

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 September	YEAR 2014
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 October 2, 2014	

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.

While most of eastern OK and northwest AR had another month with below normal rainfall, a few locations received an abundant amount of rain during September 2014. 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.

Monthly Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for September 2014 ranged from 1" in portions of eastern OK to around 11" in Choctaw County. The majority of the HSA received 2"-5" of rain this month. A large portion of the HSA only received 25%-75% of the normal September rainfall this month (Fig. 1b). However, above normal rainfall occurred across the northern portions of Osage, Washington, Nowata, and Craig Counties in northeast OK, as well as large portions of Sequoyah, Haskell, Le Flore, and Sebastian Counties. The eastern half of Choctaw County had 150% to near 300% of the normal September rainfall.

Tulsa, OK (TSA): September, 2014 Monthly Observed Precipitation
 Valid at 10/1/2014 1200 UTC- Created 10/1/14 14:16 UTC

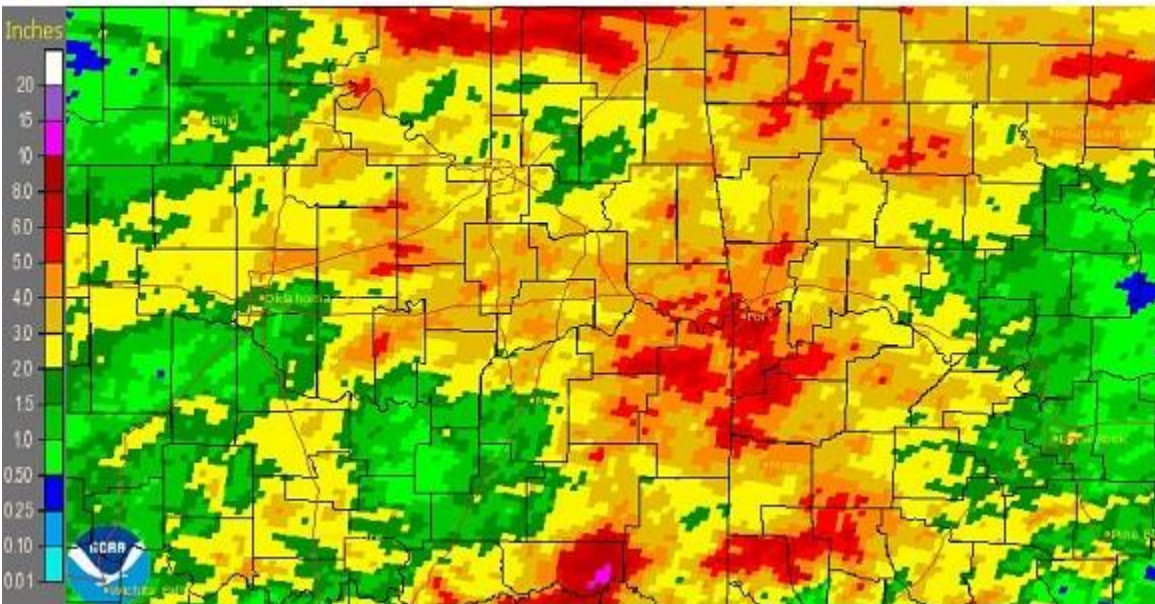


Fig. 1a. Estimated Observed Rainfall for September 2014

Tulsa, OK (TSA): September, 2014 Monthly Percent of Normal Precipitation
 Valid at 10/1/2014 1200 UTC- Created 10/1/14 14:17 UTC

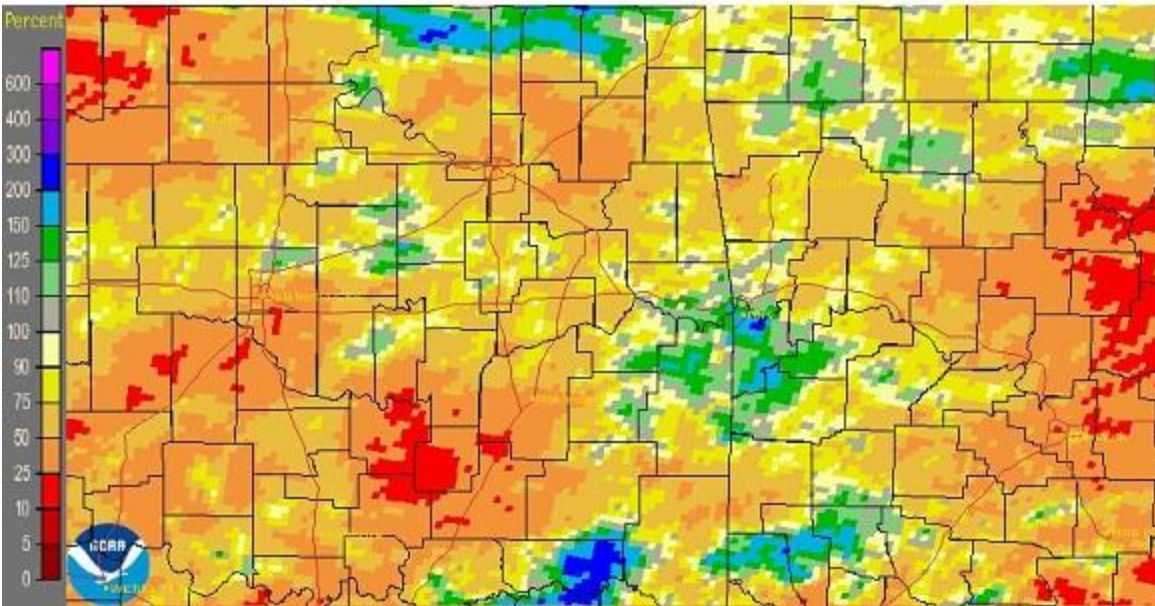


Fig. 1b. Estimated % of Normal Rainfall for September 2014

In Tulsa, OK, September 2014 ranked as the 52nd coldest September (73.8°F, tied 1981, 1941; since records began in 1905) and the 44th driest September (2.19"; since records began in 1888). Fort Smith, AR was the 64th warmest September (74.5°F, tied 1973; since records began in 1882) and the 13th wettest September (6.90"; since records began in 1882). Fayetteville, AR was the 30th coldest (68.9°F, tied 1997, 1991, 1964) and the 23rd driest (2.43") September since records began in 1949.

Some of the larger precipitation reports (in inches) for September 2014 included:

Hugo, OK (meso)	8.69	Foraker, OK (meso)	8.17	Fort Smith, AR (ASOS)	6.90
Wister, OK (meso)	6.54	Vinita, OK (meso)	6.42	Mountainburg 2NE, AR (coop)	6.39
Bengal, OK (coop)	6.26	Bartlesville, OK (ASOS)	5.82	Copan, OK (meso)	5.74

Some of the lowest precipitation reports (in inches) for September 2014 included:

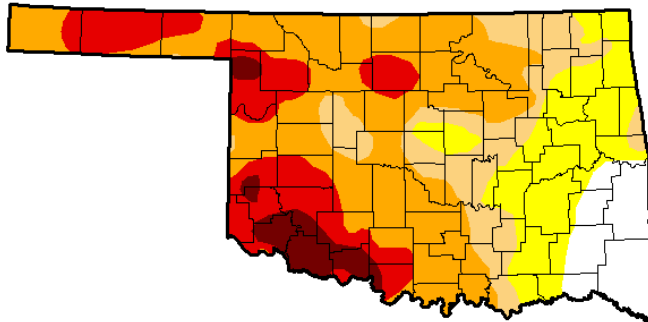
McAlester, OK (ASOS)	1.32	Inola, OK (meso)	1.34	Claremore 2ENE, OK (coop)	1.76
Wynona, OK (meso)	1.88	McAlester, OK (meso)	1.90	Antlers, OK (meso)	1.96
Tulsa, OK (meso)	2.08	Tulsa, OK (ASOS)	2.19	Pawnee, OK (meso)	2.39

According to the USACE, several of the major reservoirs in the HSA were operating within $\pm 3\%$ of the top of their conservation pools as of 9/30/2014. Skiatook Lake has had a decrease in its conservation pool from 61% at the end of August to 57% at the end of September. As of 9/30/2014, the Skiatook pool was at 698.85' and falling. This is the lowest the lake has been since it was filled in 1984. New low pool records will continue as the lake continues to fall. Eufaula Lake dropped from 95% to 84% over the last month. Several lakes were reporting below normal pool levels: Skiatook Lake 57%, Beaver Lake 77%, Eufaula Lake 84%, Keystone Lake 84%, Tenkiller Lake 85%, Ft. Gibson Lake 91%, and Birch Lake 93%. A couple of lakes had levels within their flood control pools: Hudson Lake 105% and Oologah Lake 104%.

According to the [U.S. Drought Monitor](#) (USDM) from September 30, 2014 (Figs 2, 3), Severe Drought (D2) conditions were occurring across portions of eastern Kay, Osage, Pawnee, Creek, western Tulsa, southern Washington, Counties in eastern OK. Moderate Drought (D1) conditions were present across portions of Osage, Washington, Nowata, Craig, Rogers, Tulsa, Okfuskee, Okmulgee, Mayes, Adair, and Sequoyah Counties in eastern OK, and Crawford, Madison, and Washington Counties in northwest AR. Abnormally Dry (D0), but not experiencing drought, conditions existed across the remainder of eastern OK and northwest AR, except for much of Haskell, Latimer, Le Flore, Pushmataha and Choctaw Counties in southeast OK and Sebastian and Franklin Counties in west central AR.

U.S. Drought Monitor Oklahoma

September 30, 2014
(Released Thursday, Oct. 2, 2014)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	8.55	91.45	73.31	58.13	20.92	4.64
Last Week 9/23/2014	17.17	82.83	69.10	49.31	13.59	2.25
3 Months Ago 7/1/2014	5.50	94.50	80.12	65.61	30.07	6.67
Start of Calendar Year 12/1/2013	50.84	49.16	38.17	18.99	4.84	2.40
Start of Water Year 10/1/2013	21.74	78.26	43.00	17.62	4.42	1.45
One Year Ago 10/1/2013	21.74	78.26	43.00	17.62	4.42	1.45

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:
Richard Heim
NCDC/NOAA

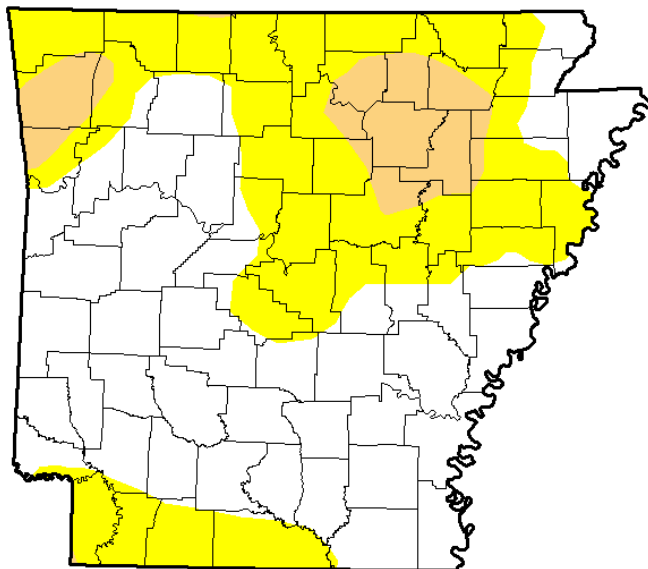


<http://droughtmonitor.unl.edu/>

Fig. 2. Drought Monitor for Oklahoma

U.S. Drought Monitor Arkansas

September 30, 2014
(Released Thursday, Oct. 2, 2014)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	54.54	45.46	9.13	0.00	0.00	0.00
Last Week 9/23/2014	79.23	20.77	2.36	0.00	0.00	0.00
3 Months Ago 7/1/2014	82.50	17.50	0.04	0.00	0.00	0.00
Start of Calendar Year 12/1/2013	96.56	3.44	0.00	0.00	0.00	0.00
Start of Water Year 10/1/2013	47.69	52.31	23.96	11.67	3.34	0.00
One Year Ago 10/1/2013	47.69	52.31	23.96	11.67	3.34	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:
Richard Heim
NCDC/NOAA



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

Fig. 3. Drought Monitor for Arkansas

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

Rank since 1921	September 2014	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 2014 (Oct 1 – Sep 30)
Northeast OK	42 nd driest	27 th driest	44 th driest	42 nd driest	26 th driest	8th driest	13th driest
East Central OK	39 th driest	21 st driest	38 th driest	43 rd driest	25 th driest	11th driest	18 th driest
Southeast OK	35 th wettest	33 rd driest	25 th wettest	21 st wettest	35 th wettest	33 rd driest	42 nd driest
Statewide	30 th driest	17 th driest	38 th wettest	38 th wettest	30 th driest	12th driest	15 th driest

Water Year Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 4a), rainfall totals for Water Year 2014 (October 1, 2013-September 30, 2014) ranged from around 25” in Pawnee County in northeast OK to around 60” in Le Flore County in southeast OK. The majority of the HSA received 25”-40” of rain during the water year, with a large portion of southeast OK and west central AR getting 40”-50”. The entire HSA, except for the far southeast corner of Le Flore County, received below normal rainfall for Water Year 2014 (Fig. 4b). Most of eastern OK and northwest AR saw only 50%-90% of the normal water year rainfall.

In Tulsa, OK, Water Year 2014 ranked as the 9th coldest Water Year (58.8°F, tied WY1979; since records began in 1906-07) and the 12th driest Water Year (27.92”; since records began in 1893-94). Fort Smith, AR was the 31st coldest Water Year (60.4°F; since records began in 1882-83) and the 65th wettest Water Year (41.02”; since records began in 1882-83). Fayetteville, AR was the **record coldest** Water Year (54.9°F; previous record 55.6°F in Water Year 1979) and the 13th driest (38.59”) Water Year since records began in 1949-50. Interestingly, just two years prior, Water Year 2012 was the hottest Water Year on record in Fayetteville.

Some of the larger precipitation reports (in inches) for Water Year 2014 included (OCS mesonet sites not available; station totals may have some missing data):

Fanshawe, OK (coop)	48.69	St. Paul, AR (coop)	46.22	Winslow 7NE, AR (coop)	46.02
Natural Dam, AR (coop)	45.23	Bengal, OK (coop)	44.64	Mountainburg 2NE, AR (coop)	43.38
Wister, OK (coop)	42.14	Ozark, AR (coop)	41.96	Antlers, OK (coop)	41.74

Tulsa, OK (TSA): 2014 Water Year. Observed Precipitation
Valid at 10/1/2014 1200 UTC- Created 10/1/14 14:17 UTC

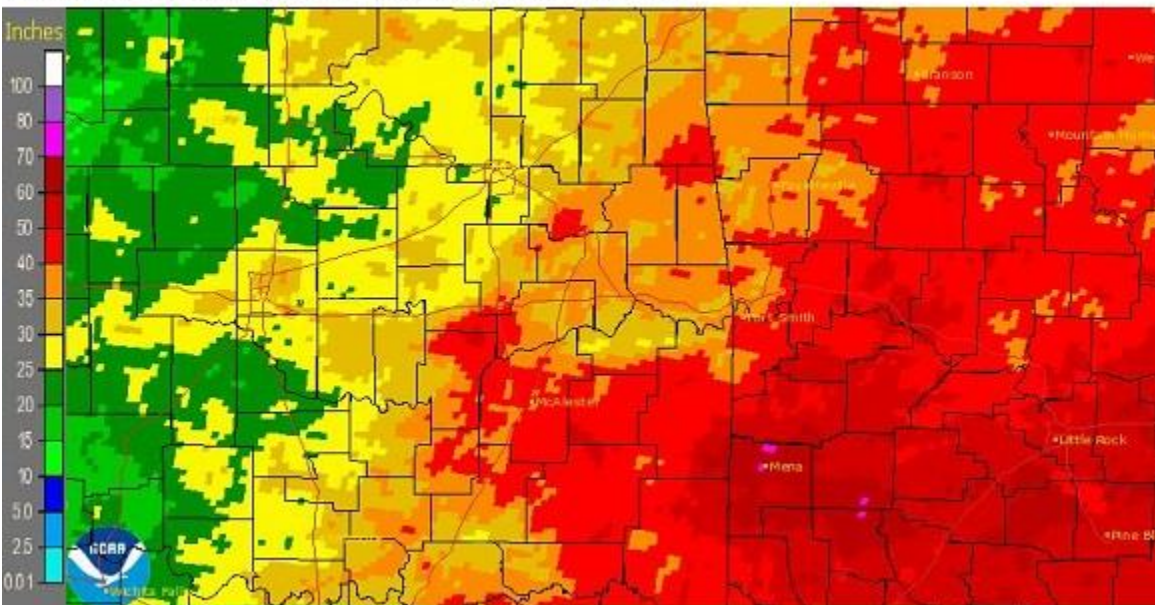


Fig. 4a. Estimated Observed Rainfall for Water Year 2014

Tulsa, OK (TSA): 2014 Water Year, Percent of Normal Precipitation
Valid at 10/1/2014 1200 UTC- Created 10/1/14 14:18 UTC

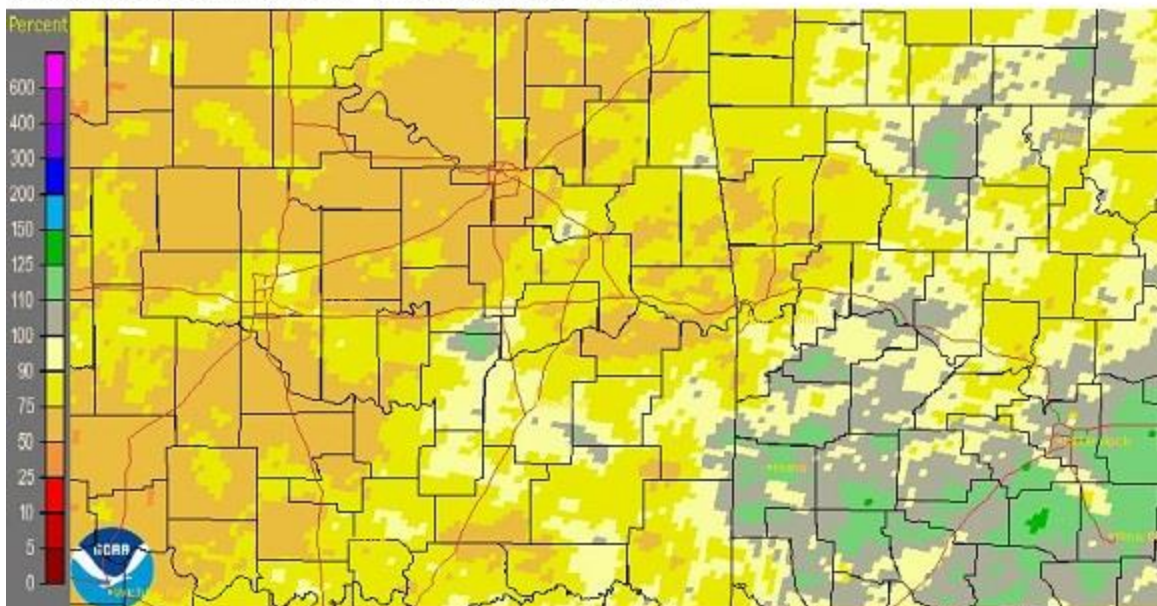


Fig. 4b. Estimated % of Normal Rainfall for Water Year 2014

Outlooks

The [Climate Prediction Center](#) (CPC) outlook for October 2014 (issued September 30, 2014) indicates a slightly enhanced chance for above median precipitation for far northeast OK and northwest AR and equal chances for above, near, and below median precipitation for the remainder of eastern OK. This outlook also indicates equal chances for above, near, and below normal temperatures across all of eastern OK and northwest AR. This outlook is based on short-range forecasts of expected weather conditions, primarily for the first half of October, as well as some medium range guidance.

For the 3-month period October-November-December 2014, CPC is forecasting a slightly enhanced chance for above median precipitation for all of the HSA except the far northeast corner of OK and far northwest corner of AR. This outlook also indicates equal chances for above, near, and below normal temperatures across all of eastern OK and northwest AR (outlook issued September 18, 2014). According to CPC, current atmospheric and oceanic observations continue to indicate ENSO neutral conditions. Forecasts still indicated a weak El Niño event will occur, peaking in late autumn or early winter. Therefore, this outlook is based on both statistical and dynamical forecast tools and considering El Niño conditions.

Summary of Precipitation Events

September 1-16

It was a wet start to September, especially along the KS/OK state line. During the early morning hours of the 1st, a mesoscale convective system (MCS) moved across KS and MO, clipping far northeast OK and far northwest AR. These storms brought around 0.25" to around 1" of rain. Showers and thunderstorms then developed again during the evening hours on the 1st in a very moist atmosphere across southeast KS near a stationary front. These storms moved south into far northeast OK, as another band of thunderstorms redeveloped near the front in southern/southeastern KS. This second round of storms drifted south and brought additional heavy rain to northeast OK due to their slow movement and training of the storms during the late evening and into the overnight hours. By morning on the 2nd, the storms began to move to the southeast across the remainder of eastern OK and northwest AR. All but far southeast OK was affected by this complex of storms, which finally dissipated during the early afternoon. The heaviest rainfall occurred across the northern portions of Osage, Washington, Nowata, and Craig Counties, where 3"-6" of rain fell. Many locations north of I-40 ended up with 1"-2.5", with around 3" in spots (Figs. 5-8). Several rivers near the KS/OK border saw sharp rises, with the Verdigris River near Lenapah climbing 18.3' in only 11.5 hours. The river crested at 21.5', which is below the 30' flood stage. Damaging straight-line winds also impacted Bartlesville, causing

damage to the hospital, many residences, and the mid-high school.

Rainfall totals >3" for 9/02/2014

Childers 2SSE, OK	5.41"	Lenapah 3E, OK	5.39"	Bartlesville 1NE, OK	4.67"
Bartlesville 2W, OK	4.26"	Vinita 10NNW, OK	3.84"	Foraker 8ESE, OK	3.63"
Copan Dam, OK	3.47"	Copan 3ENE, OK	3.35"	Quapaw, OK	3.11"
Tahlequah, OK	3.08"	Commerce, OK	3.00"		

Showers and thunderstorms developed during the afternoon and evening of the 5th as a cold front moved into the HSA. While some of the storms occurred near the front, most of the rain was post frontal. Some widely scattered thunderstorms also developed in the higher terrain areas of southeast OK and northwest AR during the heat of the afternoon. The cold front slowly progressed southward during the overnight hours and through the morning of the 6th. The rain continued behind the front on the 6th, and came to an end from northwest to southeast across northeastern OK and northwest AR. This activity was widespread along and north of an Okemah to Tahlequah line, where rainfall totals of 0.25" to 1.5" were common. Higher totals of 1.5"-4" occurred across portions of Pawnee, Osage and Washington Counties in northeast OK. Most of the post frontal rain ended before reaching southeast OK and west central AR. However, with the cold front near the Red River by the afternoon of the 6th, additional showers and thunderstorms developed during the evening across southeast OK and west central AR. Latimer, northern Pushmataha, and southwestern Le Flore Counties received 0.50" to around 3" of rain, with lesser amounts elsewhere. Residual showers and thunderstorms occurred in the wake of the cold front during the morning and afternoon hours of the 7th across far southeast OK. This brought an additional 0.25" to isolated 3" of rain to Latimer, Le Flore, Pushmataha, and Choctaw Counties. Rainfall totals for August 5-7 are shown in Fig. 9.

Tulsa, OK (TSA): Current 1-Day Observed Precipitation
Valid at 9/2/2014 1200 UTC- Created 9/2/14 18:43 UTC

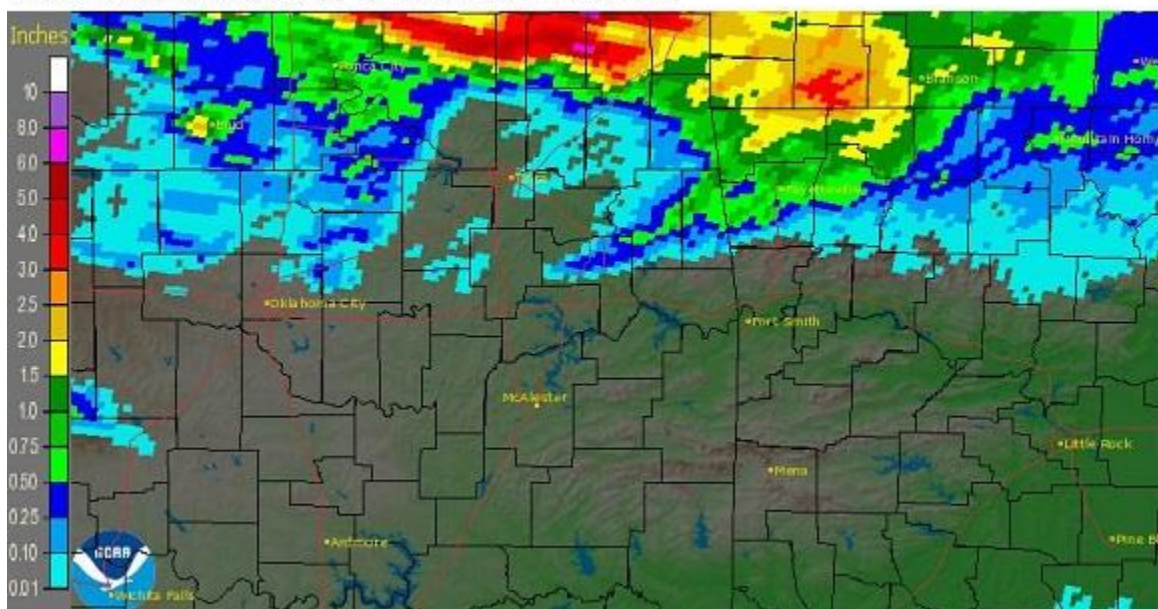


Fig. 5. 24-hr Estimated Observed Rainfall ending at 7am CDT 9/02/2014.

Tulsa, OK (TSA): Current 1-Day Observed Precipitation
 Valid at 9/3/2014 1200 UTC- Created 9/3/14 14:20 UTC

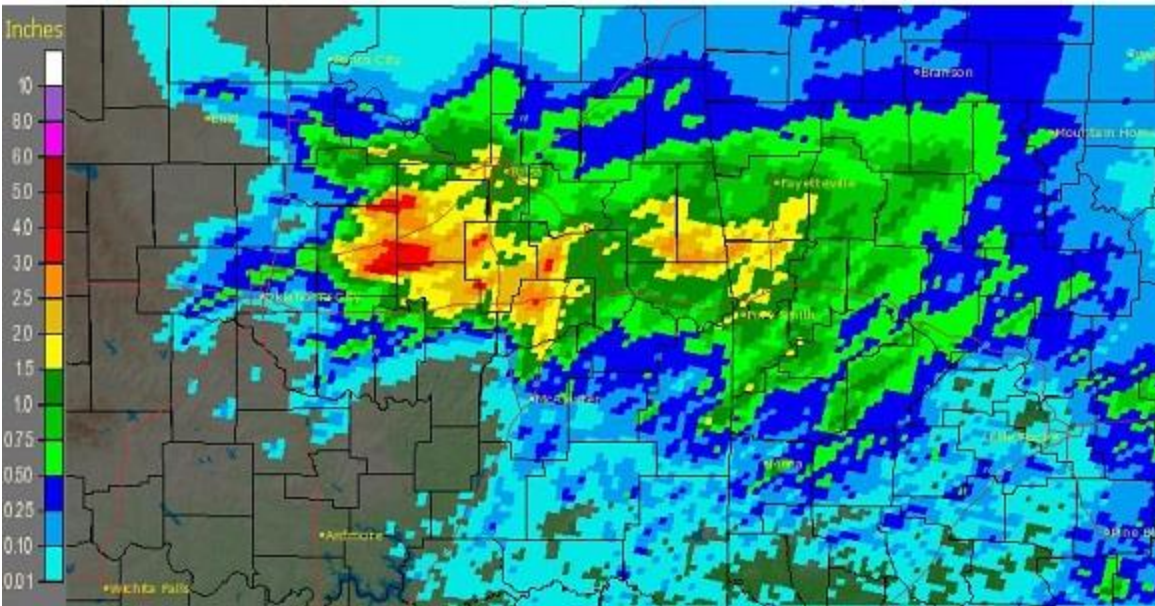
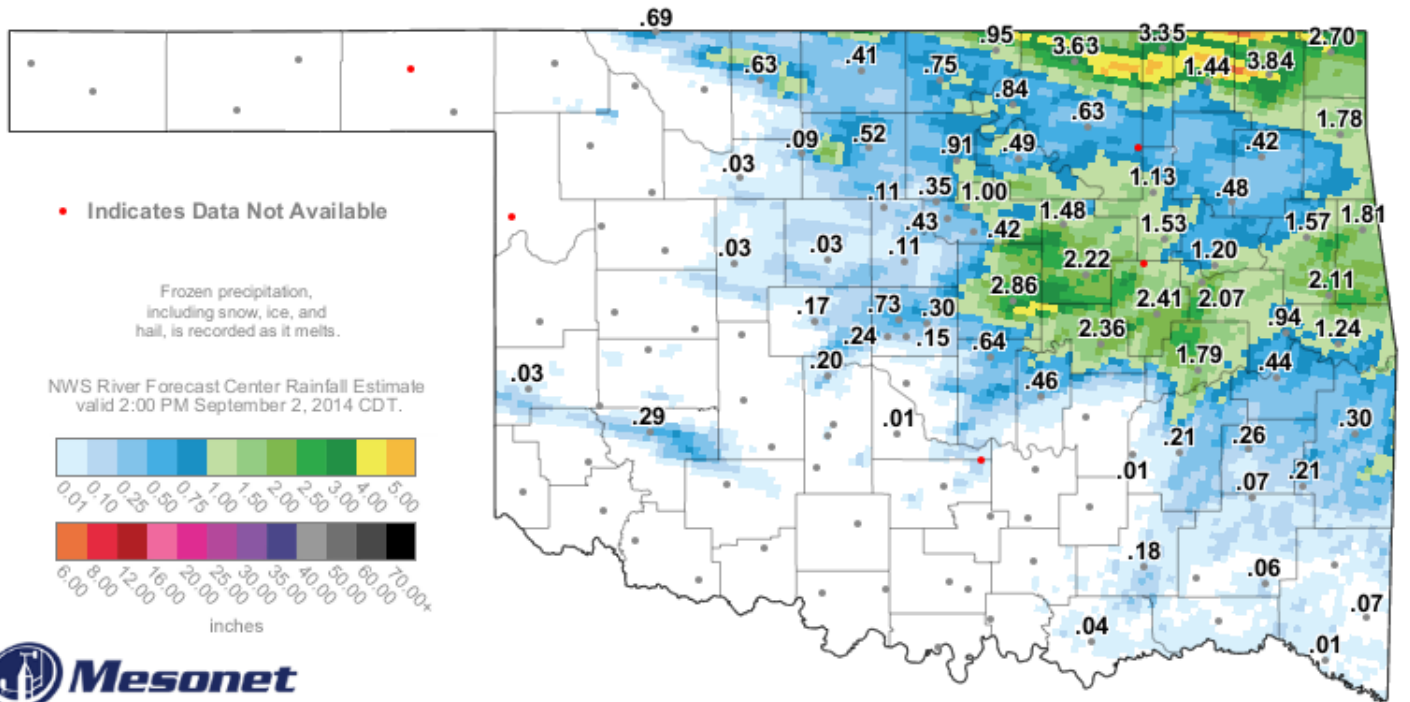


Fig. 6. 24-hr Estimated Observed Rainfall ending at 7am CDT 9/03/2014.



24-Hour Rainfall (inches)

3:05 PM September 2, 2014 CDT

Created 3:10:20 PM September 2, 2014 CDT. © Copyright 2014

Fig. 7. 24-hr estimated observed rainfall (image) and OK Mesonet measurements ending at 3:05pm 9/02/2014.

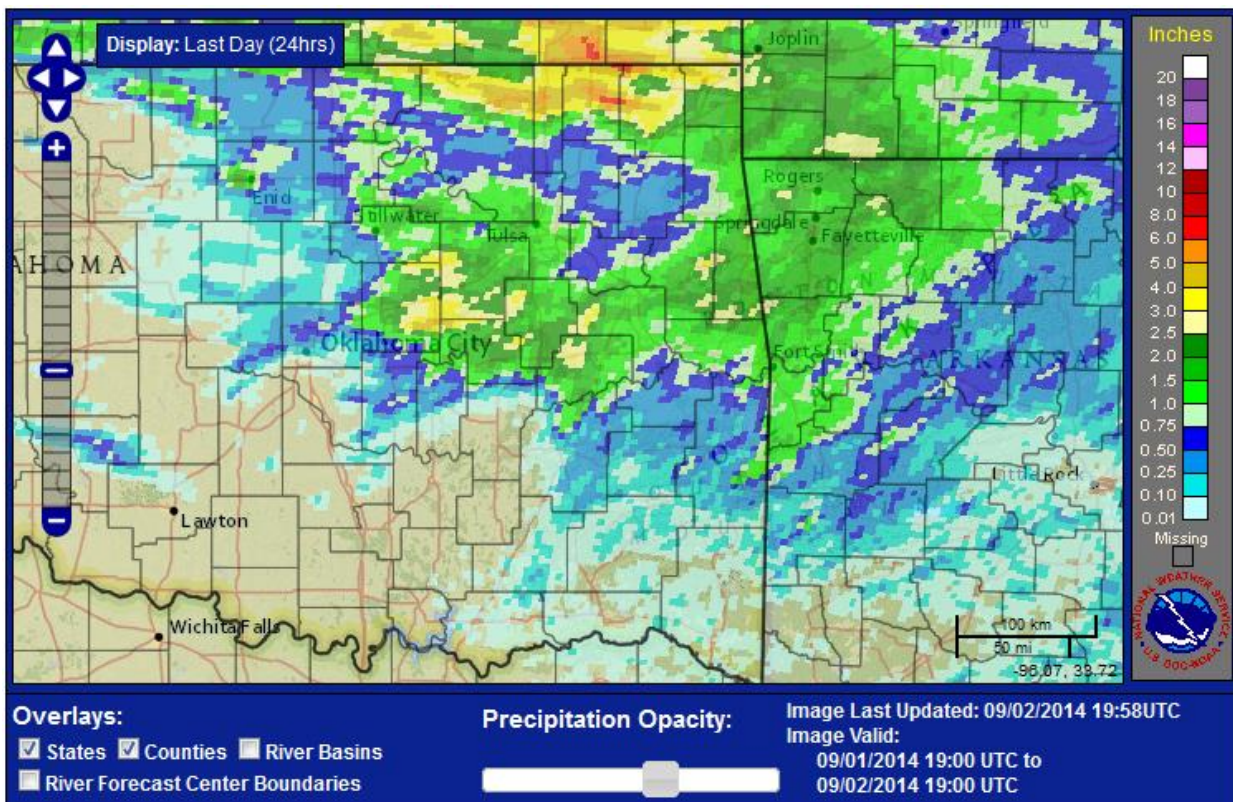


Fig. 8. 24-hr Estimated Observed Rainfall ending at 2pm CDT 9/02/2014.

A cold front moved through the region on the 10th, with showers and thunderstorms developing along this boundary during the late afternoon and evening hours southeast of an Okemah to Fayetteville line. Additional post frontal storms developed during the overnight hours and continued into the morning of the 11th primarily across east central OK and west central AR, before moving south of the HSA by mid-morning. These two rounds of storms brought 1.5" to around 4" of rain (Fig. 10) to portions of east central OK and west central AR, with the highest totals in Haskell, Le Flore, Sequoyah, and Sebastian Counties.

24-hr rainfall ending 7am CDT 9/11/2014

Greenwood 1.9WNW, AR	3.71	Lock & Dam 14 (Spiro 7NE), OK	3.50
Sallisaw 2SSW, OK	3.24	Greenwood 1.4W, AR	3.21
Abbott, AR	3.05		

The cold front from the 10th stalled across north TX on the 11th, with warm advection occurring north of the front. This led to additional showers with isolated thunderstorms starting around midnight on the 12th and continuing for much of the day. Around 1" to around 3" of rain fell across portions of southeast OK and west central AR, primarily south of an Okemah to Fort Smith line (Fig. 11). Southeast Choctaw County received over 6" of rain, with much of eastern Choctaw County getting 6"-8" of rain from the 10th-12th (Figs. 12, 13). The cloudy, rainy day, combined with a secondary surge of colder air, led to chilly temperatures on the 12th. In fact, record low maximum temperatures were set across northeast OK and northwest AR on the 12th.

Light rain affected a large portion of the area during the overnight and early morning hours of the 15th. Later in the afternoon, a cold front sagged south out of KS. A few thunderstorms affected locations near the KS/OK state line. Isolated rainfall totals of 0.50"-2" occurred in western Osage and Ottawa Counties. Isolated thunderstorms that developed near the cold front brought 0.25"-1" of rain to Franklin County on the 16th.

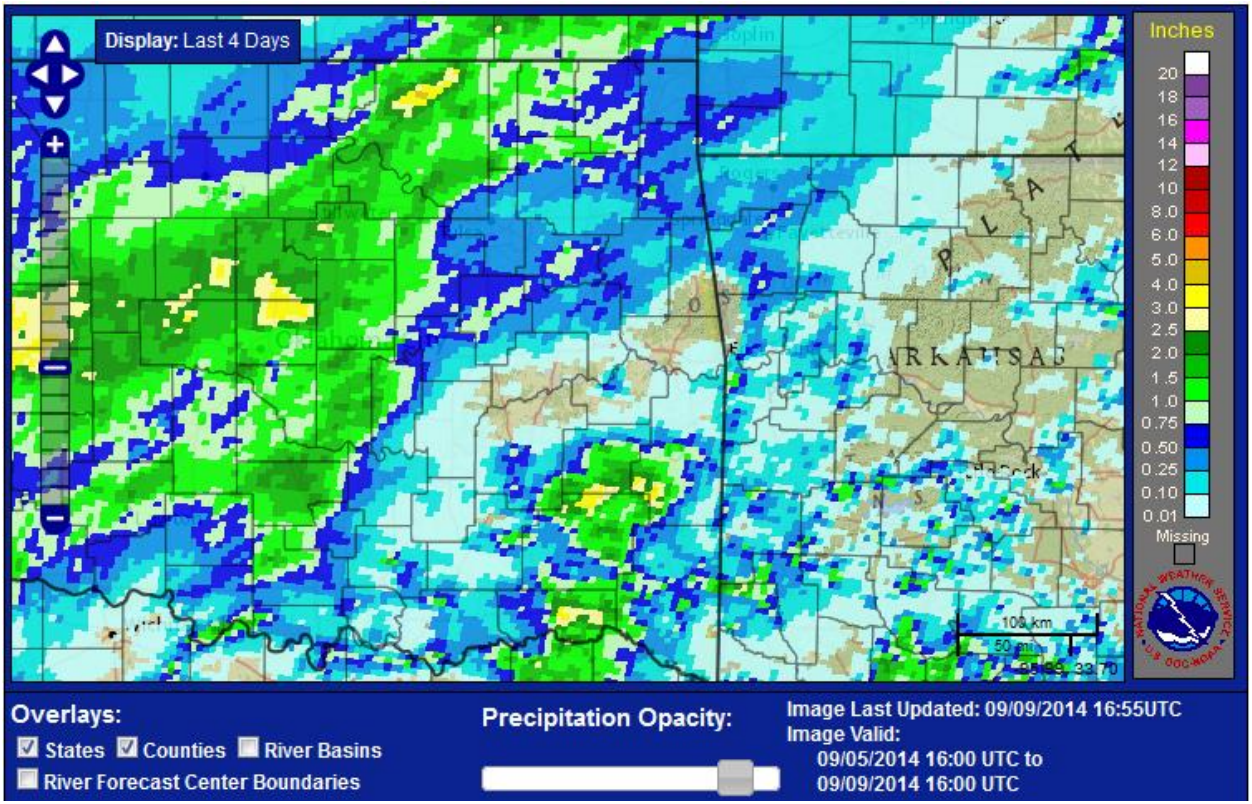


Fig. 9. 4-day Estimated Observed Rainfall ending at 11am CDT 9/09/2014.

Tulsa, OK (TSA): Current 1-Day Observed Precipitation
 Valid at 9/11/2014 1200 UTC- Created 9/11/14 17:54 UTC

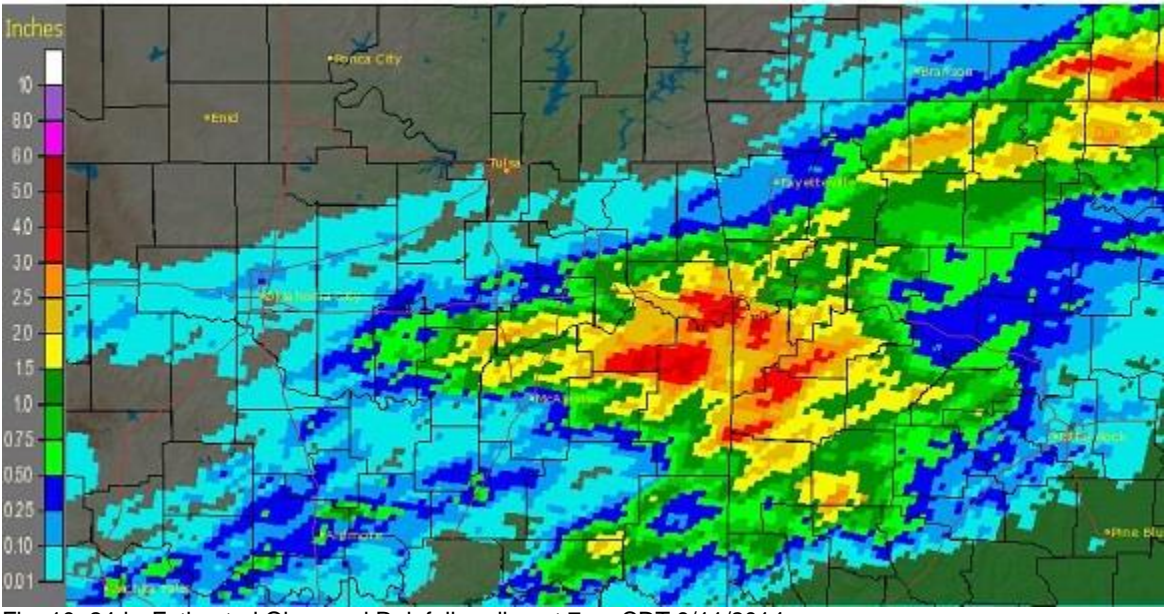


Fig. 10. 24-hr Estimated Observed Rainfall ending at 7am CDT 9/11/2014.

Tulsa, OK (TSA): 9/12/2014 1-Day Observed Precipitation
Valid at 9/12/2014 1200 UTC- Created 9/14/14 23:32 UTC

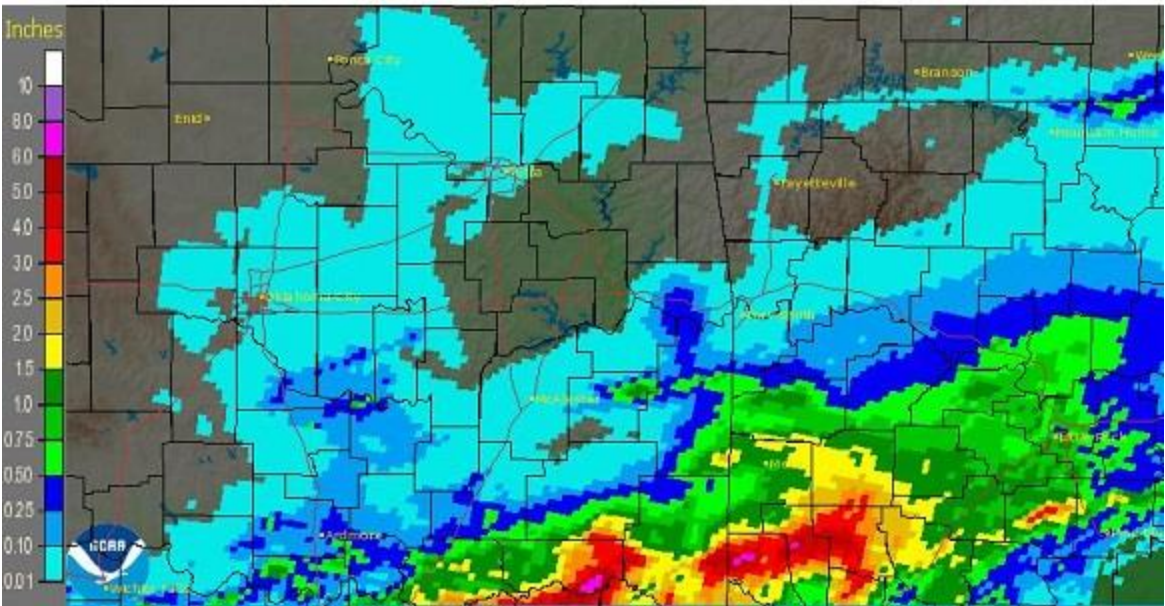


Fig. 11. 24-hr Estimated Observed Rainfall ending at 7am CDT 9/12/2014.

Tulsa, OK (TSA): Current 7-Day Observed Precipitation
Valid at 9/15/2014 1200 UTC- Created 9/15/14 20:18 UTC

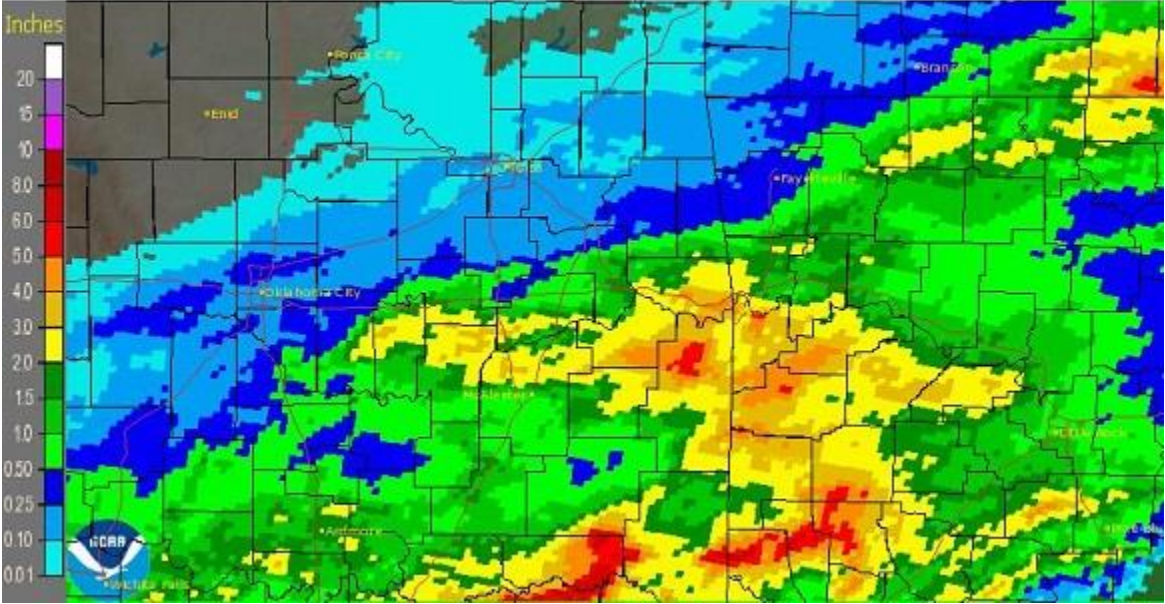
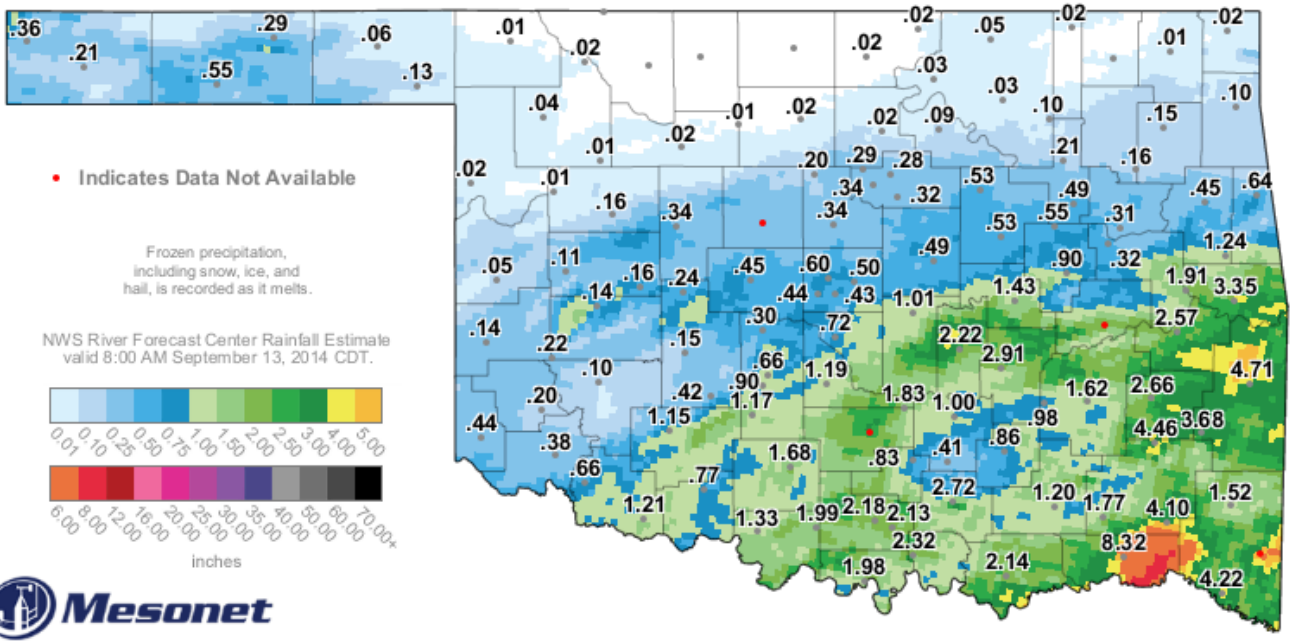


Fig. 12. 7-day Estimated Observed Rainfall ending at 7am CDT 9/15/2014.



7-Day Rainfall (inches)

Fig. 13. 24-hr estimated observed rainfall (image) and OK Mesonet measurements ending at 9:10am 9/13/2014.

September 17-30

On the 17th, showers and thunderstorms developed across southwest MO and moved south into northwest AR and adjacent parts of OK. These storms produced gusty winds and locally heavy rain. Additional storms spread southwestward along outflow from the initial activity. Another round of showers and thunderstorms developed in KS during the early morning hours of the 18th and moved south into the HSA. This activity waned by afternoon. The two rounds of thunderstorm activity brought 0.25" to near 3" to most of eastern OK and northwest AR (Fig. 14).

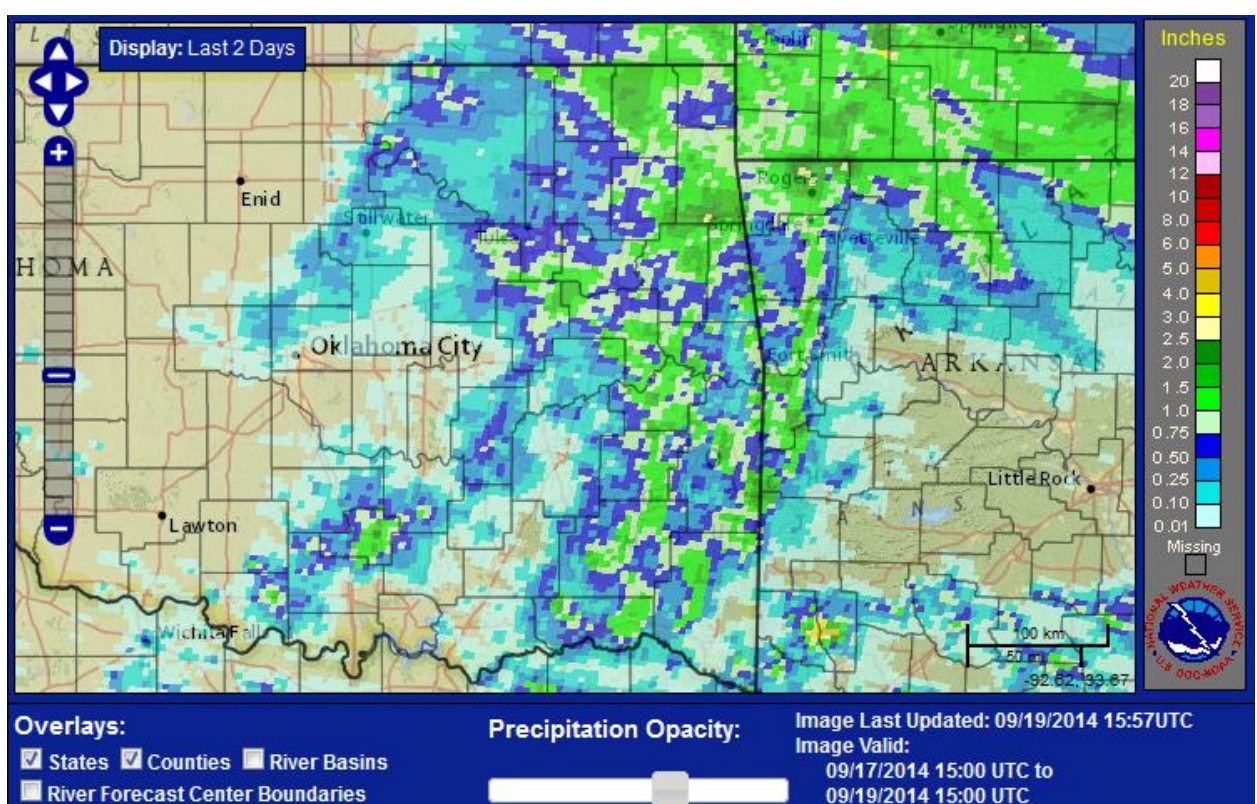


Fig. 14. 2-day Estimated Observed Rainfall ending at 11am CDT 9/19/2014.

Isolated to widely scattered showers and thunderstorms developed over northeast OK during the morning of the 22nd in advance of an approaching cold front. Most of this activity remained north of Hwy 412, and produced less than 0.50" of rain. However, several rounds of rain brought 0.50"-2" of rain to northern Tulsa and western Rogers County, with the highest amounts occurring along the county line.

Showers and thunderstorms affected Osage and eastern Kay Counties during the early morning hours of the 24th in an area of increased moisture as a weak upper-level trough passed by. However, these areas only received a few hundredths to near 0.50" of rain from this activity. The remainder of September was dry.

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in September 2014:

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

*Mixed case River Flood products began July 31, 2013

- 1 Flash Flood Warnings (FFW)
- 0 Flash Flood Statements (FFS)
- 1 Flash/Areal Flood Watches (FFA) (1 Watch FFA CON/EXT/EXA/CAN)
- 10 Urban and Small Stream Advisories (FLS)
- 1 Areal Flood Warnings (FLW)
- 0 Areal Flood Statements (FLS)
- 1 River Flood Warnings (FLW)
- 2 River Flood Statements (FLS)
- 0 River Flood Advisories (FLS) (0 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:

