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 **January** YEAR **2016**
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 **February 8, 2016**

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.**

After record rainfall and major flooding at the end of December 2015, the entire HSA received well below normal rainfall in January 2016. Flooding from December lingered into the first few days of January in the Poteau River, Lower Arkansas River, Lee Creek, and Deep Fork River basins. A few rounds of light wintry precipitation occurred during January 2016. Normal precipitation for January ranges from 1.2 inches in Pawnee County to 2.2 inches in Haskell County. In the Ozark region of northwest Arkansas, precipitation averages 2.2 inches for the month. This report, past E-5 reports, and monthly hydrology and climatology summaries can be found at http://www.srh.noaa.gov/tsa/?n=hydro-monthly-summary.

Monthly Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for January 2016 ranged from around 0.25" to near 2". Most of the HSA received 0.25"-1" of rain this month. This corresponds to only 10%-50% of the normal January rain across most of eastern OK and northwest AR (Fig. 1b). A portion of northern Le Flore County received just 5%-10% of the normal January rain.

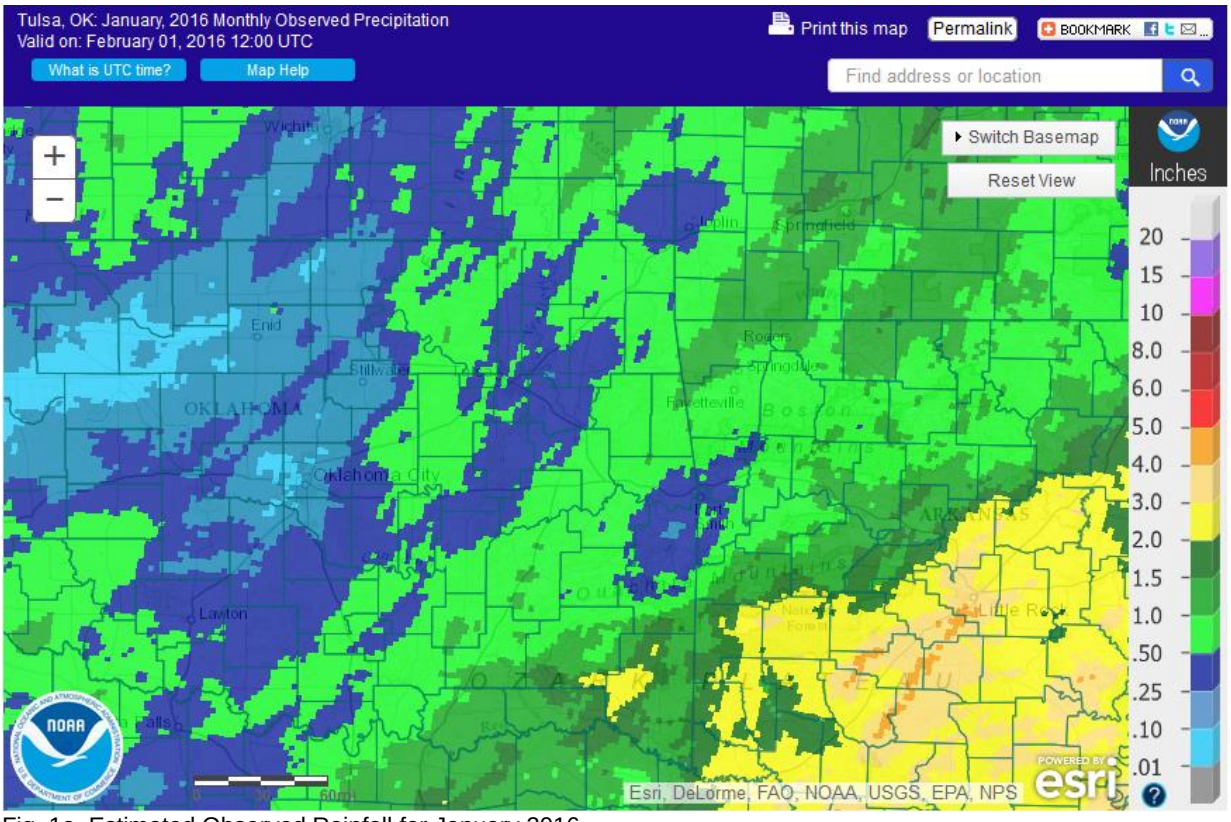


Fig. 1a. Estimated Observed Rainfall for January 2016

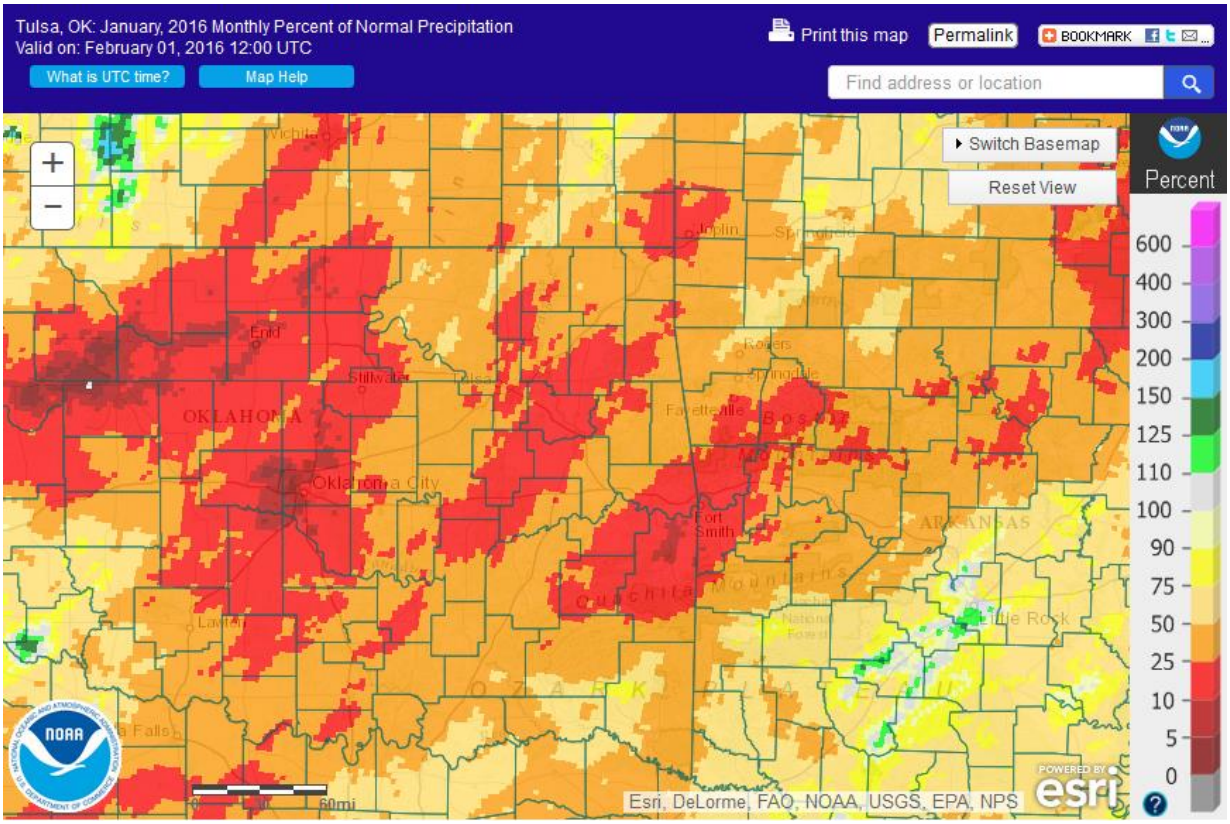


Fig. 1b. Estimated % of Normal Rainfall for January 2016

In Tulsa, OK, January 2016 ranked as the 53rd warmest January (38.1°F, tied 1945; since records began in 1905), the 25th driest January (0.61", tied 2012; since records began in 1888), and the 50th snowiest January (2.5", tied 1929; since 1900). The record latest occurrence of 24°F (killing freeze) was set on January 1, 2016 when the temperature fell to 23°F. The previous record was December 28 in both 1971 and 1941. Fort Smith, AR had the 56th warmest January (40.4°F, tied 1943; since records began in 1883) and the 6th driest January (0.39"; since records began in 1883). A trace of snow fell in January. Fayetteville, AR had the 32nd warmest (36.0°F, tied 1968) and the 5th driest (0.51", tied 1984) January since records began in 1950. A trace of snow fell in January.

Some of the larger precipitation reports (in inches) for January 2016 included:

Cloudy, OK (meso)	2.45	Antlers, OK (meso)	1.97	Antlers, OK (coop)	1.66
Antlers 6.3SE, OK (coco)	1.45	Hugo, OK (meso)	1.40	Copan, OK (meso)	1.37
Busch 0.4E, AR (coco)	1.34	Krebs 0.3WNW, OK (coco)	1.34	Northwest AR Reg. Arpt (ASOS)	1.24

Some of the lowest precipitation reports (in inches) for January 2016 included:

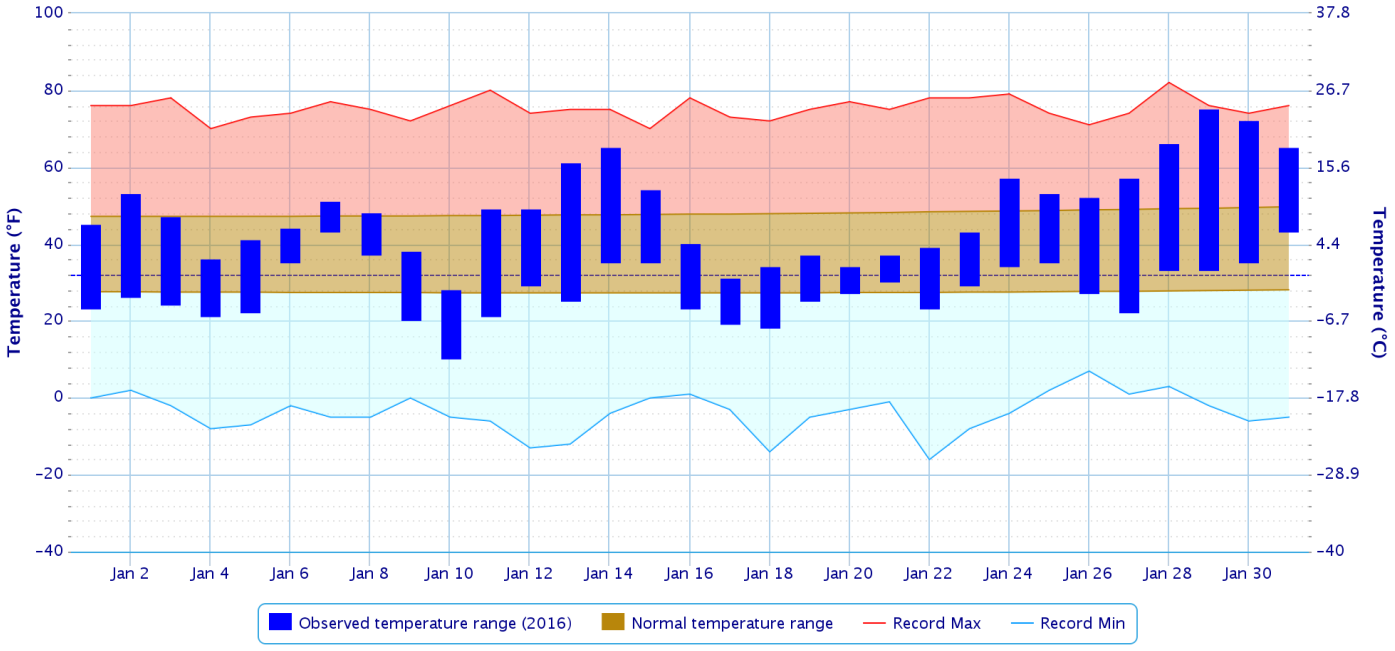
Tulsa, OK (meso)	0.36	Porter, OK (meso)	0.36	Inola, OK (meso)	0.36
Haskell, OK (meso)	0.37	Wister, OK (meso)	0.38	Fort Smith, OK (ASOS)	0.39
Okmulgee, OK (meso)	0.39	Burbank, OK (meso)	0.41	Jenks Riverside Arpt, OK (ASOS)	0.41

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

Rank since 1921	January 2016	Winter-to-Date (Dec 1 – Jan 31)	Last 90 Days (Nov 3 – Jan 31)	Water Year-to-Date (Oct 1 – Jan 31)	Cool Growing Season (Sep 1 – Jan 31)	Last 180 Days (Aug 5 – Jan 31)	Last 365 Days (Feb 1, 2015-Jan 31, 2016)
Northeast OK	13th driest	1st wettest	1st wettest	3rd wettest	11th wettest	5th wettest	2nd wettest
East Central OK	19th driest	1st wettest	1st wettest	1st wettest	2nd wettest	1st wettest	1st wettest
Southeast OK	21st driest	2nd wettest	1st wettest	1st wettest	1st wettest	1st wettest	1st wettest
Statewide	22nd driest	3rd wettest	1st wettest	1st wettest	6th wettest	9th wettest	1st wettest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

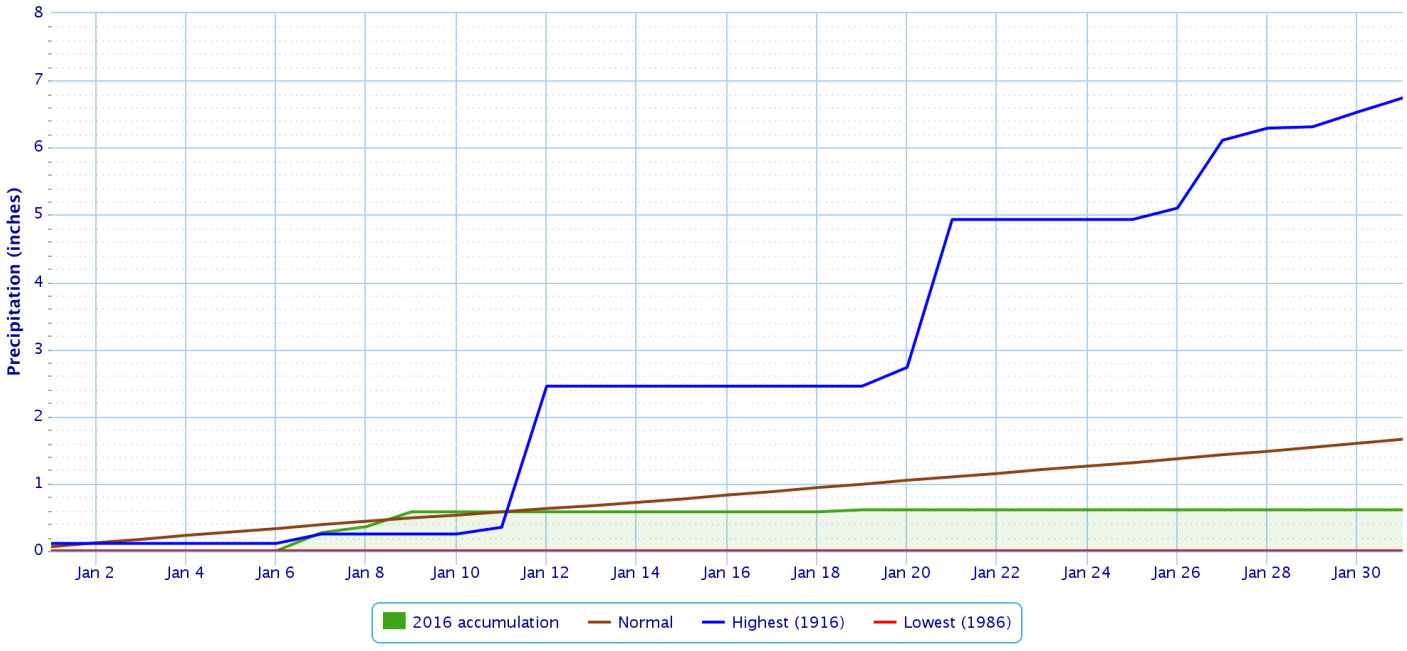
Period of Record – 1905-01-06 to 2016-01-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

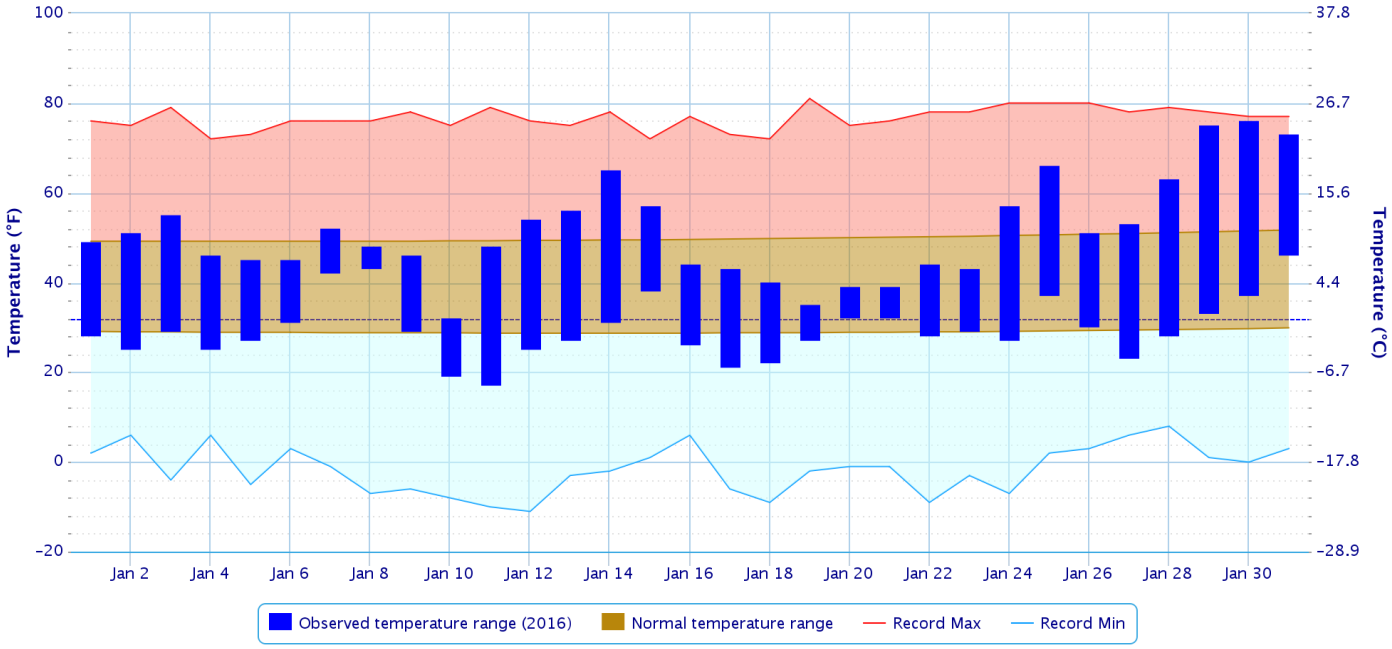
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

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

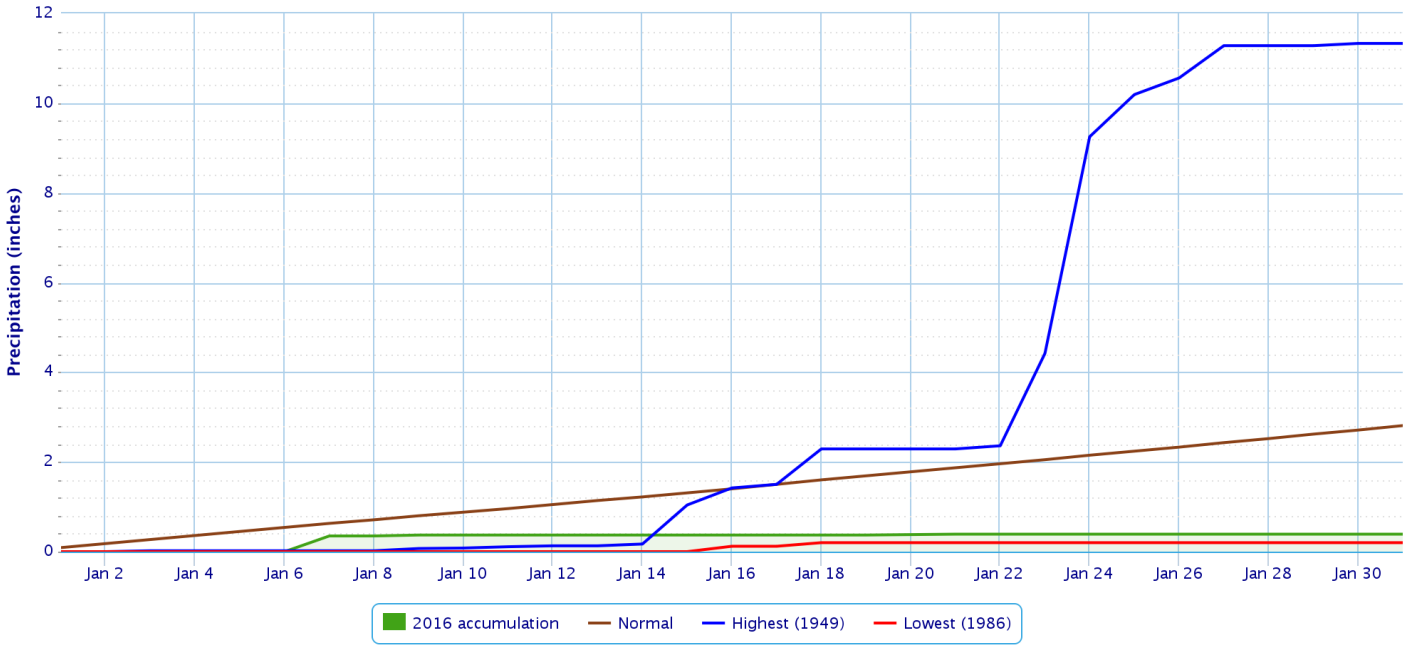
Period of Record – 1882-06-01 to 2016-01-31. Normals period: 1981-2010. Click and drag to zoom chart.



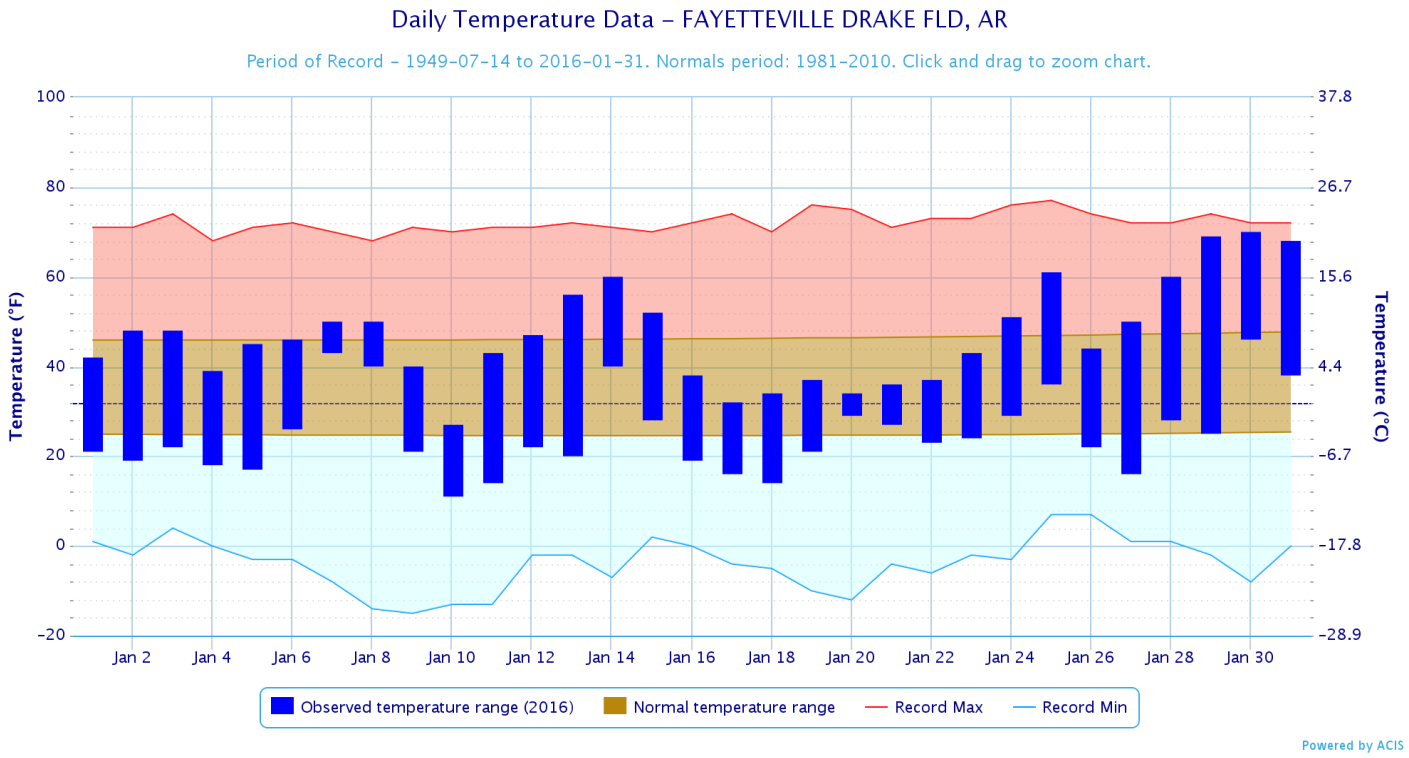
Powered by ACIS

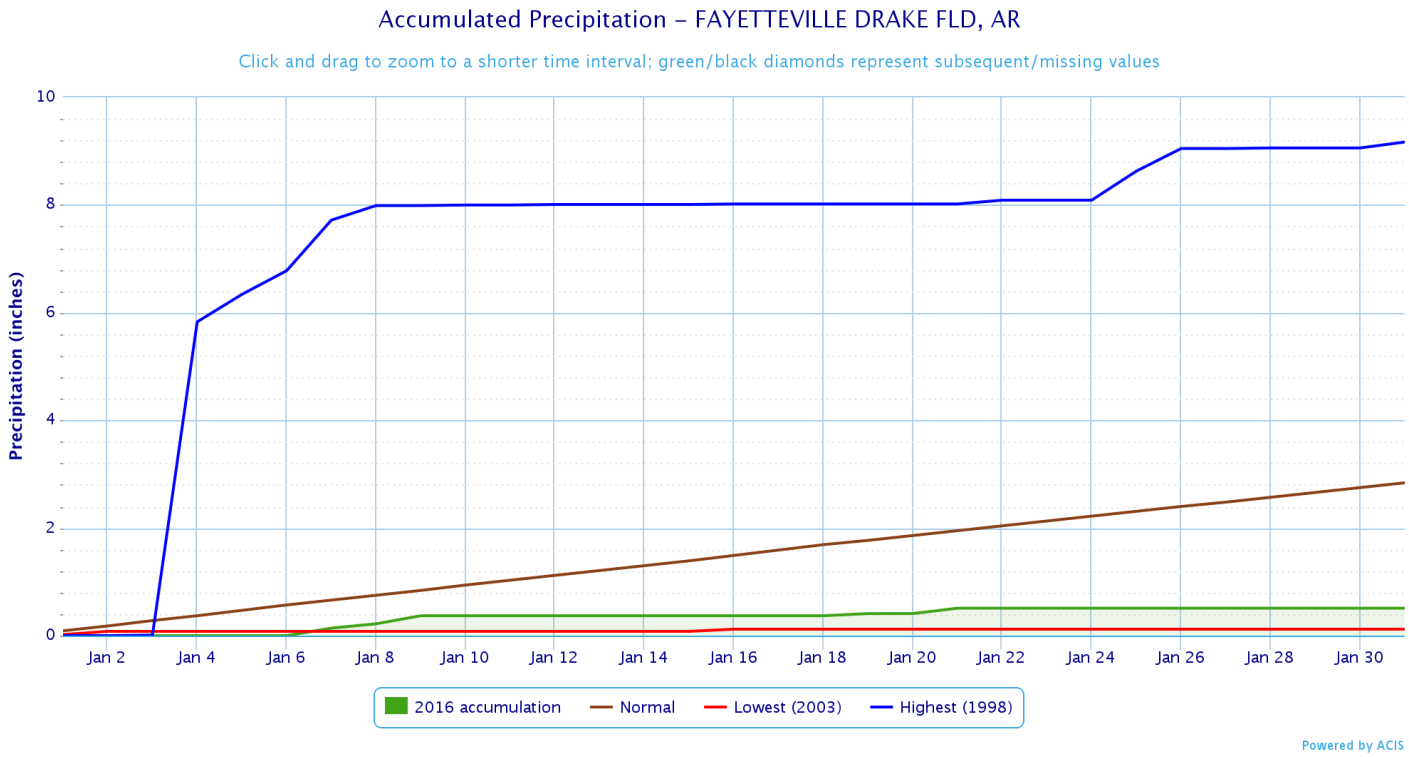
Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

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



Powered by ACIS



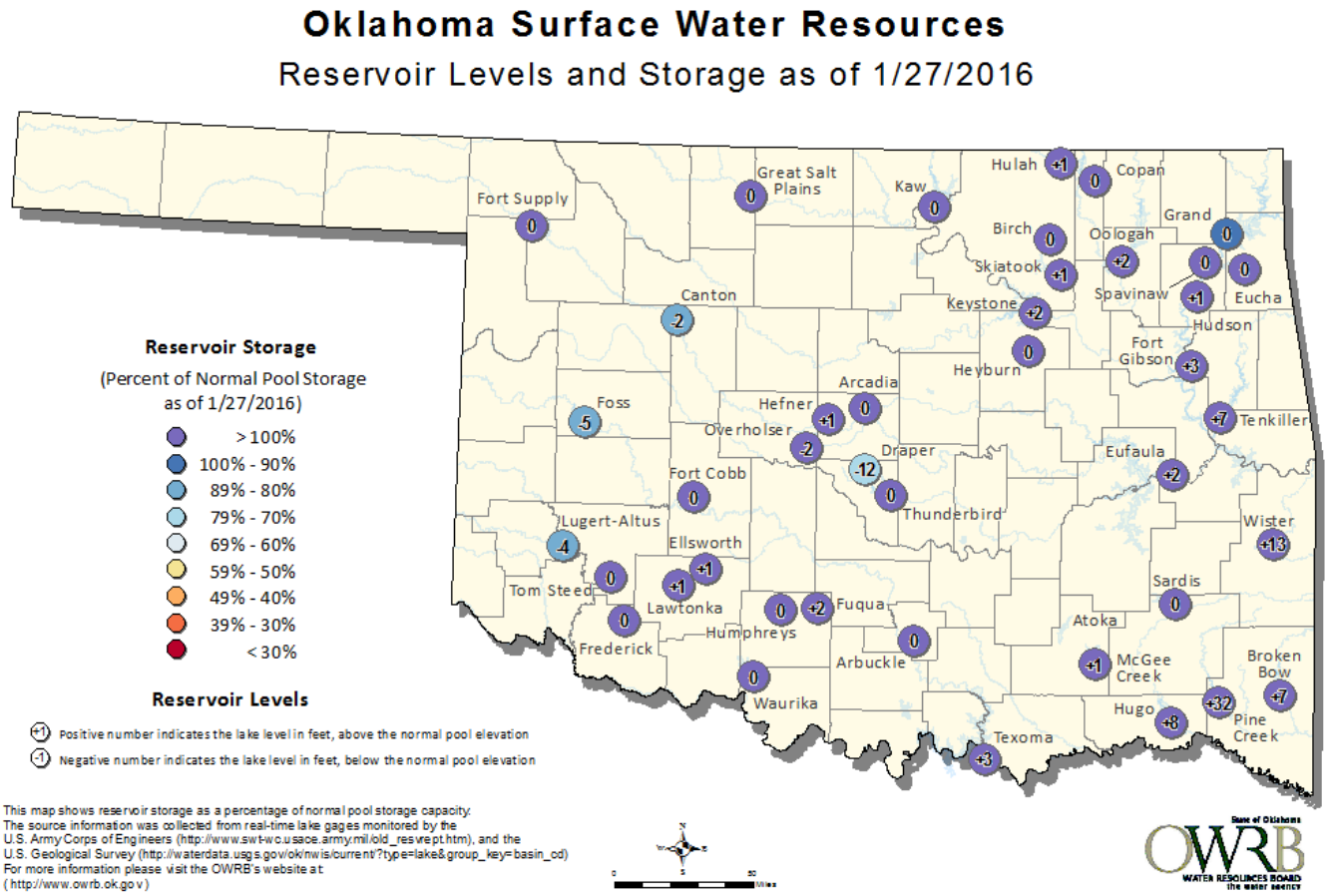


Drought

According to the U.S. Drought Monitor (USDM) from January 26, 2016, there were no drought or abnormally dry conditions present in eastern OK and northwest AR.

Reservoirs

According to the USACE, most of the major reservoirs in the HSA were operating at their conservation level or within 5% of the flood control pool as of 2/01/2016. Only a few reservoirs had higher levels: Beaver Lake 181%, Wister Lake 120%, and Eufaula Lake 106% of their conservation pools.



Outlooks

The Climate Prediction Center (CPC) outlook for February 2016 (issued January 31, 2016) indicates equal chances for above, near, and below normal temperatures across all of eastern OK and northwest AR. This outlook also calls for a slightly enhanced chance for above median precipitation across eastern OK and equal chances for above, near, and below median precipitation across northwest AR. This outlook is based on both short- and extended-range weather forecasts. It appears there will be a lack of "typical" El Niño response for the first half of the month.

For the 3-month period February-March-April 2016, CPC is forecasting an equal chance for above, near, and below normal temperatures and precipitation across all of eastern OK and northwest AR (outlook issued January 21, 2016). According to CPC, strong El Niño conditions persist, and El Niño has likely peaked. This event is likely to transition to neutral conditions during the late spring or early summer 2016. Therefore, this outlook is based primarily on both statistical and dynamical forecast tools, with a heavy reliance on typical impacts resulting from an El Niño response.

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

January 1-15

Several compact waves quickly traversed the region on the 5th-9th, bringing several rounds of precipitation. The first occurred late evening on the 5th, resulting in showers and thunderstorms moving from central OK into

northeast OK. This activity brought a few hundredths to near 0.50” of rain to Pawnee, Osage, Washington (OK), Nowata, and Craig Counties through the overnight hours. Additional widely scattered showers developed during the sunrise hours of the 6th, bringing some light rain, around 0.10” or less, to northwest AR as the wave departed. The next wave quickly followed, with rain developing again over central OK and moving into the same areas of northwest OK late on the 6th. Additionally, showers and thunderstorms blossomed over south central OK and north central TX and move northeast into east central and southeast OK a little before midnight. The rain continued to spread north and east, affecting all of eastern OK and northwest AR, during the overnight through morning hours, before finally exiting the HSA by noon on the 7th. Rainfall totals ranged from around 0.10” to near 0.75”. A few showers brought 0.10”-0.25” of rain during the evening of the 7th to Osage, Washington (OK), and Nowata Counties.

A broad, fairly potent and intensifying low tracked from New Mexico across OK on the 8th-9th while phasing with northern stream energy diving through the northern Plains. This aided in a surge of much colder early on the 9th as the low approached. A line of showers developed during the afternoon on the 8th in the vicinity of I-44, with a rapid increase in precipitation coverage through the evening across northeast and east central OK as the forcing increased ahead of the approaching low. Showers and thunderstorms then spread east into northwest and west central AR during the night. Rainfall totals ranged from a few hundredths of an inch to around 0.50”, with little to now rain across much of southeast OK. By the morning of the 9th, an impressive coupled jet structure set up to the northeast, allowing the surface low to intensify. This brought a round of snow to northeast OK and far northwest AR after sunrise, and some light rain and/or flurries elsewhere. A couple of bands of heavier snow resulted in 1”-3.5” of snow in portions of Creek, Tulsa, and Rogers Counties, with 0.50”-1” elsewhere along the I-44 corridor (Figs. 2, 3). Rainfall and snow liquid equivalent amounts were less than 0.10” for most of the area, with isolated areas of near 0.25”. All of the precipitation came to an end by midafternoon as the low moved east of the area.

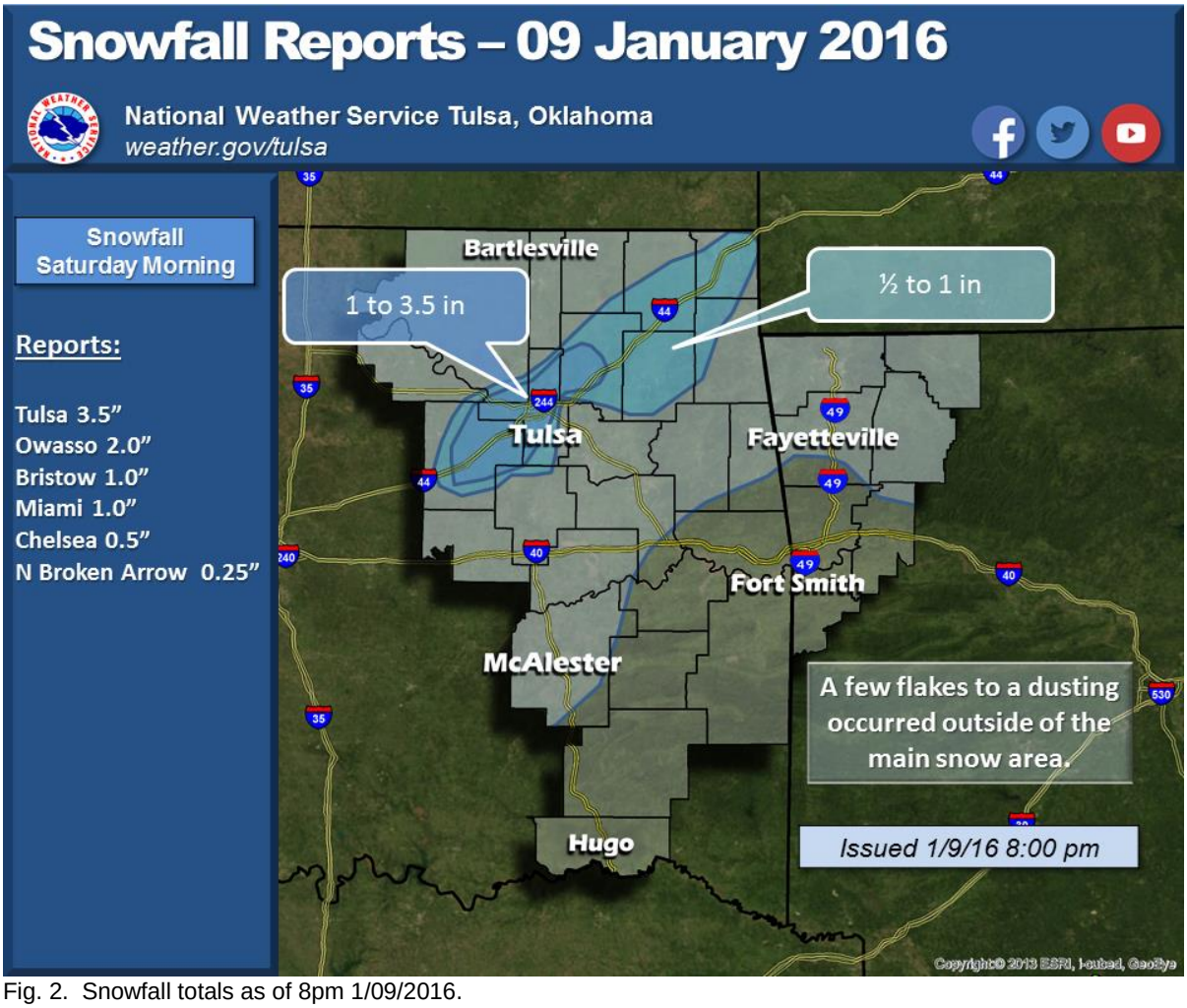


Fig. 2. Snowfall totals as of 8pm 1/09/2016.

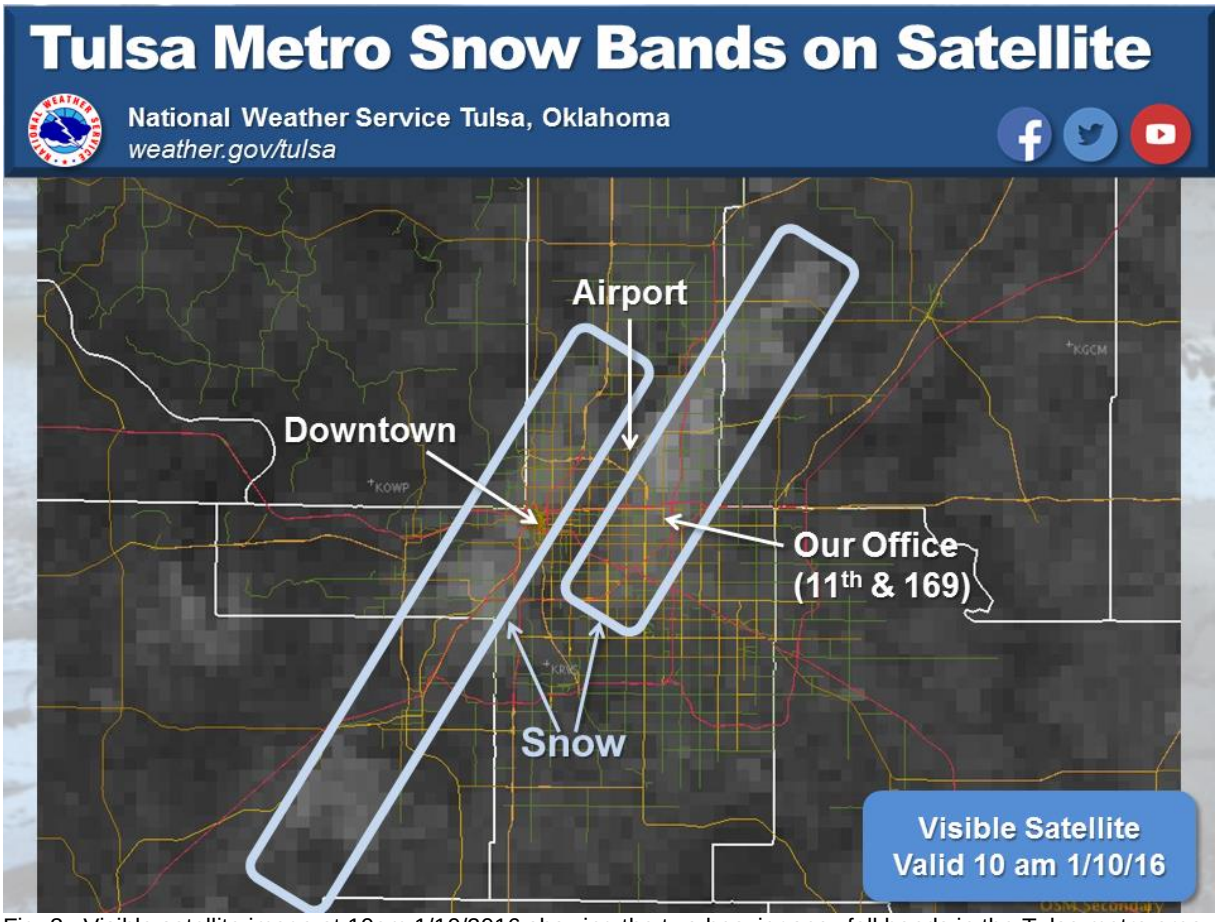


Fig. 3. Visible satellite image at 10am 1/10/2016 showing the two heavier snowfall bands in the Tulsa metro area.

A fast moving upper wave led to showers within a relative moist axis ahead of a Pacific cold front across far northeast OK and far northwest AR late on the 14th through the overnight hours. Rainfall totals were less than 0.25".

January 16-31

A cold front moved through the region early on the 15th. With cold air in place, light rain and snow spread into southeast OK during the day on the 16th as an upper-wave shifted into the southern Plains. Snow accumulations remained light, generally estimated around 0.50" or less within a moderate snowfall band across northern Pushmataha and southern Le Flore Counties. Slightly higher snowfall could have occurred at higher elevations. Rainfall and snow liquid equivalent amounts were around 0.25" and less (Fig. 4).

Another cold front swept through the area on the 17th, bringing snow to far northeast OK and northwest AR during the evening and overnight hours. Minor accumulations of 0.5"-1" were reported, primarily in Benton and Carroll Counties. Elsewhere, snowfall was less than half an inch. Liquid equivalent amounts were less than one tenth of an inch.

Drizzle and light wintry precipitation fell over northeast OK and northwest AR during the afternoon on the 19th and ending by midnight as a cold front moved through the area. Little to no accumulation was reported.

Weak forcing occurred within an area of warm air advection over eastern OK and northwest AR during the evening of the 20th through the early hours of the 21st. This, combined with a mid-level shortwave, caused mixed precipitation showers and isolated thunderstorms to develop. A mix of rain, sleet, and snow occurred across areas where temperatures remained near to below freezing. Frozen precipitation accumulations remained light, and rain and liquid equivalent totals were near 0.25" or less across portions of northeast and east central OK, and northwest and west central AR. A small area of thunderstorms developed just before sunrise on the 21st and moved across Choctaw, Pushmataha, and southern Le Flore Counties during the early morning hours on the north side of a vorticity maximum located over northern TX. A second round of showers

and isolated thunderstorms traversed southeast OK during the afternoon. Rainfall totals from both rounds of propitiation ranged from 0.10” to around 1.5”, with the highest totals of 1” to around 1.5” over southern Pushmataha County. Some minor snow accumulations may have occurred in the higher elevations of southeast OK. Light freezing drizzle and snow flurries occurred during the evening hours further north across northeast OK and northwest AR, with little to now accumulation.

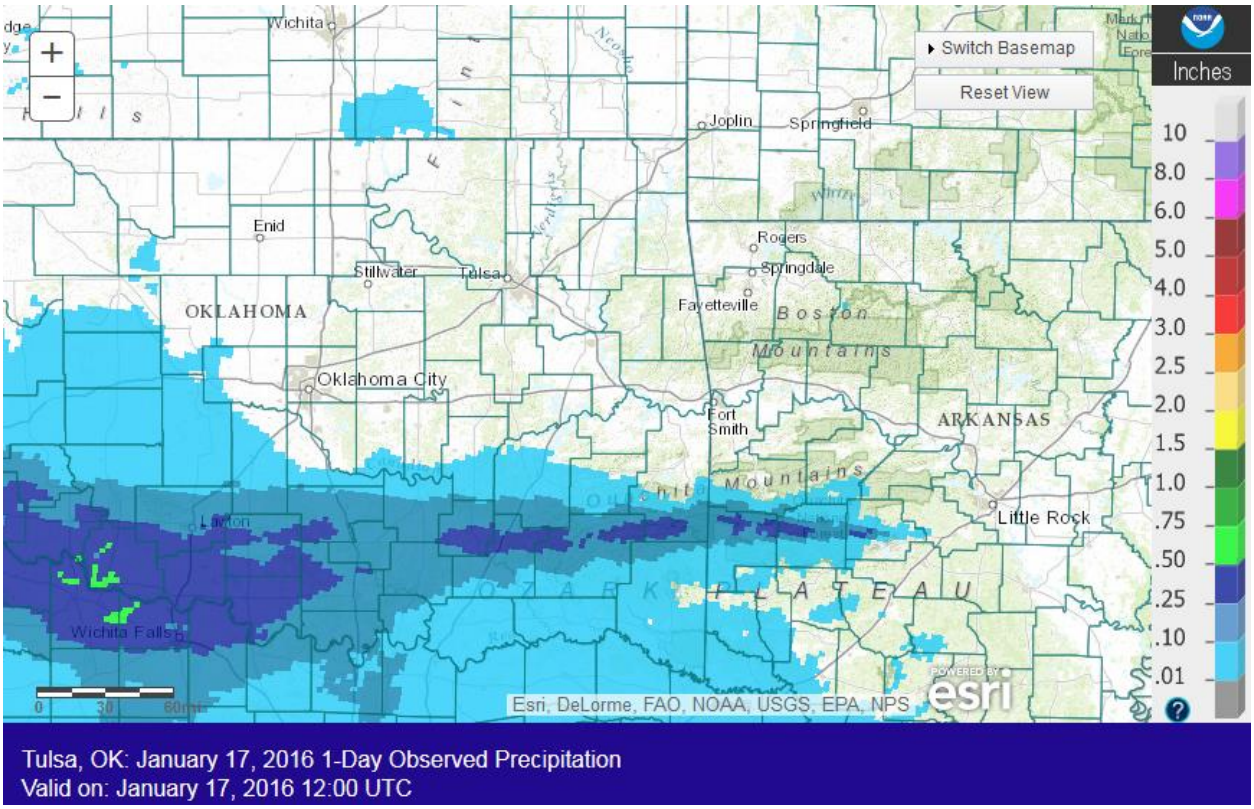


Fig. 4. 24-hour Estimated Observed Rainfall ending at 6am CST 1/17/2016.

Written by:

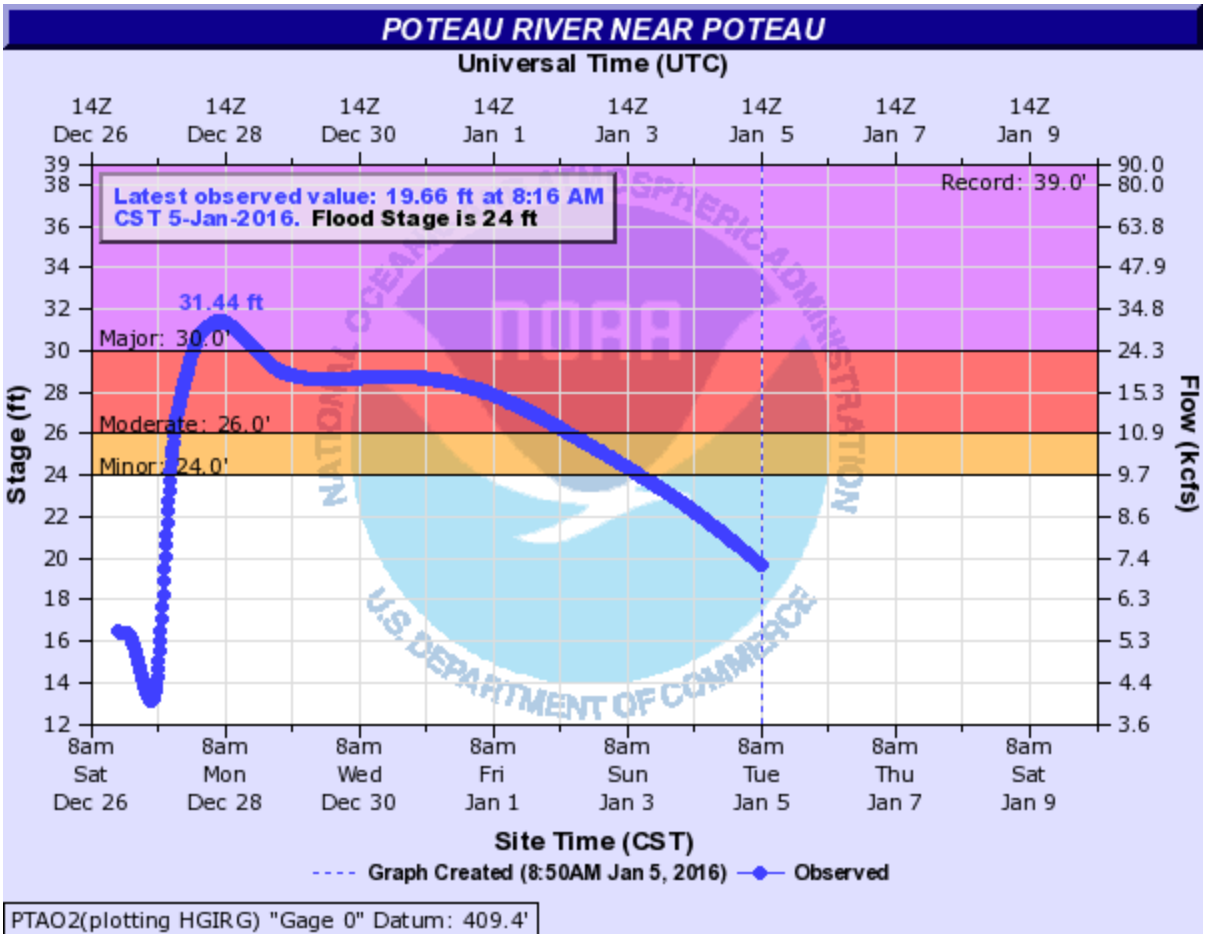
Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in January 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)
0 Urban and Small Stream Advisories (FLS)
1 Areal Flood Warnings (FLW)
1 Areal Flood Statements (FLS)
0 River Flood Warnings (FLW)
86 River Flood Statements (FLS)
0 River Flood Advisories (FLS) (0 Advisory FLS CON/EXT/CAN)
1 River Flood Watches (FFA) (1 Watch FFA CON/EXT/CAN)
0 River Statements (RVS)
0 Hydrologic Outlooks (ESF)
0 Drought Information Statements (DGT)

Preliminary Hydrographs:



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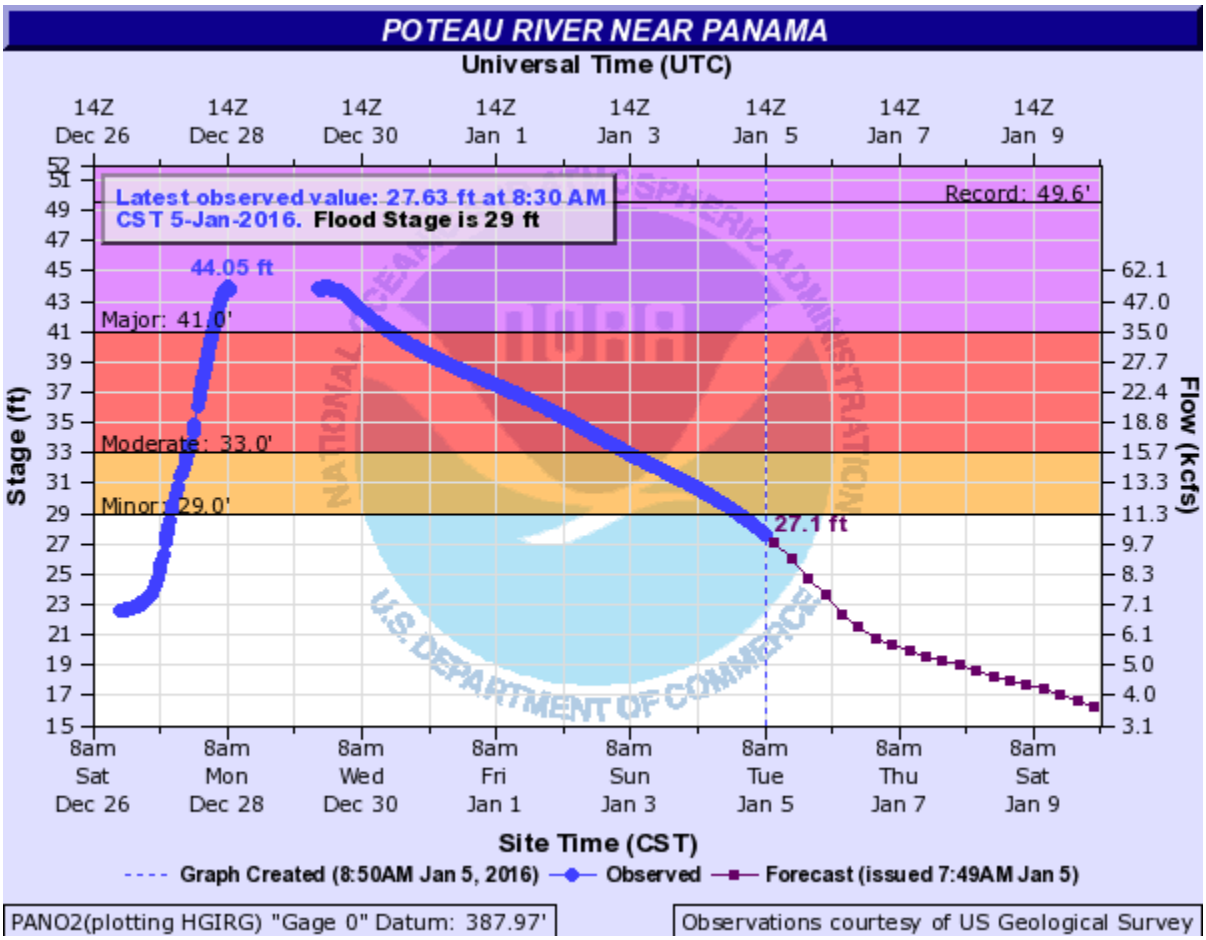

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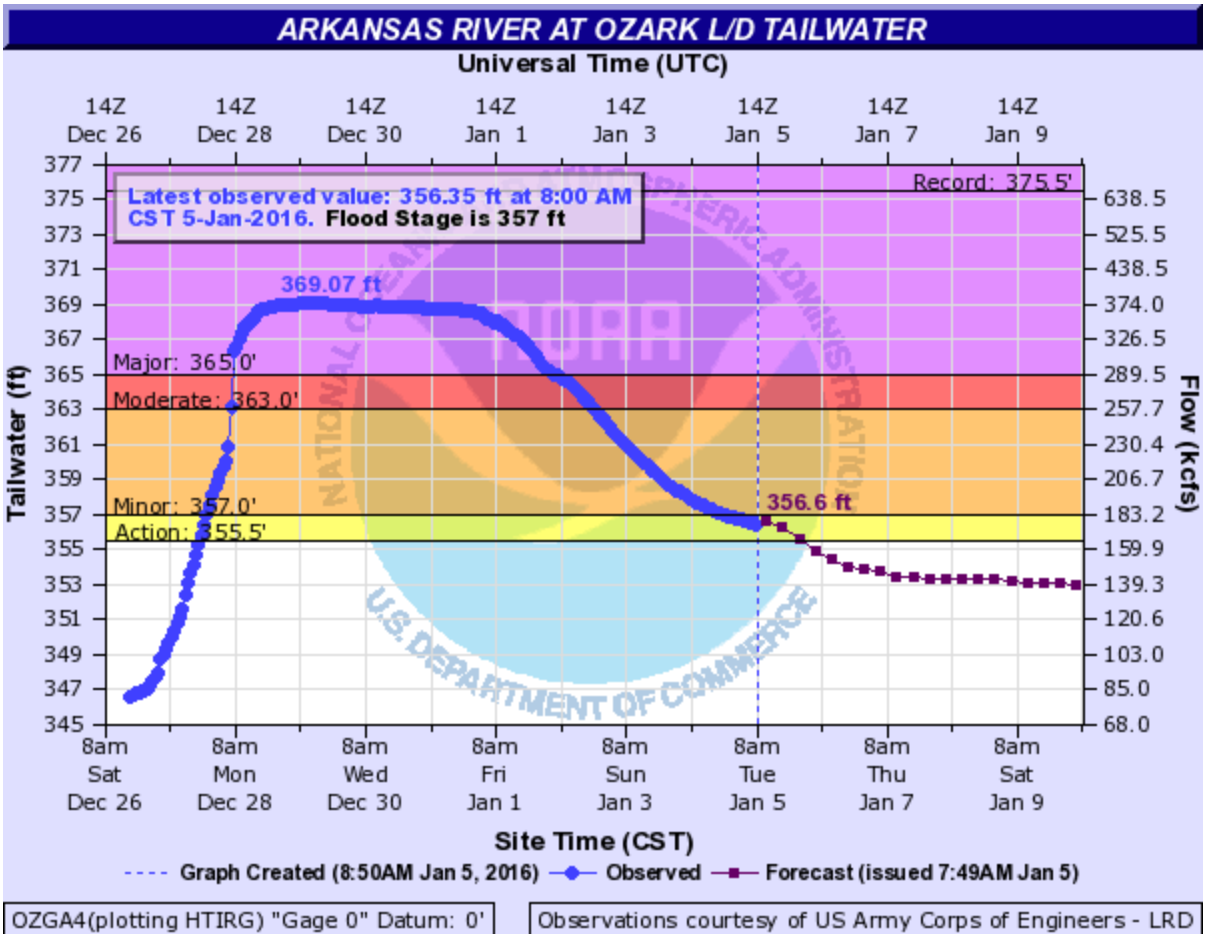
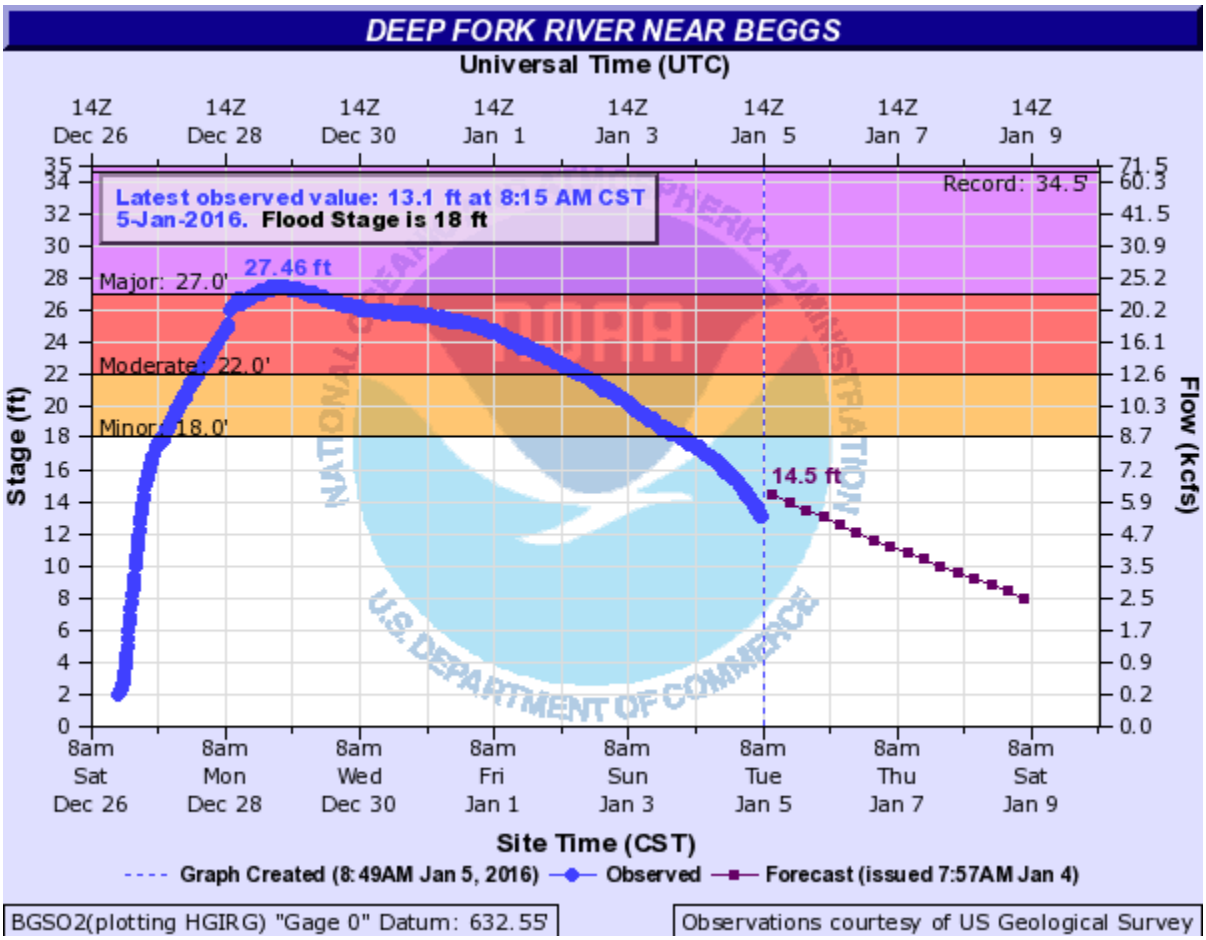
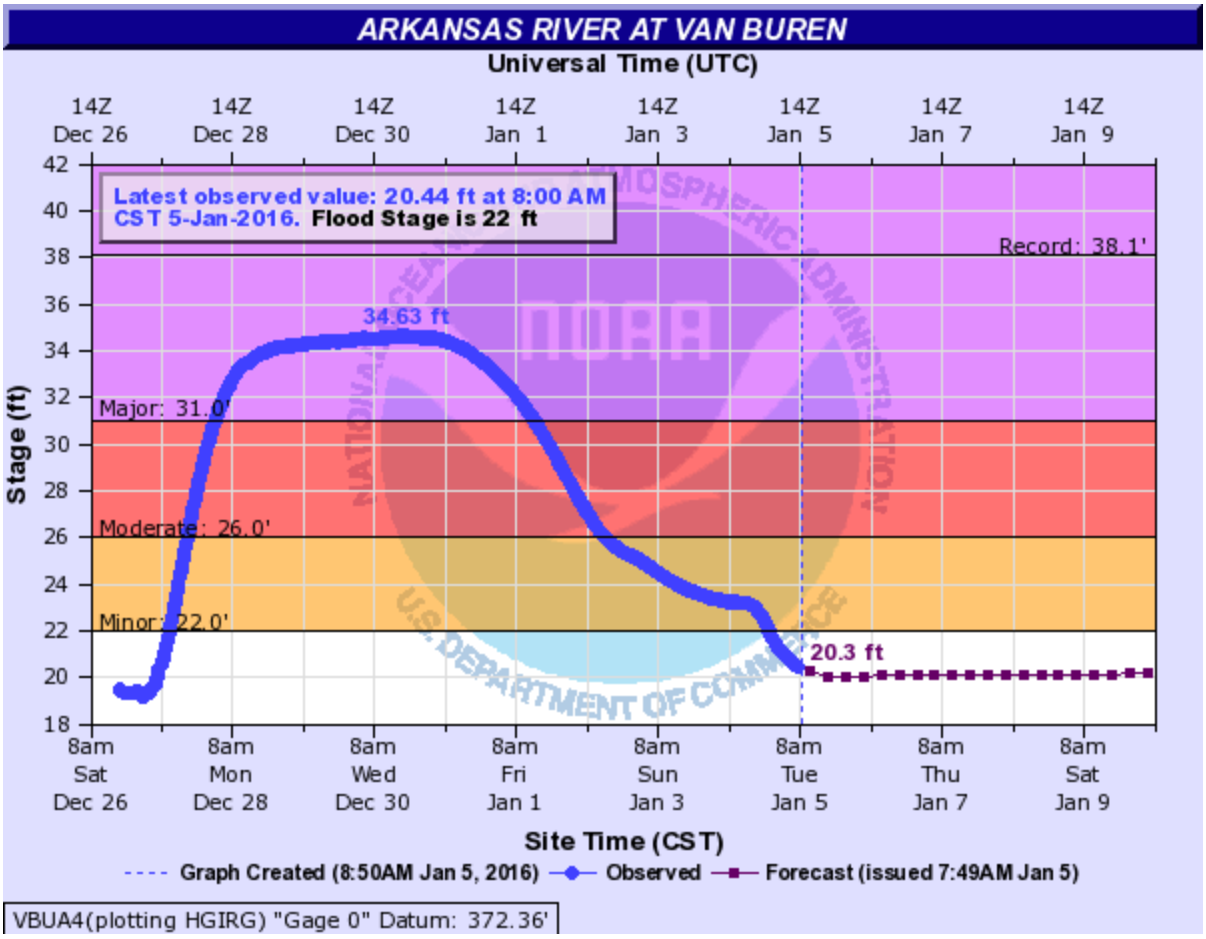
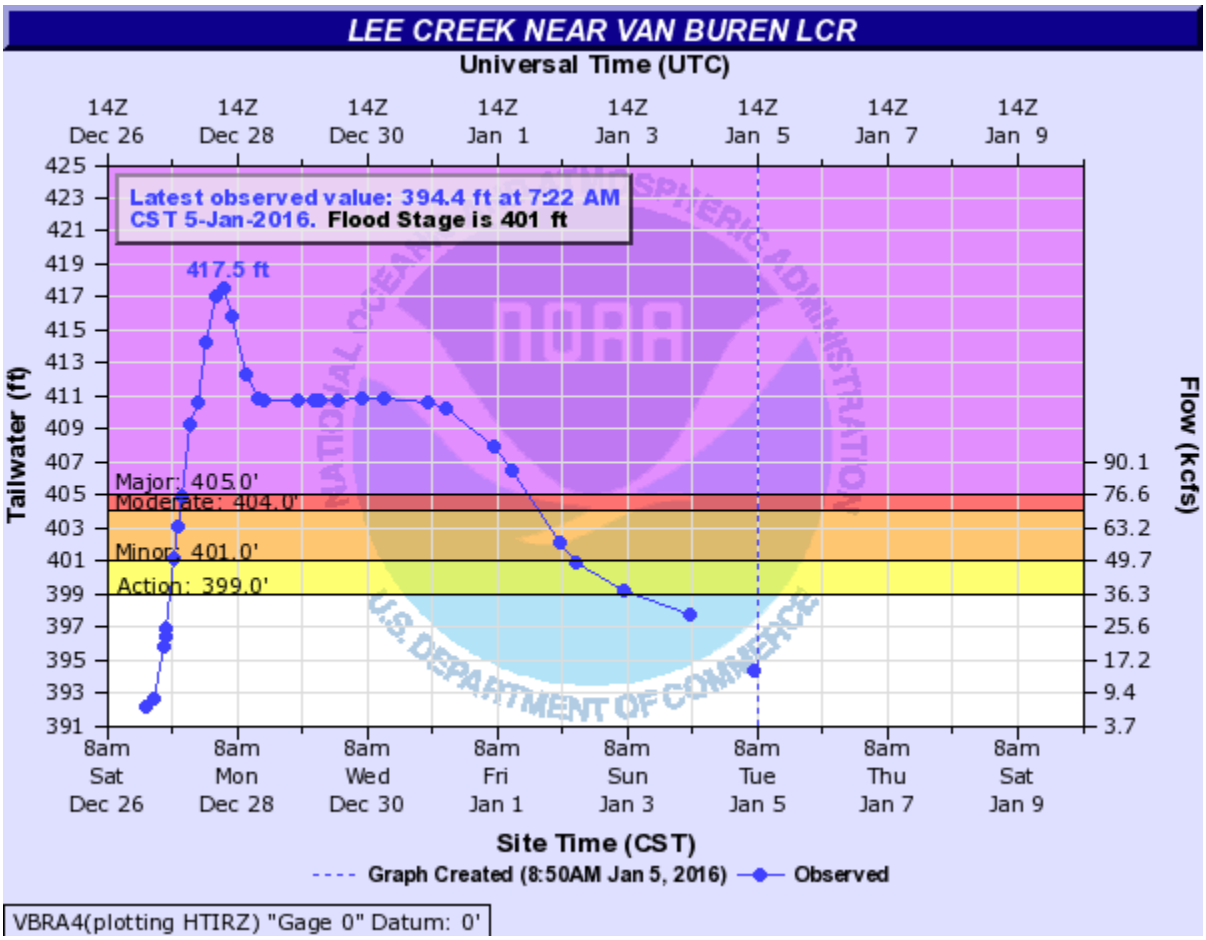
Observations courtesy of US Geological Survey


ARKANSAS RIVER AT OZARK L/D TAILWATER
Universal Time (UTC)
14Z Dec 26
14Z Dec 28
14Z Dec 30
14Z Jan 1
14Z Jan 3
14Z Jan 5
14Z Jan 7
14Z Jan 9
Latest observed value: 356.35 ft at 8:00 AM CST 5-Jan-2016. Flood Stage is 357 ft
Record: 375.5'
369.07 ft
Major: 365.0'
Moderate: 363.0'
Minor: 357.0'
Action: 355.5'
356.6 ft
Tailwater (ft)
Flow (kcfs)
8am Sat Dec 26
8am Mon Dec 28
8am Wed Dec 30
8am Fri Jan 1
8am Sun Jan 3
8am Tue Jan 5
8am Thu Jan 7
8am Sat Jan 9
Site Time (CST)
Graph Created (8:50AM Jan 5, 2016)
Observed
Forecast (issued 7:49AM Jan 5)
OZGA4(plotting HTIRG) "Gage 0" Datum: 0'
Observations courtesy of US Army Corps of Engineers - LRD


DEEP FORK RIVER NEAR BEGGS
Universal Time (UTC)
14Z Dec 26
14Z Dec 28
14Z Dec 30
14Z Jan 1
14Z Jan 3
14Z Jan 5
14Z Jan 7
14Z Jan 9
Latest observed value: 13.1 ft at 8:15 AM CST 5-Jan-2016. Flood Stage is 18 ft
Record: 34.5'
27.46 ft
Major: 27.0'
Moderate: 22.0'
Minor: 18.0'
14.5 ft
Stage (ft)
Flow (kcfs)
8am Sat Dec 26
8am Mon Dec 28
8am Wed Dec 30
8am Fri Jan 1
8am Sun Jan 3
8am Tue Jan 5
8am Thu Jan 7
8am Sat Jan 9
Site Time (CST)
Graph Created (8:49AM Jan 5, 2016)
Observed
Forecast (issued 7:57AM Jan 4)
BGSO2(plotting HGIRG) "Gage 0" Datum: 632.55'
Observations courtesy of US Geological Survey


ARKANSAS RIVER AT VAN BUREN
Universal Time (UTC)
14Z Dec 26
14Z Dec 28
14Z Dec 30
14Z Jan 1
14Z Jan 3
14Z Jan 5
14Z Jan 7
14Z Jan 9
Latest observed value: 20.44 ft at 8:00 AM CST 5-Jan-2016. Flood Stage is 22 ft
Record: 38.1'
34.63 ft
Major: 31.0'
Moderate: 26.0'
Minor: 22.0'
20.3 ft
Stage (ft)
42
40
38
36
34
32
30
28
26
24
22
20
18
8am Sat Dec 26
8am Mon Dec 28
8am Wed Dec 30
8am Fri Jan 1
8am Sun Jan 3
8am Tue Jan 5
8am Thu Jan 7
8am Sat Jan 9
Site Time (CST)
Graph Created (8:50AM Jan 5, 2016)
Observed
Forecast (issued 7:49AM Jan 5)
VBUA4(plotting HGIRG) "Gage 0" Datum: 372.36'


LEE CREEK NEAR VAN BUREN LCR
Universal Time (UTC)
14Z Dec 26
14Z Dec 28
14Z Dec 30
14Z Jan 1
14Z Jan 3
14Z Jan 5
14Z Jan 7
14Z Jan 9
Latest observed value: 394.4 ft at 7:22 AM CST 5-Jan-2016. Flood Stage is 401 ft
417.5 ft
Major: 405.0'
Moderate: 404.0'
Minor: 401.0'
Action: 399.0'
Tailwater (ft)
425
423
421
419
417
415
413
411
409
407
405
403
401
399
397
395
393
391
Flow (kcfs)
90.1
76.6
63.2
49.7
36.3
25.6
17.2
9.4
3.7
8am Sat Dec 26
8am Mon Dec 28
8am Wed Dec 30
8am Fri Jan 1
8am Sun Jan 3
8am Tue Jan 5
8am Thu Jan 7
8am Sat Jan 9
Site Time (CST)
Graph Created (8:50AM Jan 5, 2016)
Observed
VBRA4(plotting HTIRZ) "Gage 0" Datum: 0'