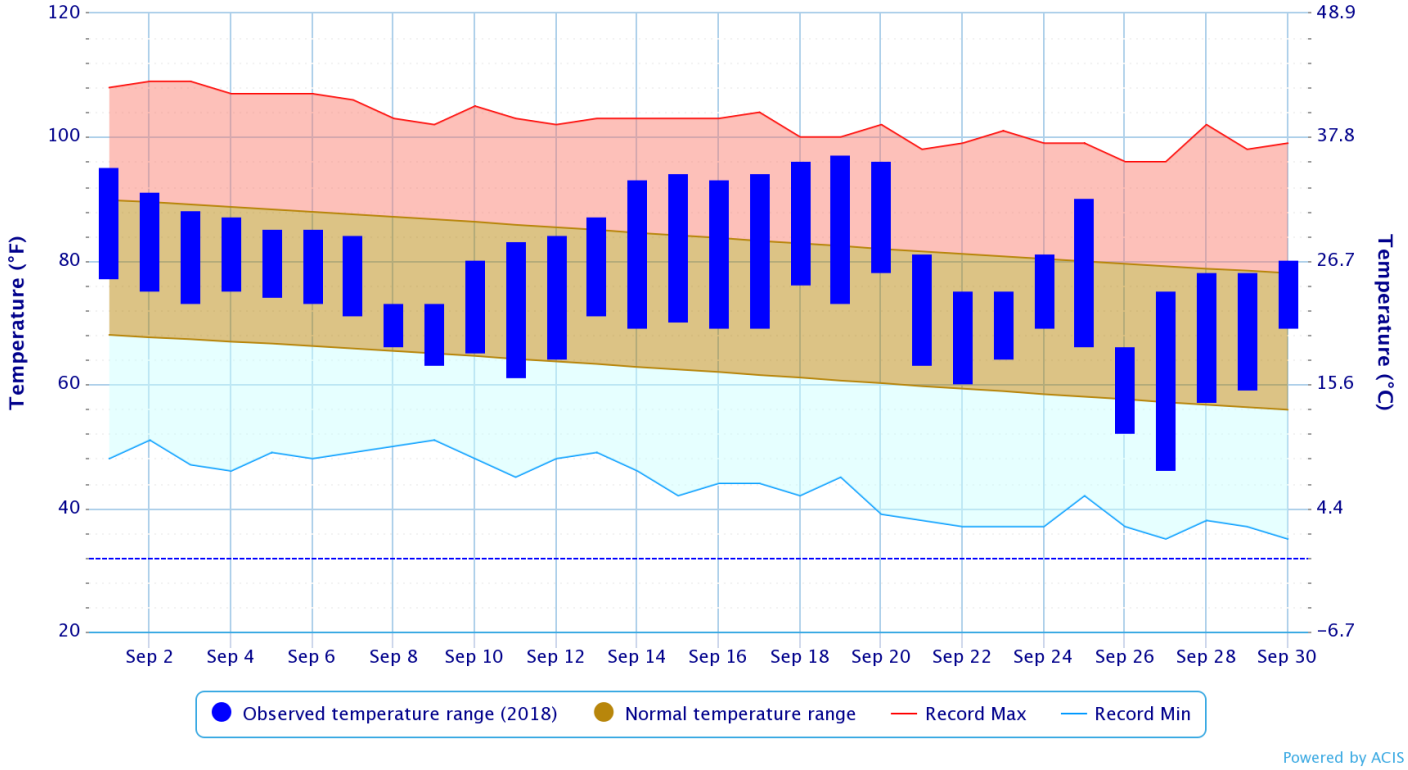
| | | | | | |
|---|---|---|---|---|---|
| Spavinaw, OK (coop) | 0.86 | Pryor, OK (meso) | 0.90 | Copan, OK (meso) | 1.07 |
| Talala, OK (meso) | 1.29 | Bartlesville, OK (ASOS) | 1.34 | Jay, OK (meso) | 1.39 |
| Foraker, OK (meso) | 1.87 | Westville, OK (meso) | 1.93 | Vinita, OK (meso) | 2.00 |

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

| Rank since 1921 | Sept. 2018 | Last 60 Days (Aug 2 – Sep 30) | Last 90 Days (Jul 3 – Sep 30) | Last 120 Days (Jun 3 – Sep 30) | Last 180 Days (Apr 4 – Sep 30) | Year-to-Date (Jan 1 – Sep 30) | Water Year 2018 (Oct 1, 2017– Sep 30, 2018) |
|---|---|---|---|---|---|---|---|
| Northeast OK | 37th driest | 49th wettest | 48th driest | 42nd driest | 23rd driest | 31st driest | 30th driest |
| East Central OK | 36th wettest | 23rd wettest | 27th wettest | 26th wettest | 44th wettest | 17th wettest | 38th wettest |
| Southeast OK | 13th wettest | **7th wettest** | 12th wettest | 14th wettest | 44th wettest | 15th wettest | 31st wettest |
| Statewide | 17th wettest | **7th wettest** | 14th wettest | 18th wettest | 45th wettest | 36th wettest | 48th driest |

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

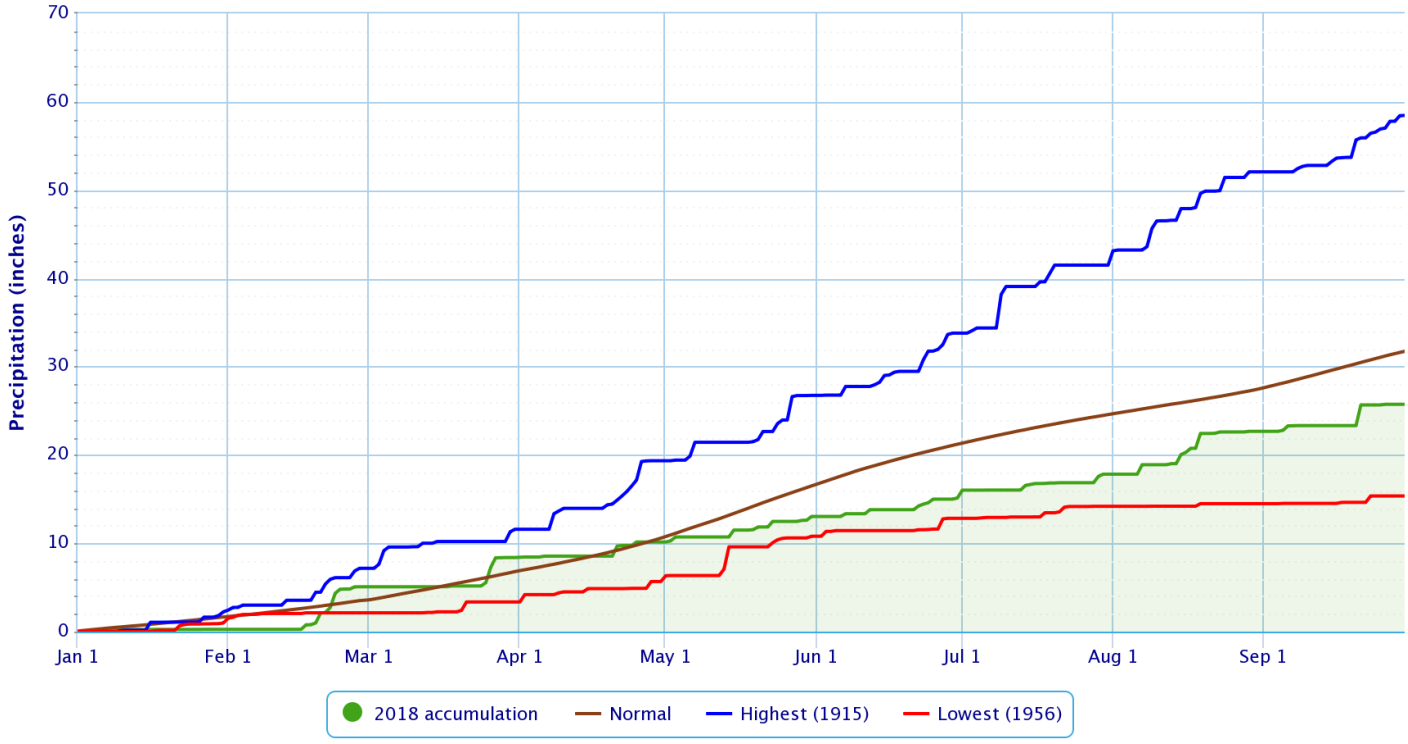
Period of Record – 1905-01-06 to 2018-09-30. Normals period: 1981-2010. Click and drag to zoom chart.




Powered by ACIS

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

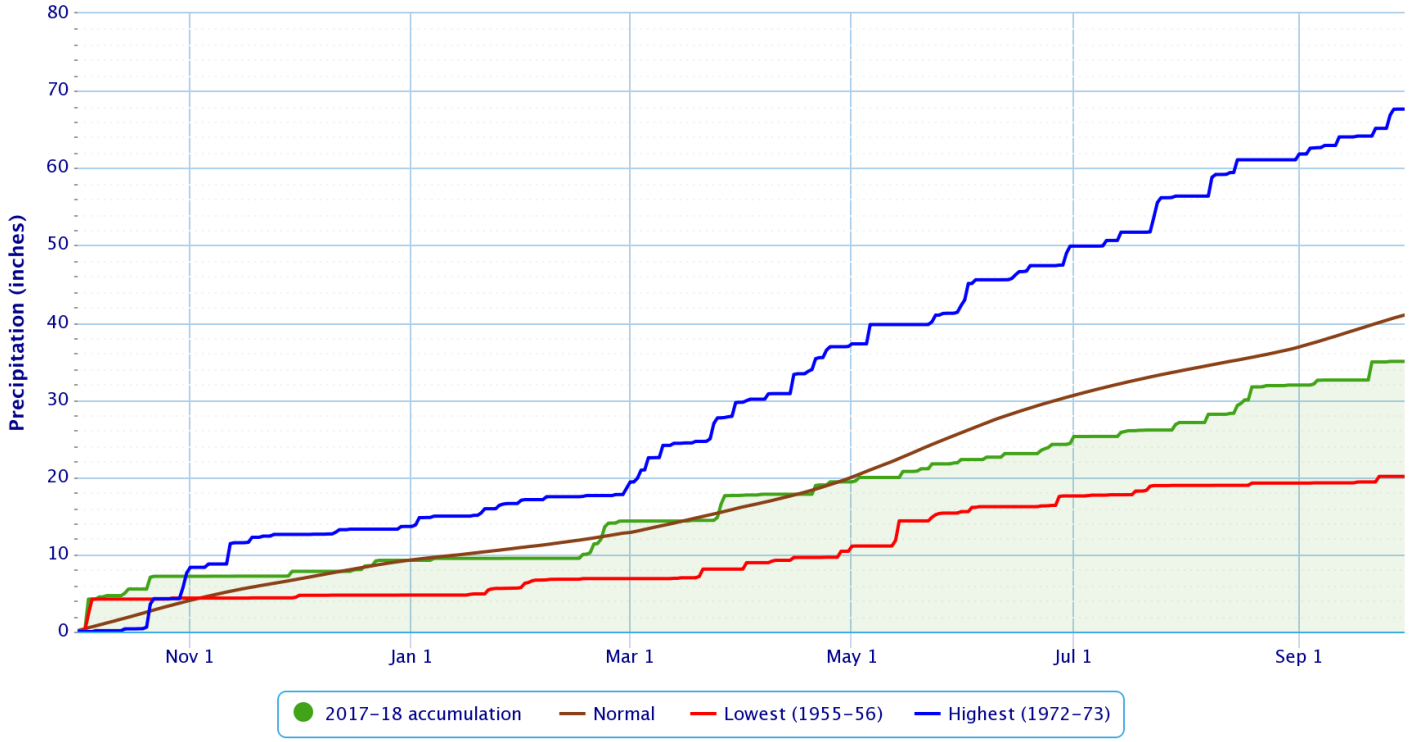
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values




Powered by ACIS

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

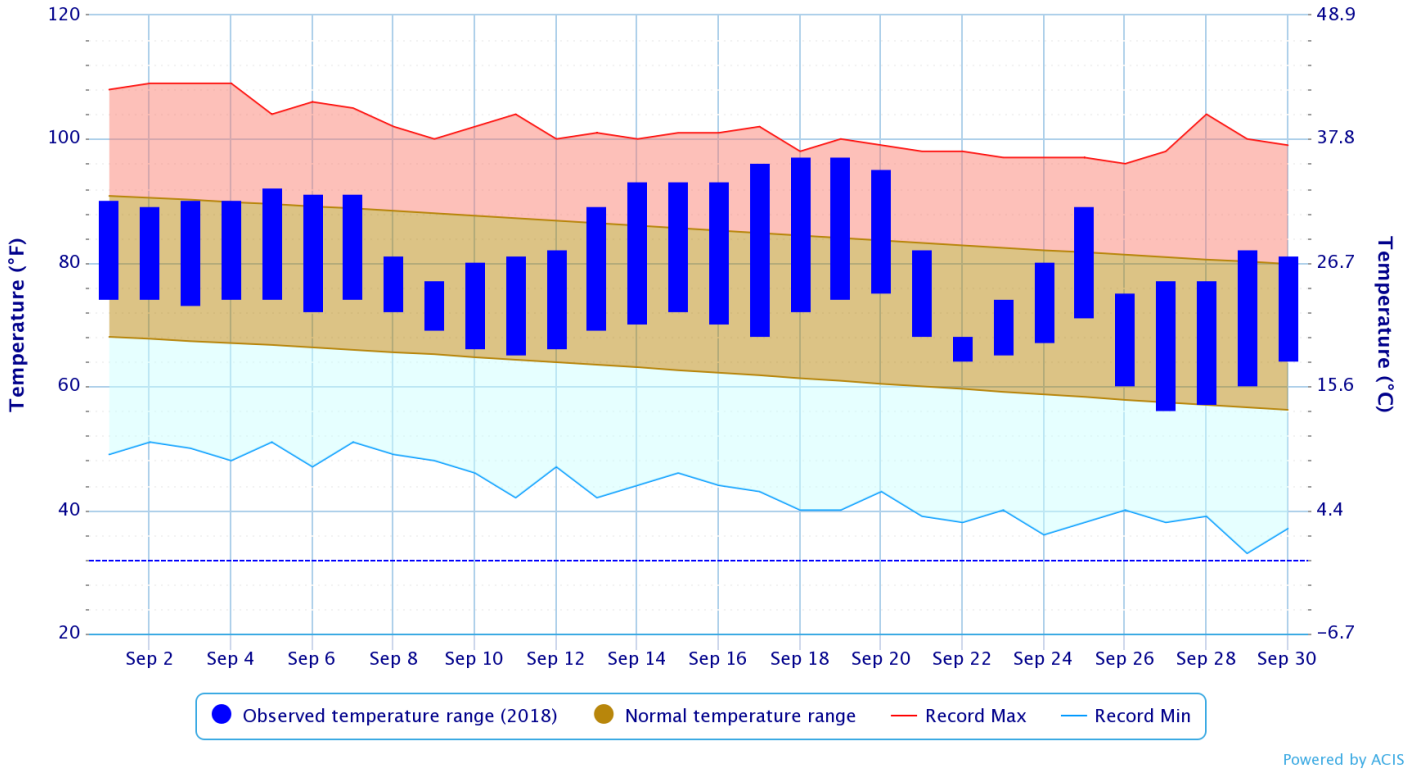
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values




Powered by ACIS

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

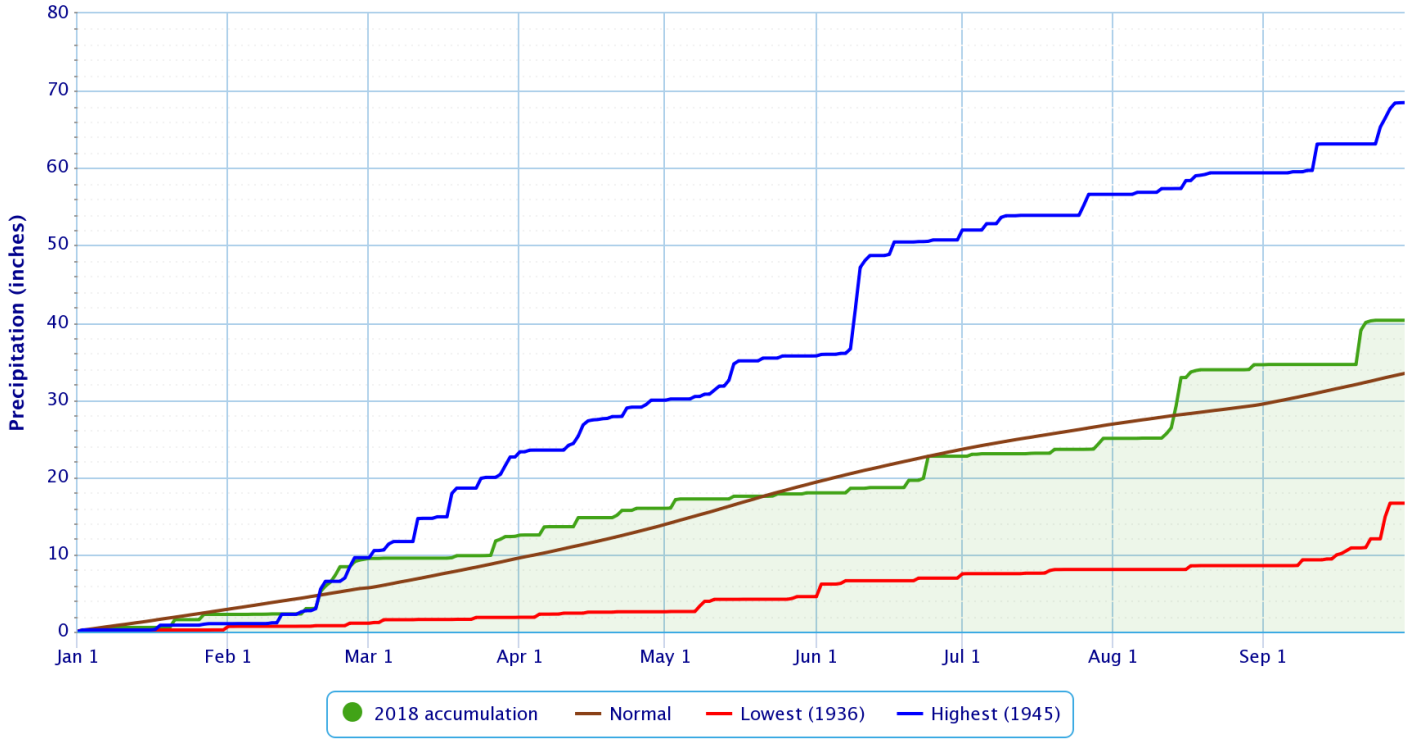
Period of Record – 1882-06-01 to 2018-09-30. Normals period: 1981-2010. Click and drag to zoom chart.




Powered by ACIS

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

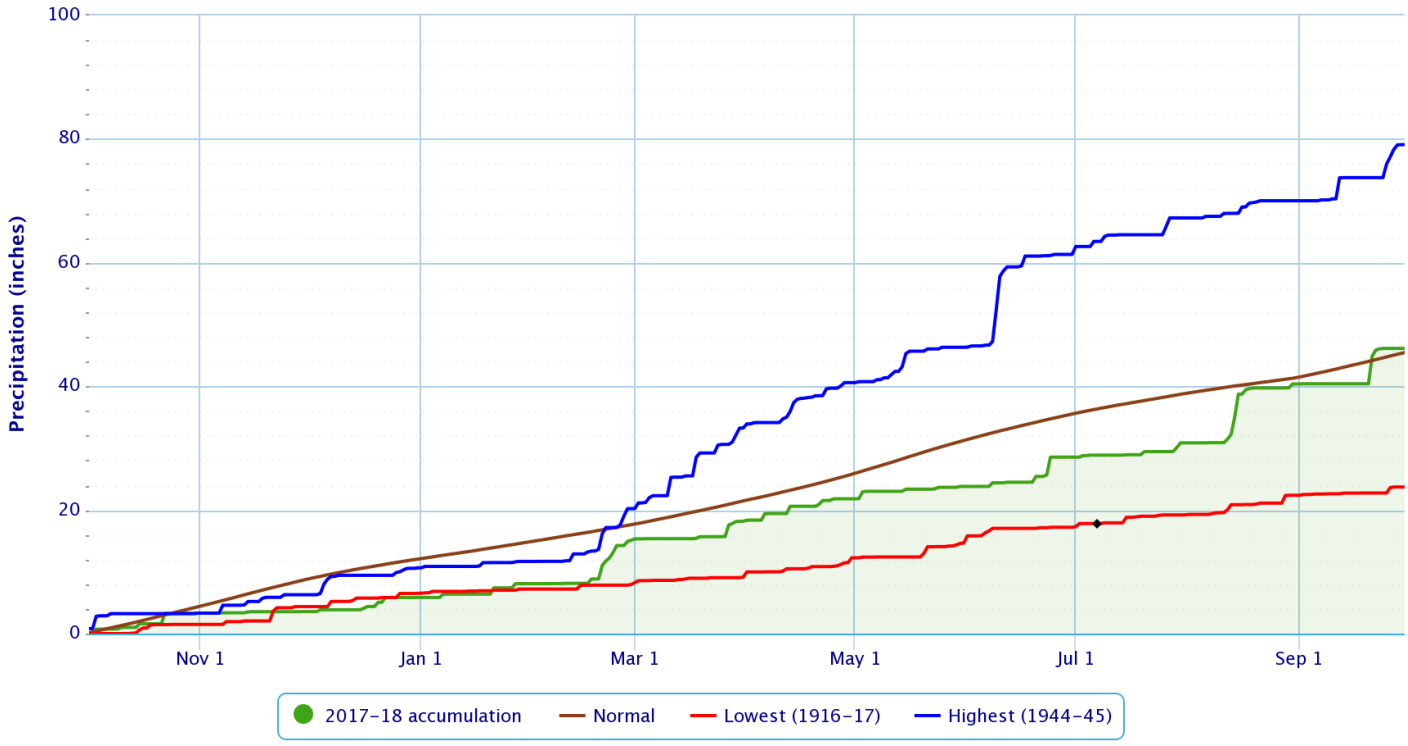
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values




Powered by ACIS

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

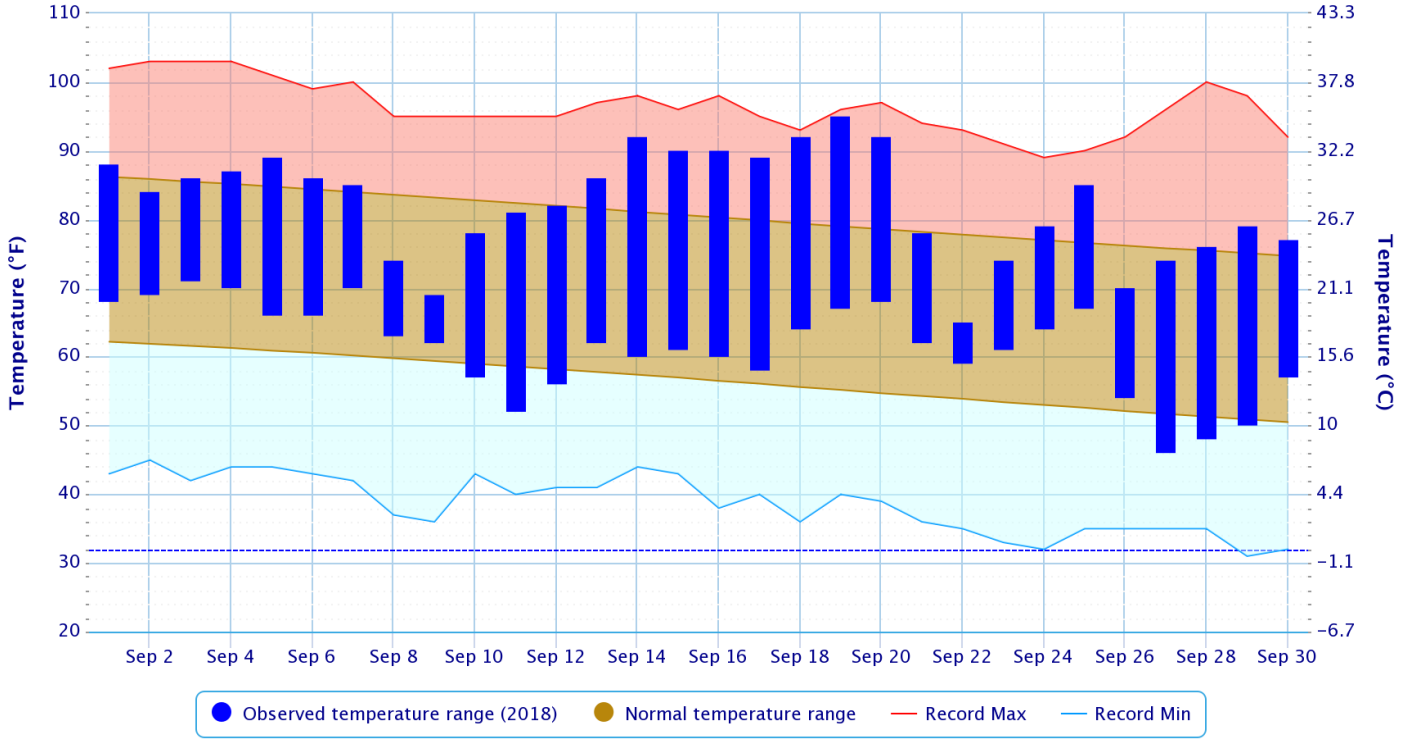
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values




Powered by ACIS

## Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

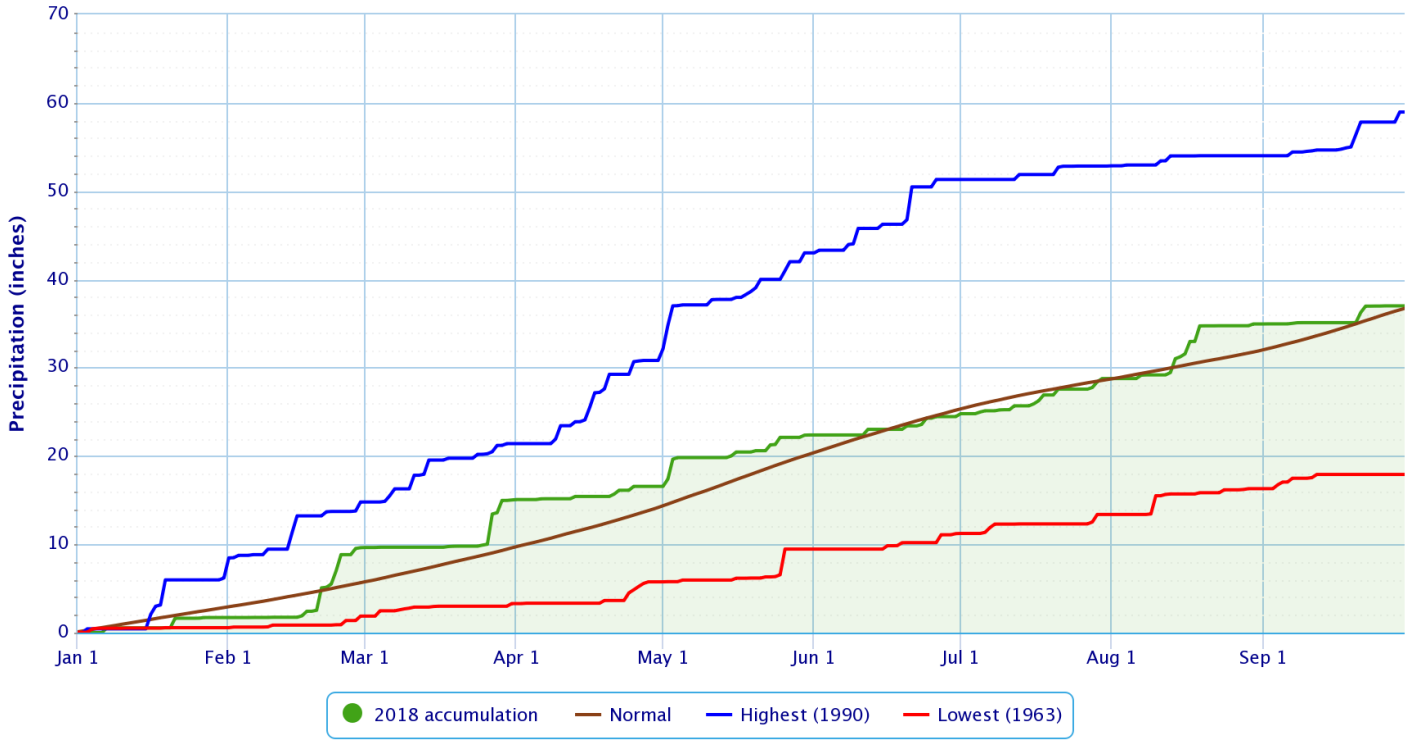
Period of Record – 1949-07-14 to 2018-09-30. Normals period: 1981-2010. Click and drag to zoom chart.



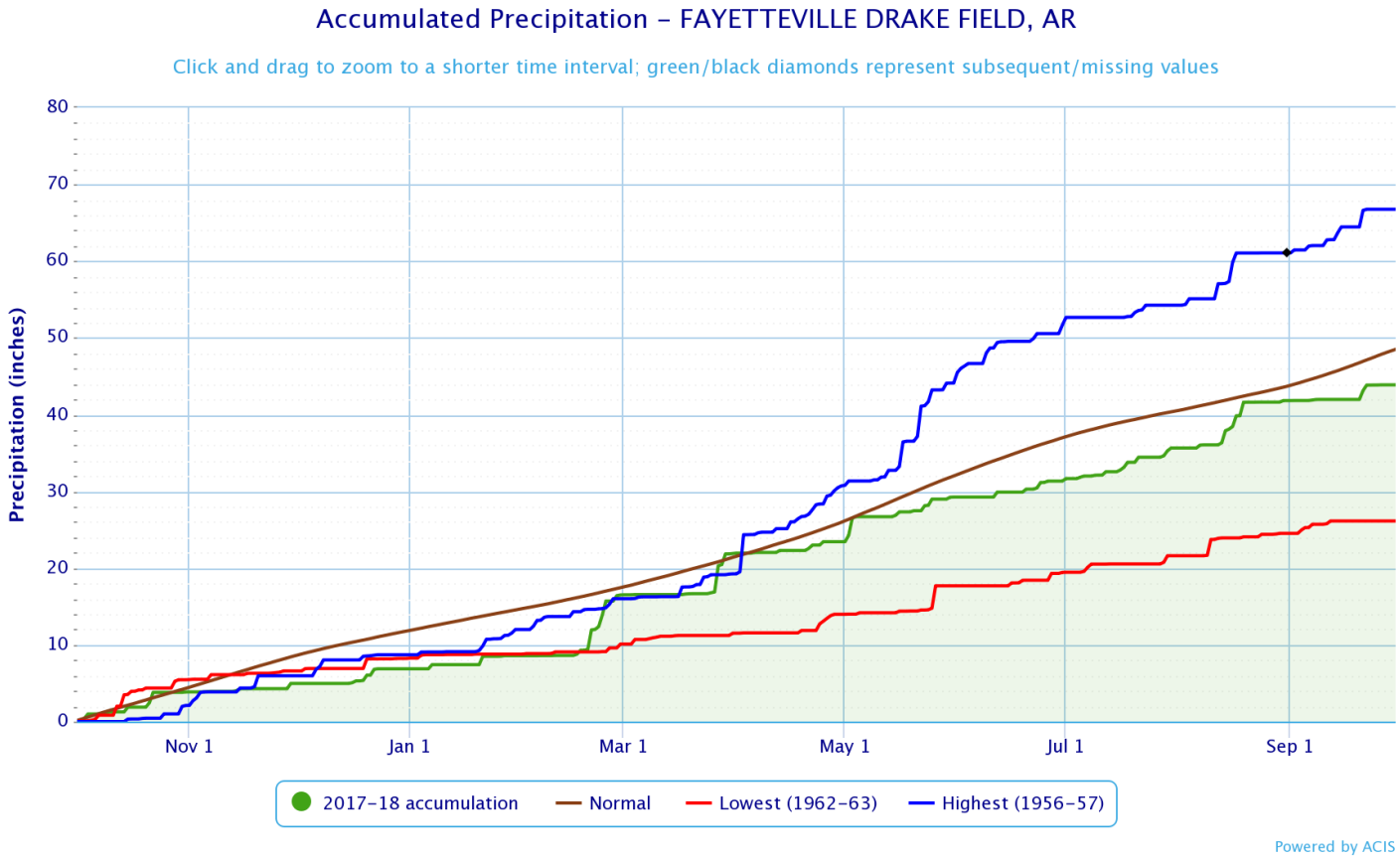

Powered by ACIS

## 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




## Water Year 2018 (Oct. 1, 2017-Sep. 30, 2018) Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 2a), rainfall totals for Water Year 2018 ranged from 25" to 70" across eastern OK and northwest AR. The highest rainfall totals of 50"-70" occurred across southeast OK and west central AR, while the lowest values of 25"-35" occurred across northeast OK. This corresponds to 50-150% of the normal water year rainfall across the area (Fig. 2b). A large portion of eastern OK and northwest AR ended the water year with 90%-110% of normal.

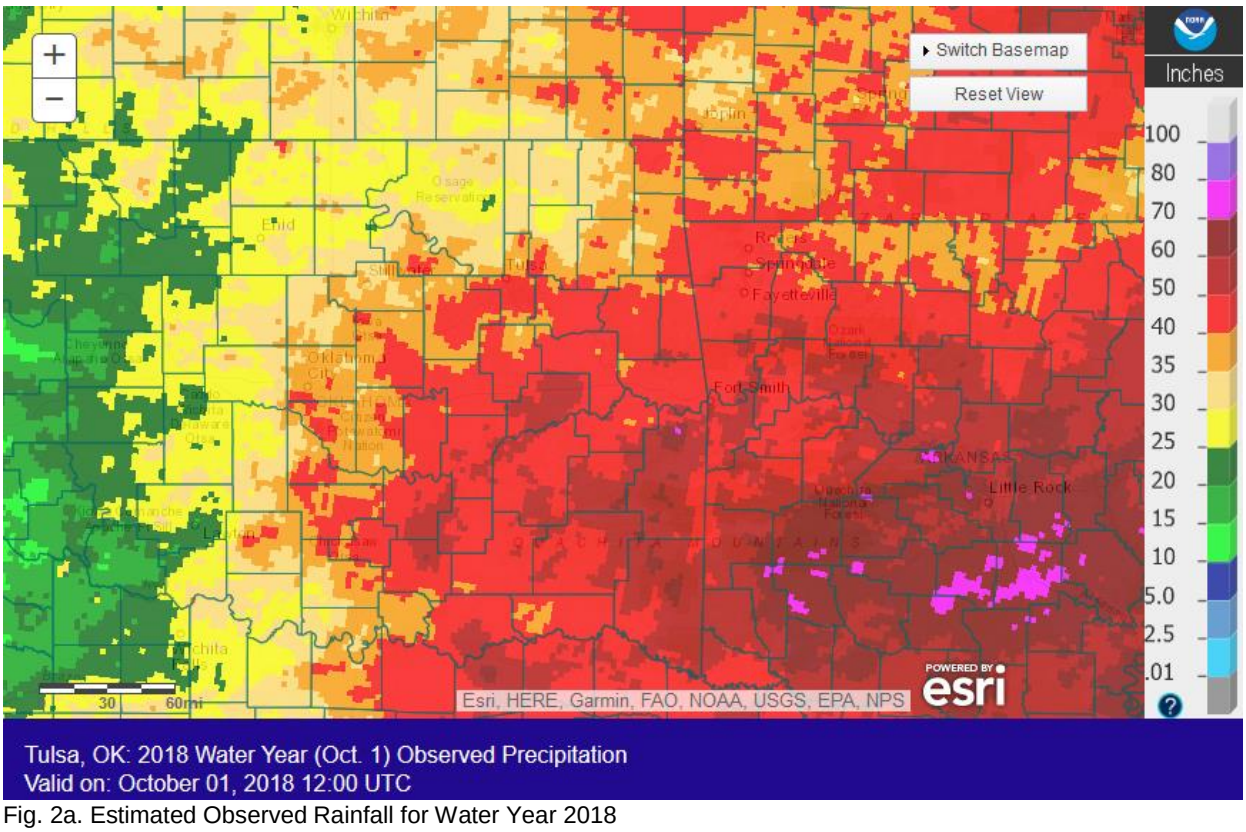



Fig. 2a. Estimated Observed Rainfall for Water Year 2018

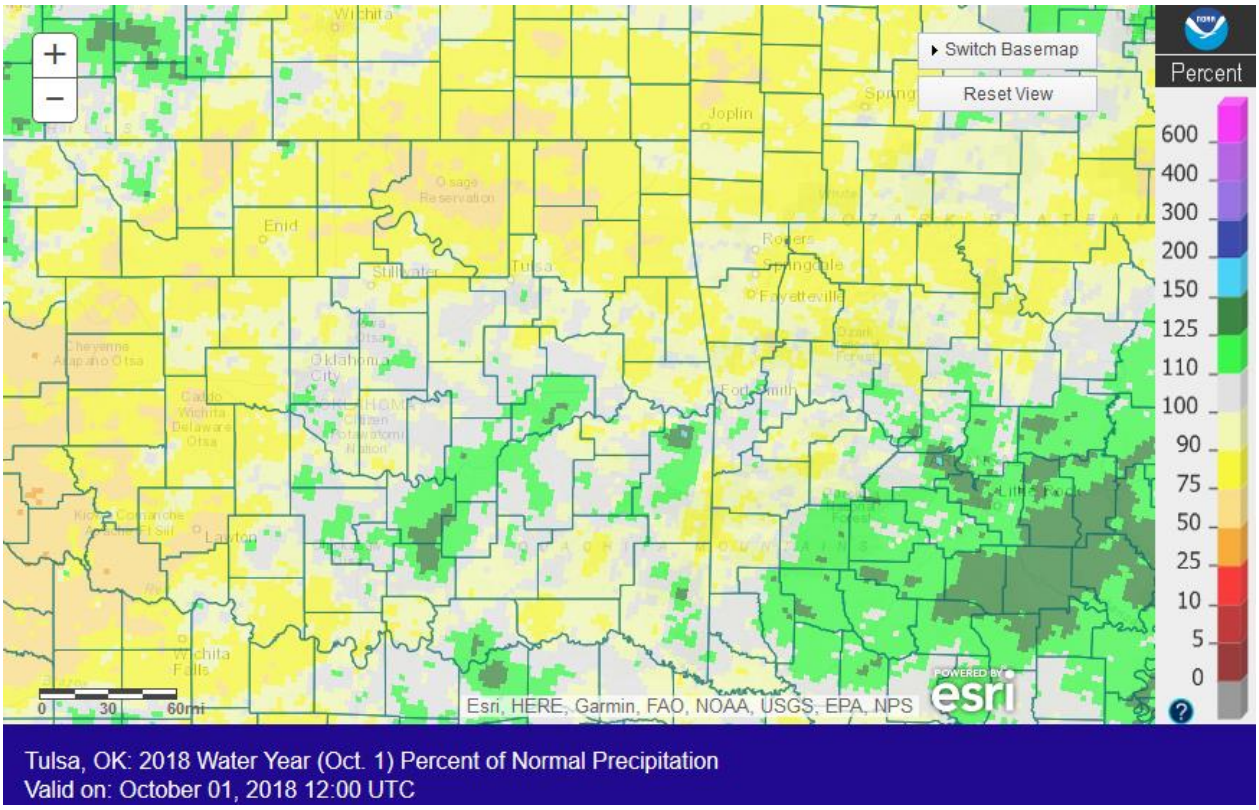
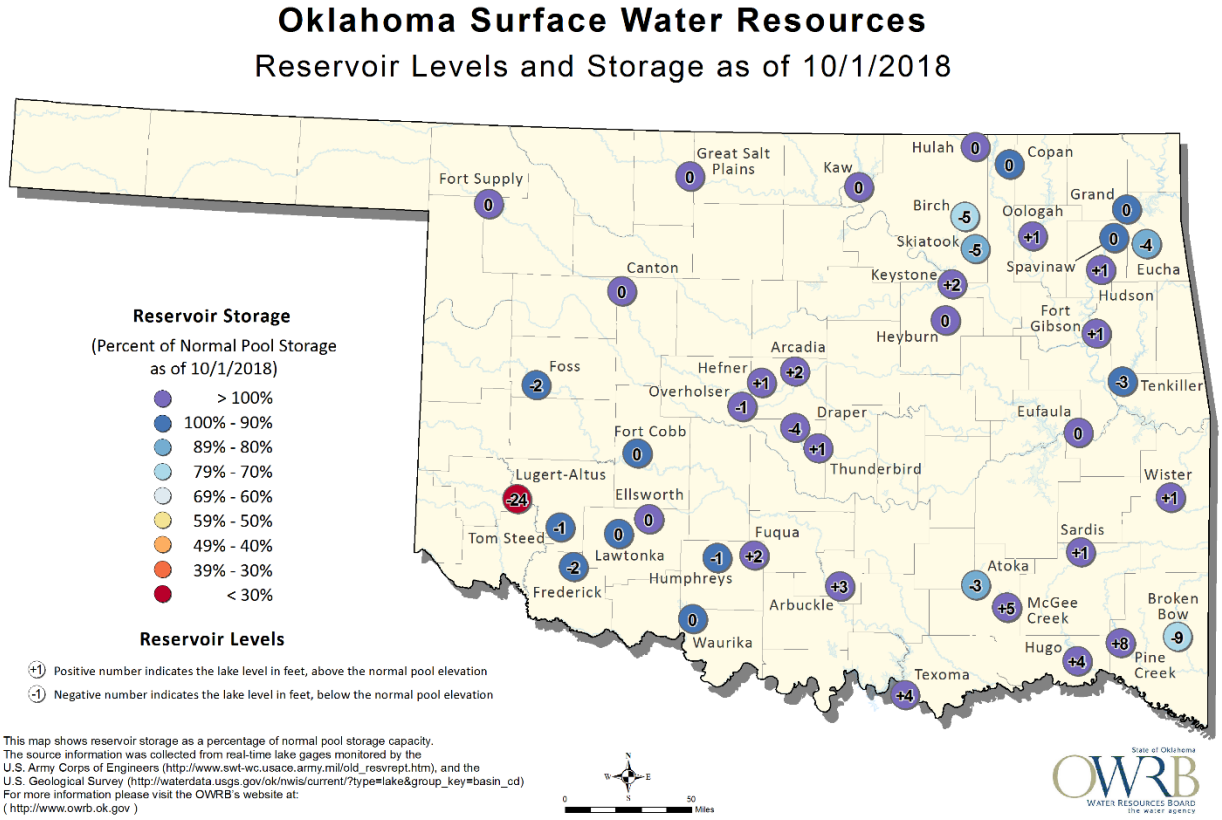


Fig. 2b. Estimated % of Normal Rainfall for Water Year 2018

## Reservoirs



According to the USACE, most lakes in the HSA were within ±3% of their conservation pool level. Reservoirs below 3% of their conservation pool storage as of 10/01/2018: Birch Lake 70%, Skiatook Lake 85%, Tenkiller Lake 90%, and Beaver Lake 93%. Reservoirs above 3% of its conservation pool storage as of 10/01/2018: Sardis Lake 107%, Hugo Lake 107%, Grand Lake 106%, Hudson Lake 105%, and Oologah Lake 104%.

## Drought

According to the U.S. Drought Monitor (USDM) from September 25, 2018 (Figs. 3, 4), Severe (D2) Drought conditions were impacting Osage, far northwest Tulsa, and southern Washington Counties in eastern OK. Moderate (D1) drought conditions were present across portions of Osage, Washington, Tulsa, Nowata, and Rogers Counties in eastern OK, and far northeast Benton County in northwest Arkansas. Abnormally Dry (D0) but not in drought conditions encompassed portions of Pawnee, Osage, eastern Kay, Washington, Tulsa, Rogers, Mayes, Nowata, Craig, Ottawa, Delaware, Cherokee, and Adair Counties in eastern Oklahoma and Benton, Carroll, and Madison Counties in northwest Arkansas.

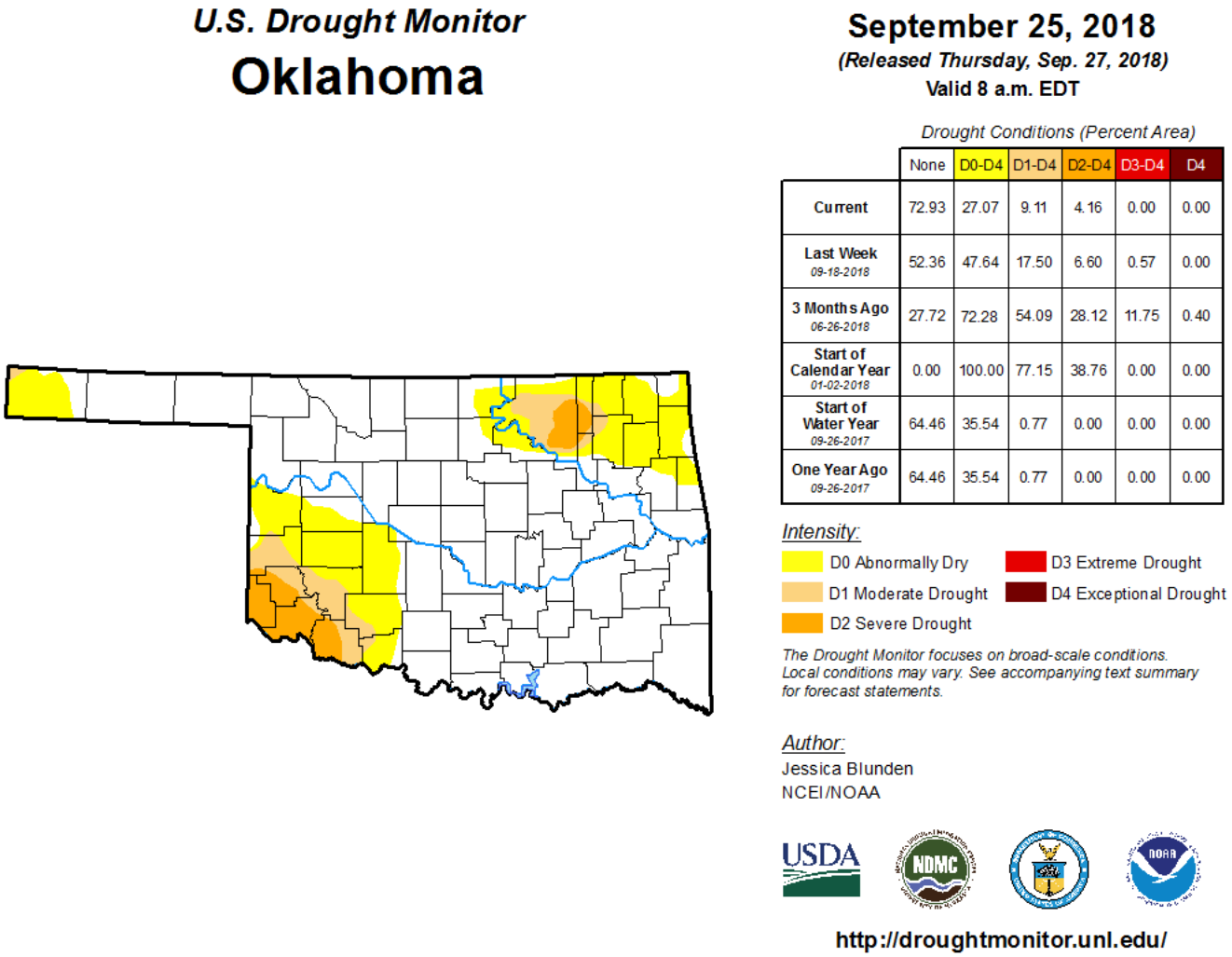



Fig. 3. Drought Monitor for Oklahoma

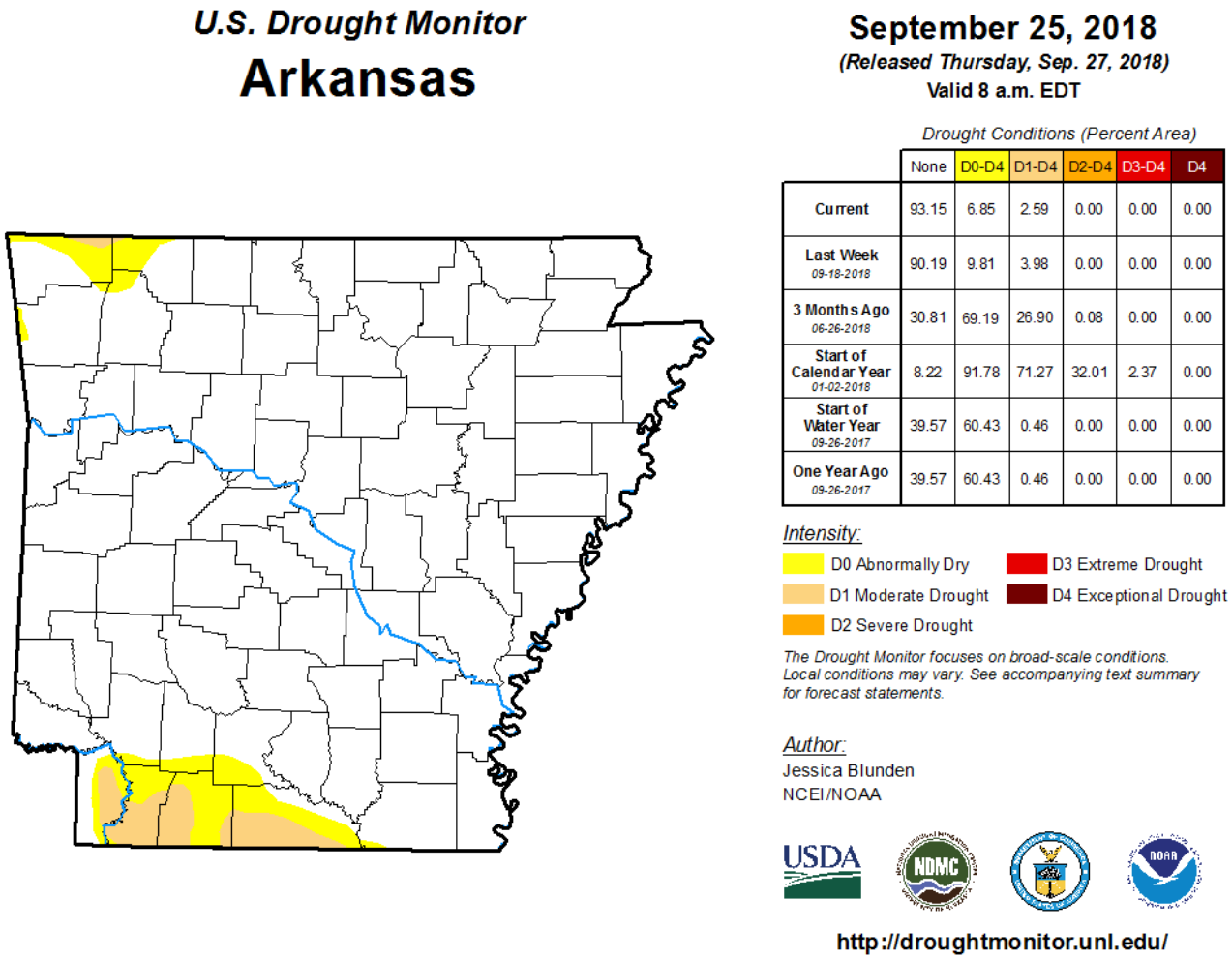



Fig.4. Drought Monitor for Arkansas

**Outlooks**

The Climate Prediction Center (CPC) outlook for October 2018 (issued September 30, 2018) indicates an enhanced chance for above normal temperatures and an enhanced chance for above 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. The increased odds for above normal temperature is due to the anticipated 500mb flow pattern during the first have of October, which favors strongly amplified ridging over the eastern CONUS. This anticipated highly amplified 500mb trough-ridge pattern from the western CONUS to the eastern CONUS favors a very active pattern during the first half of the month, with a considerably enhanced likelihood of strong low pressure systems bringing precipitation from the central CONUS to the Great Lakes.

For the 3-month period October-November-December 2018, CPC is forecasting an enhanced chance for above normal temperatures (outlook issued September 20, 2018). This outlook also indicates a slightly enhanced chance for above median rainfall southwest of a Tulsa to Fort Smith line and an equal chance for above, near, and below median precipitation across the remainder of eastern OK and northwest AR. This outlook is based on both statistical and dynamical forecast tools, decadal timescale climate trends, and influence from El Niño. According to CPC, ENSO neutral conditions persisted through early September. Weak El Niño conditions are still favored to begin this fall, with probabilities of El Niño conditions 65-70% for winter 2018-19. An El Niño Watch has been issued by CPC.

**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

Showers and thunderstorms trained over the western portion of Osage and Pawnee Counties during the morning of the 4th under the influence of a mid-level wave, with widely scattered convection across the remainder of eastern Oklahoma throughout the day. While most locations that saw rain received around 0.25" or less, western Osage and Pawnee Counties received 0.50" to around 2" of rain. Scattered showers and thunderstorms continued for much of the 5th as a weak frontal boundary interacted with a moisture rich southerly flow across eastern OK and far northwest AR. Most of the affected areas received 0.25" to 1" of rain, with localized totals of 1"-3" (Fig. 5). Rainfall lingered across Tulsa through Nowata Counties during the morning of the 6th, with isolated showers and thunderstorms in eastern OK in the afternoon and evening hours. This brought an additional 0.50" to near 2.5" in a few spots.

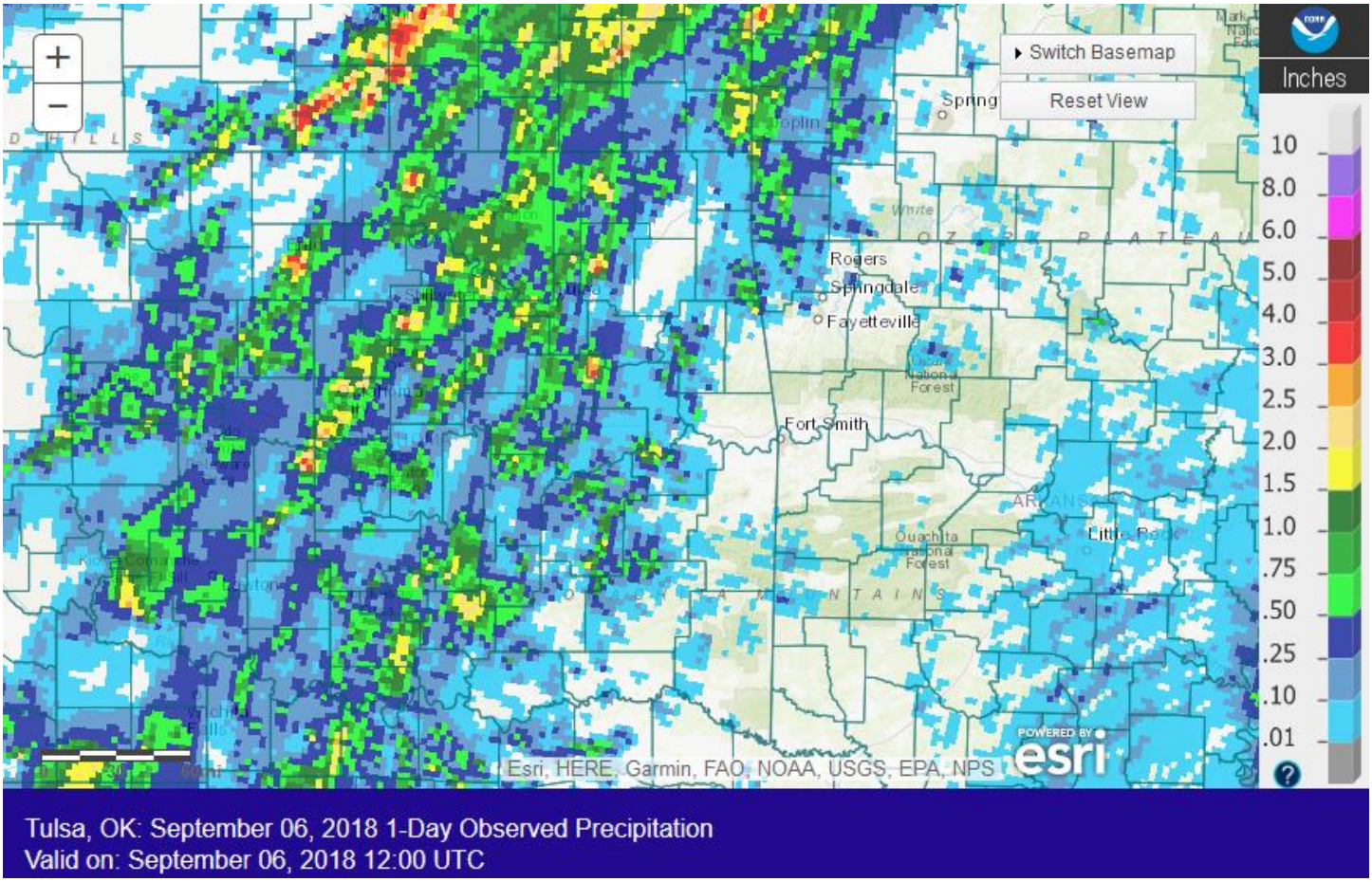


Fig. 5. 24-hour Estimated Observed Rainfall ending at 7am CDT 9/06/2018.

The remnants of Tropical Storm Gordon brought tropical moisture into the Southern Plains, which interacted with a front. Heavy rainfall of 1"-4" across southeast KS and northern Ottawa County on the 7th fell in the Neosho River basin, resulting in minor flooding at Commerce (Fig. 6; see preliminary hydrographs at the end of this report; see E3 Report for details).

A cold front moved into eastern OK and northwest AR on the 21st, with plenty of tropical moisture ahead of it from the western Gulf of Mexico and remnants of Pacific Tropical Depression 19. The front stalled, and combined with the tropical moisture and a strong upper-level trough, resulted in heavy rainfall across the area. Widespread 1.5"-4" of rain fell south of Highway 412 by 7am CDT on the 22nd, with several areas receiving higher amounts of 4"-10" of rain in just 24 hours (Figs. 7, 8). An additional 0.50"-3" of rain fell on the 22nd south of I-40, with the highest totals along the Red River (Fig. 9). This resulted in widespread 4"-7" of storm total rainfall south of I-40, with localized totals of 7"-11" in McIntosh, Pittsburg, Latimer, Pushmataha, and Le Flore Counties (Figs. 10, 11). Between Highway 412 and I-40, rainfall totals were 2"-4", with localized amounts of 4"-

7” in Creek, Tulsa, and Wagoner Counties (Figs. 10, 11). Several roads in the Tulsa metro area were closed due to high water. Large rises occurred along the Poteau, Kiamichi, and Red Rivers in southeast OK, but the rivers all remained in their banks (Figs. 12-15). The Poteau River near Panama, however, was bank full.

Some of the larger 24-hour precipitation reports (in inches) ending 7am CDT 9/22/2018 included:

| | | | | | |
|---|---|---|---|---|---|
| Talihina 4SE, OK | 8.36 | Stuart 3SE, OK | 7.01 | Krebs 0.3WNW, OK | 6.64 |
| McAlester 4S, OK | 6.60 | Canadian 1.1SE, OK | 6.23 | Eufaula 4.6ENE, OK | 6.22 |
| Tulsa 9SE, OK | 6.19 | Wister 3ENE, OK | 6.07 | Eufaula 5W, OK | 6.00 |
| McAlester 4S, OK | 6.00 | Panama 2E, OK | 5.86 | Poteau 1ENE, OK | 5.69 |
| Broken Arrow 2.7SSW, OK | 5.22 | Bixby 3NE, OK | 5.06 | Cameron 3.5WSW, OK | 5.03 |
| Fort Smith, AR | 5.01 | Daisy 4ENE, OK | 5.00 | | |

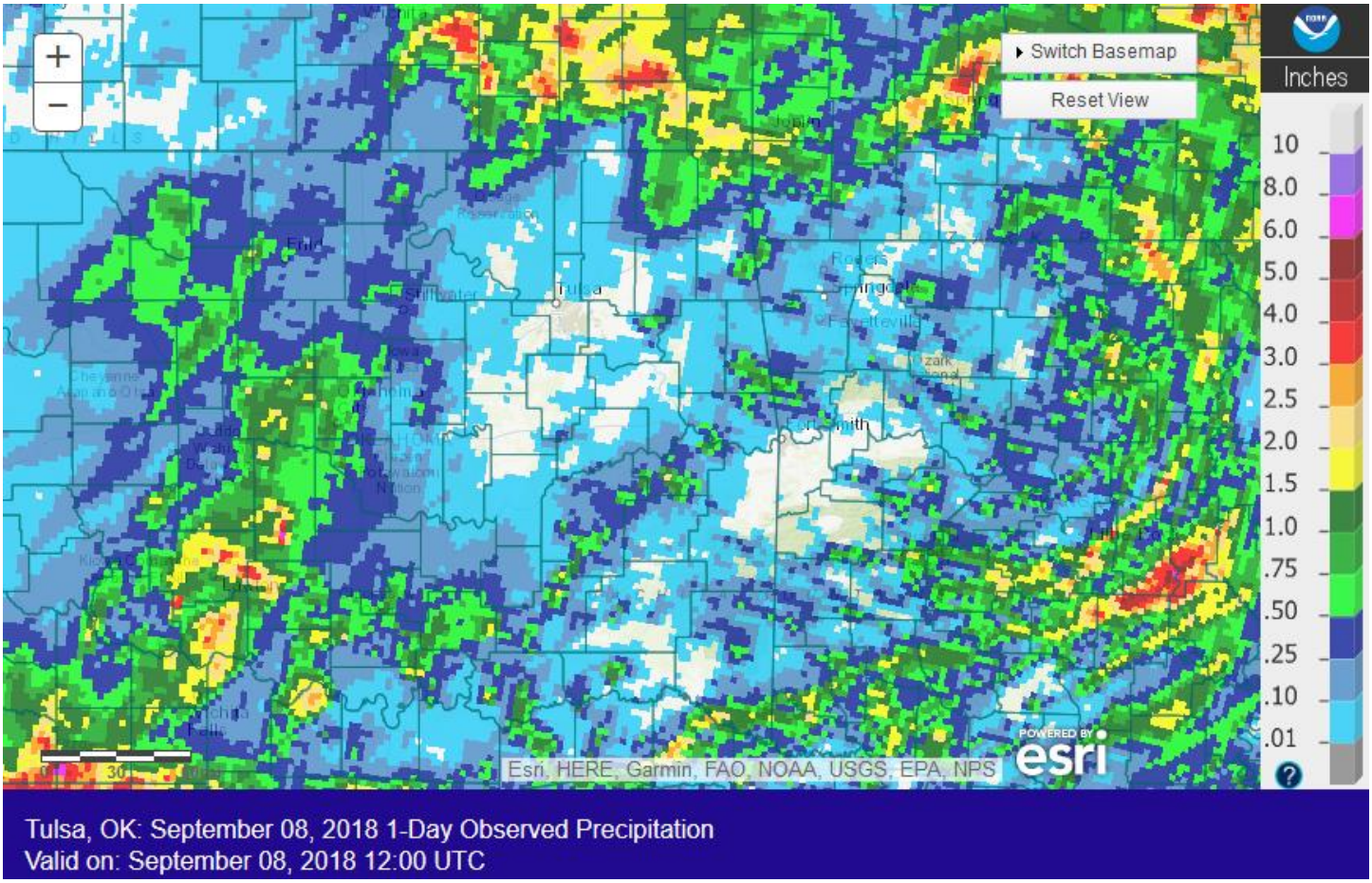


Fig. 6. 24-hour Estimated Observed Rainfall ending at 7am CDT 9/08/2018.

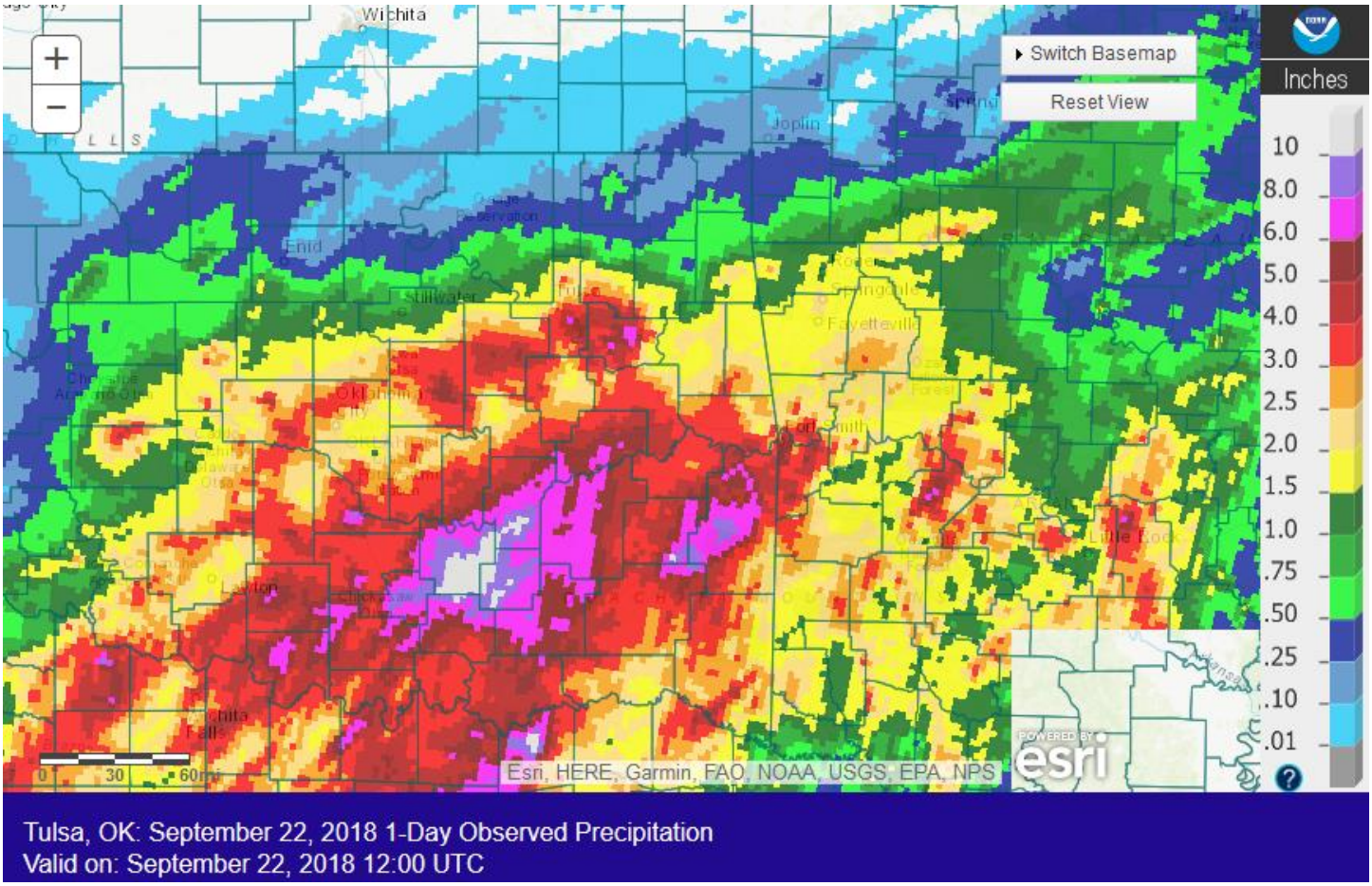



Fig. 7. 24-hour Estimated Observed Rainfall ending at 7am CDT 9/22/2018.

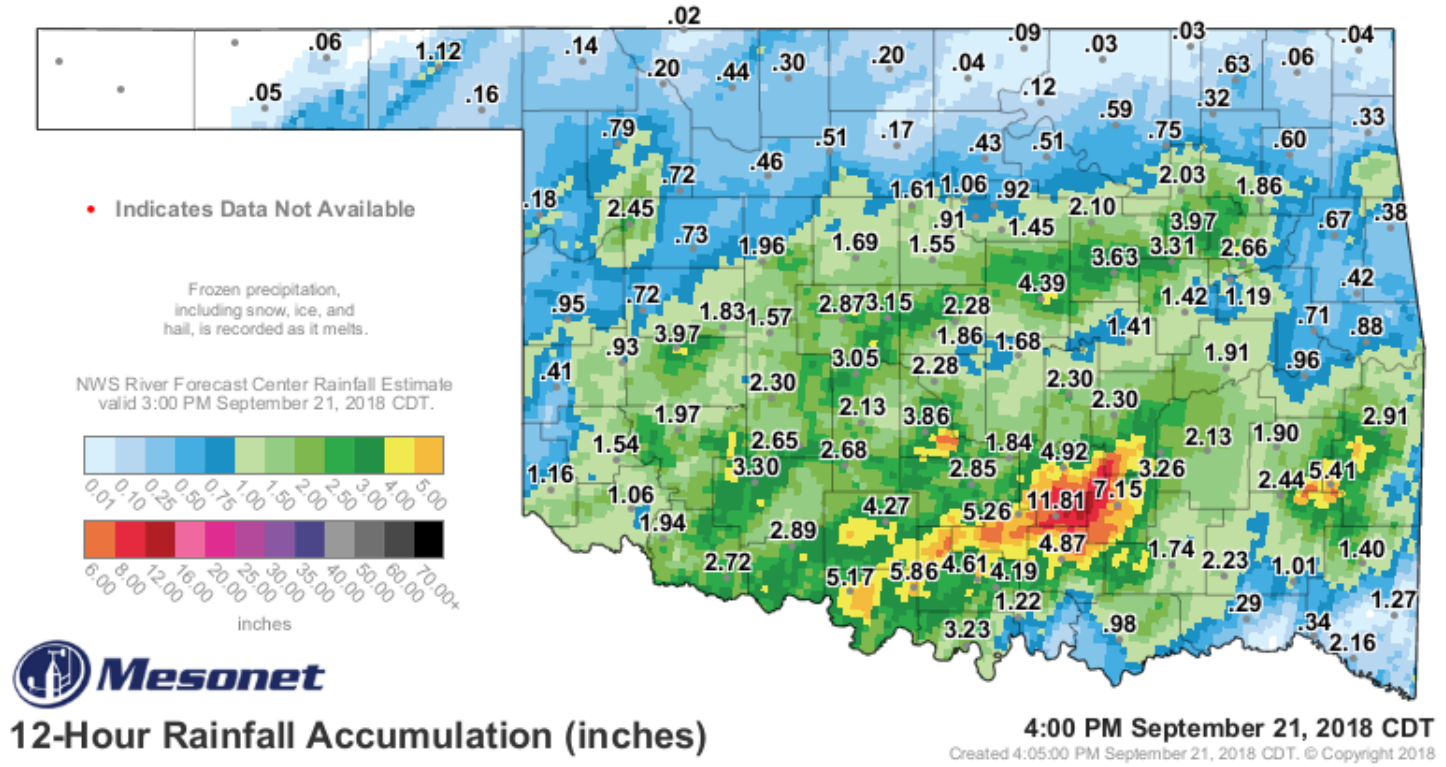



Fig. 8. 12-hour Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 4 pm CDT 9/21/2018.

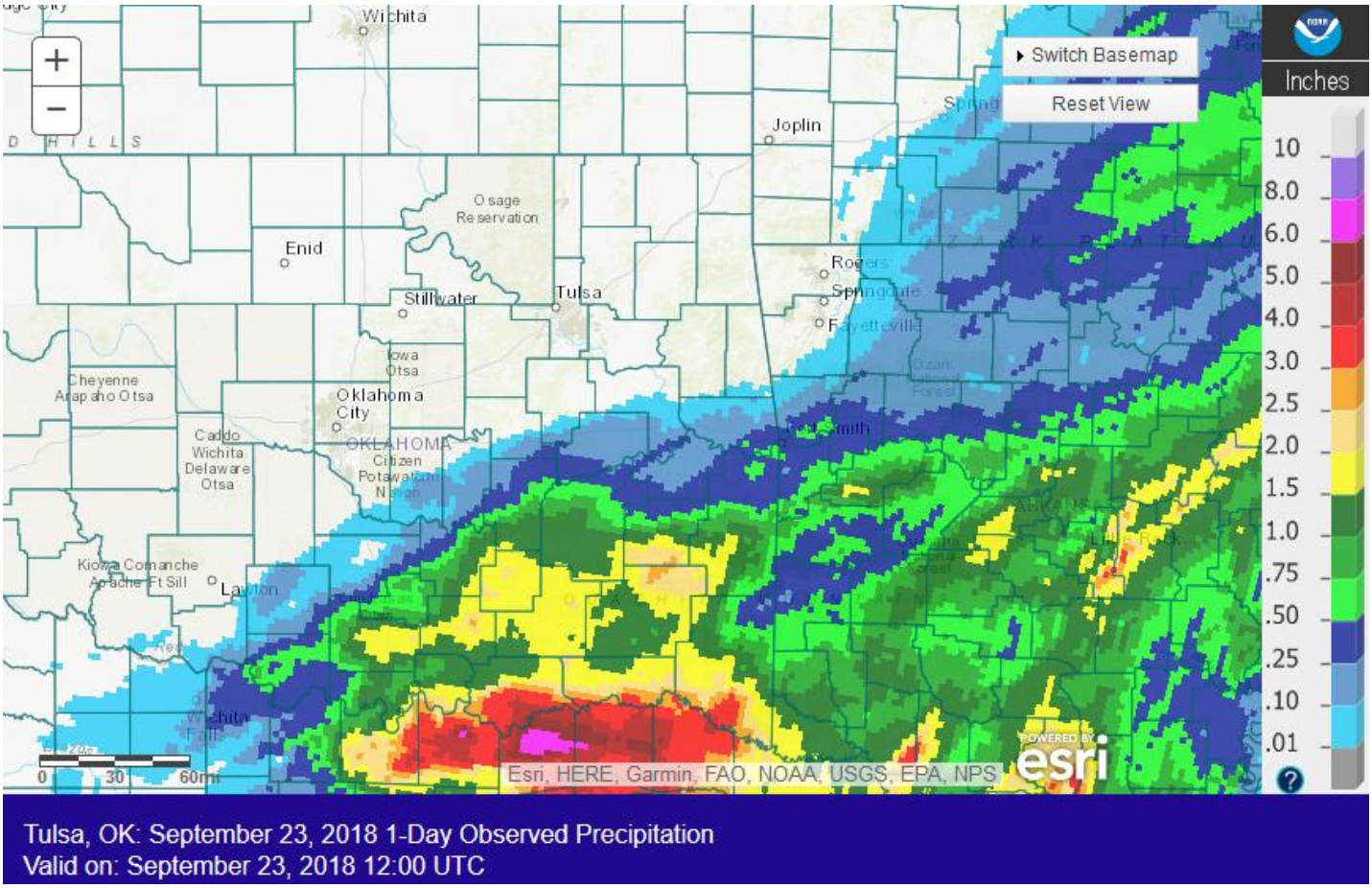


Fig. 9. 24-hour Estimated Observed Rainfall ending at 7am CDT 9/23/2018.

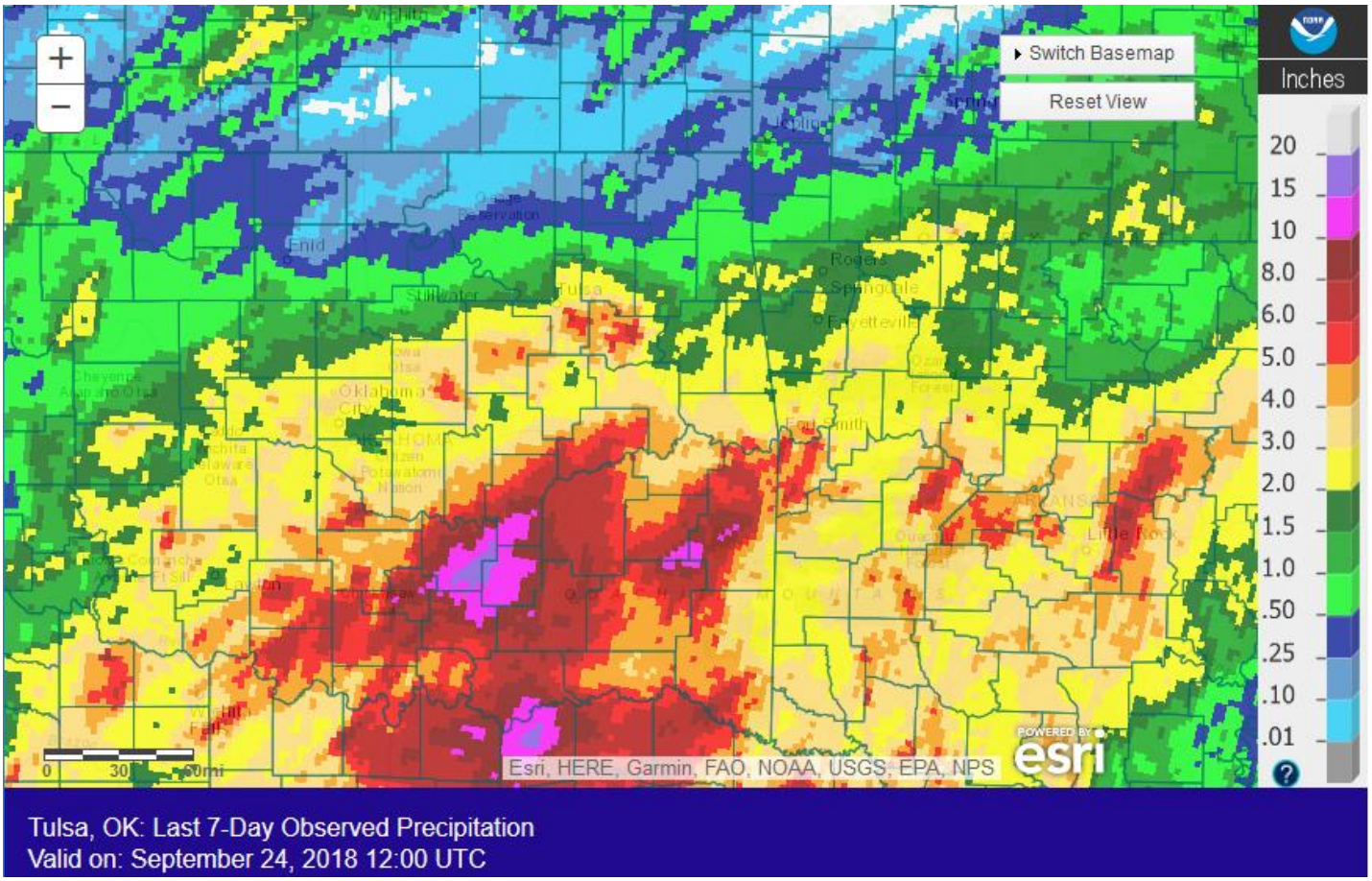


Fig. 10. 7-Day Estimated Observed Rainfall ending at 7am CDT 9/24/2018 (Rainfall primarily fell from 9/21-23/2018).

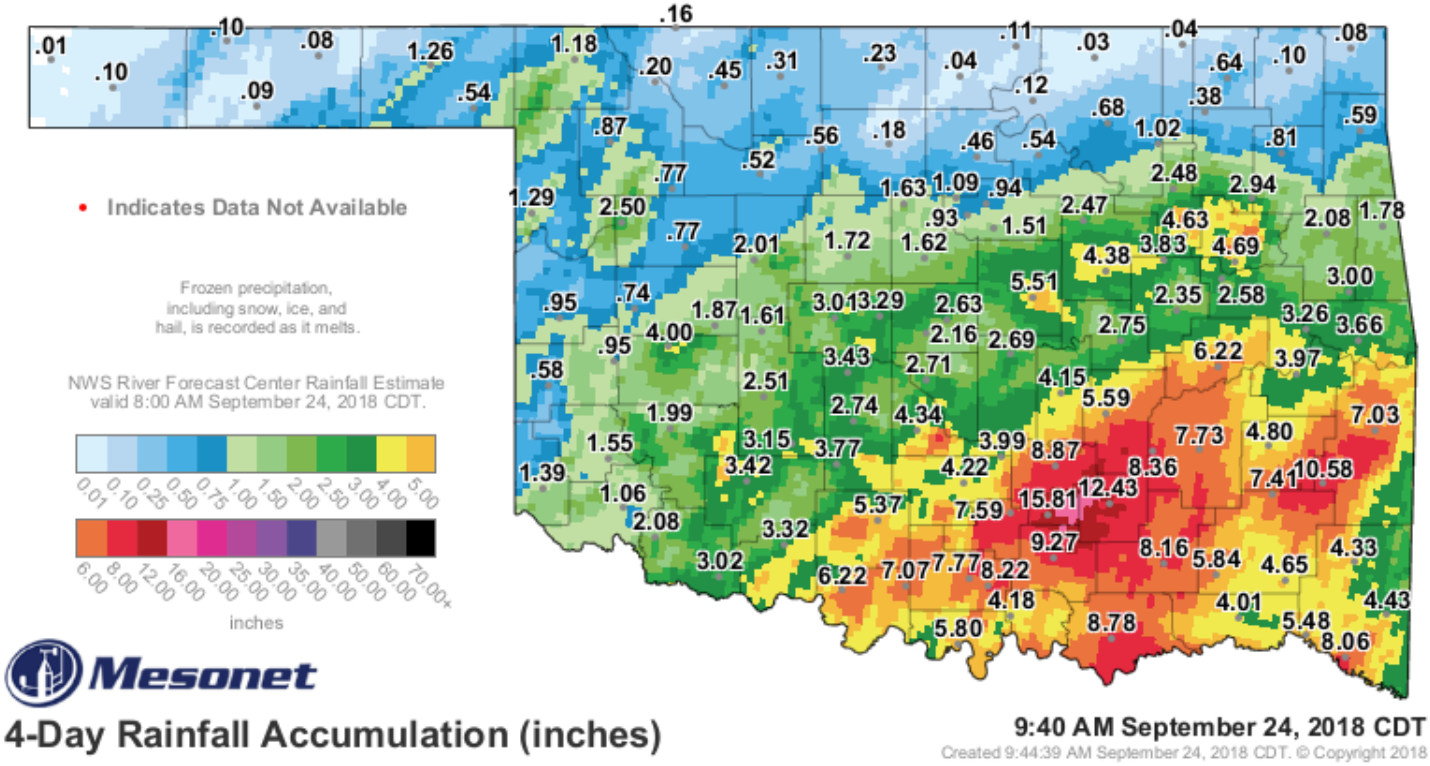



Fig. 11. 4-Day Estimated Observed Rainfall (image) and OK Mesonet measurements ending at 9:20 am CDT 9/24/2018.

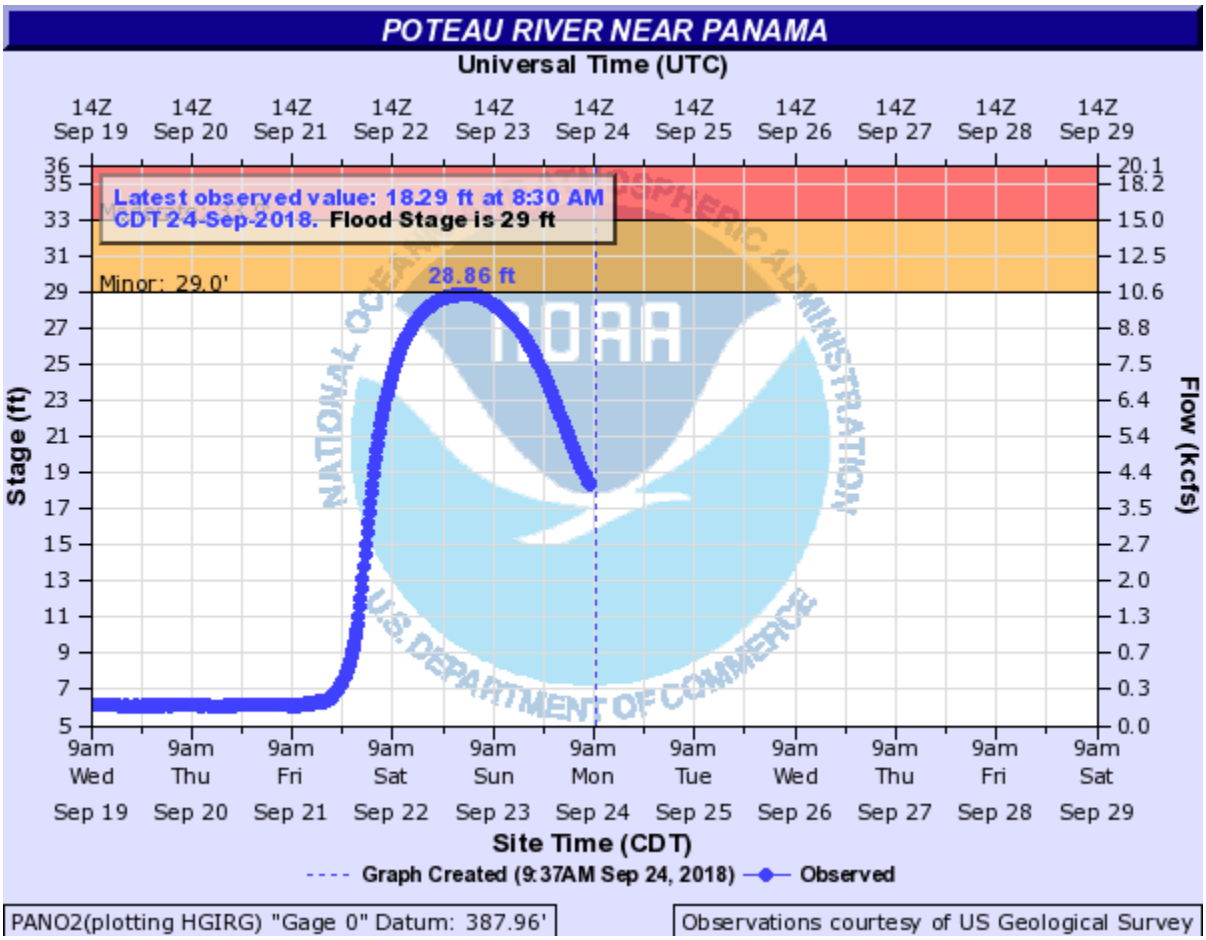



Fig. 12. Preliminary river stage observations for the Poteau River near Panama.

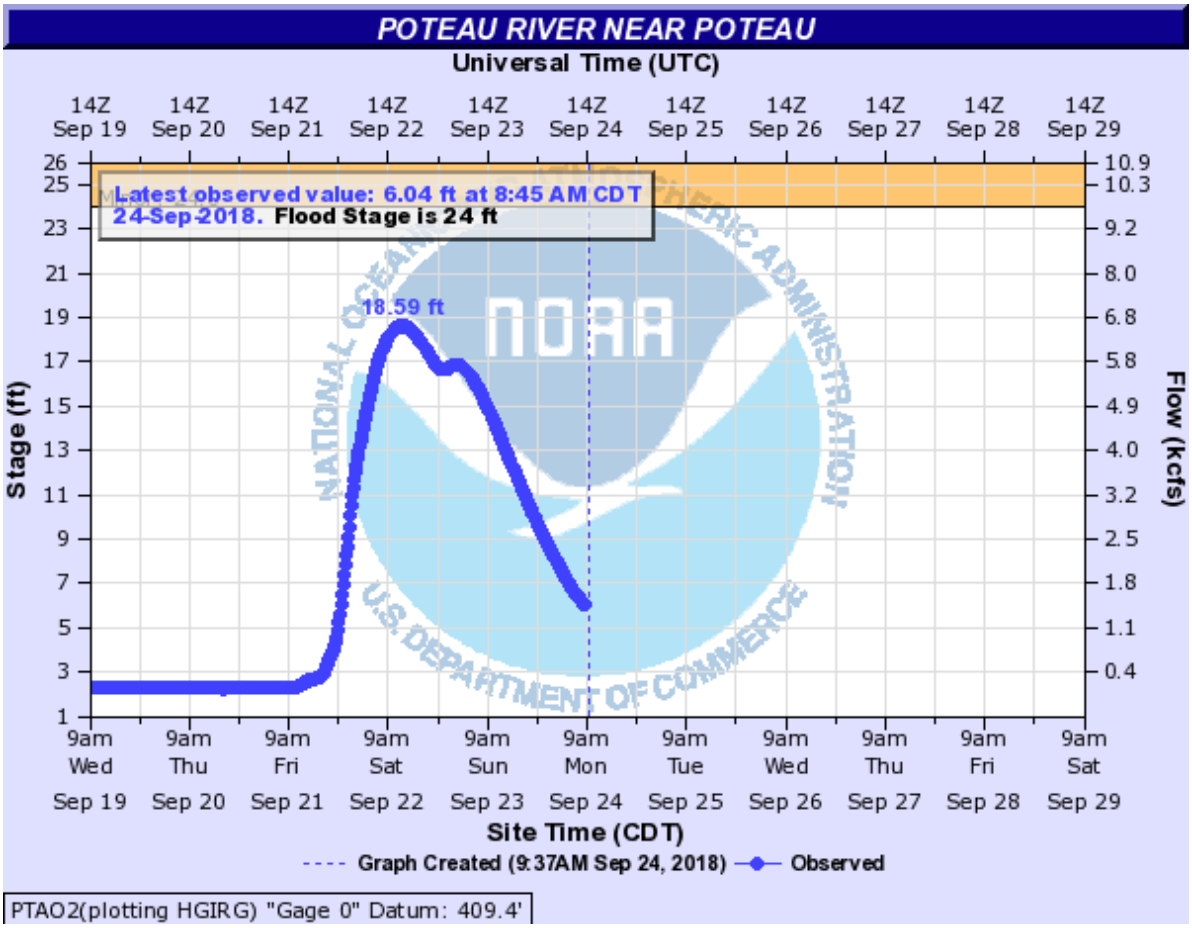



Fig. 13. Preliminary river stage observations for the Poteau River near Poteau.

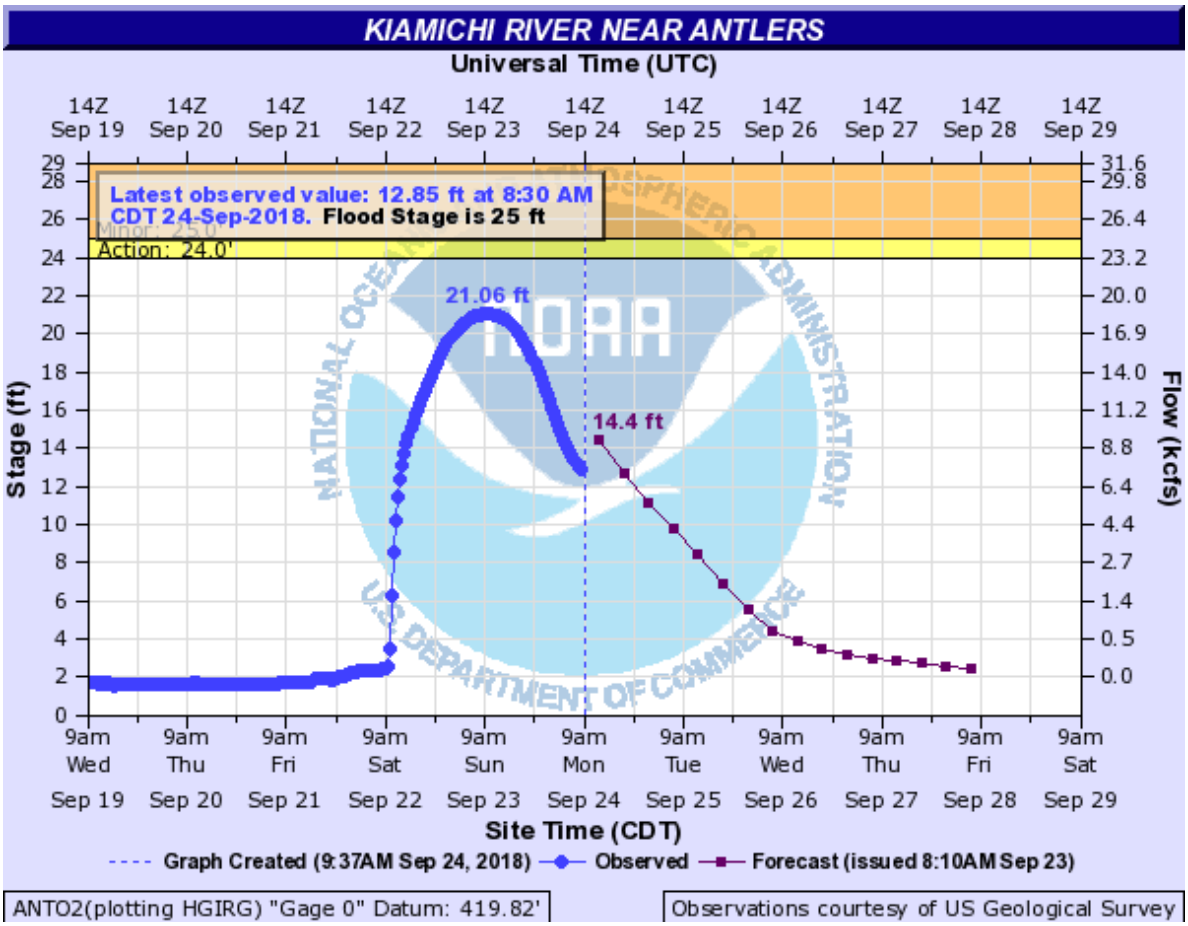



Fig. 14. Preliminary river stage observations for the Kiamichi River near Antlers.

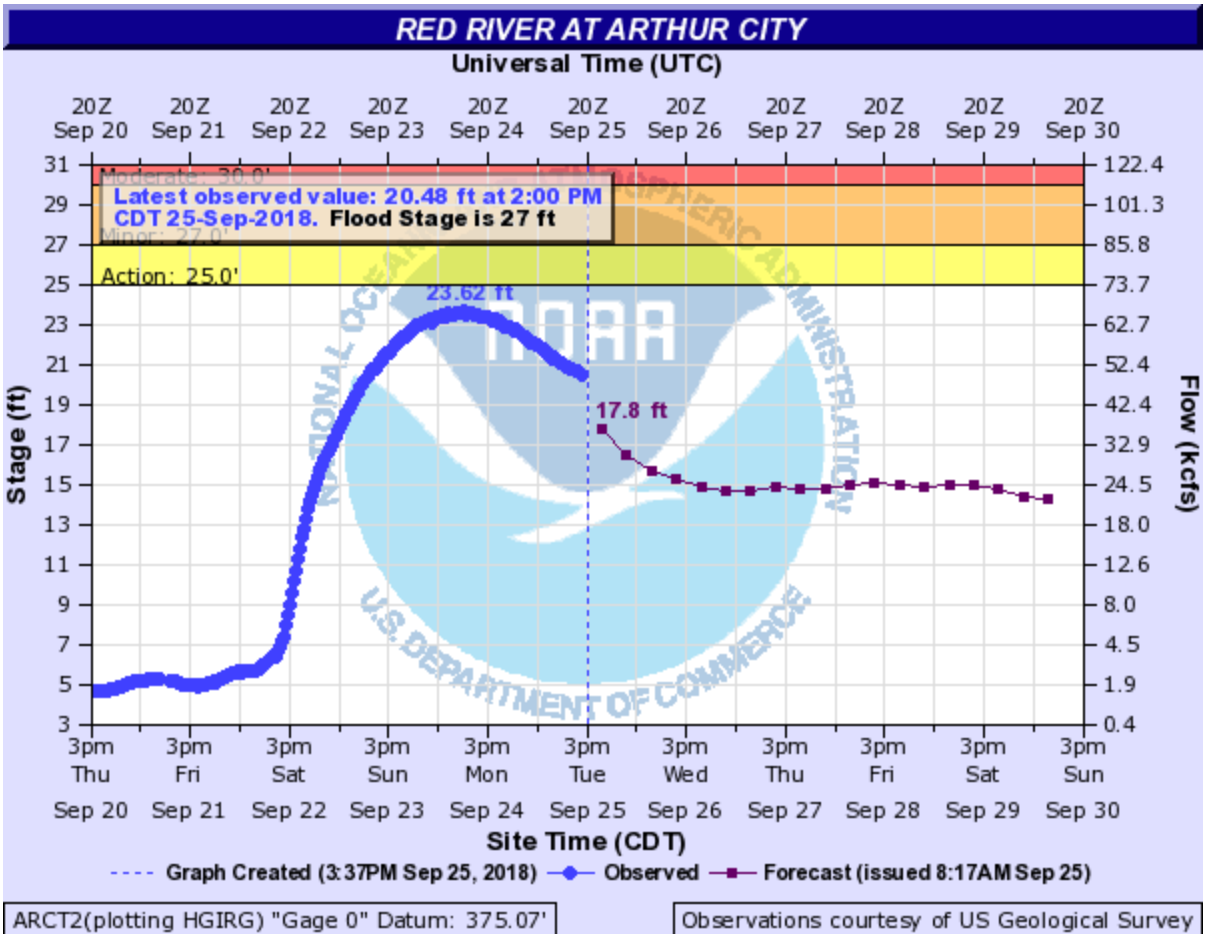


Fig. 15. Preliminary river stage observations for the Red River near Arthur City.

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

**Products issued in September 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

2 Flash Flood Warnings (FFW)
1 Flash Flood Statements (FFS)
1 Flash/Areal Flood Watches (FFA) (8 Watch FFA CON/EXT/EXA/EXB/CAN)
13 Urban and Small Stream Advisories (FLS)
1 Areal Flood Warnings (FLW)
1 Areal Flood Statements (FLS)
4 River Flood Warnings (FLW) (includes category increases)
29 River Flood Statements (FLS)
2 River Flood Advisories (FLS) (11 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:**