

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 March	YEAR 2015
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 April 2, 2015	

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.

From snow at the beginning of the month, to flooding mid-month, to tornadoes at the end of the month, March 2015 was active across eastern OK and northwest AR. Normal precipitation for March ranges from 3.1 inches in Pawnee County to 4.3 inches in Le Flore County. In the Ozark region of northwest Arkansas, the normal precipitation for the month is 4.4 inches. 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 March 2015 ranged from 0.50" in eastern Kay, western Osage, and western Pawnee Counties to near 8" in Carroll, Franklin, and southern Le Flore Counties. The majority of the HSA received 2"-5" of rain this month. There was a mixture of a well-above and well-below normal rainfall across the HSA this month (Fig. 1b). The greatest deficits occurred northwest of I-44, where 10%-75% of the normal March rainfall was received. Eastern Kay, western Osage, and northern Pawnee Counties received only 10%-25% of the normal March rainfall. On the other hand, all of Carroll County and localized areas of east central OK and west central AR received 150%-200% of the normal March rainfall. The remainder of the area generally received 75%-125% of the normal rainfall this month.

Tulsa, OK (TSA): March, 2015 Monthly Observed Precipitation
 Valid at 4/1/2015 1200 UTC- Created 4/1/15 17:57 UTC

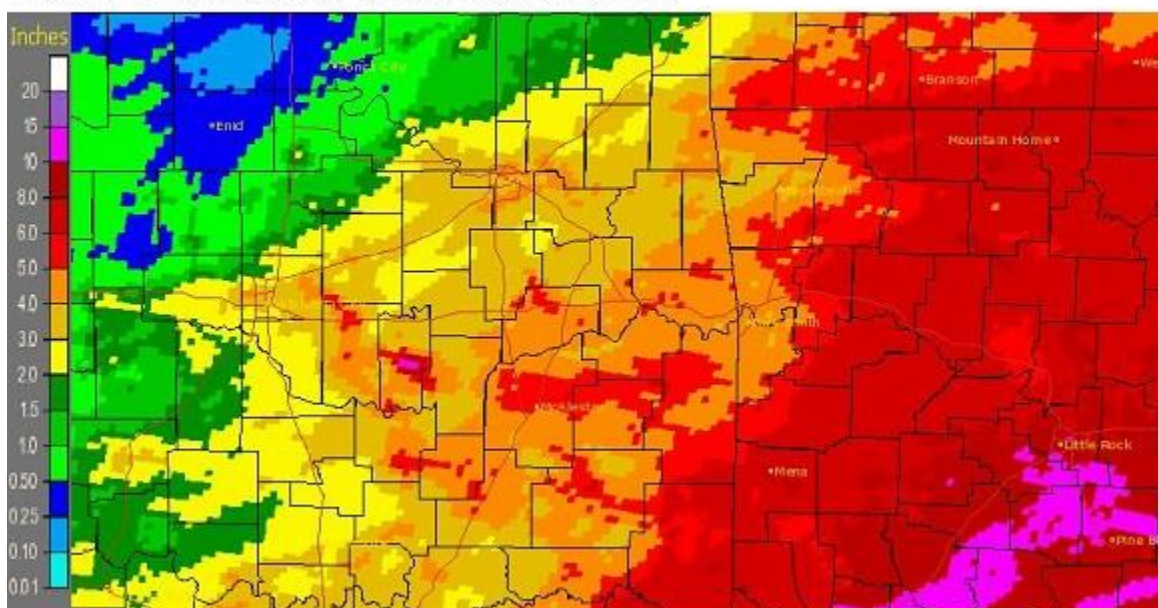


Fig. 1a. Estimated Observed Rainfall for March 2015

Tulsa, OK (TSA): March, 2015 Monthly Percent of Normal Precipitation
 Valid at 4/1/2015 1200 UTC- Created 4/1/15 17:59 UTC

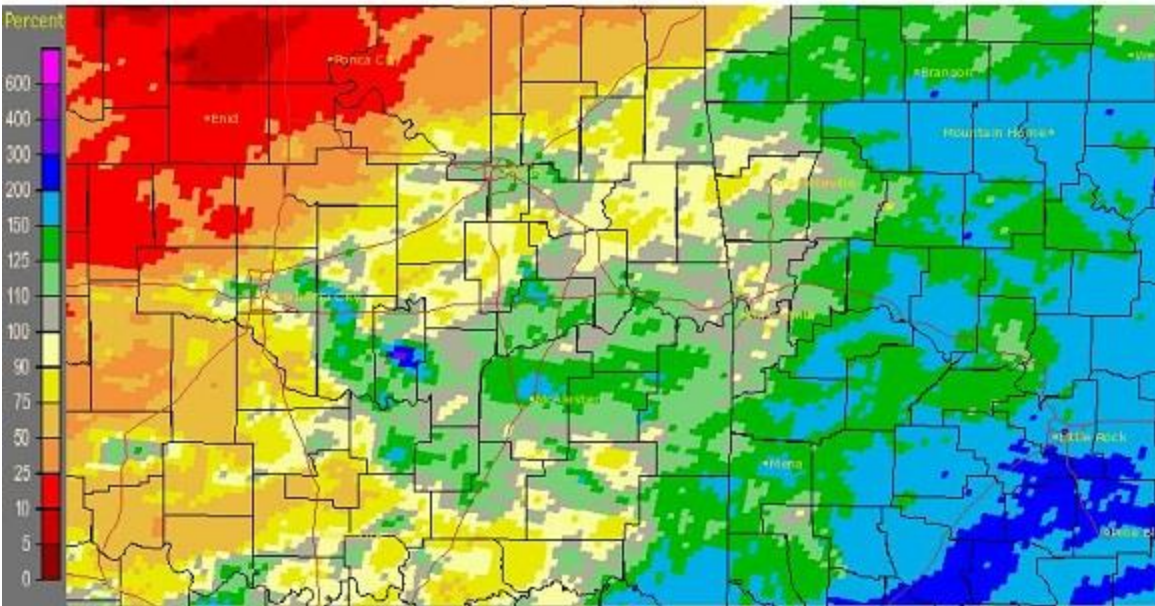


Fig. 1b. Estimated % of Normal Rainfall for March 2015

In Tulsa, OK, March 2015 ranked as the 38th warmest March (52.8°F, tied 2009; since records began in 1905), the 39th wettest March (3.71"; since records began in 1888), and the 34th snowiest March (0.3", tied 2008, 1954, 1932; since records began in 1900). Fort Smith, AR had the 58th warmest March (52.5°F, tied 1966, 1942; since records began in 1883), the 34th wettest March (4.50"; since records began in 1883), and the 21st snowiest March (1.0", tied 1887; since records began in 1884). Fayetteville, AR had the 33rd coldest (47.8°F), the 19th wettest (4.63"), and the 14th snowiest (2.6") March since records began in 1950.

Some of the larger precipitation reports (in inches) for March 2015 included:

Winslow 7NE, AR (coop)	7.65	Ozark, AR (coop)	6.69	McAlester, OK (meso)	6.40
Kingston 2S, AR (coop)	6.10	St Paul, AR (coop)	5.97	Hindsville 10NNE, AR (coop)	5.89
Sallisaw, OK (meso)	5.85	Fanshawe, OK (coop)	5.77	Wister, OK (meso)	5.64

Some of the lowest precipitation reports (in inches) for March 2015 included:

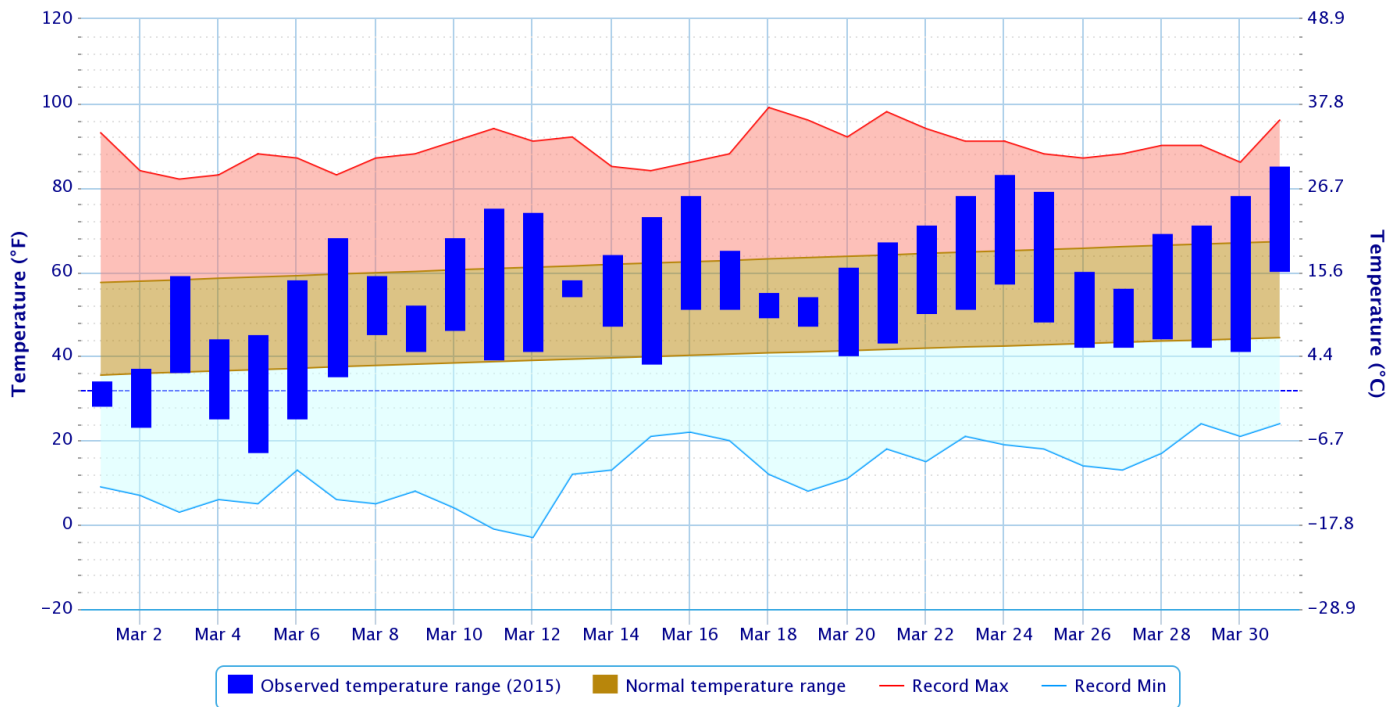
Ralston, OK (coop)	0.70	Burbank, OK (meso)	0.77	Foraker, OK (meso)	1.16
Pawnee, OK (meso)	1.28	Bartlesville, OK (ASOS)	1.38	Copan, OK (meso)	1.56
Wynona, OK (meso)	1.81	Nowata, OK (meso)	2.25	Vinita, OK (meso)	2.29

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

Rank since 1921	March 2015	Year-to-Date (Jan 1 – Mar 31)	Last 60 Days (Jan 31 – Mar 31)	Last 120 Days (Dec 2 – Mar 31)	Water Year-to-Date (Oct 1, 2014 – Mar 31, 2015)	Last 365 Days (Apr 1, 2014 – Mar 31, 2015)
Northeast OK	45 th driest	25 th driest	36 th driest	19 th driest	47 th wettest	26 th driest
East Central OK	21 st wettest	41 st driest	39 th wettest	43 rd wettest	41 st wettest	33 rd driest
Southeast OK	16 th wettest	32 nd wettest	34 th wettest	41 st wettest	44 th driest	37 th driest
Statewide	44 th wettest	32 nd driest	41 st driest	38 th driest	43 rd driest	25 th driest

Daily Temperature Data – Tulsa Area, OK (ThreadEx)

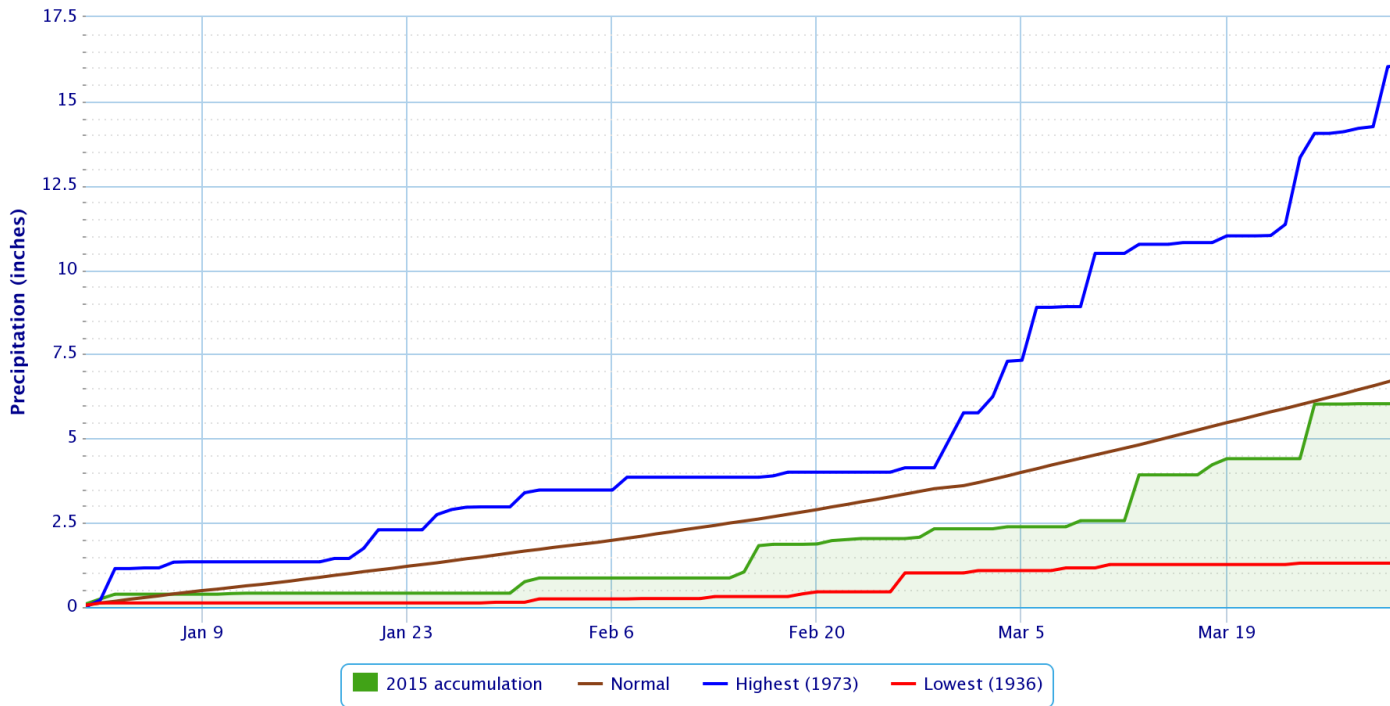
Period of Record – 1905-01-06 to 2015-03-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Tulsa Area, OK (ThreadEx)

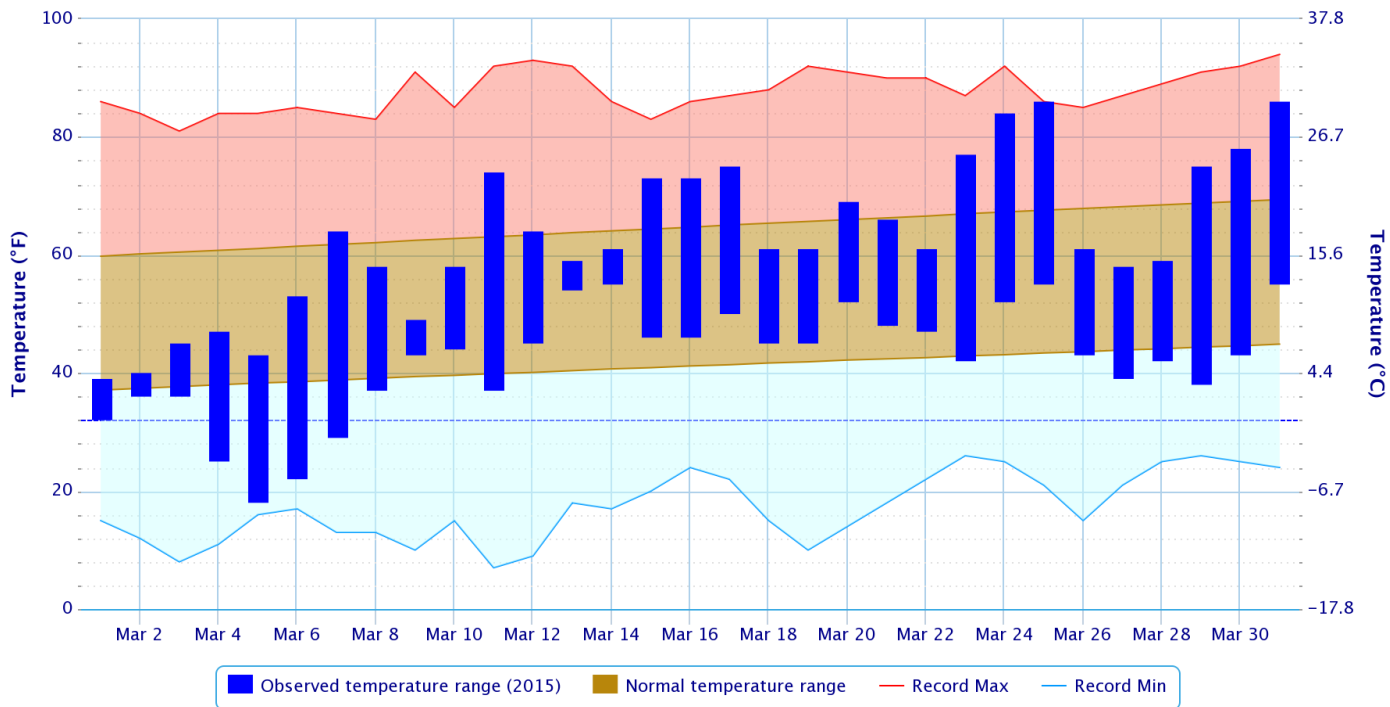
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

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

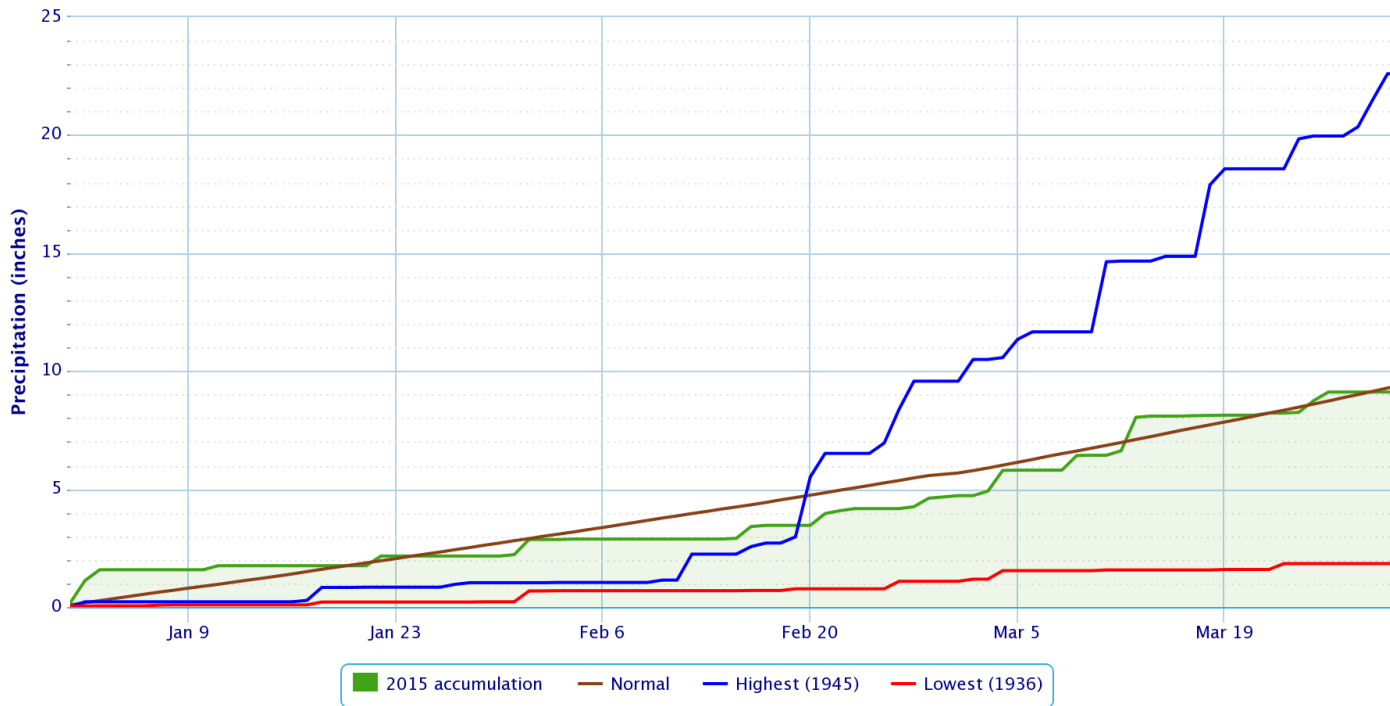
Period of Record – 1882-06-01 to 2015-03-31. Normals period: 1981-2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – Fort Smith Area, AR (ThreadEx)

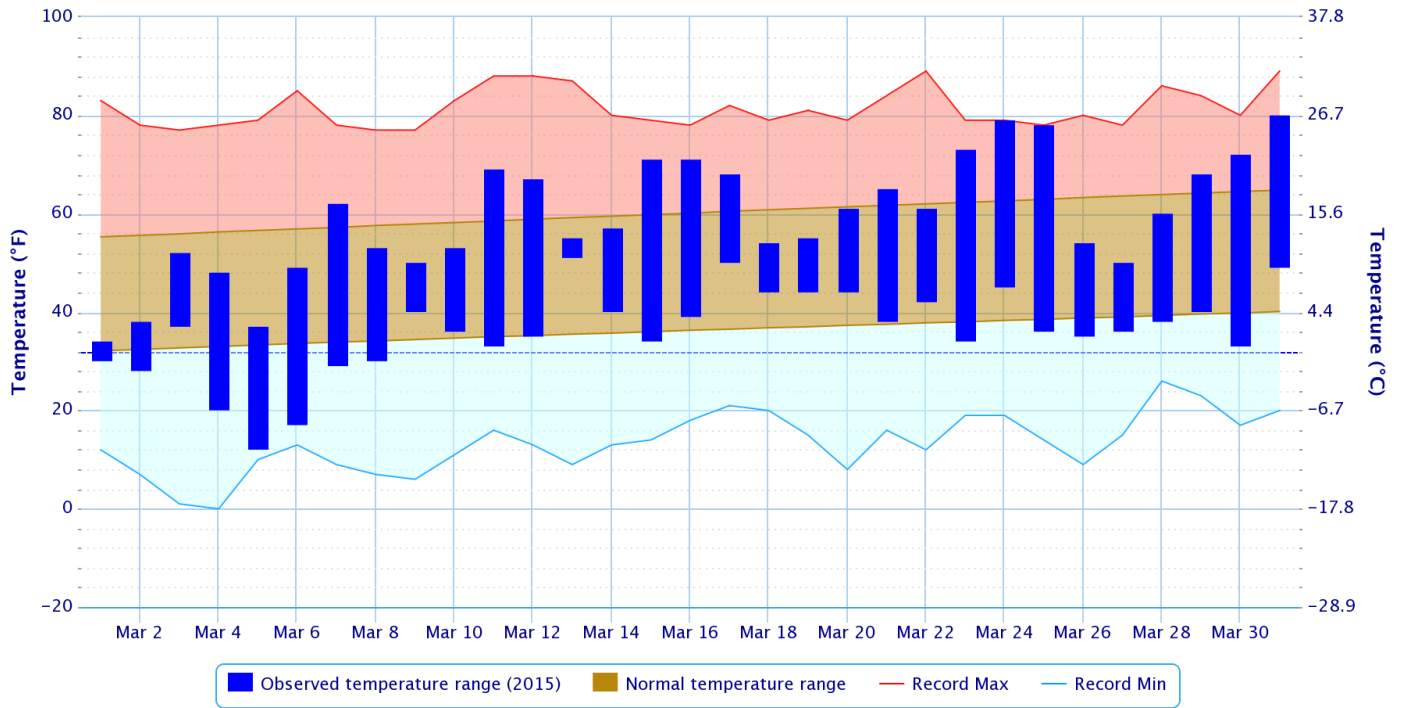
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values



Powered by ACIS

Daily Temperature Data – FAYETTEVILLE DRAKE FLD, AR

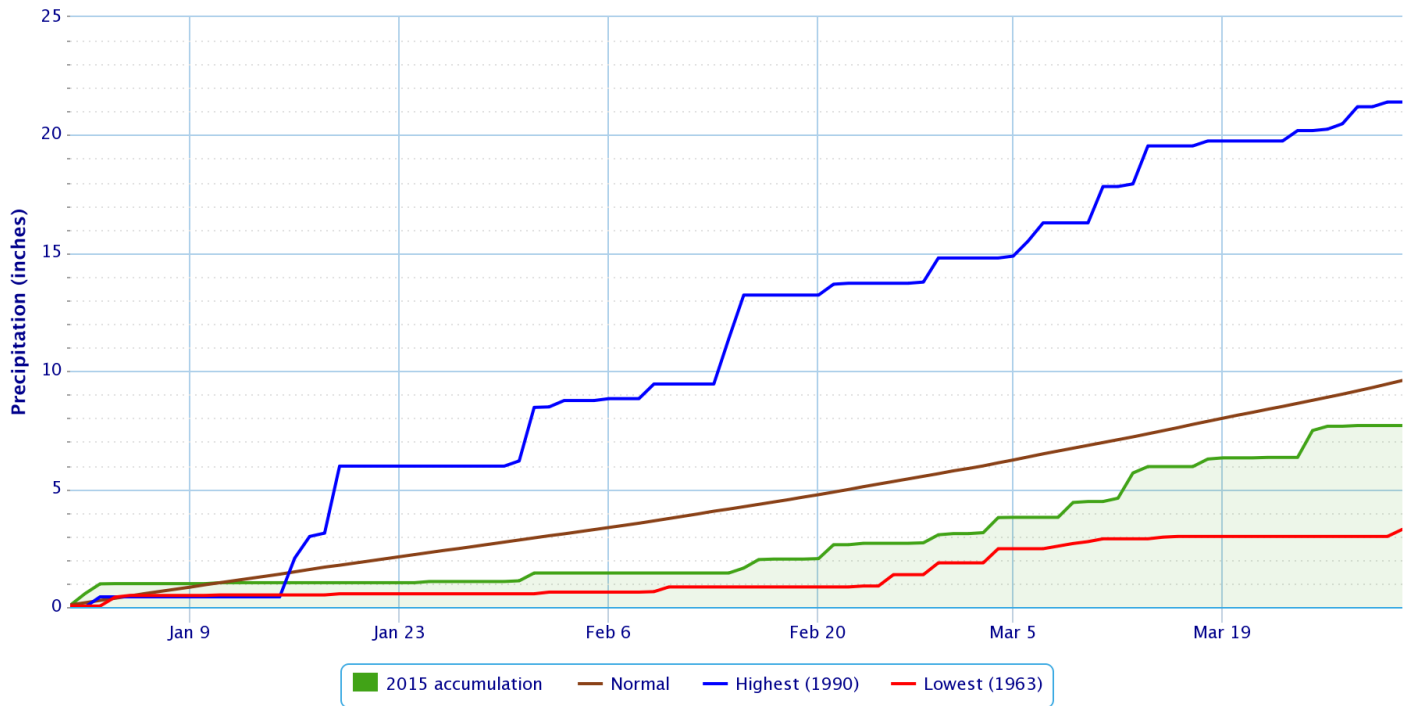
Period of Record – 1949–07–14 to 2015–03–31. Normals period: 1981–2010. Click and drag to zoom chart.



Powered by ACIS

Accumulated Precipitation – FAYETTEVILLE DRAKE FLD, AR

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



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According to the USACE, most of the major reservoirs in the HSA were operating within $\pm 3\%$ of the top of their conservation pools as of 4/01/2015. Several lakes were operating within the flood control pool: Wister Lake 117%, Ft. Gibson Lake 111%, Eufaula Lake 108% (up from 78% at the end of February), Hugo Lake 105%, and Beaver Lake 104% (up from 79% at the end of February). A couple of lakes continued to report below normal pool levels: Skiatook Lake 53% and Birch Lake 50% (down from 88% at the end of February). Keystone Lake saw an increase from 80% at the end of February to 98% at the end of March, and Tenkiller Lake had an increase from 85% at the end of February to 102% at the end of March.

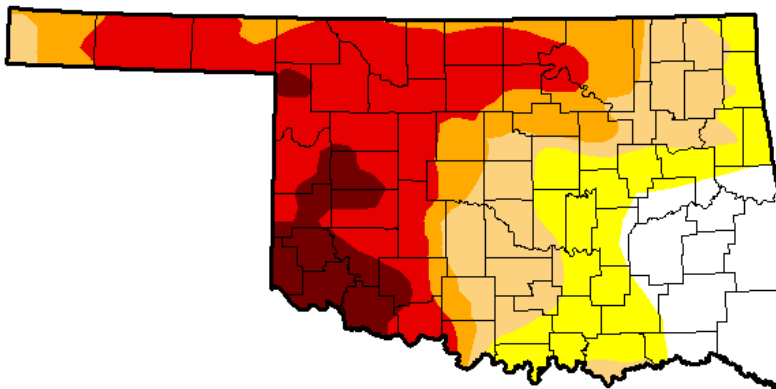
According to the [U.S. Drought Monitor](#) (USDM) from March 31, 2015 (Figs 2, 3), Extreme Drought (D3) conditions had extended eastward into eastern Kay, western Osage and northern Pawnee Counties in eastern OK. Severe Drought (D2) conditions were occurring across portions of eastern Kay, Osage, Pawnee, northern Creek, and western Washington Counties in eastern OK. Moderate Drought (D1) conditions were present across portions of Osage, Tulsa, Creek, Washington, Nowata, Craig, Rogers, Mayes, Wagoner and western Cherokee Counties in eastern OK. Abnormally Dry (D0), but not experiencing drought, conditions existed across the remainder of eastern OK north of I-40. Abnormally Dry (D0) conditions were also present in Benton, Washington, Madison, and northern Crawford Counties in northwest AR.

U.S. Drought Monitor Oklahoma

March 31, 2015
(Released Thursday, Apr. 2, 2015)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	14.36	85.64	68.62	50.68	37.38	8.41
Last Week <i>3/24/2015</i>	14.36	85.64	70.40	50.96	35.74	8.41
3 Months Ago <i>12/30/2014</i>	25.63	74.37	62.03	40.84	21.74	5.70
Start of Calendar Year <i>12/30/2014</i>	25.63	74.37	62.03	40.84	21.74	5.70
Start of Water Year <i>8/30/2014</i>	8.55	91.45	73.31	58.13	20.92	4.64
One Year Ago <i>4/1/2014</i>	4.05	95.95	77.48	50.67	24.03	8.61



Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

*Eric Luebbehusen
U.S. Department of Agriculture*

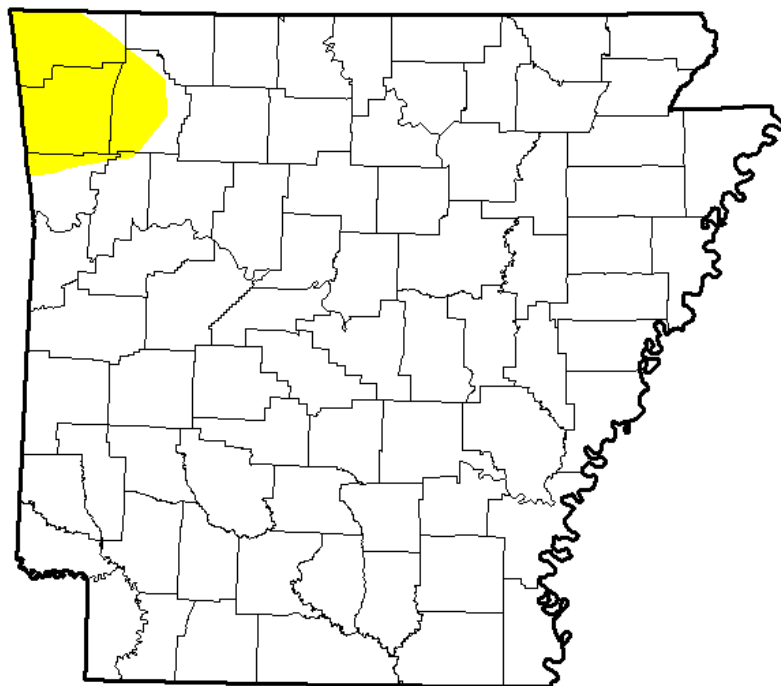


<http://droughtmonitor.unl.edu/>

Fig. 2. Drought Monitor for Oklahoma

U.S. Drought Monitor Arkansas

March 31, 2015
(Released Thursday, Apr. 2, 2015)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	95.38	4.62	0.00	0.00	0.00	0.00
Last Week 3/24/2015	84.74	15.26	2.17	0.00	0.00	0.00
3 Months Ago 12/30/2014	36.88	63.12	14.40	0.00	0.00	0.00
Start of Calendar Year 1/20/2014	36.88	63.12	14.40	0.00	0.00	0.00
Start of Water Year 9/30/2014	54.54	45.46	9.13	0.00	0.00	0.00
One Year Ago 4/1/2014	72.14	27.86	0.29	0.00	0.00	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Eric Luebbehusen
U.S. Department of Agriculture



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

Fig. 3. Drought Monitor for Arkansas

Outlooks

The [Climate Prediction Center](#) (CPC) outlook for April 2015 (issued March 31, 2015) indicates an enhanced chance for above normal temperatures across all of eastern OK and northwest AR. This outlook also calls for a slightly enhanced chance for above median rainfall across southeast OK and west central AR, with an equal chance for above, near, and below median precipitation elsewhere. This outlook is based on short- and extended-range computer models that show troughing over the western U.S. and ridging over the southeast U.S. for much of April. Mean southwesterly flow and forecast ridging over the south-central U.S. supports an enhanced chance for above normal temperatures. The enhanced rainfall chances are due to the anticipation of an active storm track during the first half of April.

For the 3-month period April-May-June 2015, 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 March 19, 2015). According to CPC, current atmospheric and oceanic observations show El Niño conditions. CPC is forecasting a 50% chance for El Niño to continue through the summer. If El Niño conditions do persist through the summer, it is historically likely that conditions will persist into the following winter. El Niño impacts are generally most significant during the cold seasons. Therefore, this outlook is based on both statistical and dynamical forecast tools and considering weak El Niño conditions.

Summary of Precipitation Events

March 1-15

March started off with some freezing rain/drizzle and rain across far southeast OK and west central AR on the 1st. Rainfall totals were light, only around 0.10" or less and a glaze of ice.

A strong cold front moved through the region on the 4th, bringing winter weather to all of eastern OK and northwest AR. Ahead of the front, rain developed during the evening of the 3rd and continued through the overnight hours. As the cold front pushed south, the rain transitioned briefly to freezing rain and sleet before finally becoming snow. Around 0.05" or less of ice accumulation was reported across the area. Many locations reported up to 0.50" of sleet before the precipitation transitioned to snow. Sleet and snowfall totals ranged from a trace to 5", with the majority of the area getting 1"-2" (Figs. 4, 5). The highest totals of 3"-4" occurred across Cherokee, Adair, Delaware, Crawford, Franklin, Madison, and Carroll County. 5" of sleet and snow were reported 4 miles north of Pettigrew, AR (Madison Co.). There was a minimum in the snowfall totals along the I-44 corridor from Bristow to Vinita, which includes much of the Tulsa metro area. Rainfall/liquid equivalent totals from the 3rd-4th ranged from a few hundredths to around 1.5" (Fig. 6).

Light rain moved from south to north across the region on the 9th ahead of an upper-level low pressure system moving across TX. As the low moved closer, rainfall increased across southeast OK and west central AR during the afternoon and evening. The rain came to an end before sunrise on the 10th as the system pushed east of the area. Rainfall totals were less than 0.10" for much of Osage and eastern Kay Counties, with totals of 0.10" to near 1.5" elsewhere across eastern OK and northwest AR (Figs. 7, 8). The highest totals of 1"-1.5" occurred across southeast and far east central OK.

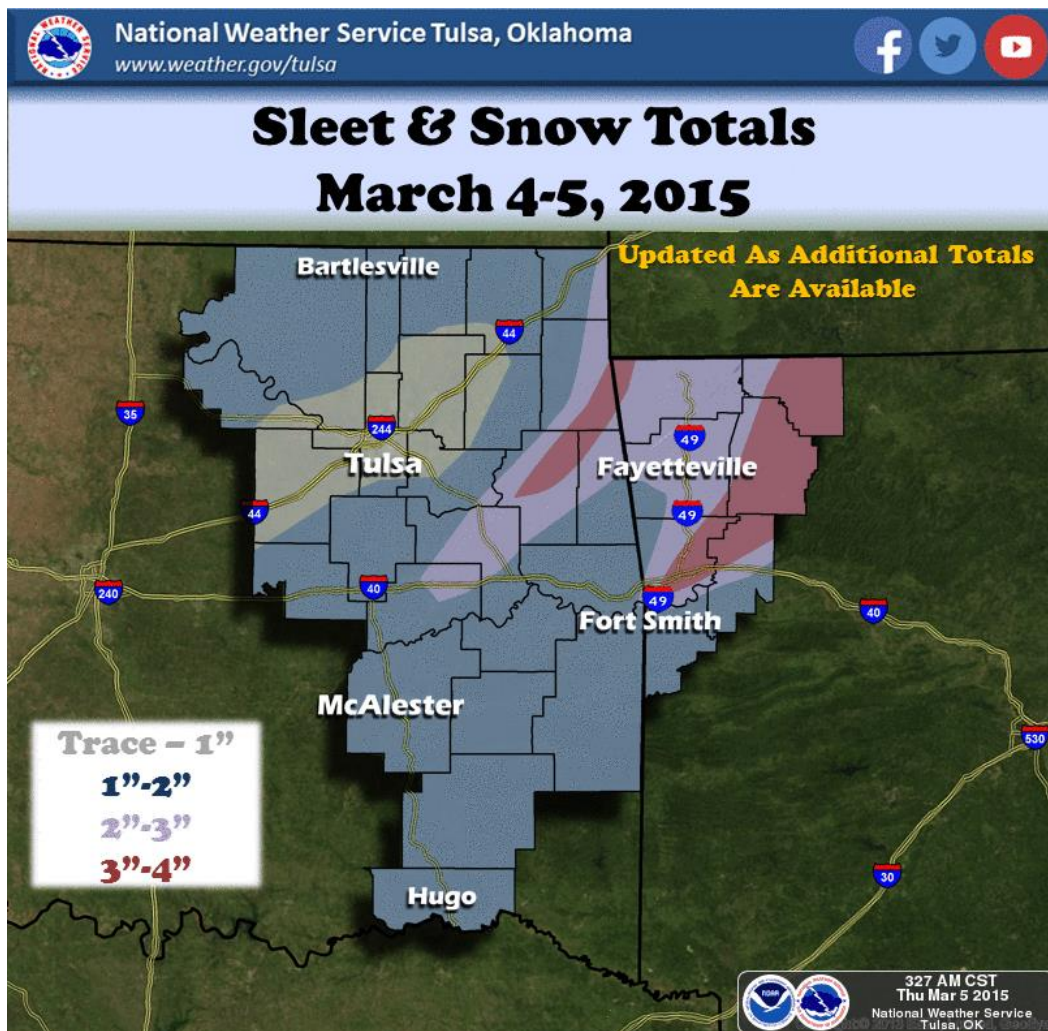


Fig. 4. Preliminary Snow and Sleet Accumulations for March 4-5, 2015 based on reports.

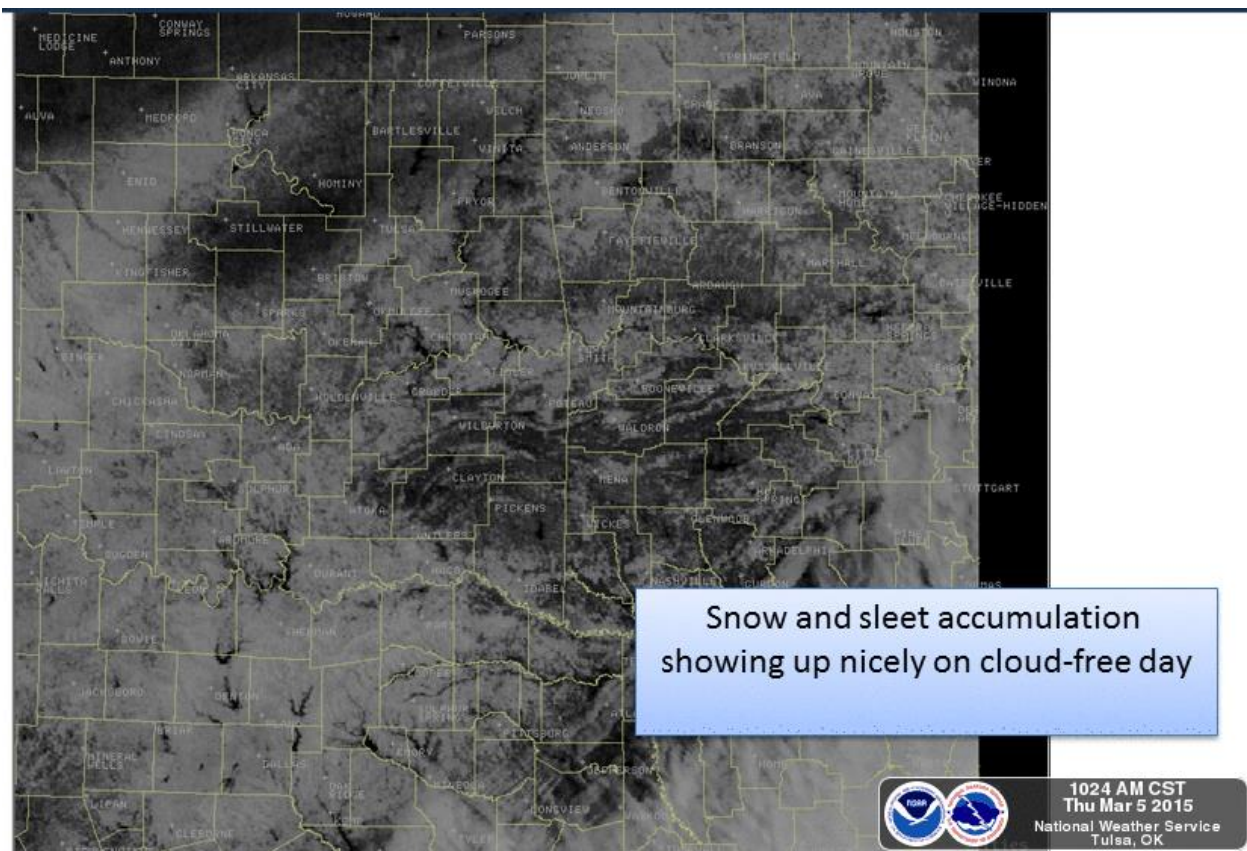


Fig. 5. Visible satellite image from 10:24am CST March 5, 2015 showing the sleet/snow accumulation (white areas).

Tulsa, OK (TSA): Current 7-Day Observed Precipitation
Valid at 3/8/2015 1200 UTC- Created 3/9/15 13:44 UTC

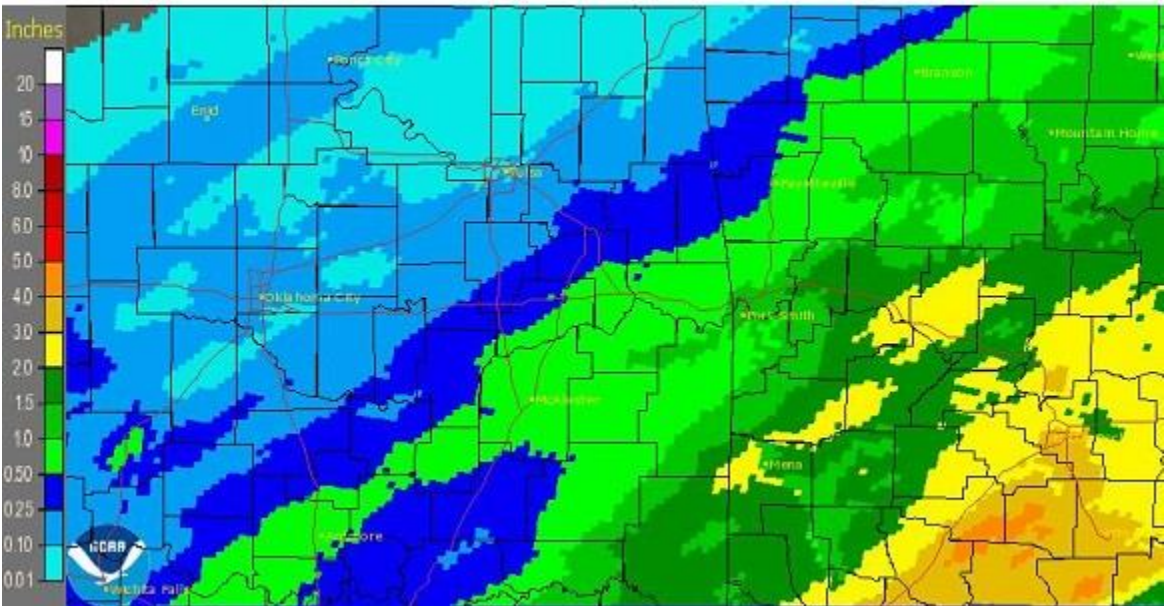


Fig. 6. 7-day Estimated Observed Rainfall/Liquid Equivalent (for Mar. 4-5 event) ending at 6am CST 03/08/2015.

Tulsa, OK (TSA): 3/10/2015 1-Day Observed Precipitation
 Valid at 3/10/2015 1200 UTC- Created 3/10/15 18:26 UTC

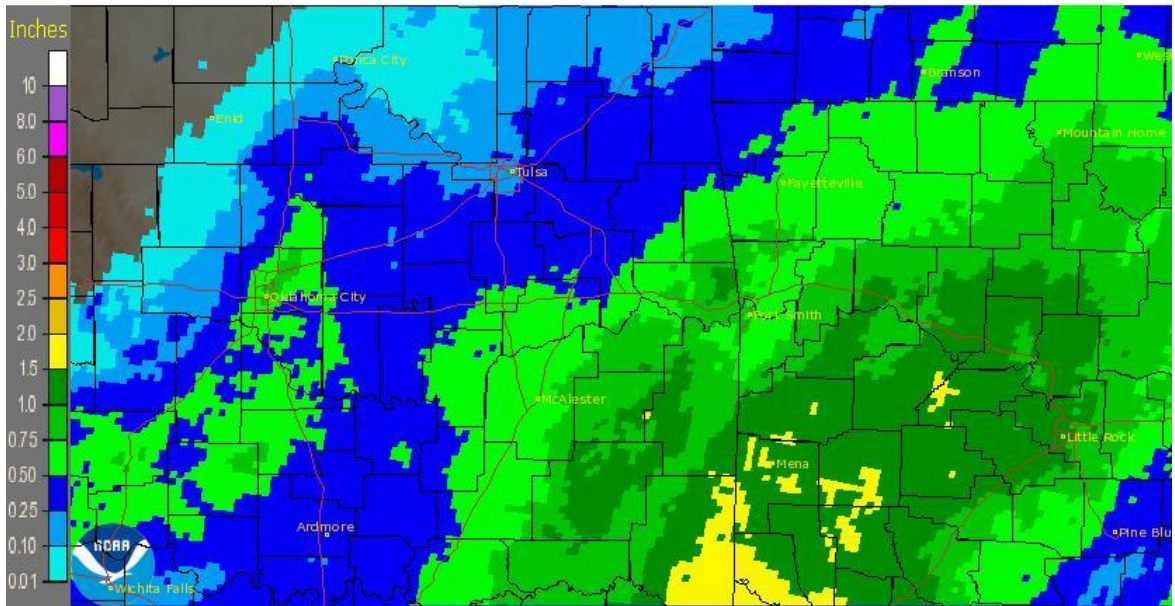
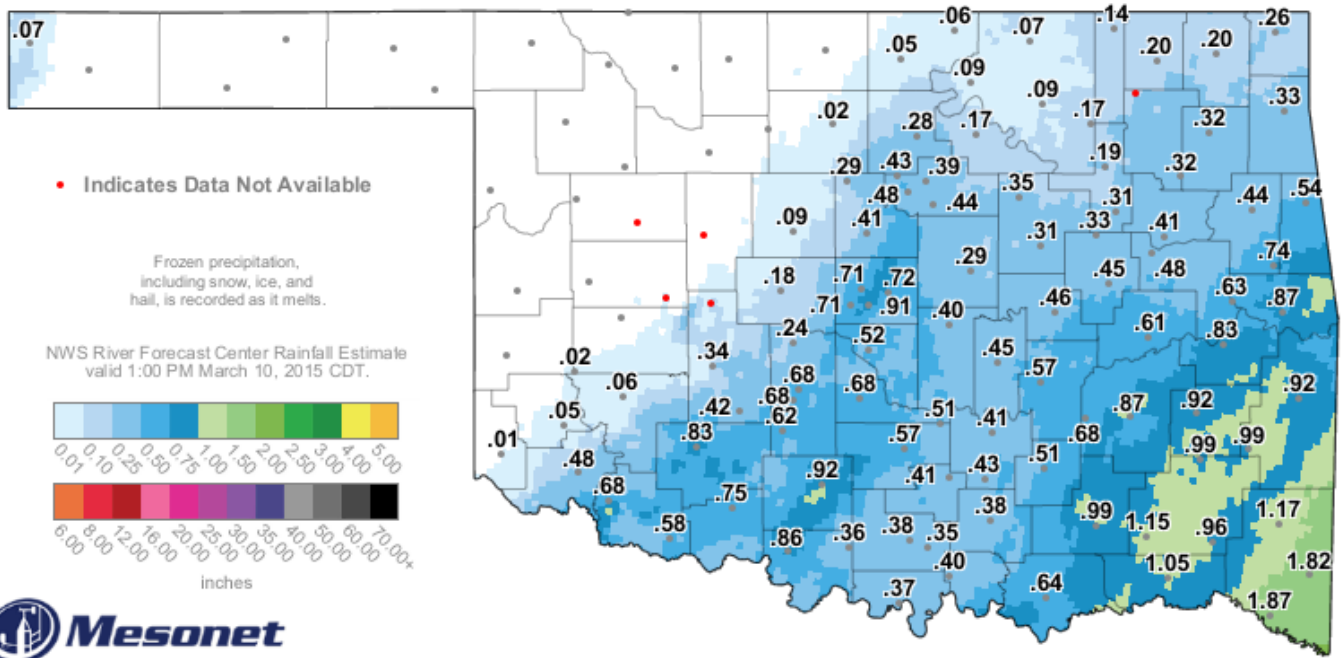


Fig. 7. 24-hr Estimated Observed Rainfall ending at 7am CDT 03/10/2015.



2:00 PM March 10, 2015 CDT
 Created 2:05:17 PM March 10, 2015 CDT. © Copyright 2015

Fig. 8. 2-Day Estimated and Observed Rainfall ending at 2pm CDT 03/10/2015.

As a surface low moved north out of Louisiana and into AR, very deep Gulf moisture was drawn north into the HSA. Showers first developed on the 12th, bringing around 0.10" to around 0.50" of rain to southeast OK and northwest/west central AR. A mid-level low over southeast TX then moved north on the 13th, bringing widespread rainfall to eastern OK and northwest AR as it interacted with the unusually high moisture for this time of year. The rain continued on the 14th before moving south of the HSA. Storm total rainfall ranged from only around 0.10" in northwest Osage and eastern Kay Counties, to near 3" in portions of east central OK and west central AR (Figs. 9, 10). Most locations south of I-44 received over an inch of rain. A large area of 2.5"-3" of rain fell across Pittsburg County, including McAlester, which measured 2.66" at the Mesonet site. Rises occurred along rivers and streams within the White, Illinois, lower Arkansas, Canadian, and lower Red River Basins. The Poteau River near Panama exceeded Moderate Flood Stage (see E3 Report for details), making this the first time for mainstem flooding in the HSA since October 2014. The Illinois River near Tahlequah exceeded Action Stage, but remained below Flood Stage.

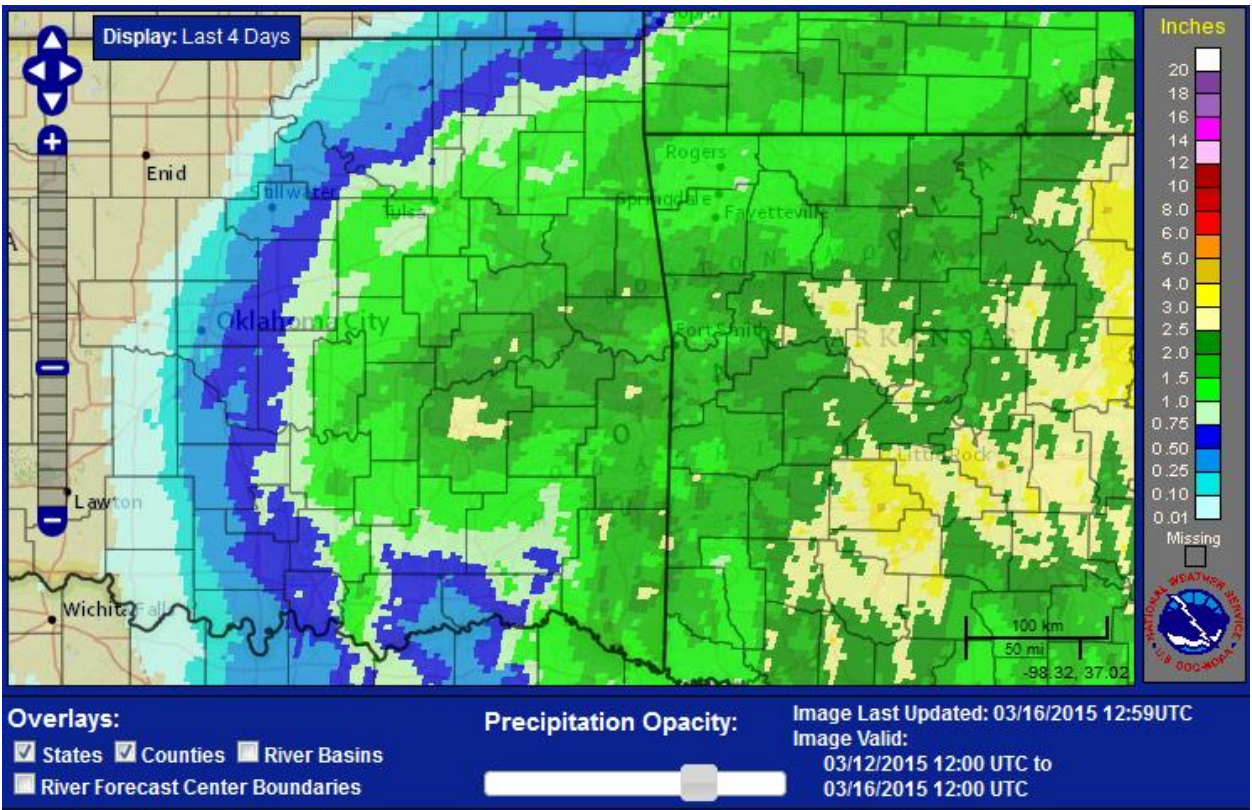


Fig. 9. 4-day Estimated Observed Rainfall ending at 7am CDT 03/16/2015.

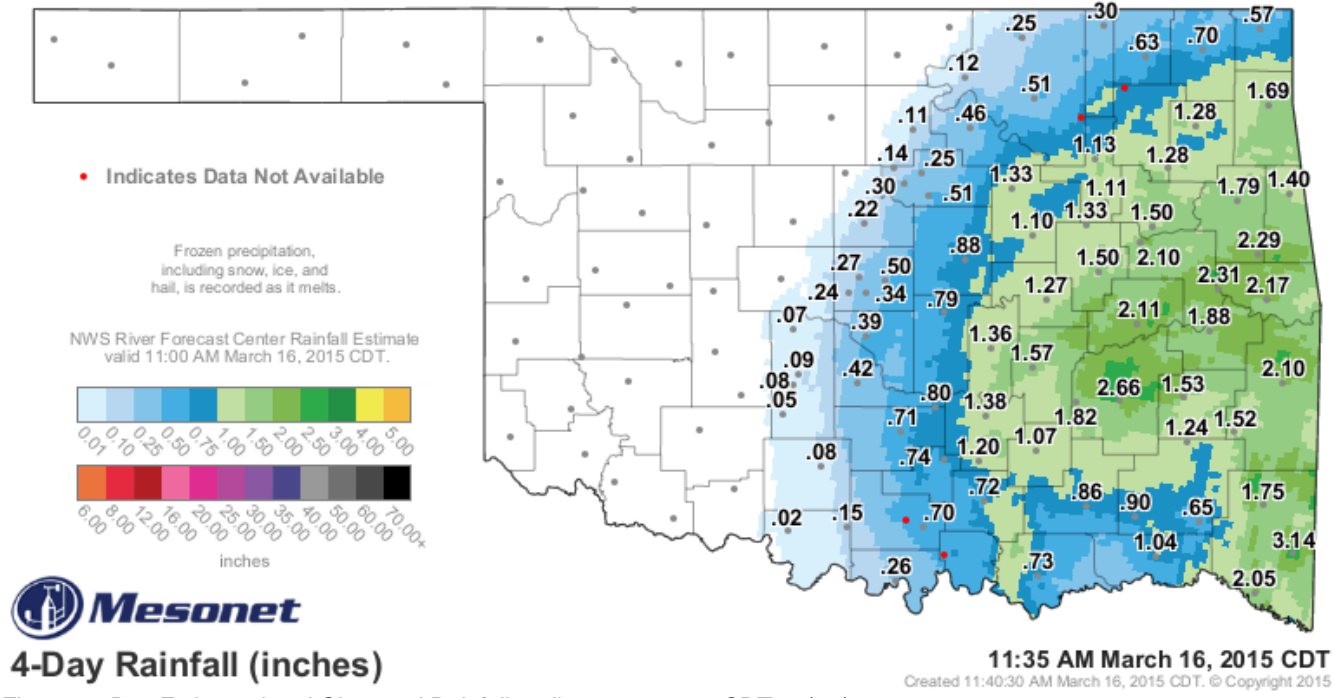


Fig. 10. 4-Day Estimated and Observed Rainfall ending at 11:35am CDT 03/16/2015.

March 16-31

Rain spread across the region overnight on the 17th and continued through the 18th as an upper-level low lifted out of Mexico and across TX. A large portion of the area received 0.10"-0.50" of rain, with the highest totals of 0.50"-1" in Delaware and Benton Counties (Fig. 11).

Another round of showers developed over the area in response to an upper-level low and cold front. Rainfall amounts remained light, with totals of a few hundredths to near half an inch (Figs. 12, 13).

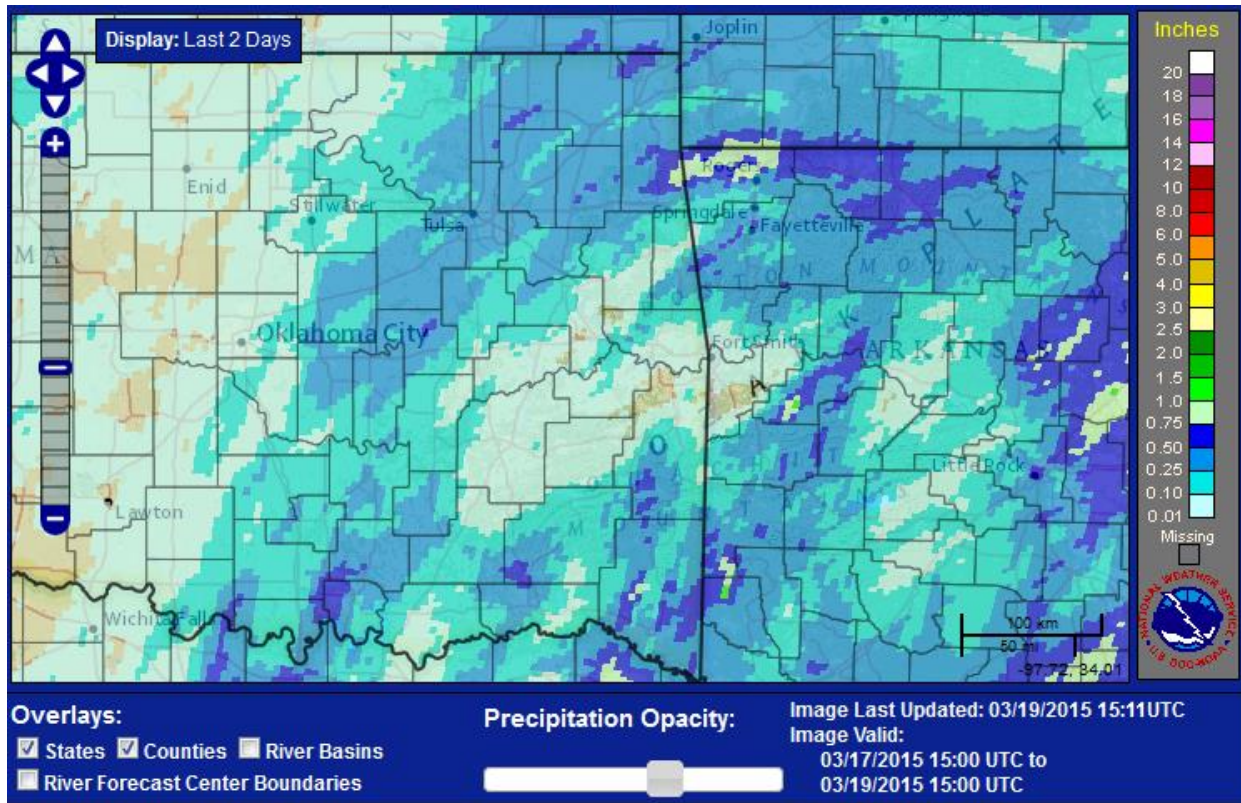
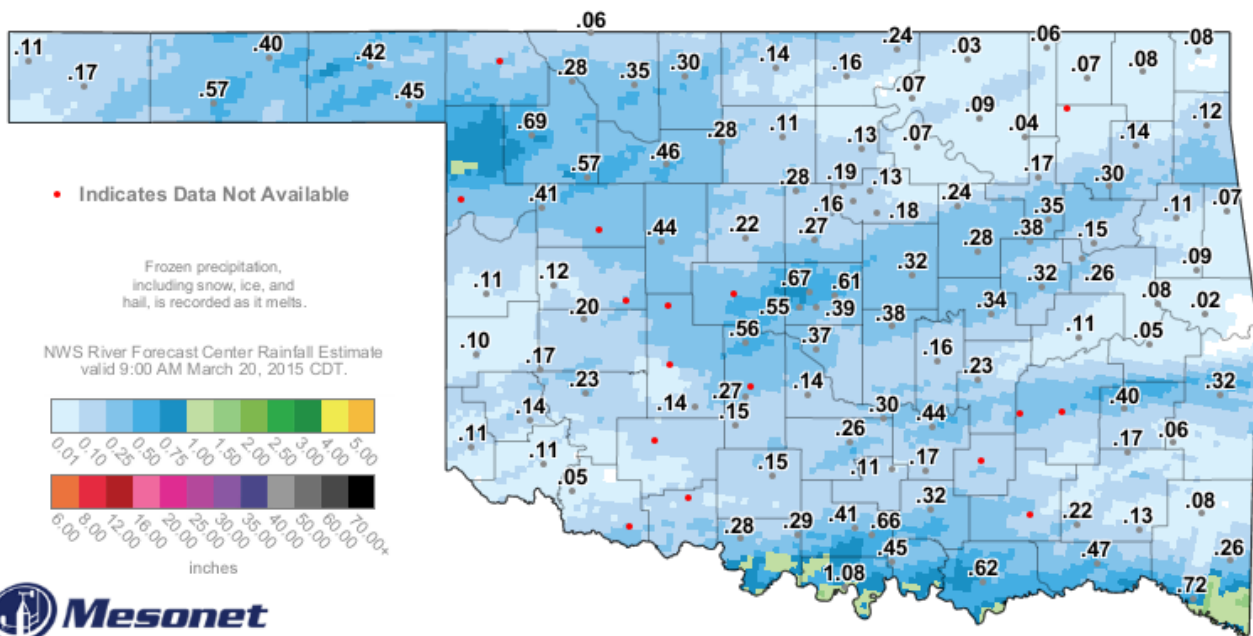


Fig. 11. 2-day Estimated Observed Rainfall ending at 10am CDT 03/19/2015 for the March 17-18 rainfall.



24-Hour Rainfall (inches)

10:25 AM March 20, 2015 CDT

Created 10:30:22 AM March 20, 2015 CDT. © Copyright 2015

Fig. 12. 24-hour Estimated and Observed Rainfall ending at 10:25am CDT 03/20/2015.

Tulsa, OK (TSA): 3/20/2015 1-Day Observed Precipitation
Valid at 3/20/2015 1200 UTC- Created 3/22/15 23:33 UTC

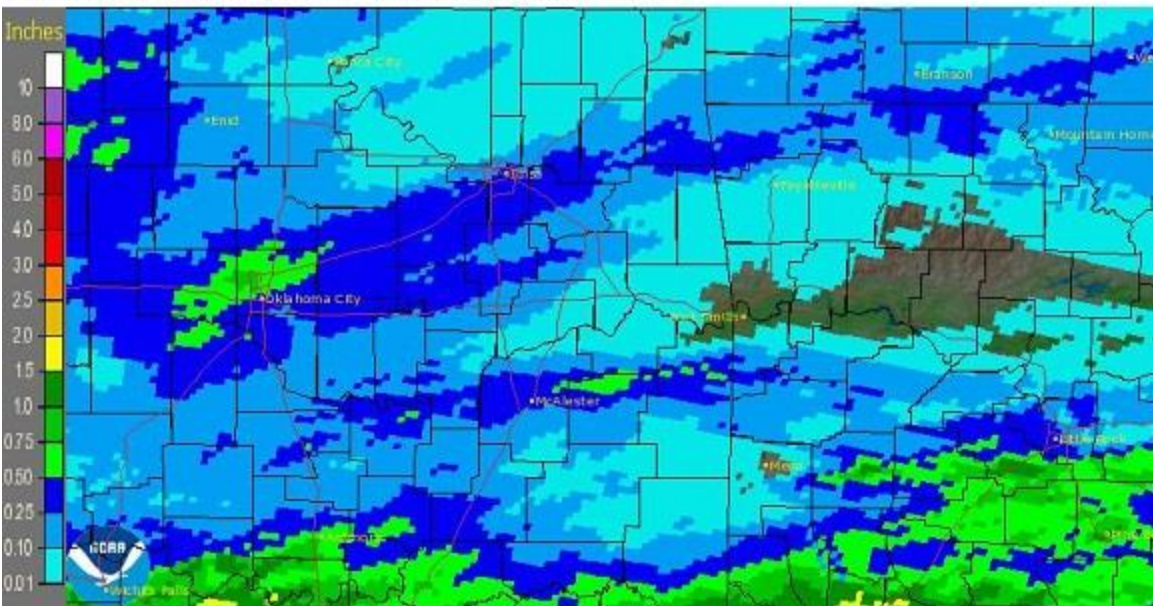


Fig. 13. 24-hr Estimated Observed Rainfall ending at 7am CDT 03/20/2015.

An upper-level low moved from the Baja Peninsula and across TX on the 21st, resulting in shower activity across southeast OK and isolated locations in west central AR. The rain was confined primarily to locations along and south of a McAlester to Poteau line, where rainfall totals were 0.10" to around 0.50".

The first round of severe weather this year occurred as a potent shortwave trough moved into the Central Plains. A line of thunderstorms developed during the late afternoon of the 24th as a Pacific cold front provided a focus. There were several reports of 1.5"-2" diameter hail reported in Benton and Washington (AR) Counties, with the 2" hail reports occurring near Lowell and Beaver Lake in Benton Co. The storms moved southeast quickly and dissipated before midnight. A Severe Thunderstorm Watch was issued for portions of northeast OK and northwest AR for this event, making it the latest watch ever issued in March (since 1970) for the entire country. Rainfall totals ranged from around 0.10" to around 1" under the core of each thunderstorm. One thunderstorm did bring 0.50" to around 2" of rain to central Pushmataha County.

The cold front stalled across southeast OK and west central AR and then lifted back north as a warm front to northeast OK and northwest AR. A second round of severe weather broke out during the late afternoon of the 25th near the front as a strong shortwave approached. The initial storms were supercells, which produced several tornadoes from west of Tulsa into northwest AR. As the evening wore on, a cold front surged into the area from the northwest and thunderstorms congealed into a line along the cold front, marching to the south and east during the evening and overnight hours. Many of the storms became severe producing large hail and damaging winds, including softball size hail and winds of 100mph in Tulsa, before exiting southeast Oklahoma and west-central Arkansas. Several tornadoes occurred during this event, leading to one fatality when an EF-2 tornado hit a mobile home community west of Sand Springs. More information on the tornadoes can be found here: http://www.srh.noaa.gov/tsa/?n=weather-event_2015mar25 These storms also brought heavy rain and flash flooding to northeast OK and northwest AR. All but eastern Kay and the far western portions of Pawnee and Osage Counties received 0.25" to over 1.5" of rain (Fig. 14). The greatest rainfall occurred over Benton and Carroll Counties, where 1.5" to near 4" of rain fell. Most of the northern half of Carroll Co. received 3"-4" of rain. 1.5" to around 2.5" of rain occurred across eastern Pawnee, southern Osage, far eastern Creek, Tulsa, far northwest Wagoner, and southwest Rogers Counties, with isolated 1.5"-2" amounts elsewhere in northeast OK and northwest AR. However, no mainstem river flooding occurred from this rainfall. Unfortunately, one SUV was swept away when the driver drove into water over Hwy 187 northwest of Eureka Springs, AR in Carroll Co. The SUV was recovered, but the driver has yet to be found as of the time of this writing and is assumed deceased. South Fork Creek 6 miles southwest of Webbers Falls, OK (Muskogee Co.) rose to about 12 feet high at a low water crossing according to local residents. A pickup truck with two passengers tried to cross this creek at the low water crossing and was swept off the road. Both passengers drowned.

Several CoCoRaHS volunteers measured over 2" of rain during this event:

Bella Vista 2E, AR	2.70"	Bella Vista 1.5NNE, AR	2.62"	Sand Springs 2.1ENE, OK	2.13"
Tulsa 4.2NE, OK	2.07"	Tulsa 2.6NE, OK	2.06"	Tulsa 1SW, OK (DCP gage)	2.02"

Tulsa, OK (TSA): 3/26/2015 1-Day Observed Precipitation
Valid at 3/26/2015 1200 UTC- Created 3/28/15 23:33 UTC

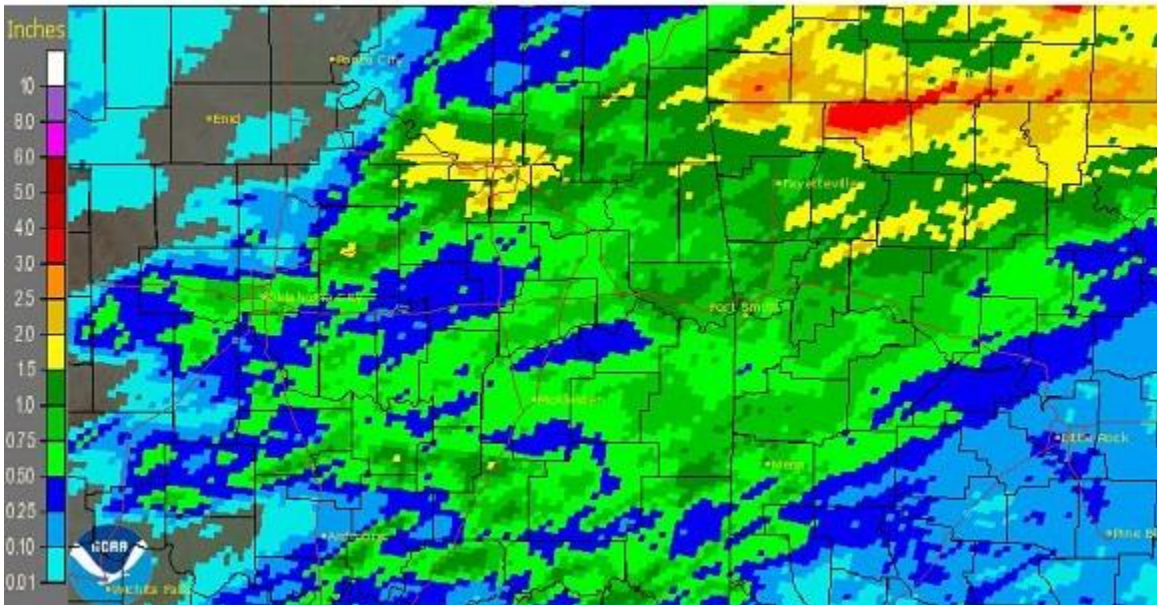


Fig. 14. 24-hr Estimated Observed Rainfall ending at 7am CDT 03/26/2015.

Isolated thunderstorms developed during the late afternoon and through the evening of the 31st near a weak frontal boundary. Additional storms moved into eastern OK during the overnight hours. Some of the evening storms became severe, producing large hail. 2.5" hail was reported near Welty (Okfuskee Co.), and there were reports of 1.75" hail in Haskell, McIntosh, and Okfuskee Counties. The thunderstorm cores produced 0.50" - 1.5" of rain during the afternoon and evening hours, with 1.5" to around 2" of rain in isolated locations of southeast Okmulgee and McIntosh Counties (Fig. 15). The overnight activity produced less than 0.50" of rain across the affected area.

Tulsa, OK (TSA): 4/1/2015 1-Day Observed Precipitation
Valid at 4/1/2015 1200 UTC- Created 4/1/15 16:25 UTC

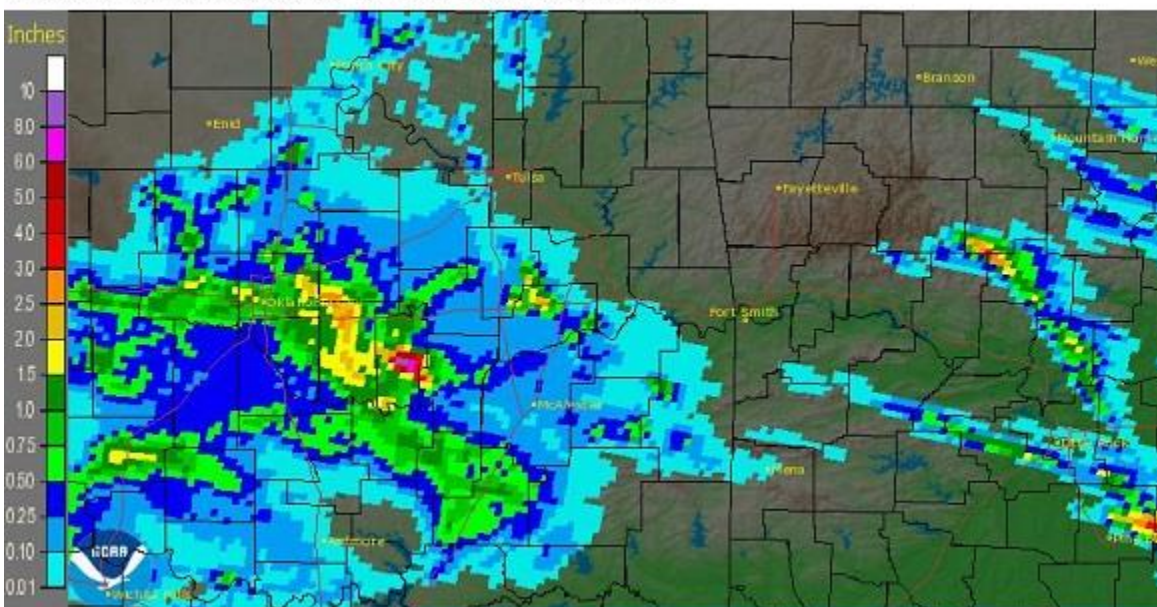


Fig. 15. 24-hr Estimated Observed Rainfall ending at 7am CDT 04/01/2015.

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

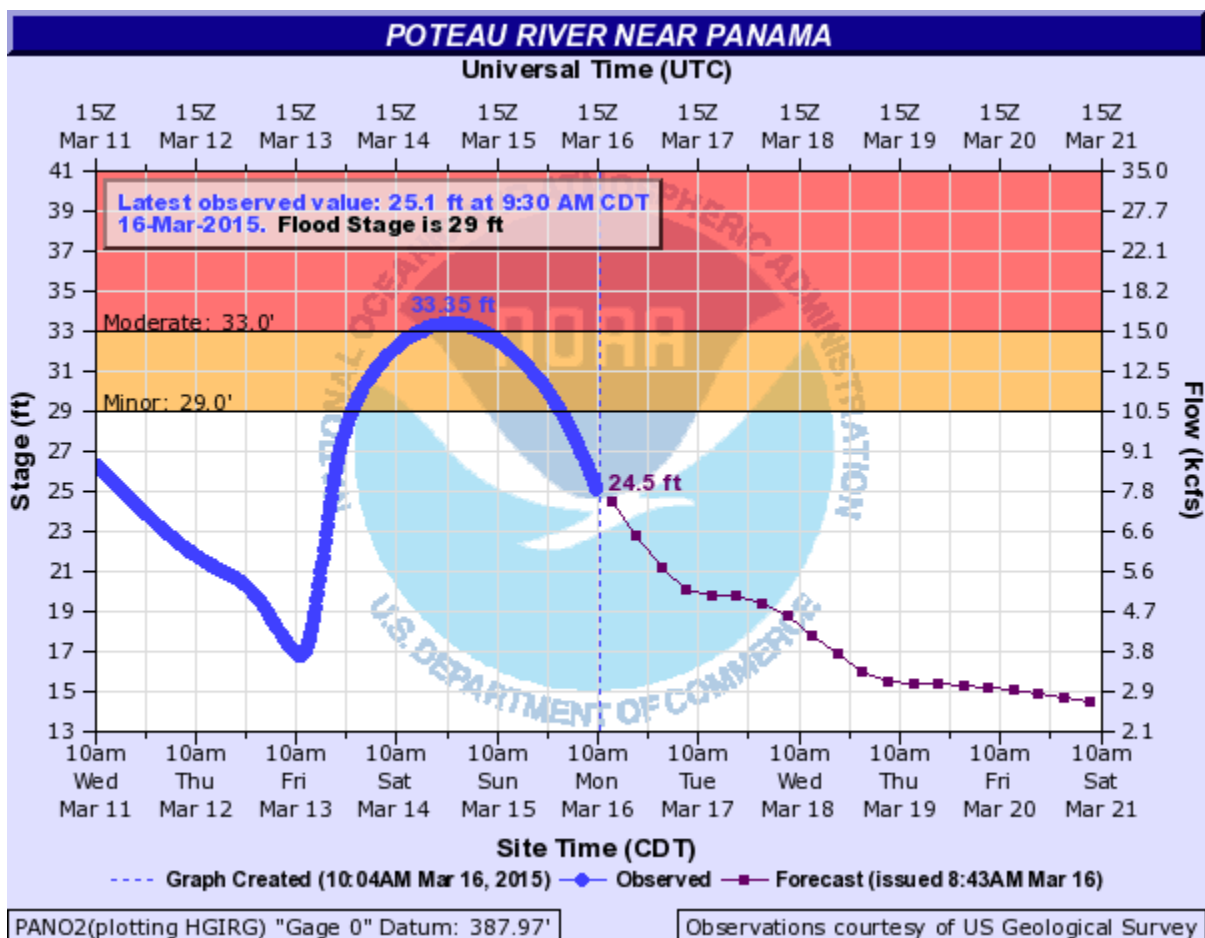
Products issued in March 2015:

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

*Mixed case River Flood products began July 31, 2013

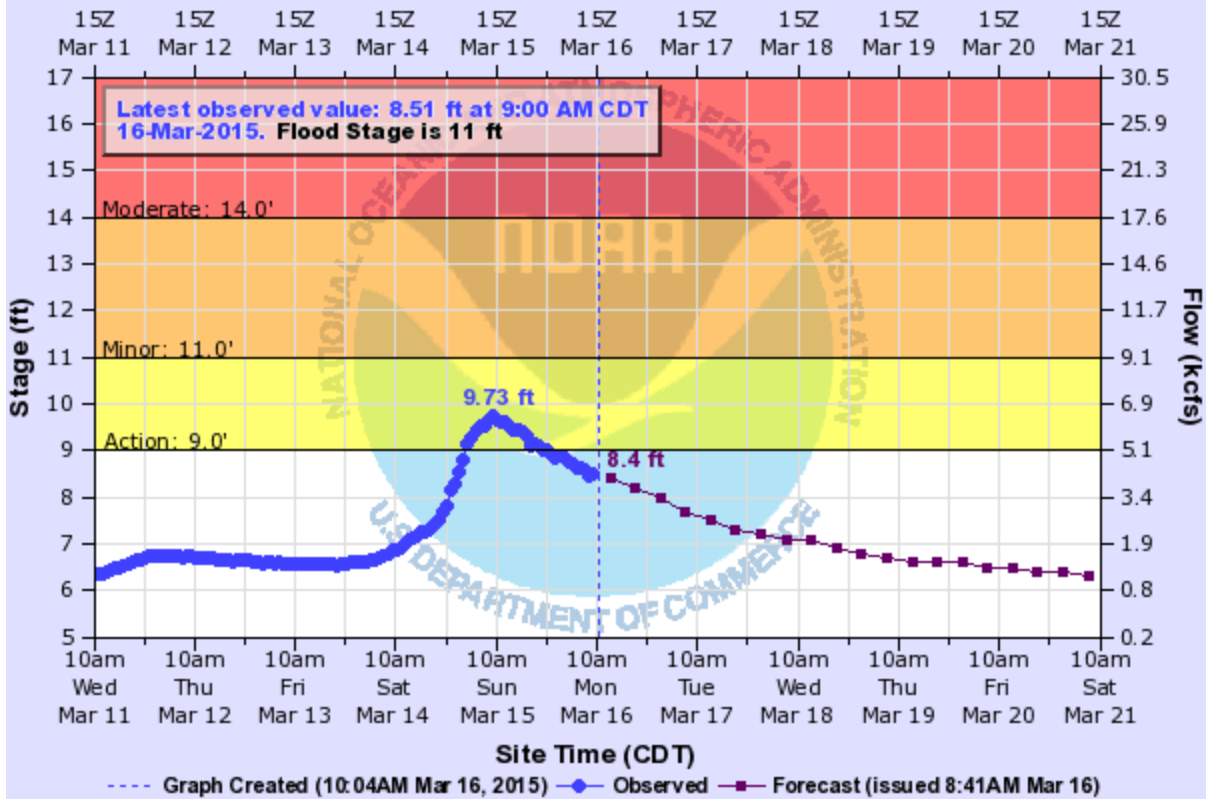
- 8 Flash Flood Warnings (FFW)
- 0 Flash Flood Statements (FFS)
- 1 Flash/Areal Flood Watches (FFA) (4 Watch FFA CON/EXT/EXA/CAN)
- 5 Urban and Small Stream Advisories (FLS)
- 2 Areal Flood Warnings (FLW)
- 0 Areal Flood Statements (FLS)
- 4 River Flood Warnings (FLW)
- 11 River Flood Statements (FLS)
- 3 River Flood Advisories (FLS) (14 Advisory FLS CON/EXT/CAN)
- 0 River Flood Watches (FFA) (0 Watch FFA CON/EXT/CAN)
- 0 River Statements (RVS)
- 1 Hydrologic Outlooks (ESF)
- 0 Drought Information Statements (DGT)

Preliminary Hydrographs:



ILLINOIS RIVER (AR OK) NEAR TAHLEQUAH

Universal Time (UTC)



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

Observations courtesy of US Geological Survey