

NWS FORM E-5 (11-88) (PRES. by NWS Instruction 10-924)	U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NATIONAL WEATHER SERVICE	HYDROLOGIC SERVICE AREA (HSA)	
		Tulsa, Oklahoma (TSA)	
MONTHLY REPORT OF RIVER AND FLOOD CONDITIONS		REPORT FOR:	
		MONTH November	YEAR 2019
TO: Hydrometeorological Information Center, W/OH2 NOAA / National Weather Service 1325 East West Highway, Room 7230 Silver Spring, MD 20910-3283		SIGNATURE Steven F. Piltz (Meteorologist-in-Charge)	
		DATE December 13, 2019	

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.

November was several degrees below normal overall, with some light snow and a few rain events that caused flooding along the Illinois River, Polecat Creek, and the Poteau River. The northeast OK area's average January-November total was 61.65", 21.33" above normal, setting a new rainfall record for the year, with a month still left to go. The previous record annual total was 57.82" from 1973. Miami, OK has measured 80.00" of rain (Mesonet station) so far this year, breaking its annual rainfall record of 66.85" measured by the NWS COOP station in 1973. Normal precipitation for November ranges from 2.6 inches in Pawnee County to 4.4 inches in Haskell County. Normal precipitation for the Ozark region of northwest Arkansas averages 4.2 inches. 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 November 2019 ranged from 1" to around 7" generally northwest to southeast across eastern OK and northwest AR. These rainfall totals correspond to 50%-200% of the normal November rainfall across the area, with most of eastern OK and northwest Arkansas $\pm 25\%$ of normal (Fig. 1b).

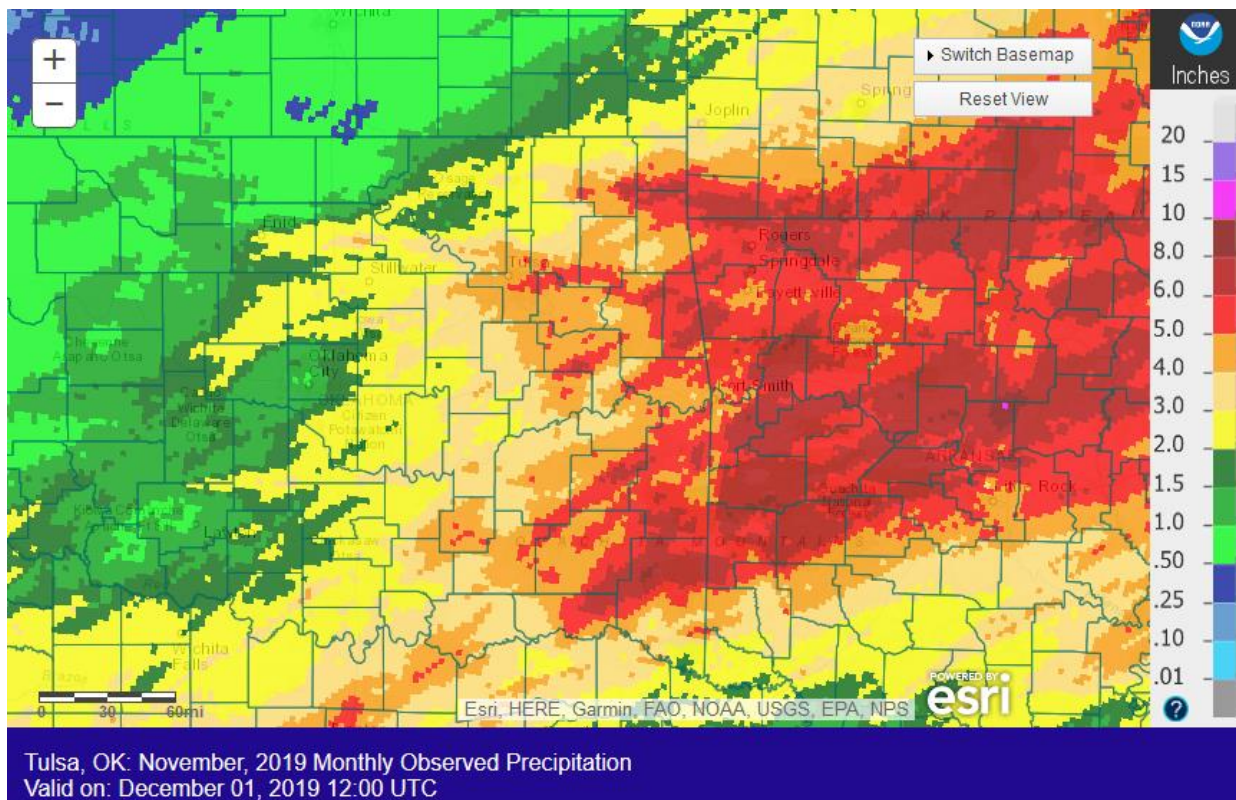


Fig. 1a. Estimated Observed Rainfall for November 2019

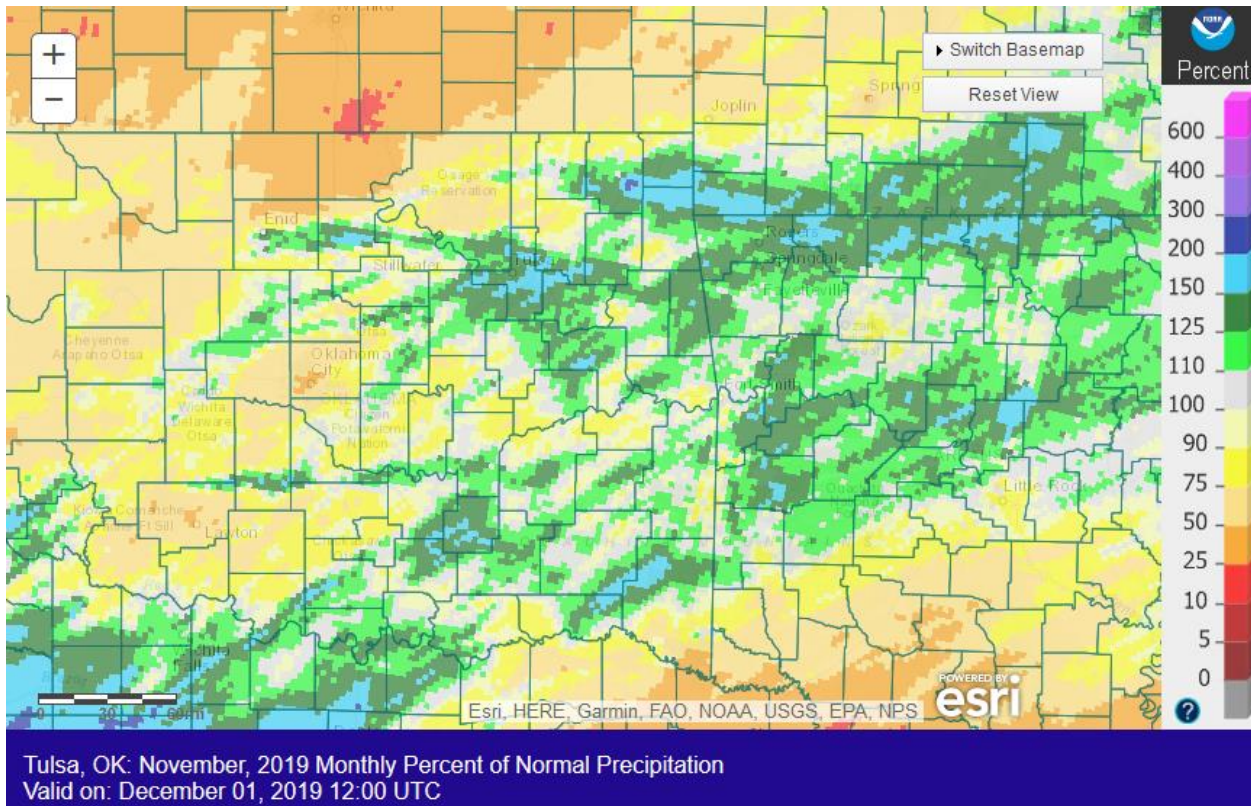


Fig. 1b. Estimated % of Normal Rainfall for November 2019

In Tulsa, OK, November 2019 ranked as the 33rd coldest November (47.6°F, tied 1957, 1919; since records began in 1905), the 23rd wettest November (4.71"; since records began in 1888), and the 29th snowiest November (0.1"; since records began in 1900). Fort Smith, AR had the 36th coldest November (48.6°F, tied 2002, 1937; since records began in 1882), the 38th wettest November (4.41"; since records began in 1882), and the 18th snowiest November (Trace, tied 17 other years; since records began in 1883). Fayetteville, AR had the 15th coldest (44.3°F), the 24th wettest (4.52"), and the 14th snowiest (0.2", tied 1969) November since records began in 1949.

Some of the larger precipitation reports (in inches) for November 2019 included:

Bella Vista 2.0E, AR (coco)	7.98	Garfield 3.9E, AR (coco)	7.78	Holiday Island 1.3SSW, AR (coco)	7.63
Berryville, AR (coco)	7.33	Eureka Springs 4.0NNW, AR (coco)	7.25	Rogers 2.4SSW, AR (coco)	6.97
Springdale 0.6E, AR (coco)	6.74	Pea Ridge 0.2WSW, AR (coco)	6.62	Ozark, AR (coop)	6.49

Some of the lowest precipitation reports (in inches) for November 2019 included:

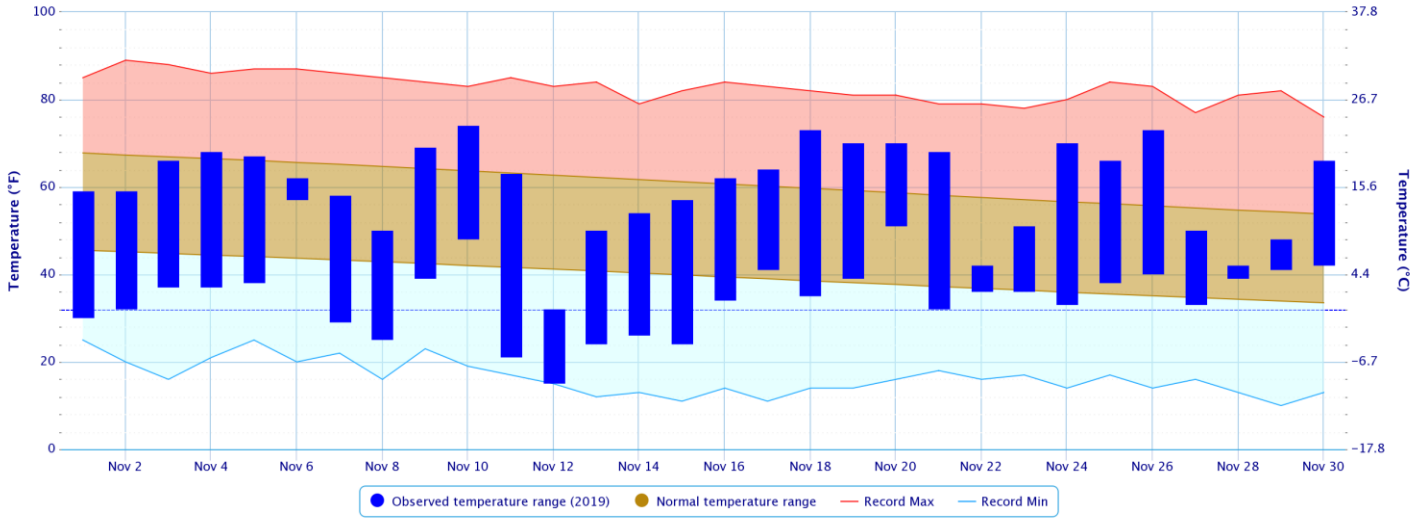
Burbank, OK (meso)	1.69	Foraker, OK (meso)	1.80	Wynona, OK (meso)	2.06
Copan, OK (meso)	2.08	Bartlesville, OK (ASOS)	2.24	Oologah 2.8NE, OK (coco)	2.38
Bartlesville, OK (coop)	2.45	Ochelata 5.6N, OK (coco)	2.68	Pawnee, OK (meso)	2.96

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

Rank since 1921	November 2019	Water Year-to-Date (Oct 1 – Nov 30)	Autumn 2019 (Sep 1 – Nov 30)	Last 120 Days (Aug 3 – Nov 30)	Last 180 Days (Jun 4 – Nov 30)	Year-to-Date (Jan 1 – Nov 30)	Last 365 Days (Dec 1, 2018 – Nov 30, 2019)
Northeast OK	25 th wettest	13 th wettest	12 th wettest	4 th wettest	2 nd wettest	1 st wettest	1 st wettest
East Central OK	24 th wettest	3 rd wettest	9 th wettest	1 st wettest	1 st wettest	5 th wettest	4 th wettest
Southeast OK	26 th wettest	12 th wettest	6 th wettest	6 th wettest	8 th wettest	8 th wettest	5 th wettest
Statewide	37 th wettest	23 rd wettest	27 th wettest	10 th wettest	19 th wettest	5 th wettest	3 rd wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

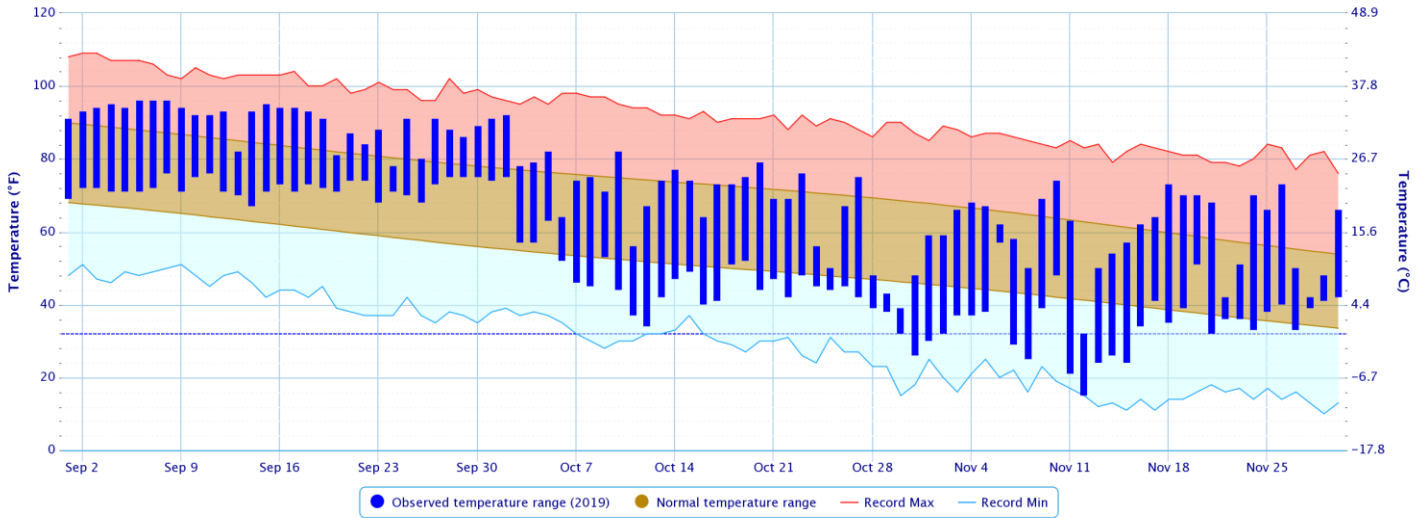
Period of Record – 1905-01-06 to 2019-12-01. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

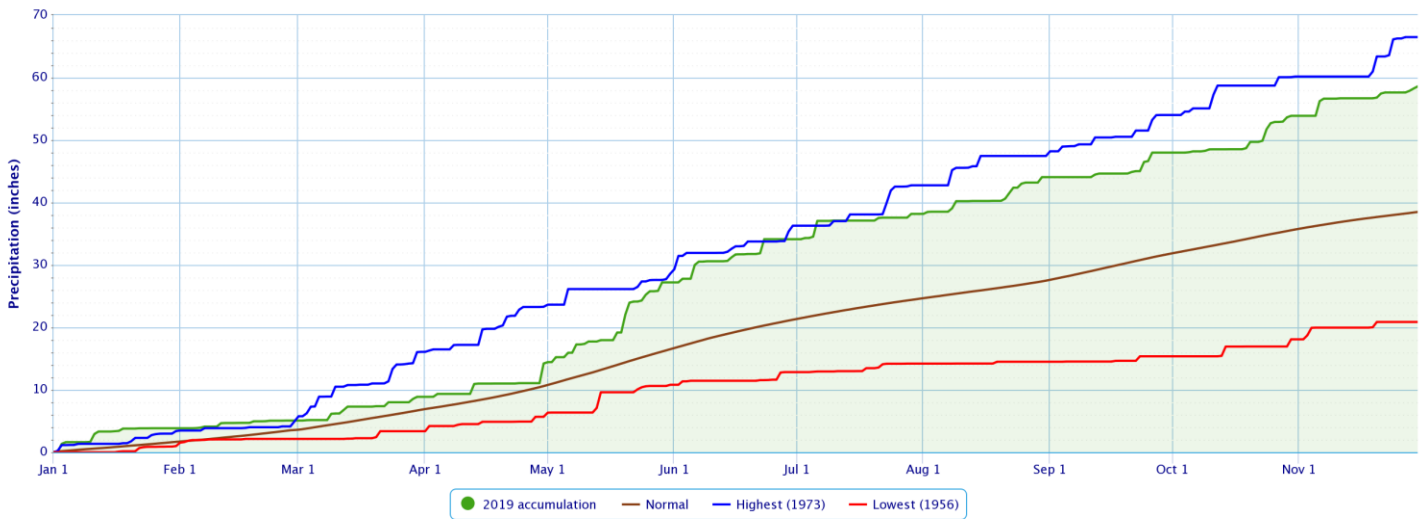
Period of Record – 1905-01-06 to 2019-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

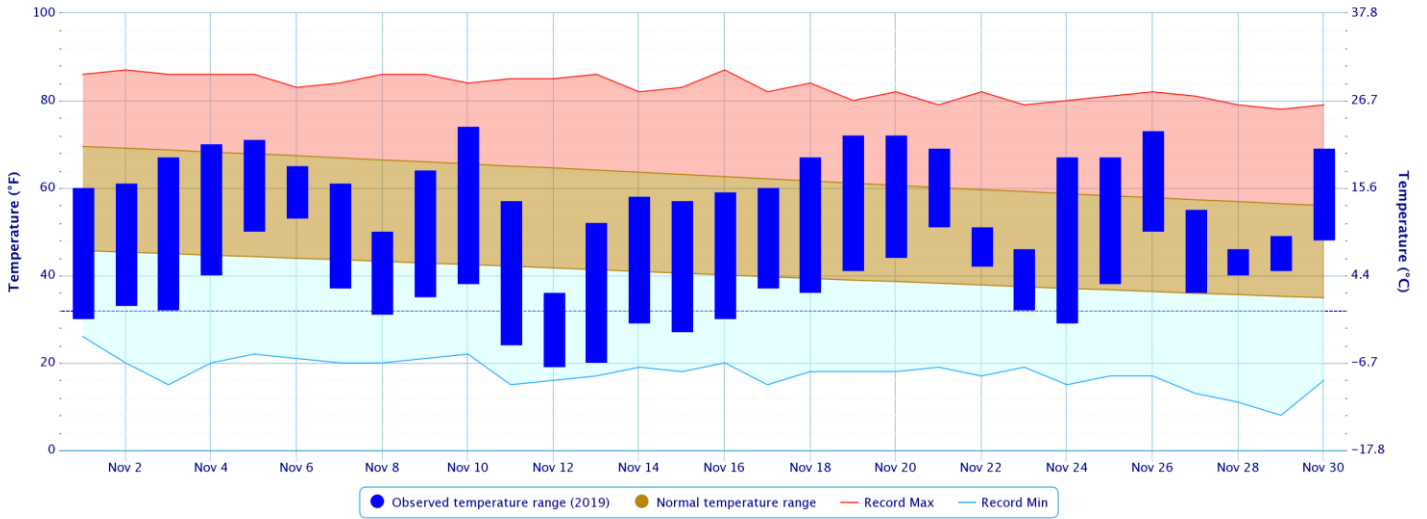
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

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

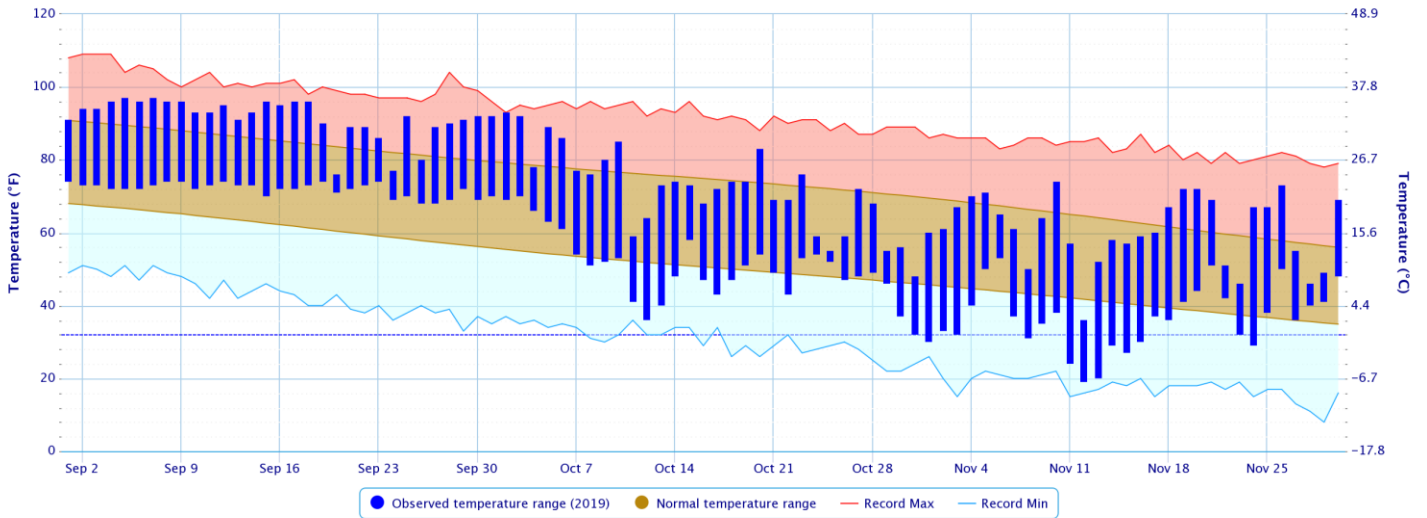
Period of Record – 1882-06-01 to 2019-12-01. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

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

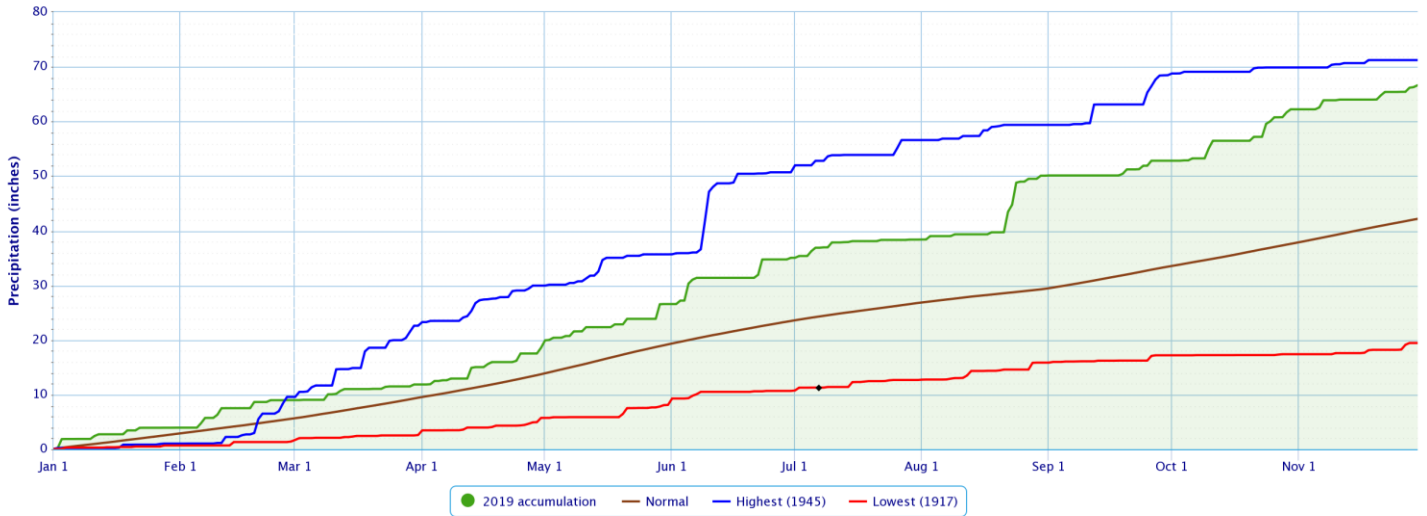
Period of Record – 1882-06-01 to 2019-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

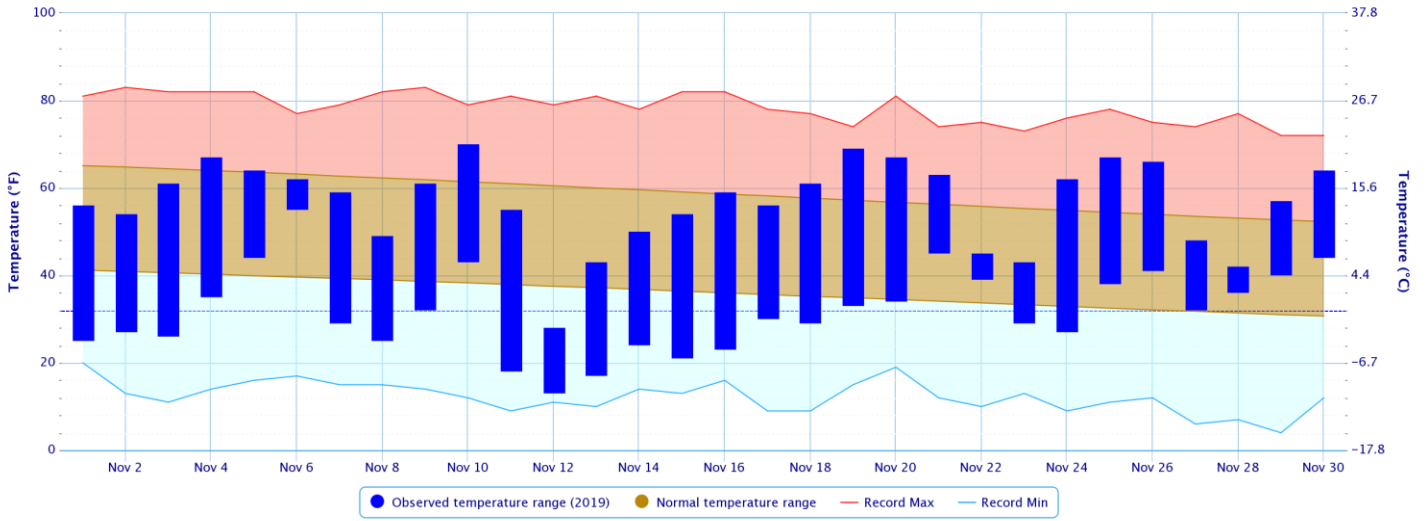
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

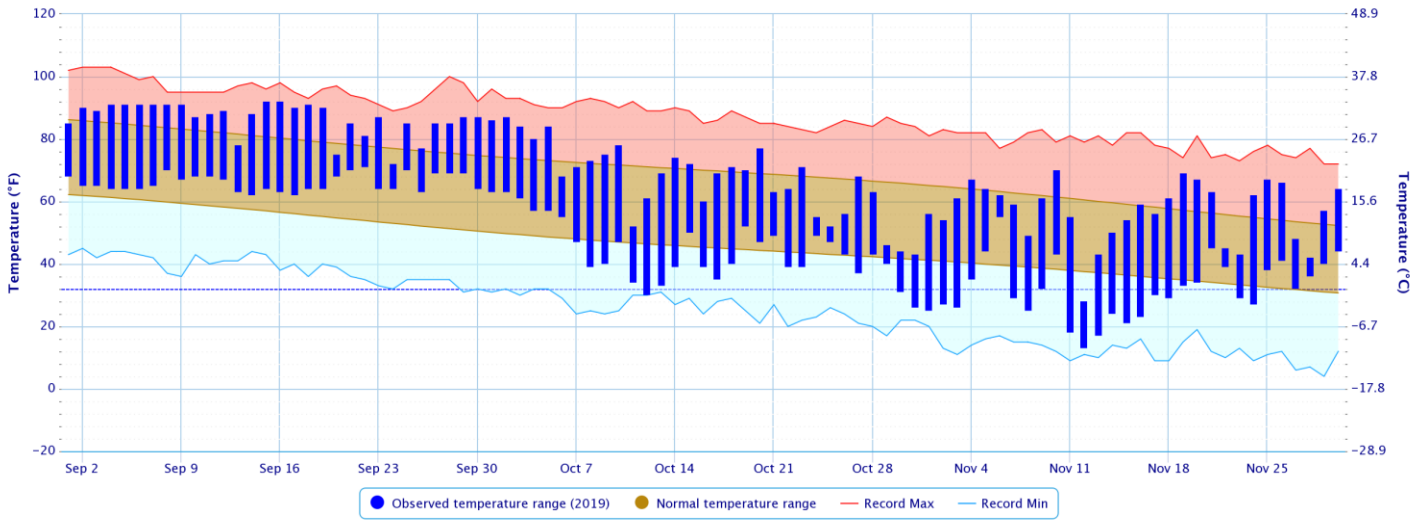
Period of Record – 1949-07-14 to 2019-12-01. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Daily Temperature Data – FAYETTEVILLE DRAKE FIELD, AR

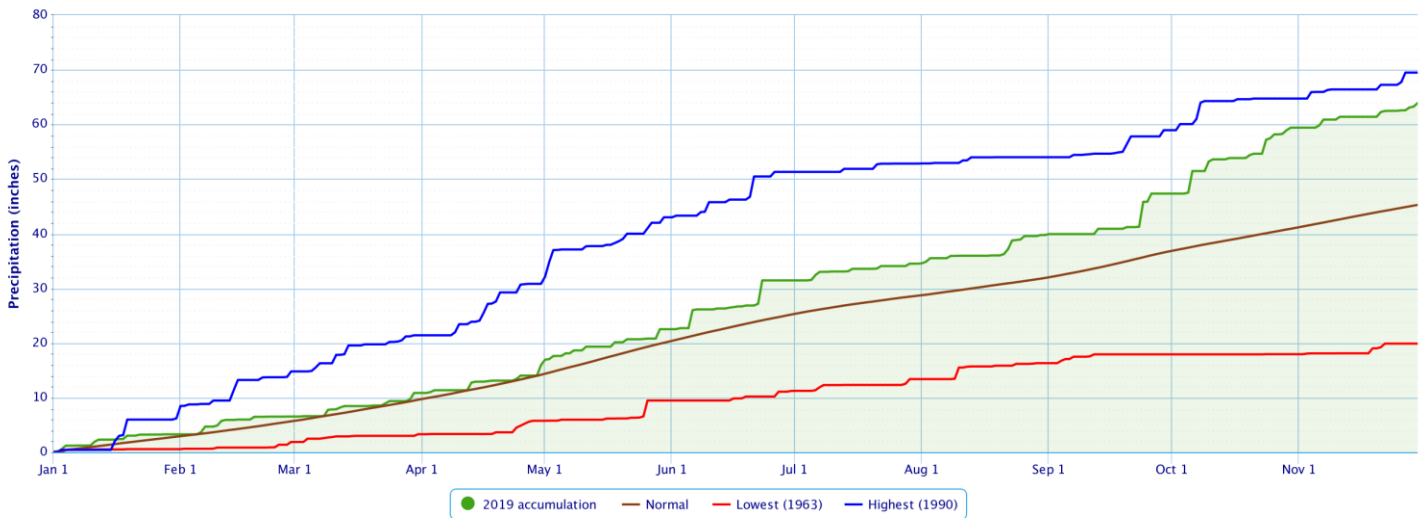
Period of Record – 1949-07-14 to 2019-12-02. Normals period: 1981-2010. Click and drag to zoom chart.



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



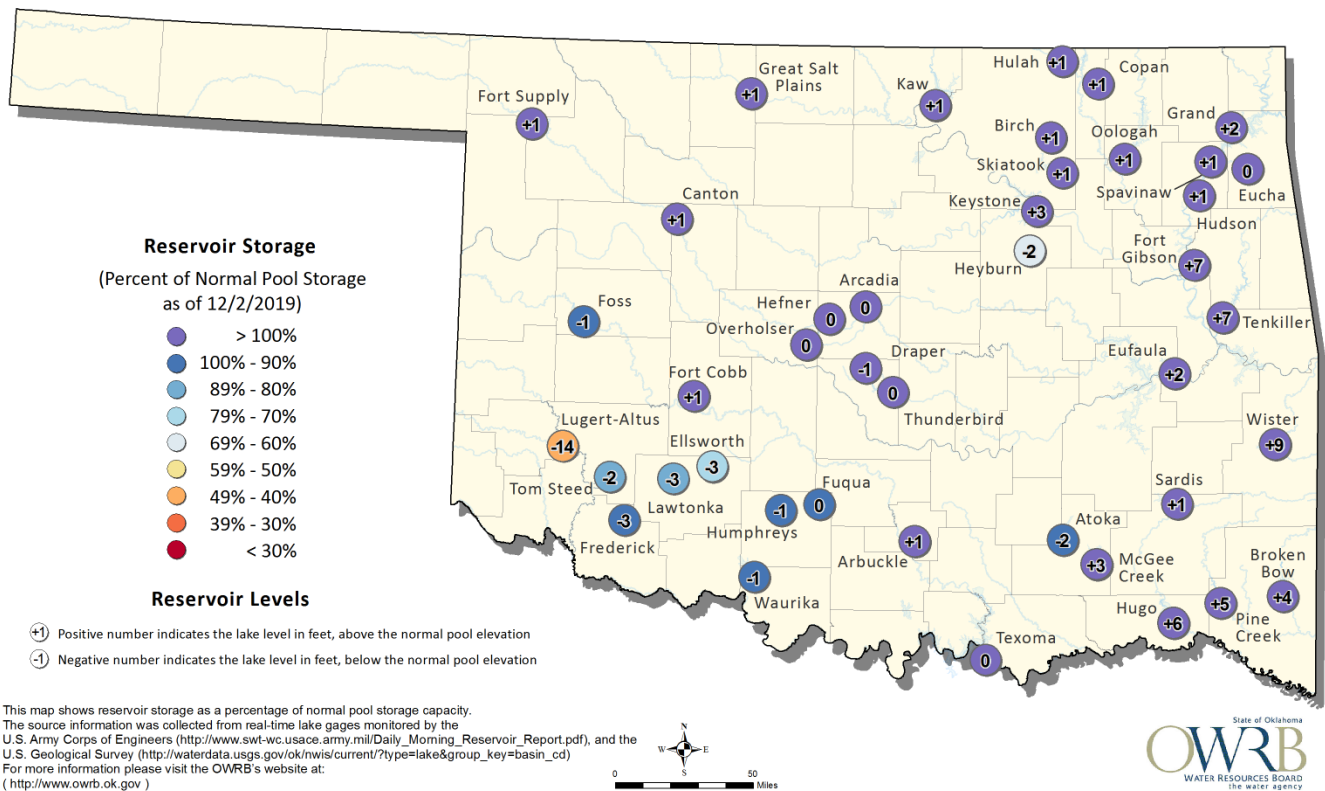
Powered by ACIS

Autumn (September-October-November) 2019 Summary

In Tulsa, OK, Autumn 2019 ranked as the 51st warmest Autumn (62.2°F, tied 1920; since records began in 1905) and the 20th wettest Autumn (14.53"; since records began in 1888). Fort Smith, AR had the 39th warmest Autumn (64.0°F, tied 1971, 1934; since records began in 1882) and the 15th wettest Autumn (16.56"; since records began in 1882). Fayetteville, AR had the 25th warmest (58.8°F, tied 1989, 1981, 1958) and the Record wettest (24.17", previous record 24.10" in 1996) Autumn since records began in 1949.

Reservoirs

Oklahoma Surface Water Resources Reservoir Levels and Storage as of 12/2/2019



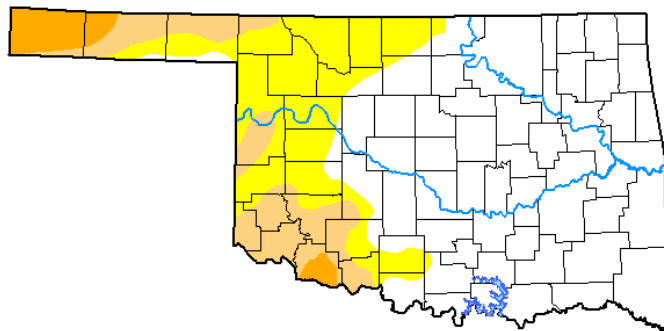
According to the USACE, several of the lakes in the HSA were utilizing more than 3% of their flood control pools as of 12/02/2019: Beaver Lake 92%, Wister Lake 23%, Ft. Gibson Lake 18%, Tenkiller Lake 18%, Sardis Lake 18%, Eufaula Lake 12%, Grand Lake 10%, Hugo Lake 10%, Hudson Lake 5%, and Keystone Lake 4%.

Drought

According to the [U.S. Drought Monitor](#) (USDM) from December 3, 2019 (Figs. 2, 3), eastern OK and northwest AR were drought free.

U.S. Drought Monitor Oklahoma

December 3, 2019
(Released Thursday, Dec. 5, 2019)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	65.35	34.65	14.27	3.67	0.00	0.00
Last Week 11-26-2019	76.05	23.95	12.58	3.67	0.00	0.00
3 Months Ago 09-03-2019	65.89	34.11	14.07	5.19	2.01	0.00
Start of Calendar Year 01-01-2019	94.85	5.15	0.00	0.00	0.00	0.00
Start of Water Year 10-01-2019	71.94	28.06	11.08	1.01	0.00	0.00
One Year Ago 12-04-2018	81.67	18.33	3.15	0.00	0.00	0.00

Intensity:

- None
- 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. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Deborah Bathke
National Drought Mitigation Center

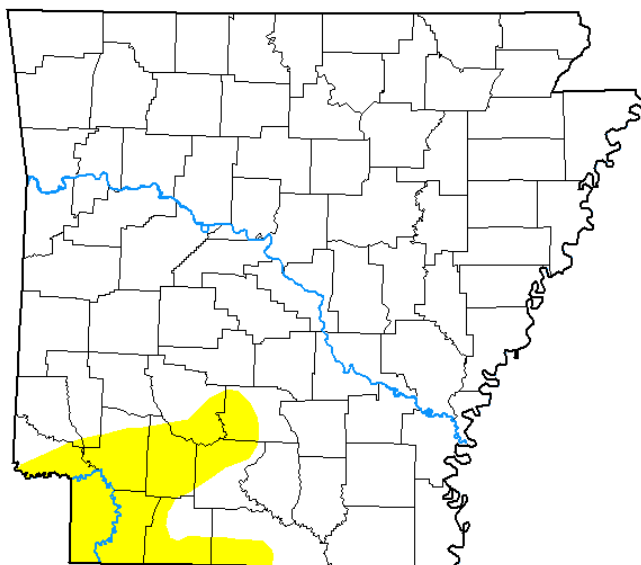


droughtmonitor.unl.edu

Fig. 2. Drought Monitor for Oklahoma

U.S. Drought Monitor Arkansas

December 3, 2019
(Released Thursday, Dec. 5, 2019)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	91.66	8.34	0.00	0.00	0.00	0.00
Last Week 11-26-2019	93.10	6.90	0.00	0.00	0.00	0.00
3 Months Ago 09-03-2019	93.85	6.15	1.28	0.00	0.00	0.00
Start of Calendar Year 01-01-2019	98.79	1.21	0.00	0.00	0.00	0.00
Start of Water Year 10-01-2019	54.35	45.65	11.77	5.79	0.00	0.00
One Year Ago 12-04-2018	93.02	6.98	0.00	0.00	0.00	0.00

Intensity:

- None
- 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. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Deborah Bathke
National Drought Mitigation Center



droughtmonitor.unl.edu

Fig. 3. Drought Monitor for Arkansas

Outlooks

The [Climate Prediction Center](#) (CPC) outlook for December 2019 (issued November 30, 2019) indicates a greatly enhanced chance for above normal temperatures and equal chances for above, near, and below median precipitation across all of eastern OK and northwest AR. This outlook takes into account dynamical model guidance and the weeks 3-4 outlook. The Madden-Julian Oscillation (MJO) will propagate eastward across the Indian Ocean during the first two weeks of December, which favors above normal temperatures across the central and eastern U.S. during December.

For the 3-month period December-January-February 2019-20, CPC is forecasting an enhanced chance for above normal temperatures and equal chances for above, near, or below median rainfall across nearly all of eastern OK and northwest AR (outlook issued November 21, 2019). However, there is an equal chance for above, near, and below normal temperatures in far northeast OK and along the AR/MO state line. This outlook is based on both statistical and dynamical forecast tools, and decadal timescale climate trends. According to CPC, the combined effect of the ocean-atmosphere system is consistent with ENSO neutral currently. The consensus forecast is for ENSO neutral conditions to be the most likely through the winter and the upcoming spring. With ENSO-neutral favored to persist through the upcoming winter, the odds of other sub-seasonal factors, such as the Arctic Oscillation (AO), will play a larger role in the temperature pattern, and long-term climate trends were used heavily in the outlooks.

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

Isolated showers and thunderstorms moved through portions of eastern OK and northwest AR during the morning of the 6th. Showers and thunderstorms developed during the late afternoon hours in central OK and far northeast OK in response to an approaching upper-level jet. This activity increased in coverage and intensity during the evening hours, especially near a cold front as it was moving across the area. Light to moderate rain then continued overnight and through the early morning hours of the 7th across most of eastern OK and northwest AR. This activity then ended from northwest to southeast during the morning. A large portion of eastern OK and western AR received 1" to 3" of rain, with 3" to 5" falling in portions of northeast OK and near the MO border in northwest AR (Fig. 4). Bella Vista 2E, AR measured 4.95" of rain in the 24 hours ending at 6 am on the 7th. This heavy rain resulted in minor to moderate river flooding along the Illinois River, minor flooding along Polecat Creek near Sapulpa, and minor flooding along the Poteau River near Panama (see preliminary hydrographs at the end of this report; see E3 Report for details).

A strong cold front moved through the region on the 11th. Scattered showers and thunderstorms initially developed ahead of the front in the early morning hours across southeast OK and northwest AR. By mid-morning, rain developed behind the front north of I-44 and progressed southeast through east central OK and northwest AR through early afternoon. Sleet was reported during this time as sub-freezing air infiltrated northeast OK and northwest AR. Patches of sleet, slight snow, and/or freezing drizzle occurred through early evening. Little to no frozen accumulation occurred, with most locations reporting around 0.25" or less of snow/sleet accumulation.

A cold front moved through eastern OK and northwest AR on the 21st, bringing showers and isolated thunderstorms to the region during the afternoon and evening hours. The front stalled across southeast OK and west central AR during the evening, with rain continuing over this area through 2 am CST. As the main upper-level low pressure system moved into the Plains overnight, additional showers and isolated thunderstorms moved east across eastern OK and northwest AR during the early through mid-morning hours of the 22nd. All of eastern OK and northwest AR received rain from this storm system, with most locations seeing around 0.25" to around 1" of rain. Higher totals of 1" to 3" fell across southeast OK and west central AR (Figs. 5, 6).

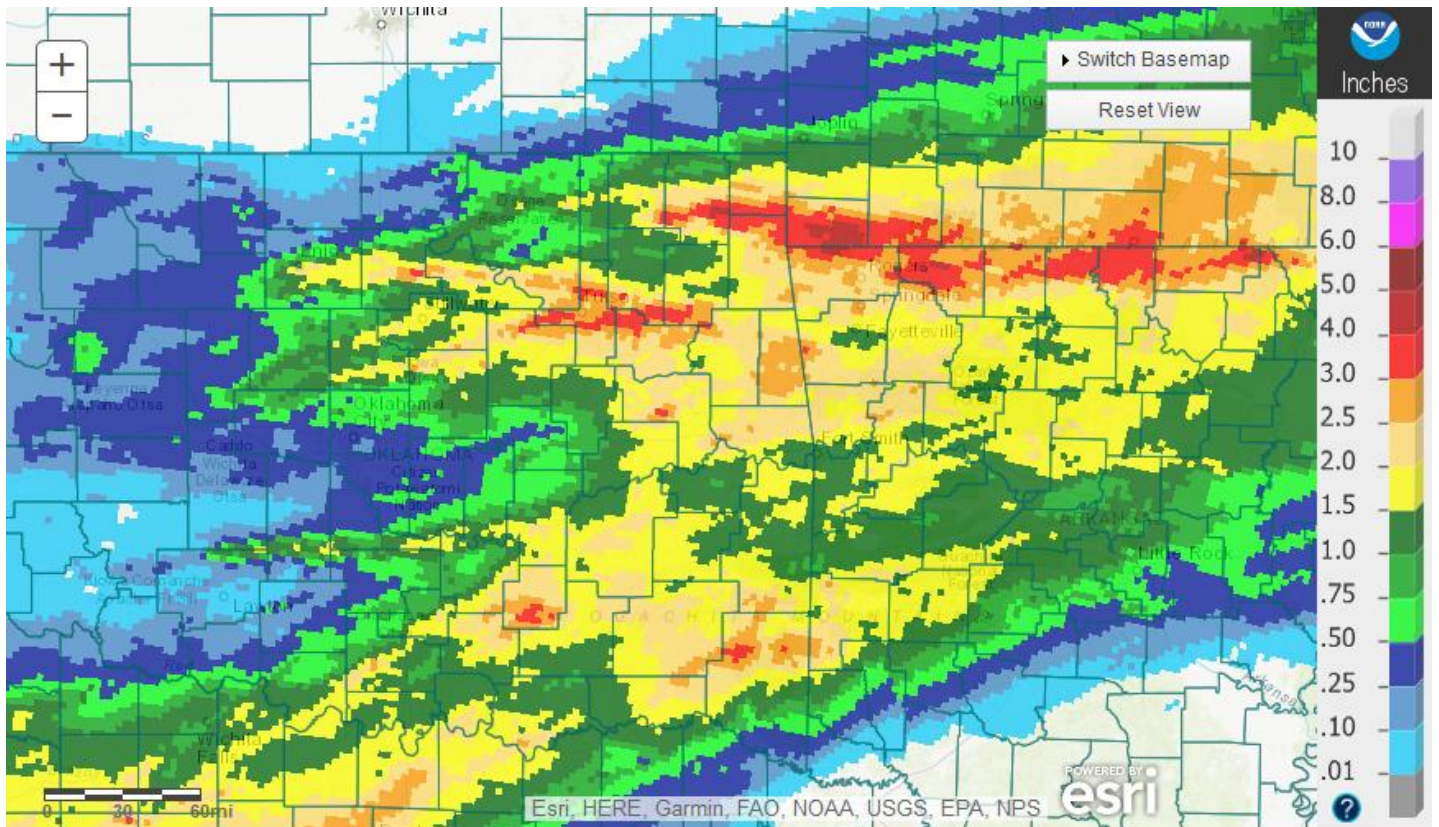


Fig. 4. 24-hour Estimated Observed Rainfall ending at 6am CST 11/07/2019.

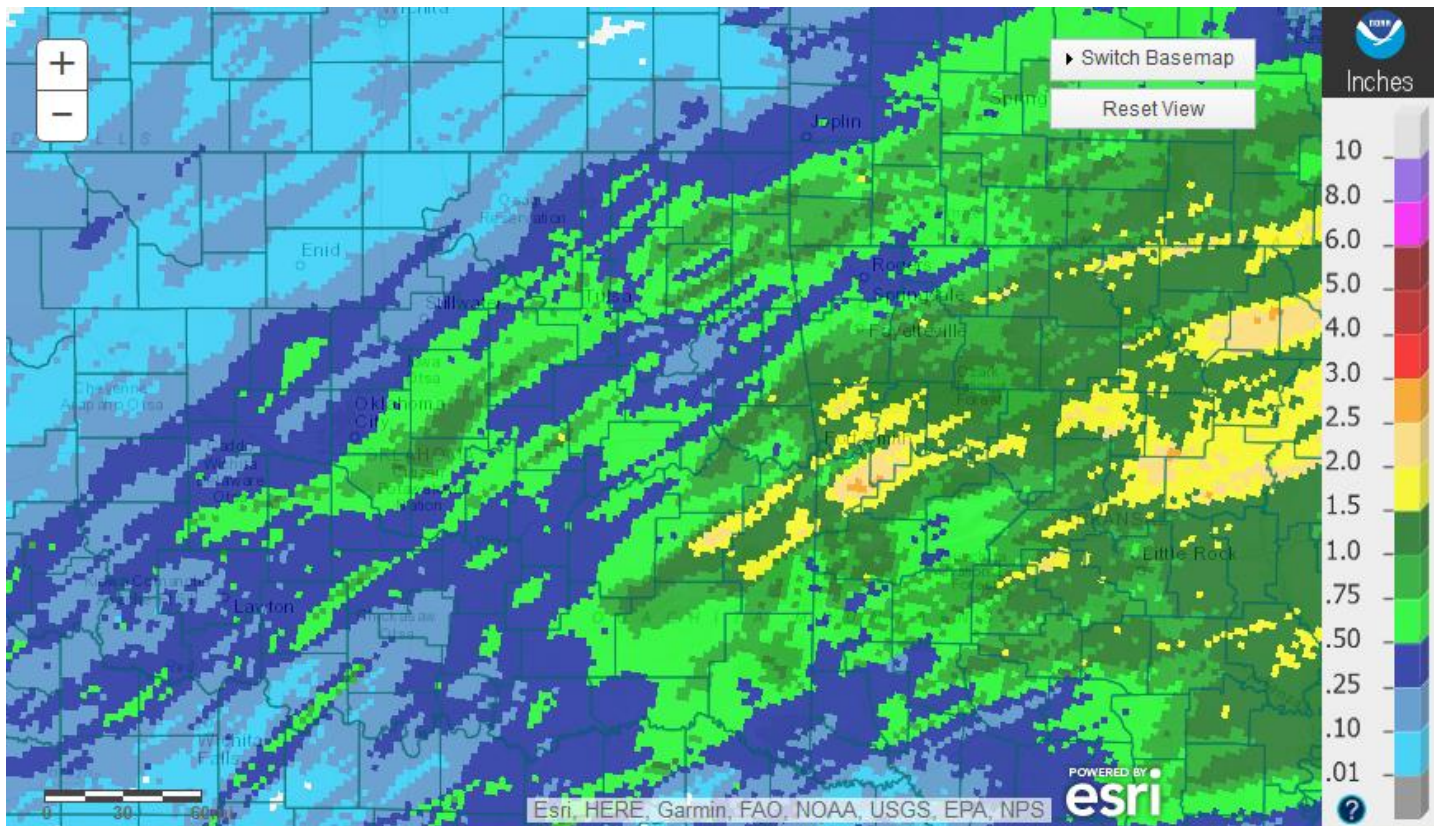


Fig. 5. 24-hour Estimated Observed Rainfall ending at 6am CST 11/22/2019.

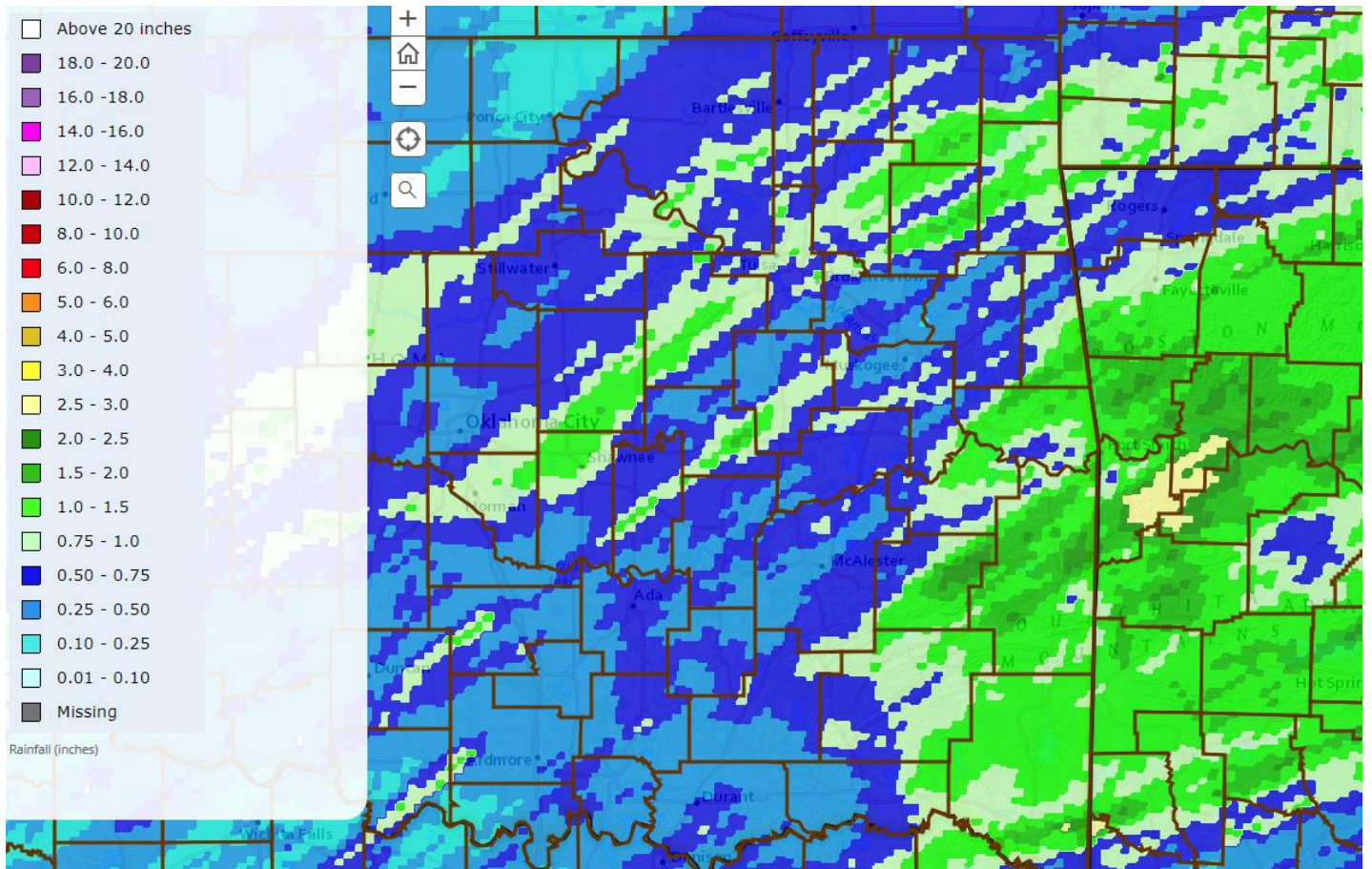


Fig. 6. 48-hour Estimated Observed Rainfall ending at 9am CST 11/22/2019.

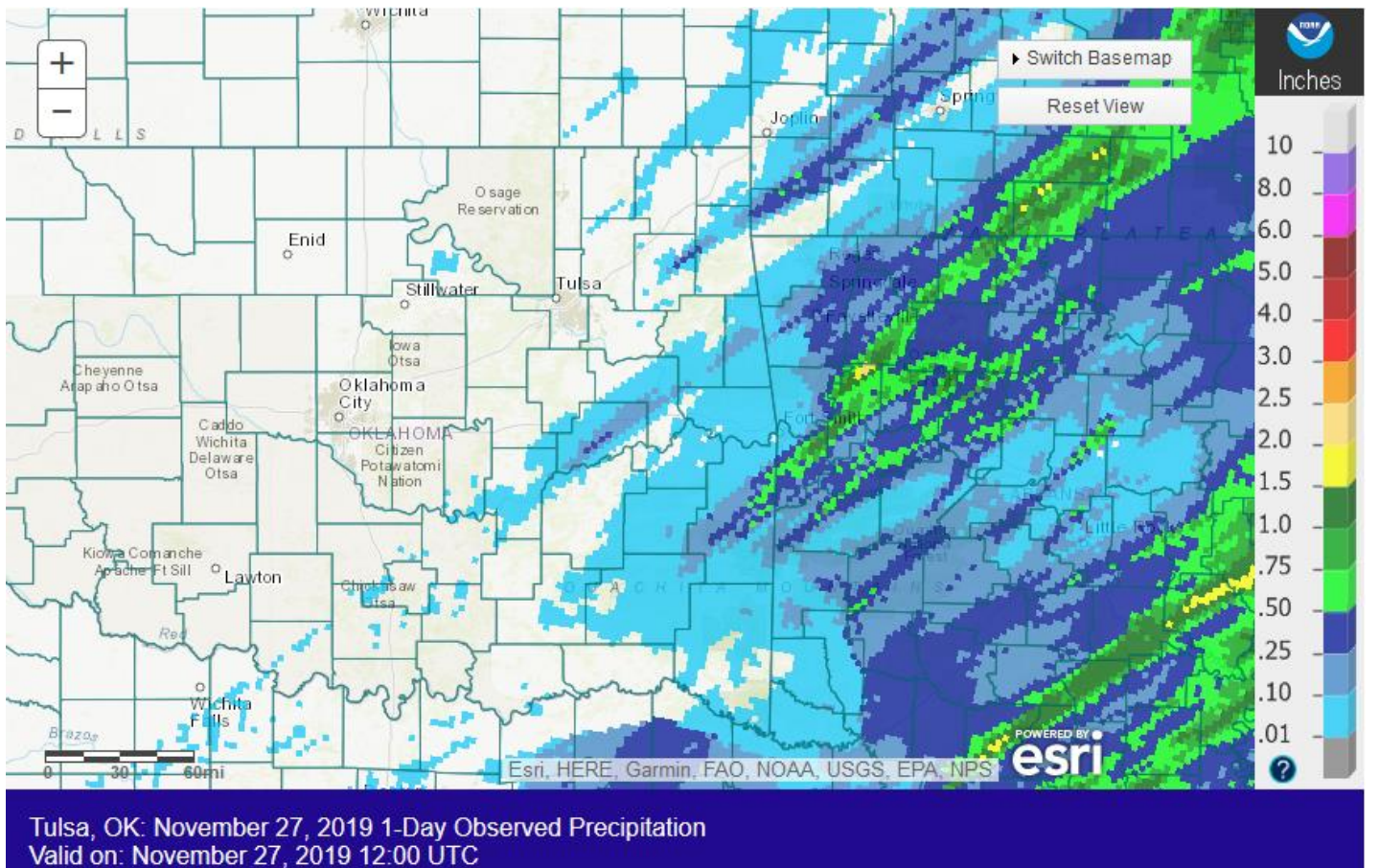


Fig. 7. 24-hour Estimated Observed Rainfall ending at 6am CST 11/27/2019.

Showers and isolated thunderstorms developed around noon on the 26th from southeast OK into northwest AR as a potent upper-level trof moved into the central Plains and interacted with an area of enhanced low-level moisture. As the corresponding surface low lifted northeast into KS, very strong winds developed over the area, with frequent wind gusts of 40 to 50 mph. The initial showers and thunderstorms pushed east of the area by late afternoon, with some additional development occurring across eastern OK during the evening. This secondary line of storms quickly moved east and exited the area by late evening. The wind gusts increased during the evening as a strong cold front moved through, with gusts reaching 60 to 70 mph. Severe (≥ 58 mph) non-thunderstorm wind gusts were measured at the Pawnee Mesonet station (58 mph), Bartlesville ASOS station (66 mph), Tulsa ASOS station (66 mph), Copan Mesonet station (63 mph), and the Northwest Arkansas Regional Airport (Highfill) ASOS station (58 mph). Rainfall totals were generally less than 0.50", though a portion of Sebastian, Franklin, and Madison Counties received 0.75" to near 2" of rain (Fig. 7).

Scattered rain showers began to develop on the morning of the 29th in a zone of stronger isentropic lift and warm air advection ahead of a cold front and continued through the afternoon hours. Deeper low-level moisture surged north into the area by evening as a strong upper-level jet streak lifted into the Central Plains in association with larger scale upper low moving over the Intermountain West. Scattered thunderstorms affected locations along and north of I-40 through the evening hours. A few of these storms became severe, producing hail of 1.25" (half dollar size) - 2" (hen egg size) in northeast OK. These thunderstorms shifted east of the region by midnight. A line of showers and thunderstorms then developed across eastern OK during the overnight hours with the aid of a 60 knot southwesterly low-level jet and a potent mid-level low spinning over western Nebraska. At the surface, a warm front had surged northward to near I-40, and a Pacific cold front stretched across northeast OK into south-central OK. This line of rain continued to move east across eastern OK and northwest AR, exiting the area by mid-morning on the 30th as the cold front moved east through the region. Rainfall totals from both rounds of precipitation ranged from 0.10" to near 2.5" (Fig. 8). The heaviest rain of 1.5"-2.5" fell over the Illinois River basin, resulting in minor flooding along the Illinois River (see preliminary hydrographs at the end of this report; see E3 Report for details).

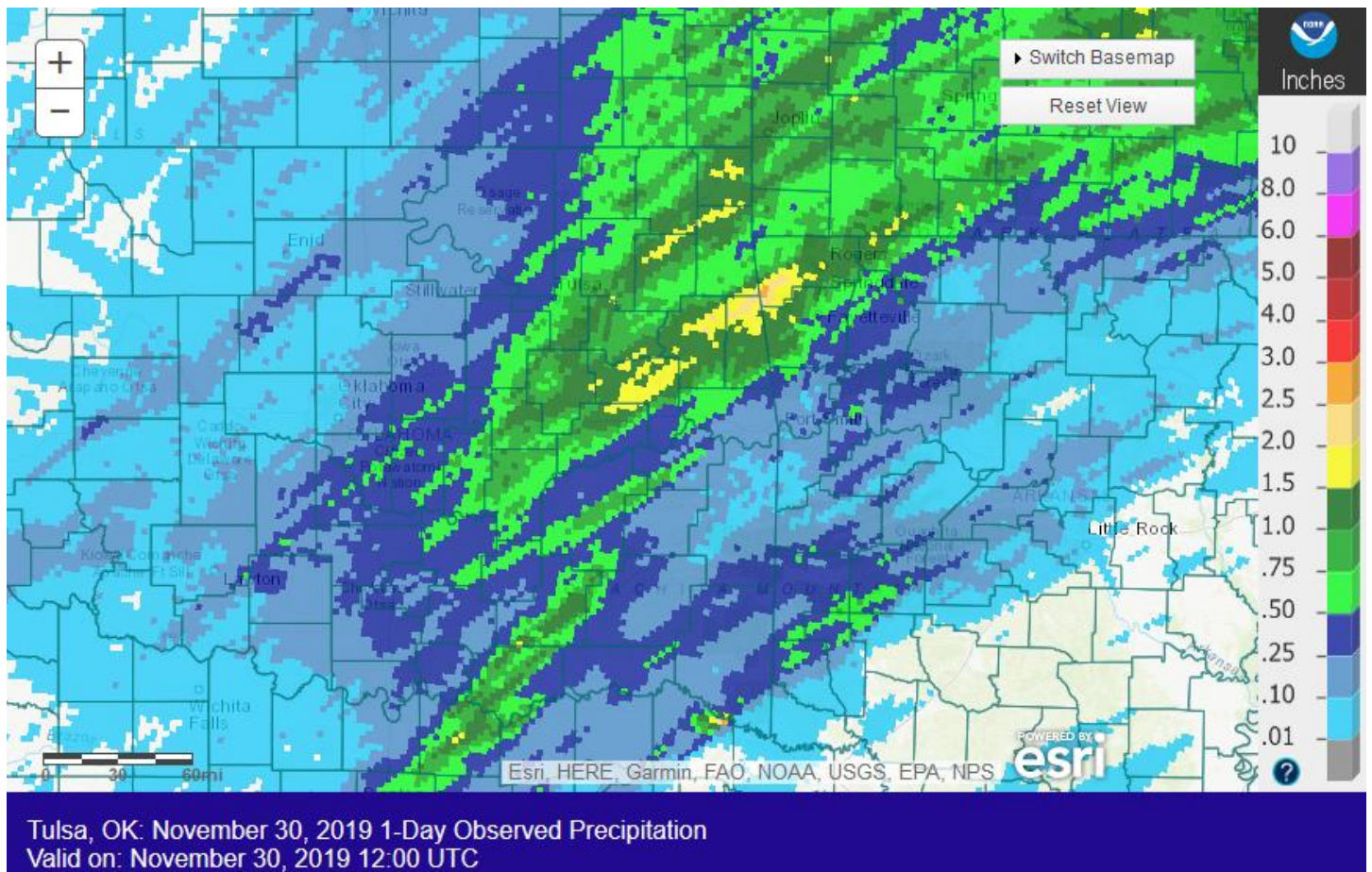


Fig. 8. 24-hour Estimated Observed Rainfall ending at 6am CST 11/30/2019.

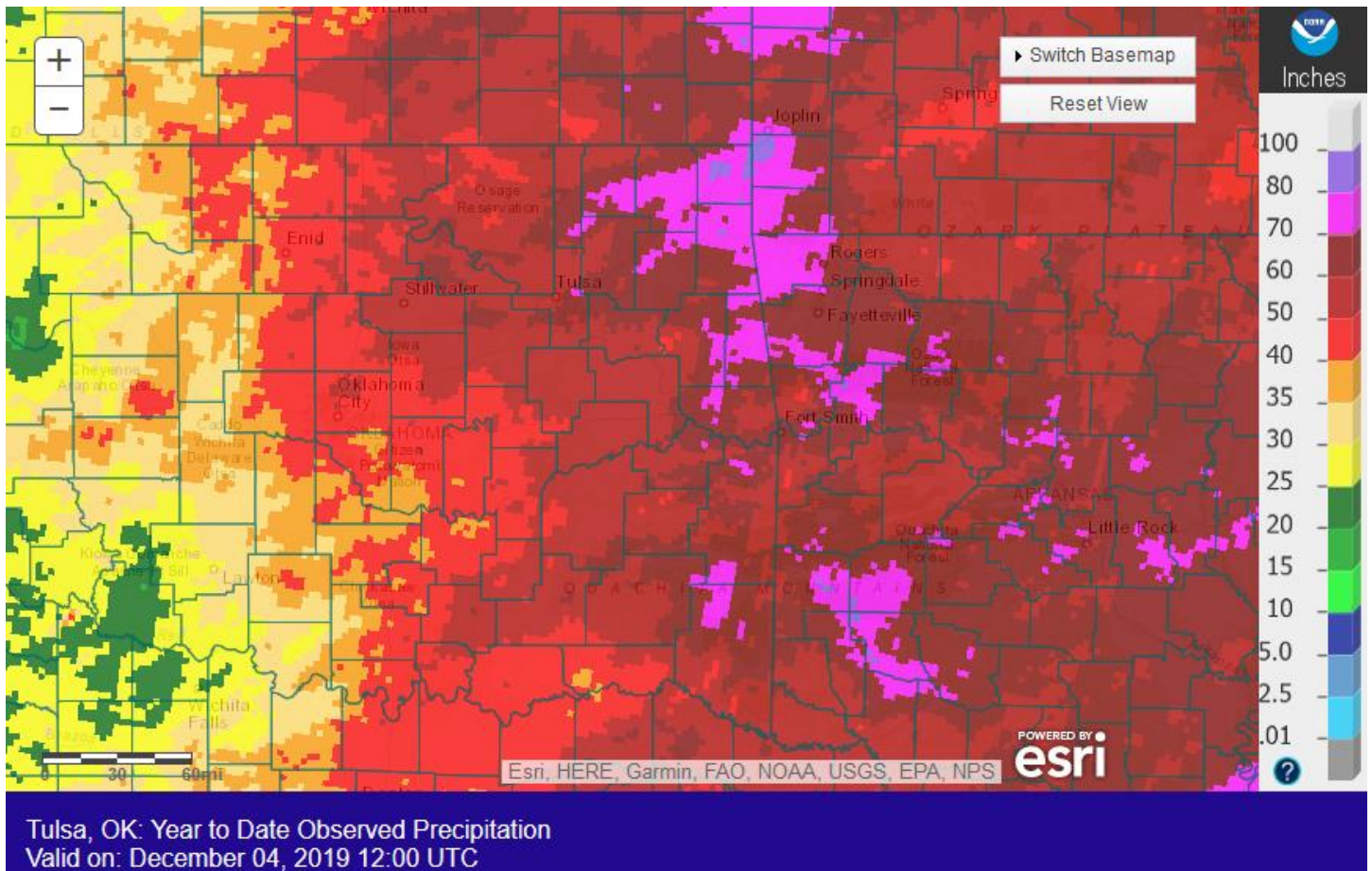
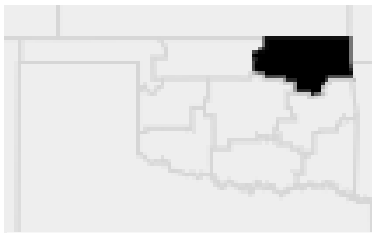


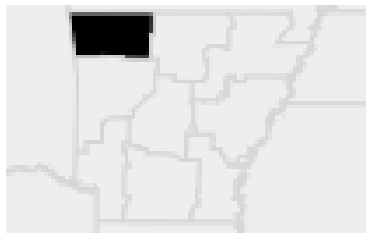
Fig. 9. Year-to-Date Estimated Observed Rainfall ending at 6am CST 12/04/2019.

By the end of November 2019, the northeast OK climate division had recorded its wettest 7-month (May-Nov, 48.77"), 8-month (Apr-Nov, 52.40"), 9-month (Mar-Nov, 55.37"), 10-month (Feb-Nov, 57.08"), 11-month/Year-to-Date (Jan-Nov, 60.77"), and 12-month (Dec 2018-Nov 2019, 64.20") periods since records began in 1895. The January – November total of 60.77" (Figs. 9, 10) is 6.08" significantly greater than the previous January – November record in 2008. The annual (calendar year) record of 57.82" from 1973 has also already been greatly surpassed, with a month still left in 2019.

By the end of November 2019, the northwest AR climate division had recorded its wettest 4-month (Aug-Nov, 27.19"), 5-month (Jul-Nov, 29.76"), 6-month (Jun-Nov, 37.25"), and 7-month (May-Nov, 46.58") periods since records began in 1895.



Oklahoma Climate Division 3



Arkansas Climate Division 1

Oklahoma, Climate Division 3, Precipitation, January-November

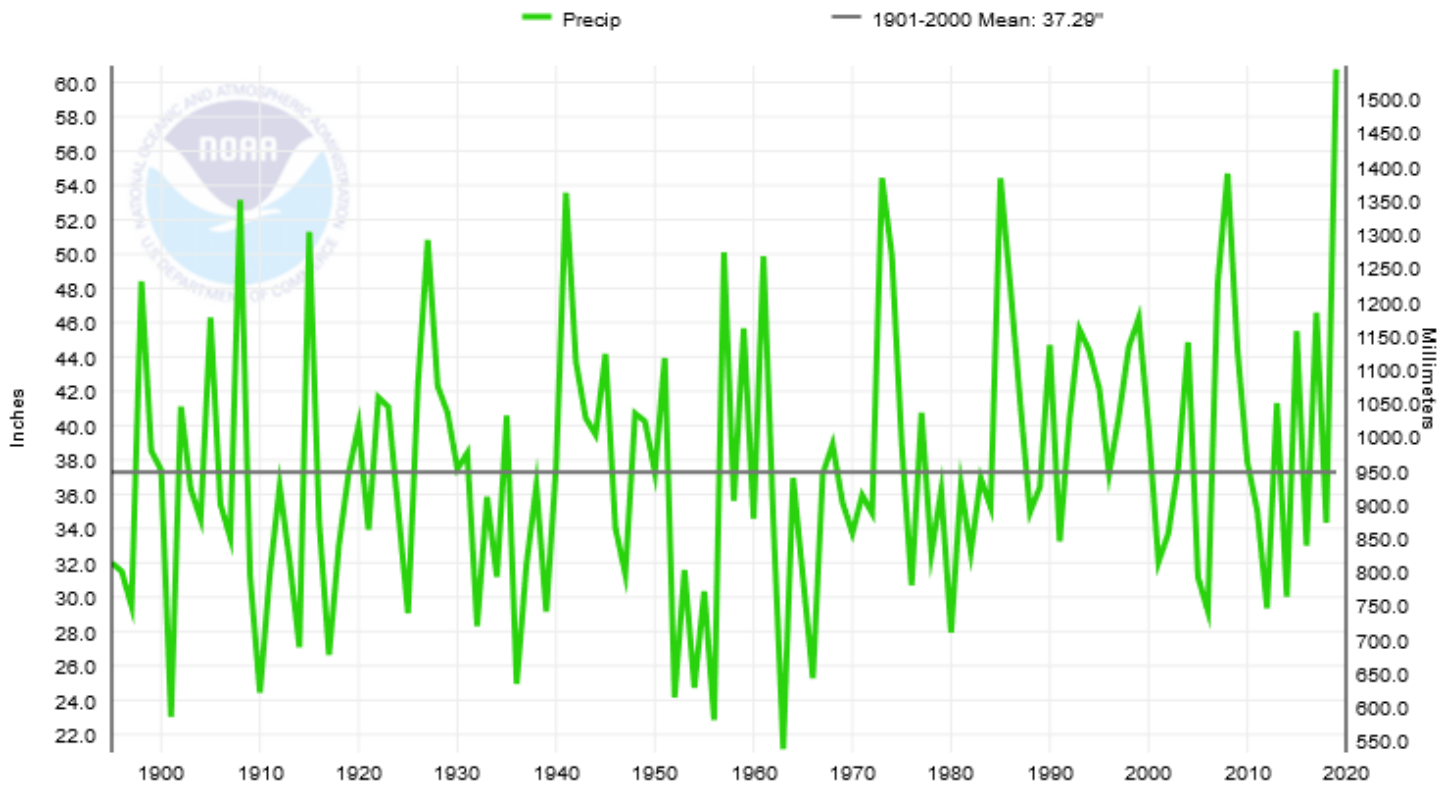


Fig. 10. Time series of January-November Rainfall from 1895 through 2019 for OK Climate Division 3 (northeast OK).

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in November 2019:

*CWYO2 became a daily river forecast point September 7, 2016

*MLBA4 and OZGA4 transferred to NWS Tulsa HSA February 5, 2014

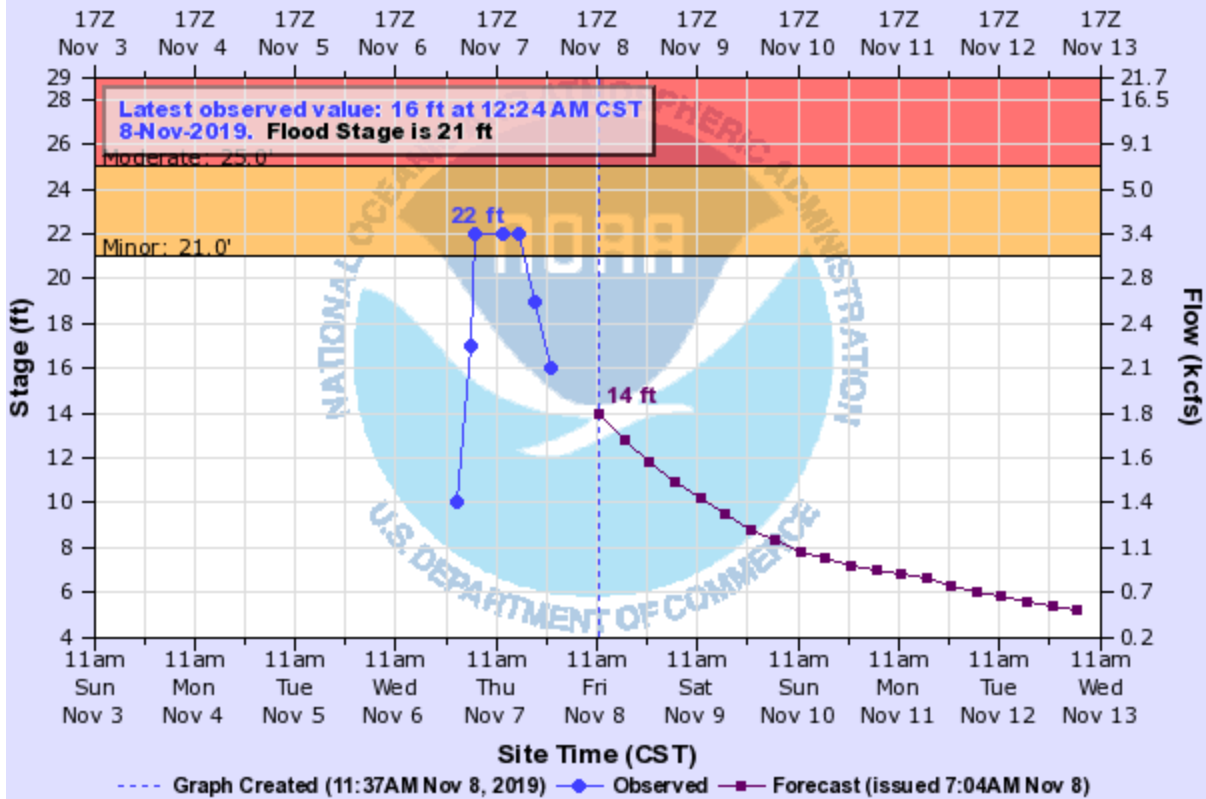
*Mixed case River Flood products began July 31, 2013

- 1 Flash Flood Warnings (FFW)
- 2 Flash Flood Statements (FFS)
- 1 Flash/Areal Flood Watches (FFA) (5 Watch FFA CON/EXT/EXA/EXB/CAN)
- 10 Urban and Small Stream Advisories (FLS)
- 2 Areal Flood Warnings (FLW)
- 1 Areal Flood Statements (FLS)
- 13 River Flood Warnings (FLW) (includes category increases)
- 36 River Flood Statements (FLS)
- 8 River Flood Advisories (FLS) (30 Advisory FLS CON/EXT/CAN)
- 4 River Flood Watches (FFA) (10 Watch FFA CON/EXT/CAN)
- 0 River Statements (RVS)
- 0 Hydrologic Outlooks (ESF)
- 0 Drought Information Statements (DGT)

Preliminary Hydrographs:

POLECAT CREEK NEAR SAPULPA

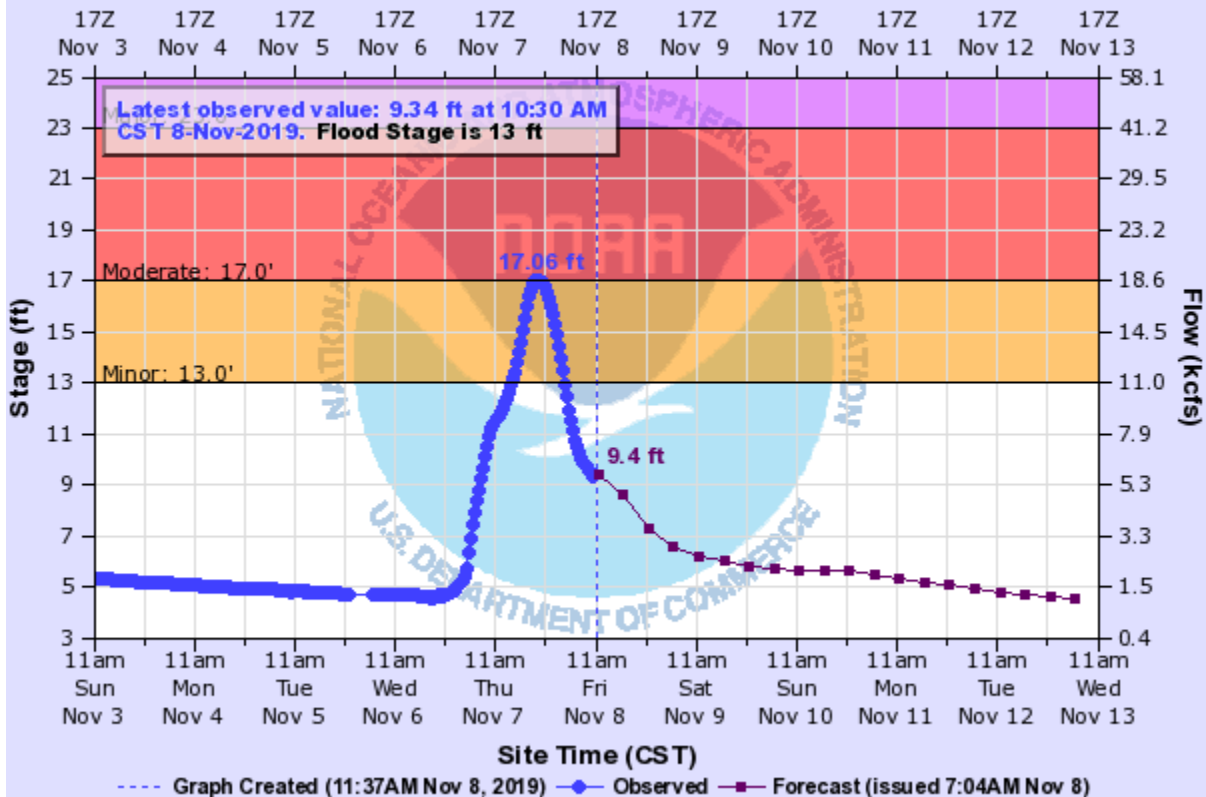
Universal Time (UTC)



SPCO2(plotting HGIRZ) "Gage 0" Datum: 626.2'

ILLINOIS RIVER (AR OK) NEAR WATTS

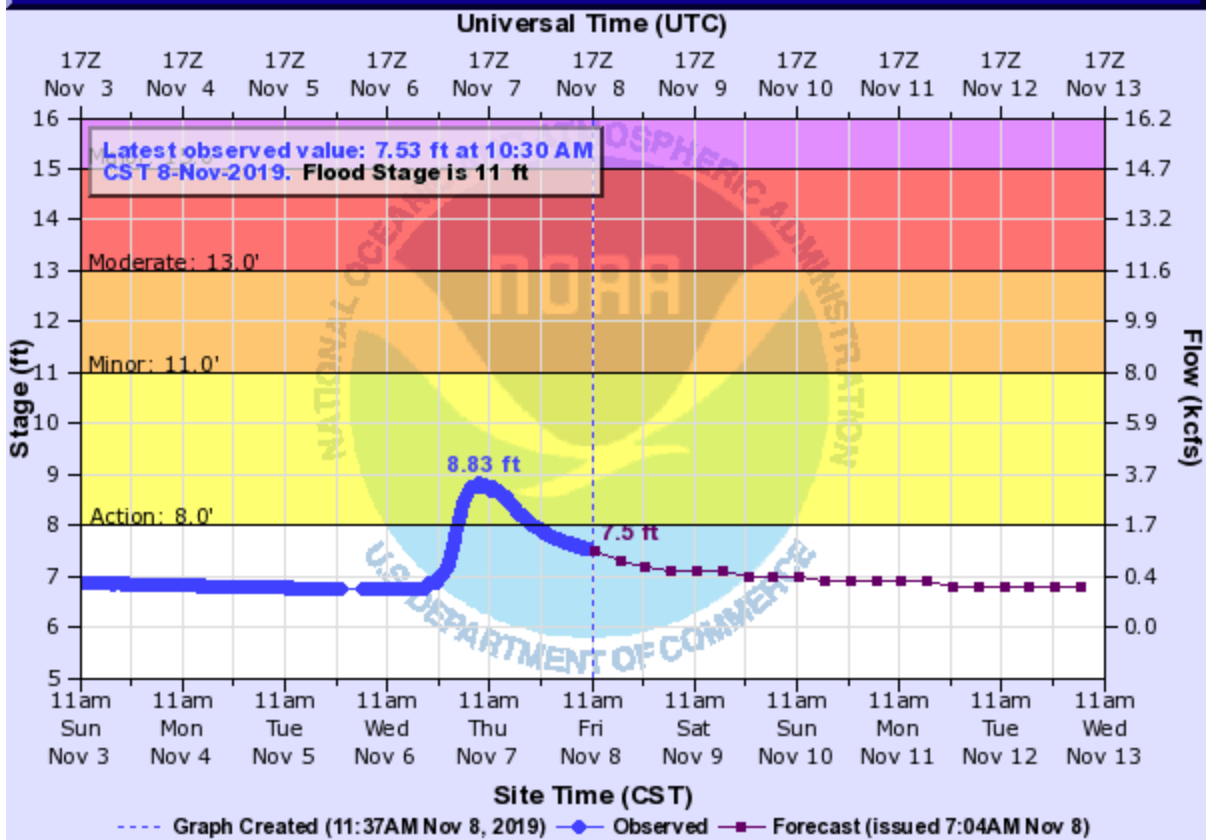
Universal Time (UTC)



WTTO2(plotting HGIRG) "Gage 0" Datum: 893.78'

Observations courtesy of US Geological Survey

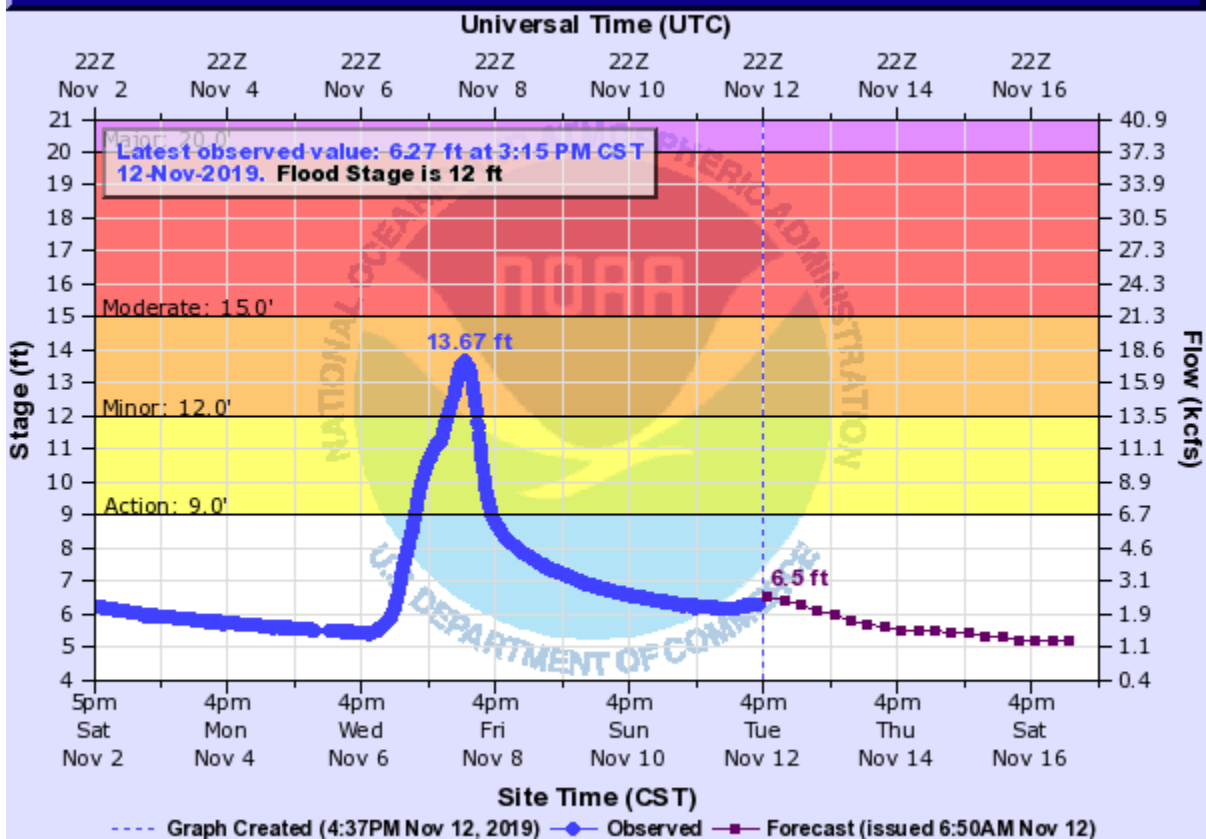
FLINT CREEK (OK) NEAR KANSAS



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

Observations courtesy of US Geological Survey

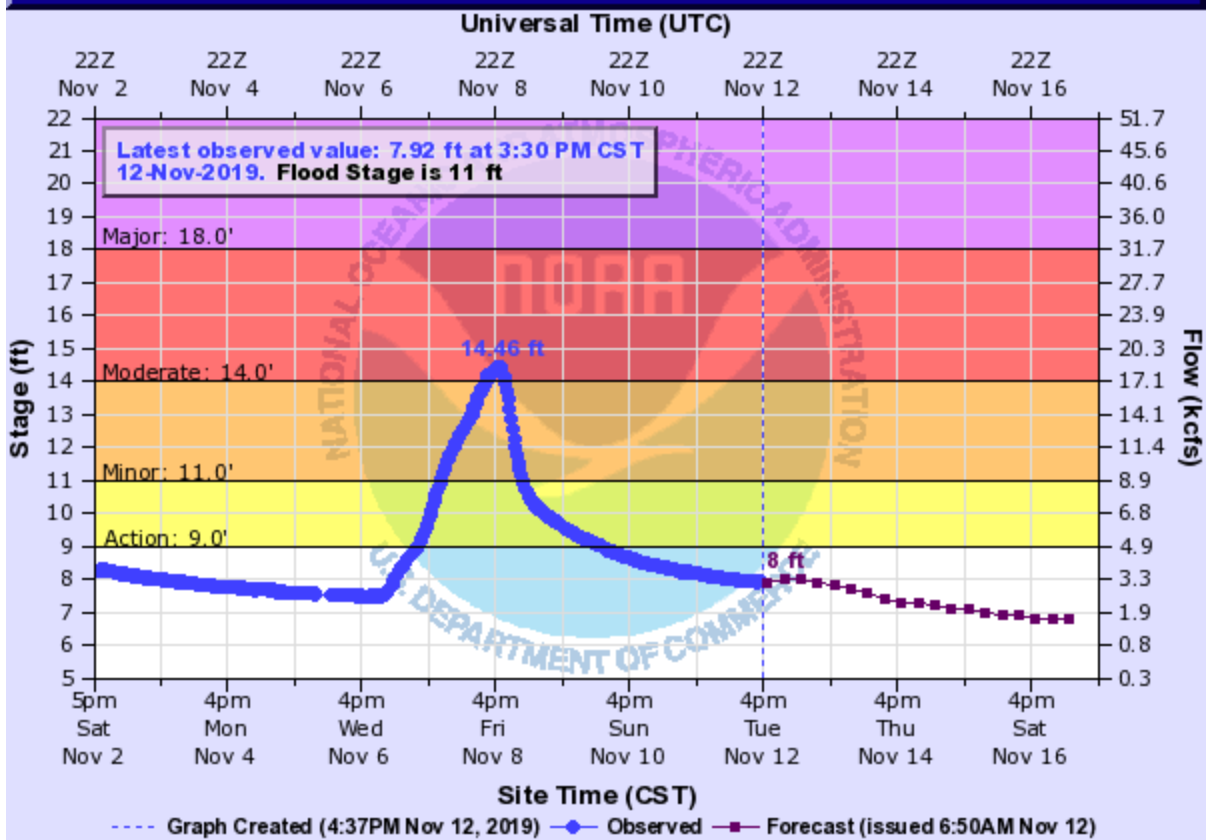
ILLINOIS RIVER (AR OK) AT CHEWEY



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

Observations courtesy of US Geological Survey

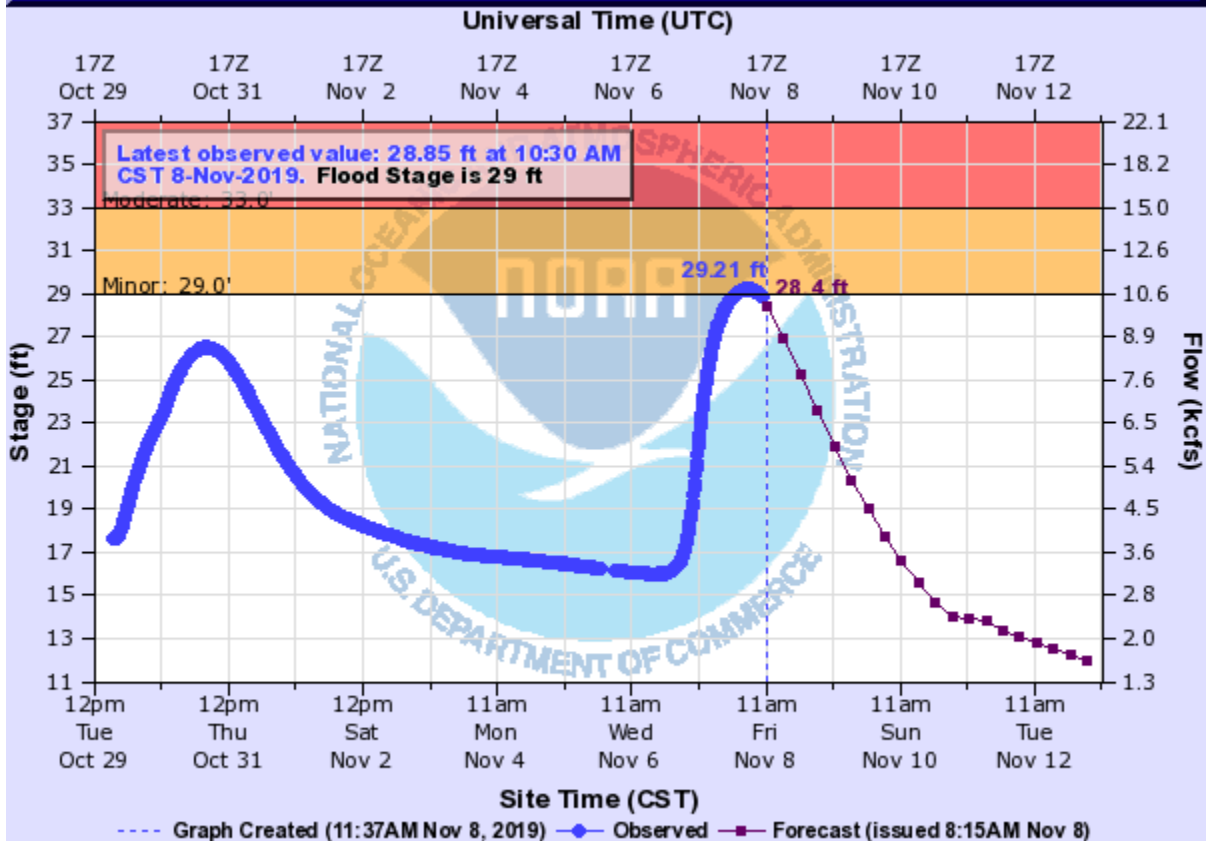
ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH



TALO2(plotting HGIRG) "Gage 0" Datum: 664.14'

Observations courtesy of US Geological Survey

POTEAU RIVER NEAR PANAMA

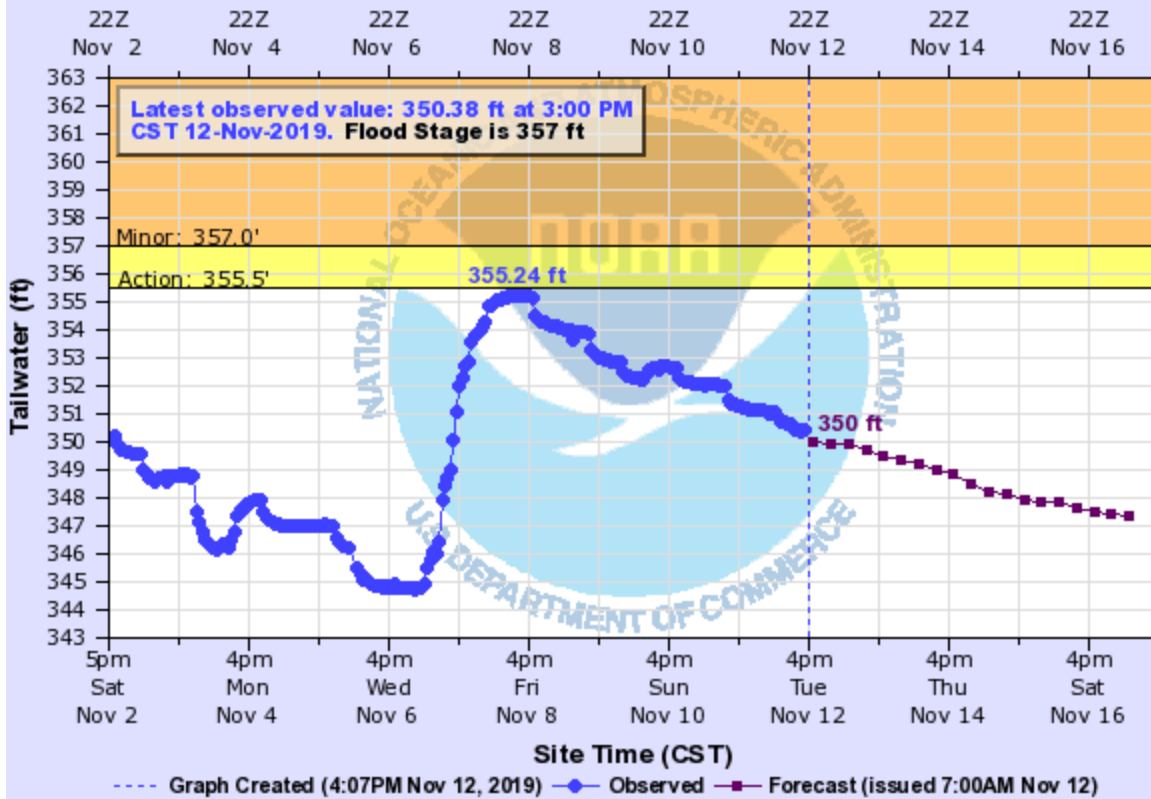


PANO2(plotting HGIRG) "Gage 0" Datum: 387.96'

Observations courtesy of US Geological Survey

ARKANSAS RIVER AT OZARK L/D TAILWATER

Universal Time (UTC)

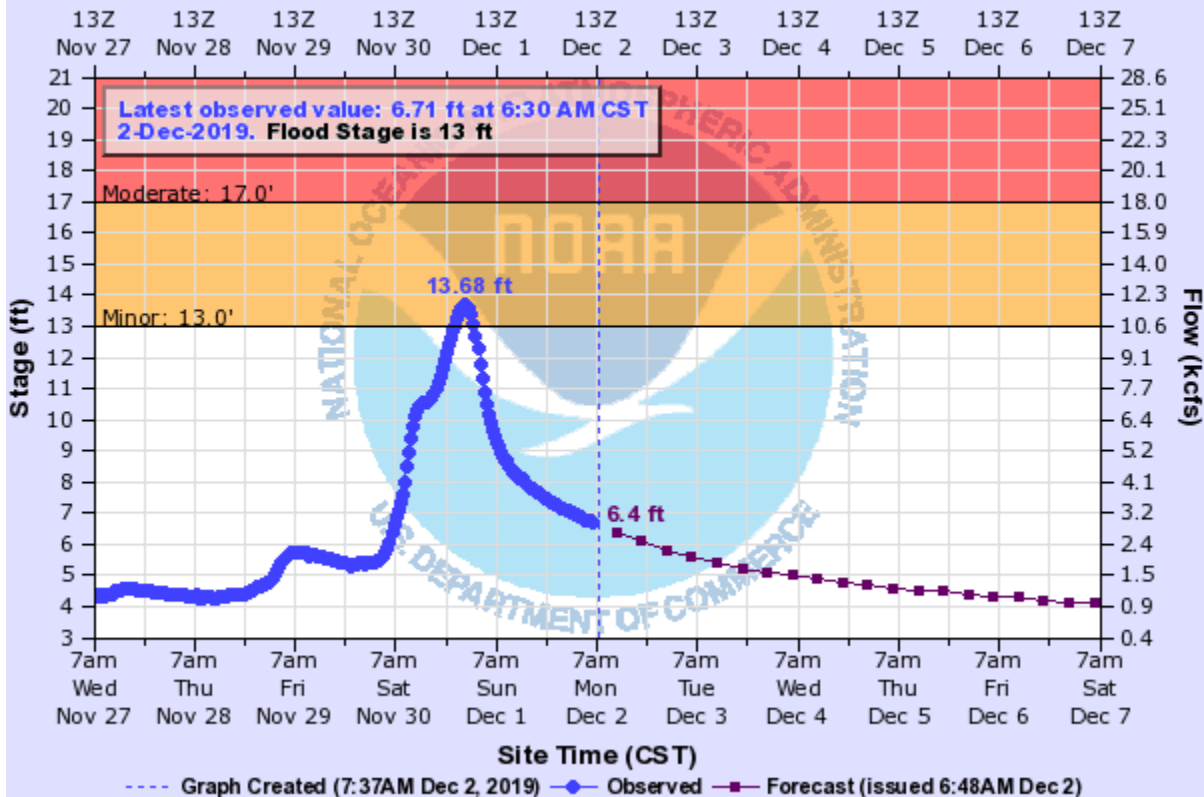


OZGA4(plotting HTIRG) "Gage 0" Datum: 0'

Observations courtesy of US Army Corps of Engineers - LRD

ILLINOIS RIVER (AR OK) NEAR WATTS

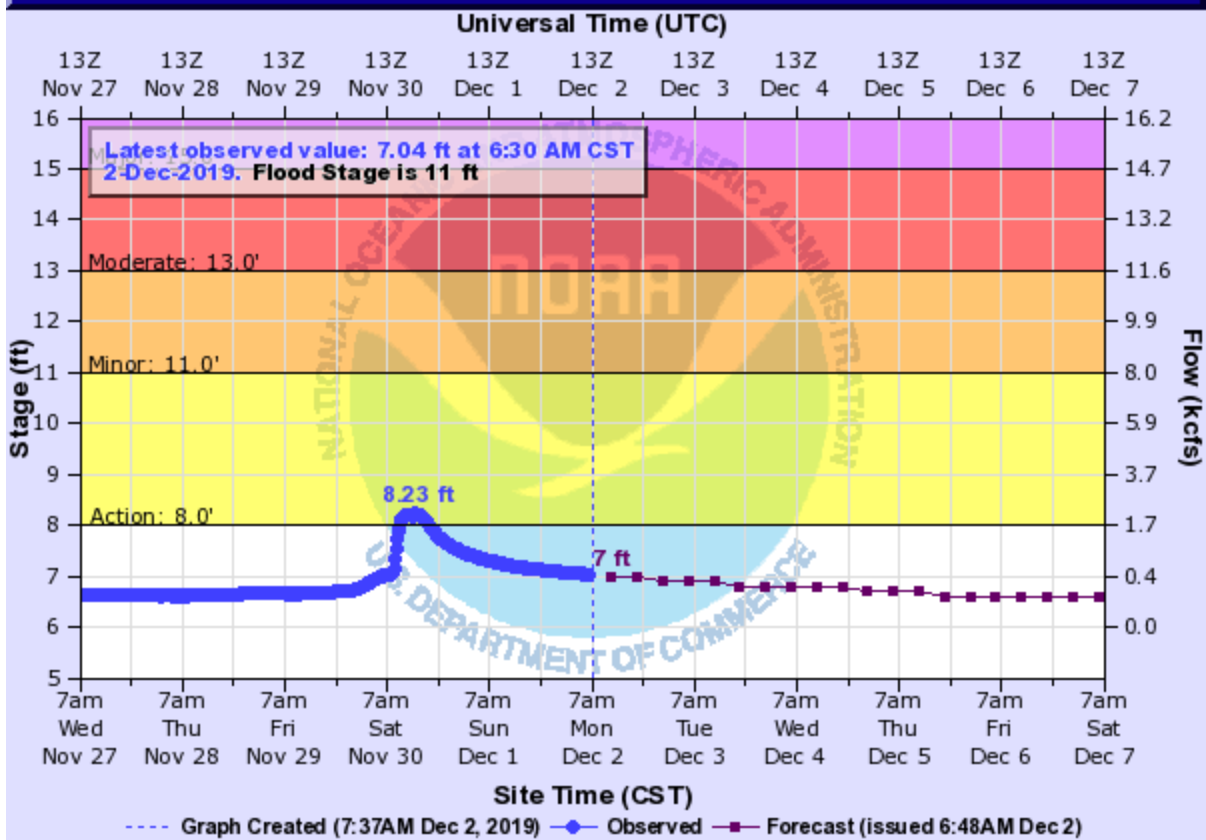
Universal Time (UTC)



WTTO2(plotting HGIRG) "Gage 0" Datum: 893.78'

Observations courtesy of US Geological Survey

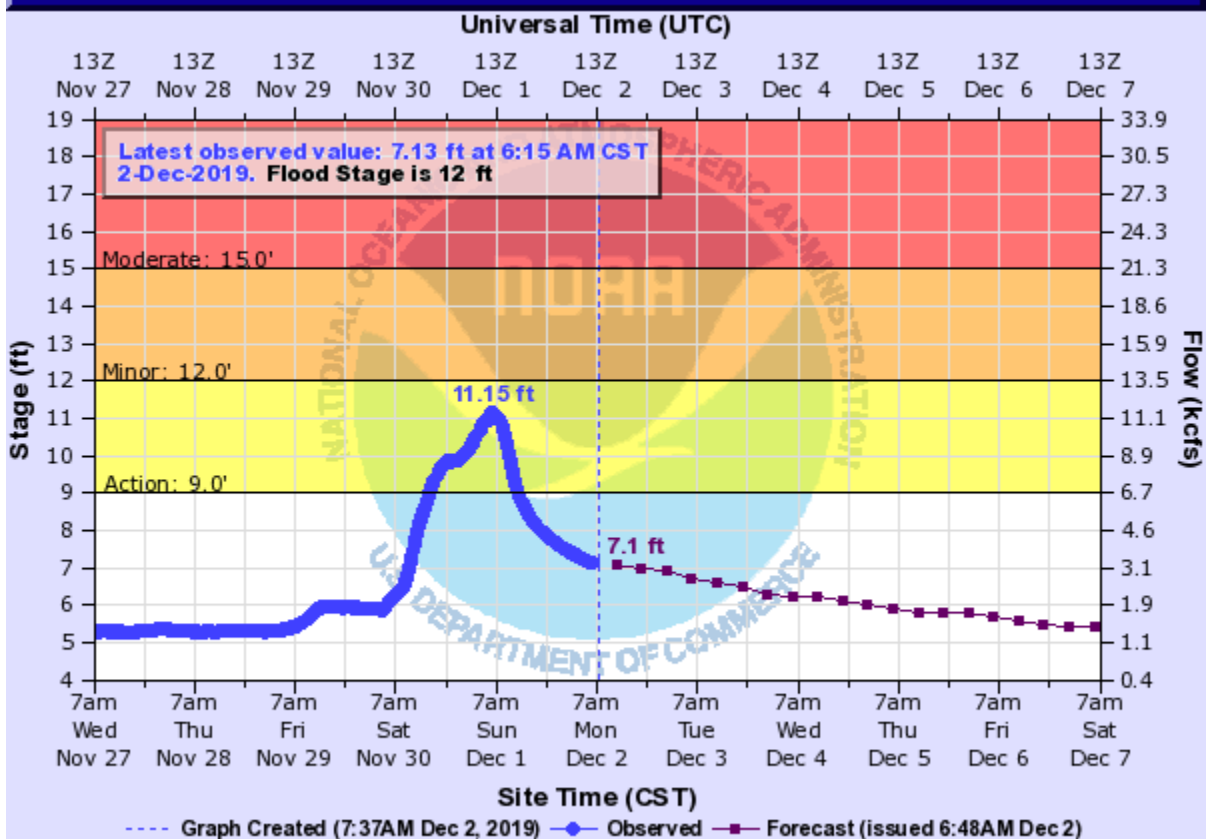
FLINT CREEK (OK) NEAR KANSAS



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

Observations courtesy of US Geological Survey

ILLINOIS RIVER (AR OK) AT CHEWEY

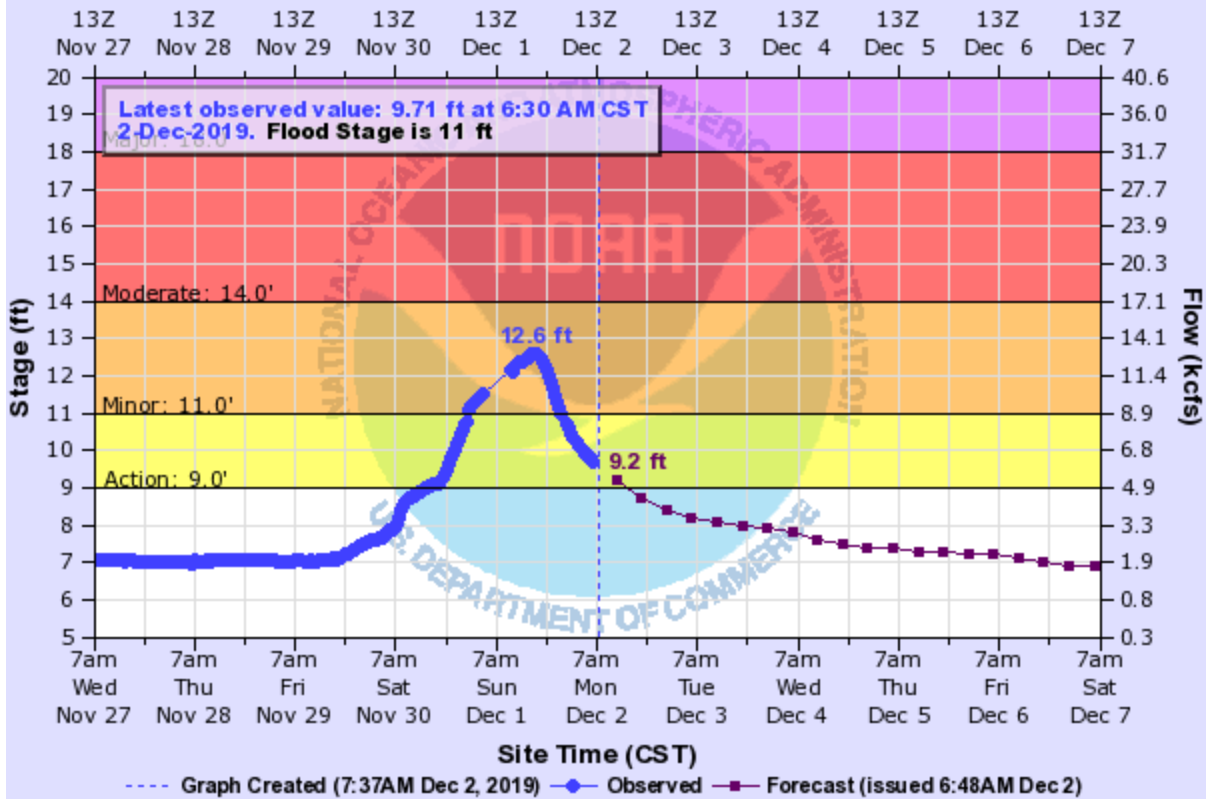


CWYO2(plotting HGIRG) "Gage 0" Datum: 800.88'

Observations courtesy of US Geological Survey

ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH

Universal Time (UTC)



TALO2(plotting HGIRG) "Gage 0" Datum: 664.14'

Observations courtesy of US Geological Survey