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 **2013**
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 4, 2013**

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)

[X] An "X" in the box indicates no flood stages were reached in this Hydrologic Service Area (HSA) during the month above.

Despite several rounds of precipitation during the second half of the month, March 2013 ended up with below normal rainfall. 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.

Monthly Summary

Using the radar-derived estimated observed precipitation from the RFCs (Fig. 1a), rainfall totals for March 2013 ranged from less than 1" to around 6", with the highest totals east of a Nowata to Wagoner to McAlester to Atoka line. Only a small portion of the area ended the month above normal, with a majority of eastern OK and northwest AR receiving 50% to 90% of the normal March rainfall (Fig. 1b). Portions of Osage, Pawnee, Creek, Okmulgee, and Okfuskee Counties only received 10% to 25% of the normal rainfall this month.

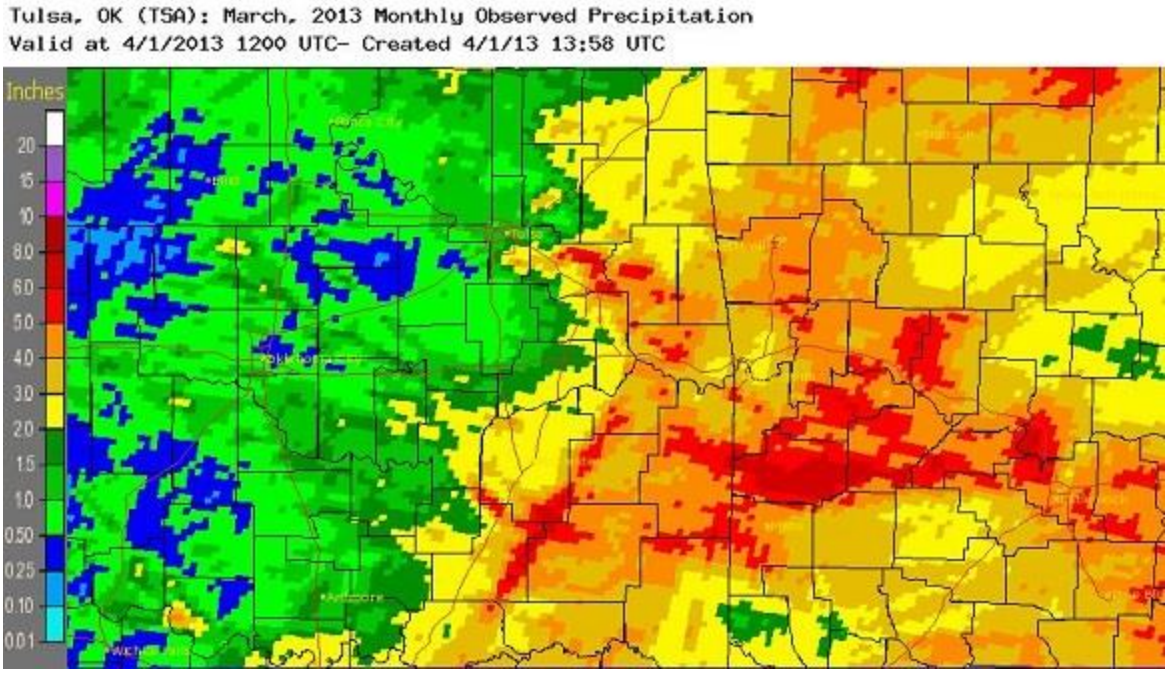

Fig. 1a. Estimated Observed Rainfall for March 2013

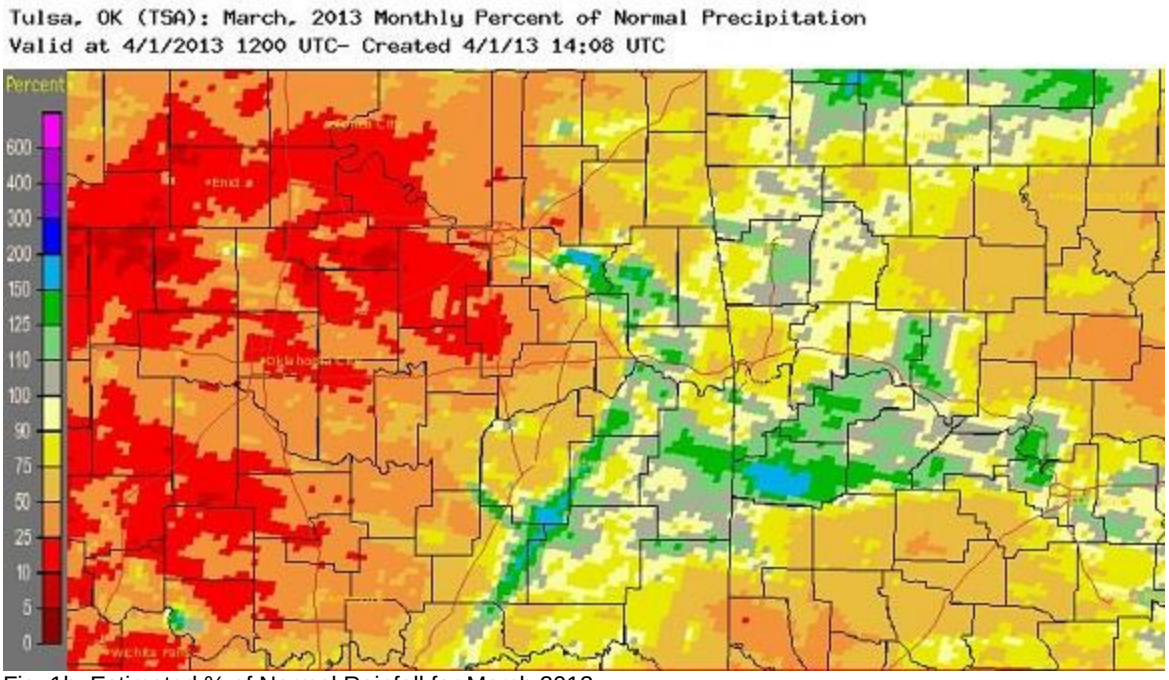

Fig. 1b. Estimated % of Normal Rainfall for March 2013

In Tulsa, OK, March 2013 ranked as the 29th coldest March (47.7°F, tied 1951; since records began in 1905) and the 27th driest March (1.10", tied 1895; since records began in 1888). A trace of snow fell in Tulsa in March. Fort Smith, AR was the 41st coldest March (49.7°F, tied 1954; since records began in 1883) and the 53rd wettest March (3.42"; since records began in 1883). Fayetteville, AR was the 9th coldest (44.0°F) and the 20th wettest (4.48") March since records began in 1950. A trace of snow fell in Fayetteville in March.

Some of the larger precipitation reports (in inches) for March 2013 included:

Wister, OK (meso)	6.10	Fanshawe, AR (coop)	5.48	Sallisaw, OK (coop)	4.93
St Paul, AR (coop)	4.82	Cookson, OK (meso)	4.73	Fayetteville, AR (ASOS)	4.48
Talihina, OK (meso)	4.43	Antlers, OK (meso)	4.35	Clayton, OK (meso) & Mountainburg, AR 2NE (coop)	4.34

Some of the lowest precipitation reports (in inches) for March 2013 included:

Pawnee, OK (meso)	0.51	Oilton, OK (meso)	0.57	Ralston, OK (coop)	0.61
Pawnee, OK (coop)	0.66	Burbank, OK (meso)	0.67	Skiatook, OK (meso)	0.88
Hectorville, OK (meso)	0.95	Okmulgee, OK (meso)	0.98	Bristow, OK (meso)	1.01

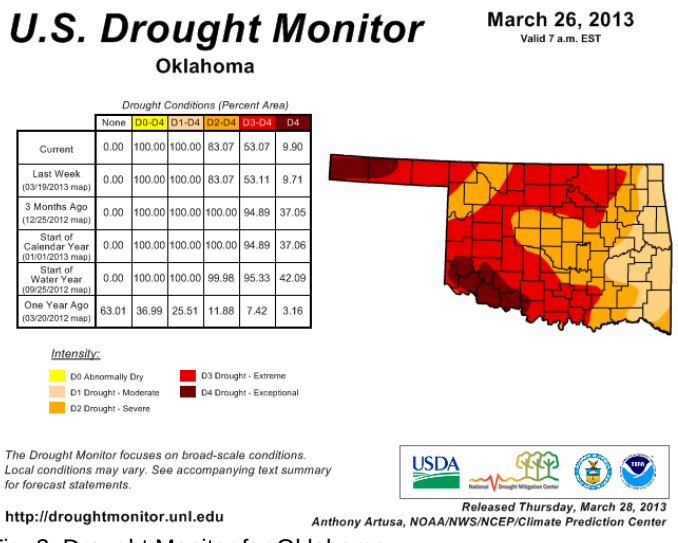

Fig. 2. Drought Monitor for Oklahoma

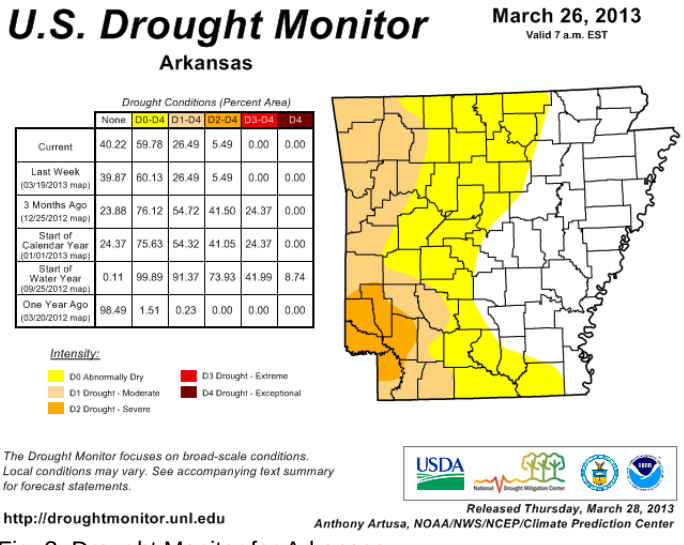

Fig. 3. Drought Monitor for Arkansas

According to the U.S. Drought Monitor (USDM) from March 26, 2013 (Figs 2, 3), all of eastern OK and northwest AR was in Moderate to Extreme drought, except for eastern Carroll County which has been classified as abnormally dry. The rain at the end of March helped reduce the drought impacts across the HSA, even

though the March 26 Drought Monitor does not include the rain that fell in the last days of the month. Extreme drought (D3) conditions were still affecting portions of Osage, Pawnee, Creek, western Tulsa, Washington, and western Nowata Counties in eastern OK. Severe (D2) drought was present across eastern Nowata, western Craig, Rogers, western Mayes, Tulsa, Wagoner, western Muskogee, Okmulgee, Okfuskee, western Pushmataha, and western Choctaw Counties in eastern OK. The remainder of the area, except for eastern Carroll County, was experiencing Moderate (D1) conditions existed.

Some of the major reservoirs in the Tulsa HSA were operating below 90% of their conservation pools as of April 1, 2013. However, several were above their conservation pools: Wister Lake 111%, Hudson Lake 109%, Sardis Lake 108%, Ft. Gibson Lake 107%, and Tenkiller Lake 103%. Reservoirs reporting conservation pool deficits below 90% as of April 1, 2013: Birch Lake 49%, Skiatook Lake 63%, Hulah Lake 71%, Beaver Lake 83%, Eufaula Lake 84%, and Oologah Lake 89%.

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

Rank since 1921	March 2013	Year-to-Date 2013 (Jan 1 – Mar 31)	Last 120 Days (Dec 2 – Mar 31)	Water Year-to-Date (Oct 1 – Mar 31)	Last 365 Days (Apr 1, 2012 – Mar 31, 2013)
Northeast OK	29th driest	31st wettest	43rd wettest	22nd driest	**9th driest**
East Central OK	34th driest	33rd wettest	42nd wettest	18th driest	**3rd driest**
Southeast OK	38th wettest	35th wettest	42nd wettest	17th driest	**3rd driest**
Statewide	22nd driest	38th wettest	41st wettest	**12th driest**	**2nd driest**

Outlooks

The Climate Prediction Center (CPC) outlook for April 2013 (issued March 31, 2013) indicates a slightly enhanced chance for above normal temperatures across all of eastern OK and northwest AR. This outlook also indicates a slightly enhanced chance for above median rainfall south of I-40 and equal chances for above, near, and below median precipitation across the remainder of northeast OK and northwest AR. The precipitation portion of this outlook is based primarily on short-range computer models that show a storm system during the first few days of April. The beginning of April will be cold, but keep in mind this temperature outlook is for the monthly mean temperature.

For the 3-month period Apr-May-Jun 2013, CPC is forecasting a greatly enhanced chance for above normal temperatures and an equal chance for above, near, and below median precipitation across all of eastern OK and northwest AR (outlook issued March 21, 2013). According to CPC, ENSO neutral conditions remained through March. ENSO neutral conditions are expected to continue through Spring 2013, followed by uncertain conditions in the ENSO state beyond that time. Therefore, this outlook is primarily based on dynamic computer model output, with some input from statistical forecast tools and long-term trends.

Summary of Precipitation Events

March 1-20

A strong cold front moved through eastern OK and northwest AR on the 4th, bringing some light showers to the area during the overnight hours into the early morning of the 5th. Most affected locations received less than 0.10” of rain, though much of Wagoner County had 0.10” to around 0.50”.

A strong upper-level low pressure system increased the moisture across the region on the 9th, allowing showers and thunderstorms to develop near a cold front. More widespread and stronger thunderstorms developed later in the afternoon in north central TX and southeast OK, and these storms continued to spread northeastward into east central OK and northwest AR. Training of storms resulted in a narrow swath of 3” to 5” rainfall over far western Pushmataha, far eastern Pittsburg, western Latimer, and southern Haskell Counties (see. Fig. 4). In

general, rainfall totals east of a McAlester to Bentonville line were 1” to 2.5”, with lesser amounts of 0.10” to 1.25” to the west of this line. Light to moderate showers lingered over eastern OK and northwest AR during the morning of the 10th before the system moved east of the area.

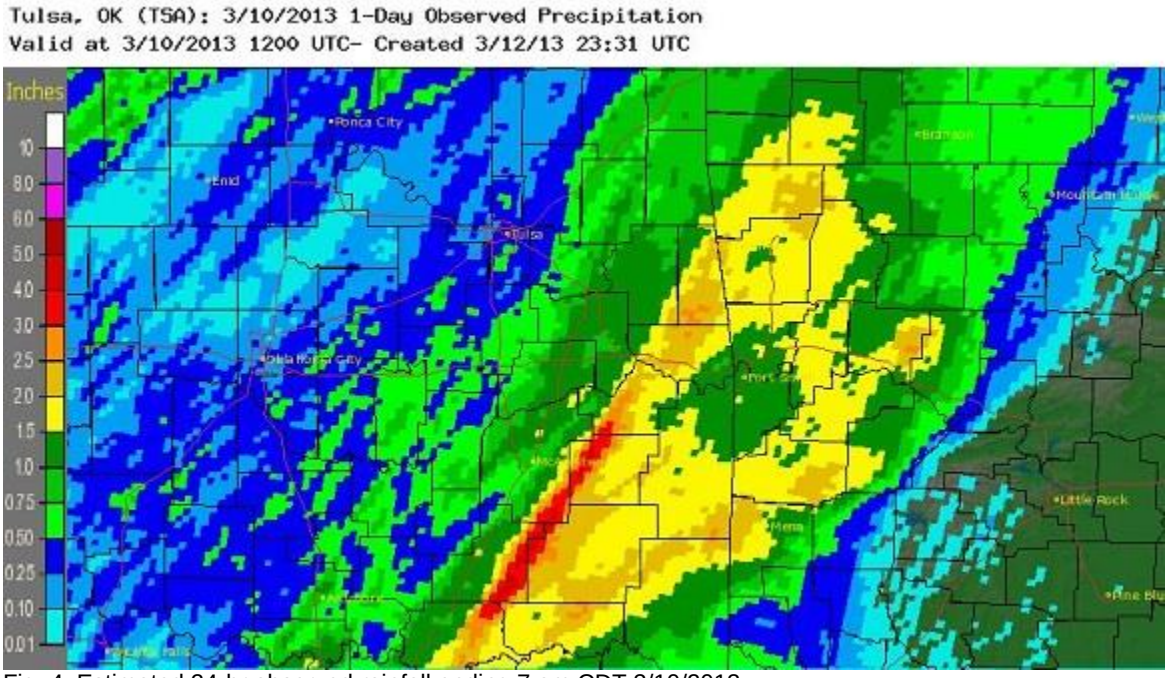

Fig. 4. Estimated 24-hr observed rainfall ending 7 am CDT 3/10/2013.

Isolated light showers and thunderstorms affected far northeast OK early on the 17th due to warm air advection over a stalled front that was located near I-40. As the day progressed, another shortwave trough swung across the Southern Plains, sparking additional showers and isolated thunderstorms over east central OK and northwest and west central AR and pushing the front east of the HSA. Rainfall totals were around 0.25” or less, with around 0.50” falling in western Crawford Co.

March 21-31

An unsettled weather pattern developed at the end of the month, bringing several rounds of precipitation to the region. Showers and thunderstorms began on the 21st across the area, with some sleet and pockets of snow mixed in across far eastern OK and northwest AR. Rainfall totals ranged from just a trace to around 1” (see Fig. 5). Reports of up to 2” of snow and a light glaze were received from northwest AR.

Showers and thunderstorms developed over northern TX on the 23rd and moved northeast into southeast OK and west central AR during the morning hours. Rainfall totals from this activity ranged from around 0.25” to near 0.75”. Additional showers and thunderstorms traversed northeast OK later in the day as the main upper-level low pressure system moved into the Plains. This activity only brought between 0.10” to 0.25” of rain. Wrap-around snow developed as the upper-low passed by, bringing up to 3” of snow by the morning of the 24th to northeast OK and along the AR/MO state line (see Fig. 6).

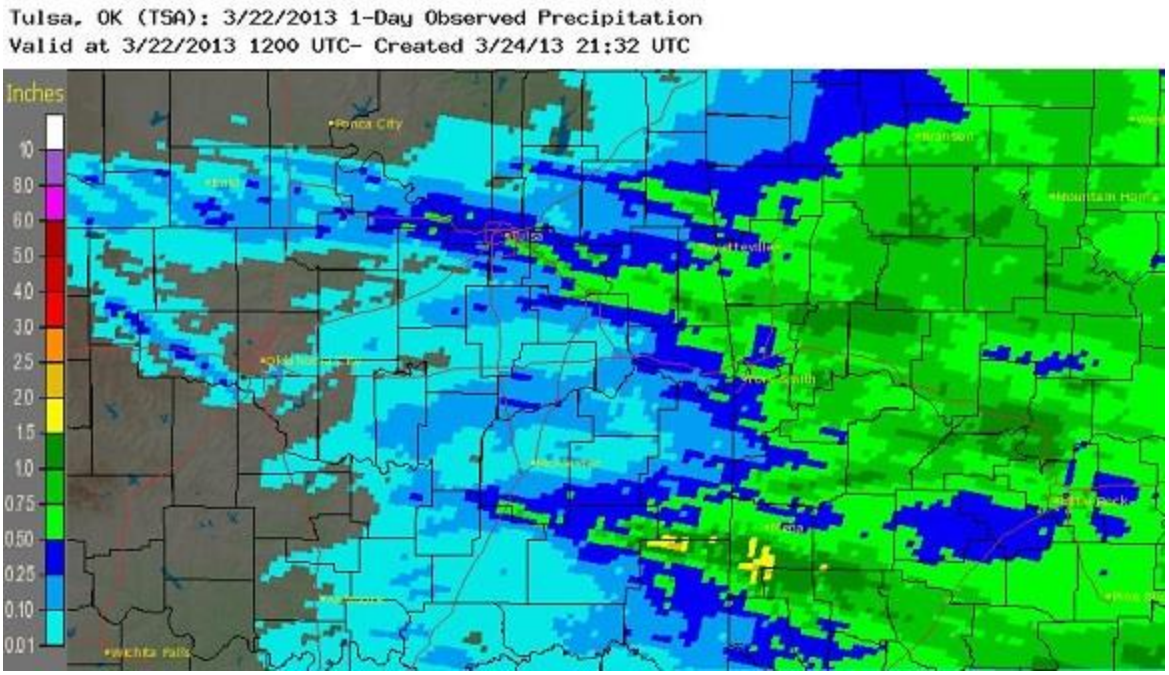

Fig. 5. Estimated 24-hr observed rainfall ending 7 am CDT 3/22/2013.

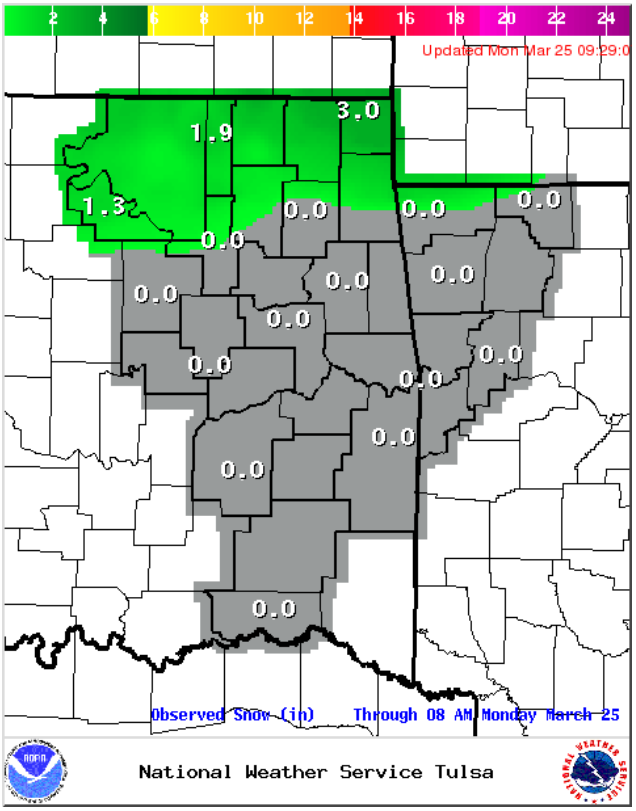

Fig. 6. Estimated and observed snowfall total map for March 23-24, 2013

A frontal boundary that had sagged into northeast OK lifted northward on the 28th and became nearly stationary along the OK/KS border. This boundary provided a focus for showers and thunderstorms for several days as subtle waves passed overhead. Convection first began across far northeast OK and northwest AR during the morning hours of the 29th. While most of the rainfall remained light, southwest Benton and northwest Washington Counties in AR received 0.50" to near 1" of rain. A second upper-level wave brought more widespread showers and thunderstorms during the afternoon of the 29th into the morning of the 30th. Training of thunderstorms led to rainfall totals of 1.5" to around 3" in areas of eastern OK, particularly southern Tulsa, Wagoner, Cherokee, Haskell, and Le Flore Counties (see Fig. 7). Hail of around 1" was reported with the strongest storms.

24-hr rainfall reports >1.5" ending 7am 3/30/13:

Bixby 2ENE, OK	2.90	Wister 3ENE, OK	2.01	Muskogee 4ENE, OK	1.97
Claremore 2WNW, OK	1.82	Fanshawe, OK	1.55		

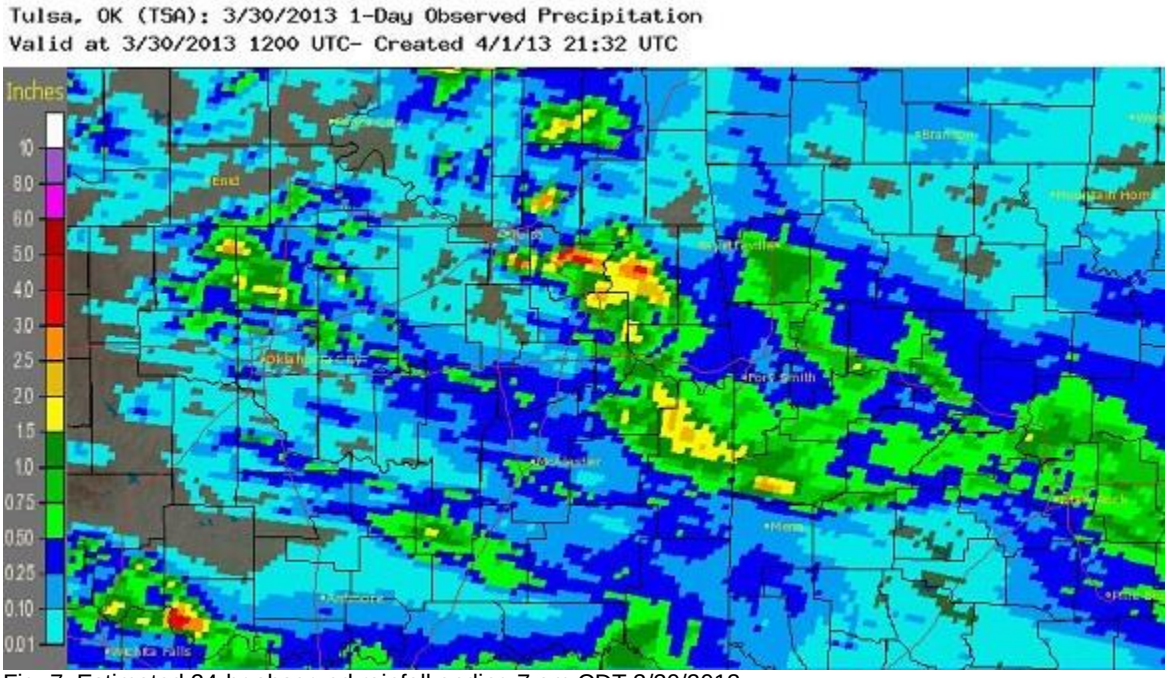

Fig. 7. Estimated 24-hr observed rainfall ending 7 am CDT 3/30/2013.

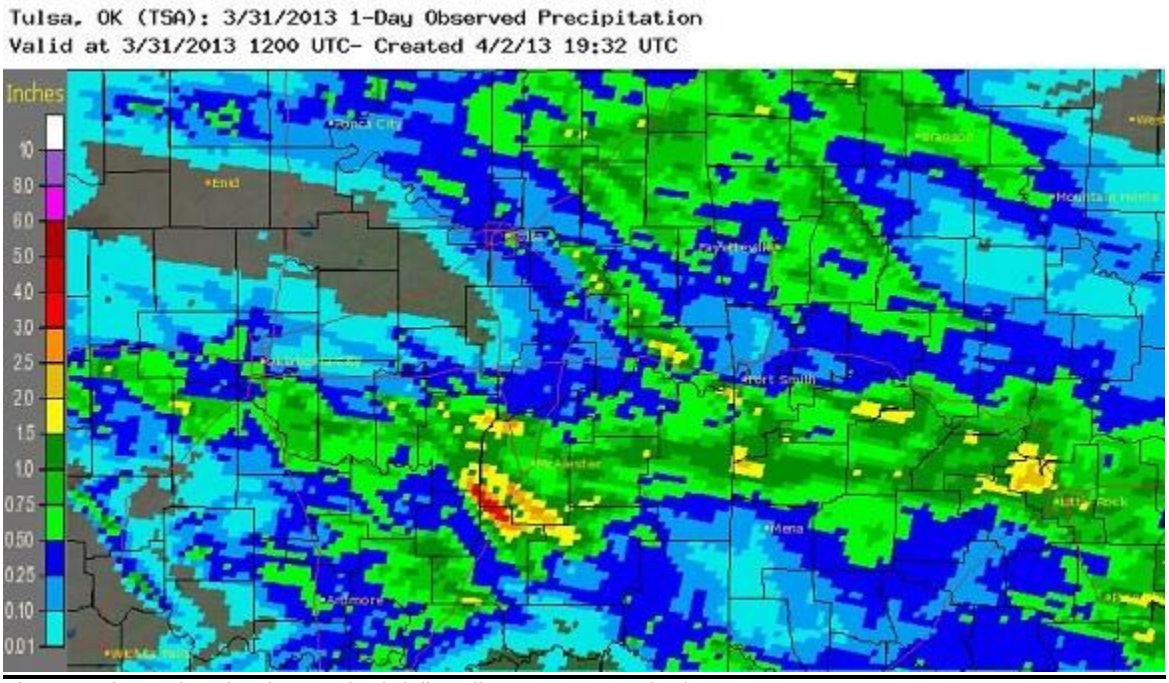

Fig. 8. Estimated 24-hr observed rainfall ending 7 am CDT 3/31/2013.

Thunderstorms developed again during the afternoon and evening hours of the 30th as the cold front finally pushed southeast into and through eastern OK and northwest AR. These thunderstorms moved east and southeast across an unstable airmass. Several thunderstorms became severe with numerous reports of hail up to golf ball size and a few reports of larger hail up to the size of baseballs. The largest report was 3" (tea cup-sized) hail measured near Fort Gibson, OK. Two severe thunderstorms produced tornadoes as well: an EF-0 near Fort Gibson and an EF-1 near Sallisaw (http://www.srh.noaa.gov/tsa/?n=weather-event2013mar30). Widespread rainfall of 0.25" to around 1" occurred, with isolated higher totals of 1.5" to around 3" (see Fig. 8). The rain lingered across far southeast OK on the 31st, with an additional 0.25" to around 1.5" across southern Le Flore, Pushmataha, and Choctaw Counties.

24-hr rainfall reports >1.50” ending 7am 3/31/13:

Stuart 3SE, OK	1.90	Vian 5.3 ENE, OK	1.62	Sallisaw 2NW, OK	1.60

In the end, rainfall totals from March 29-31 ranged from around 0.50” to around 4” across eastern OK and northwest AR (see Figs. 9, 10). The exception was across Pawnee, Creek, and Okmulgee Counties, where 0.10” or less fell. All of this precipitation will help to improve short-term drought conditions across a large portion of the HSA.

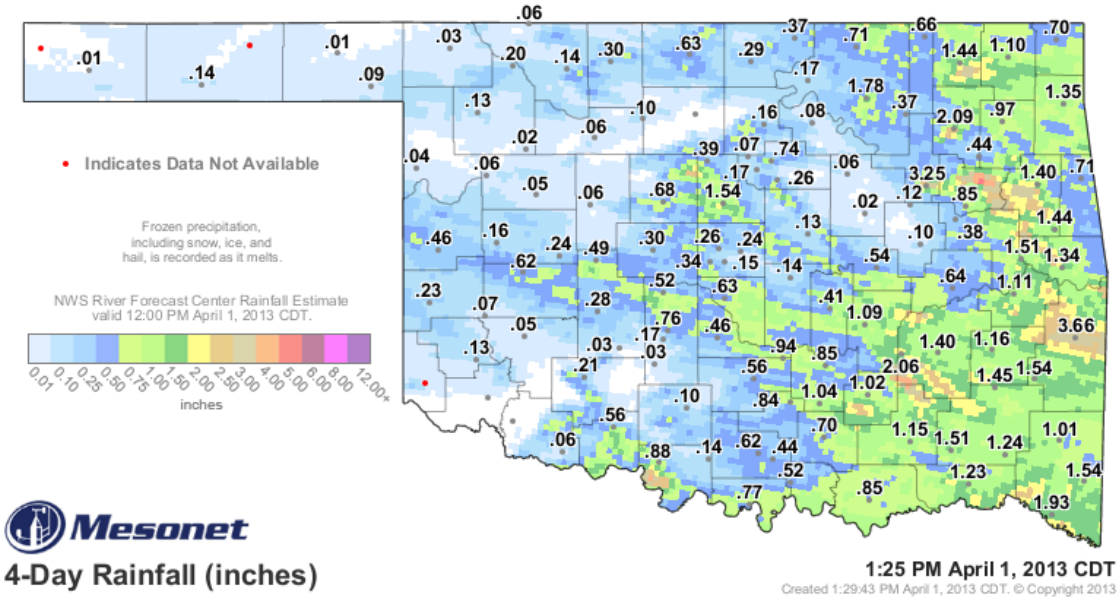

Fig. 9. Estimated (image) and measured (plotted) 4-day observed rainfall ending 1:25 pm CDT 4/1/2013.

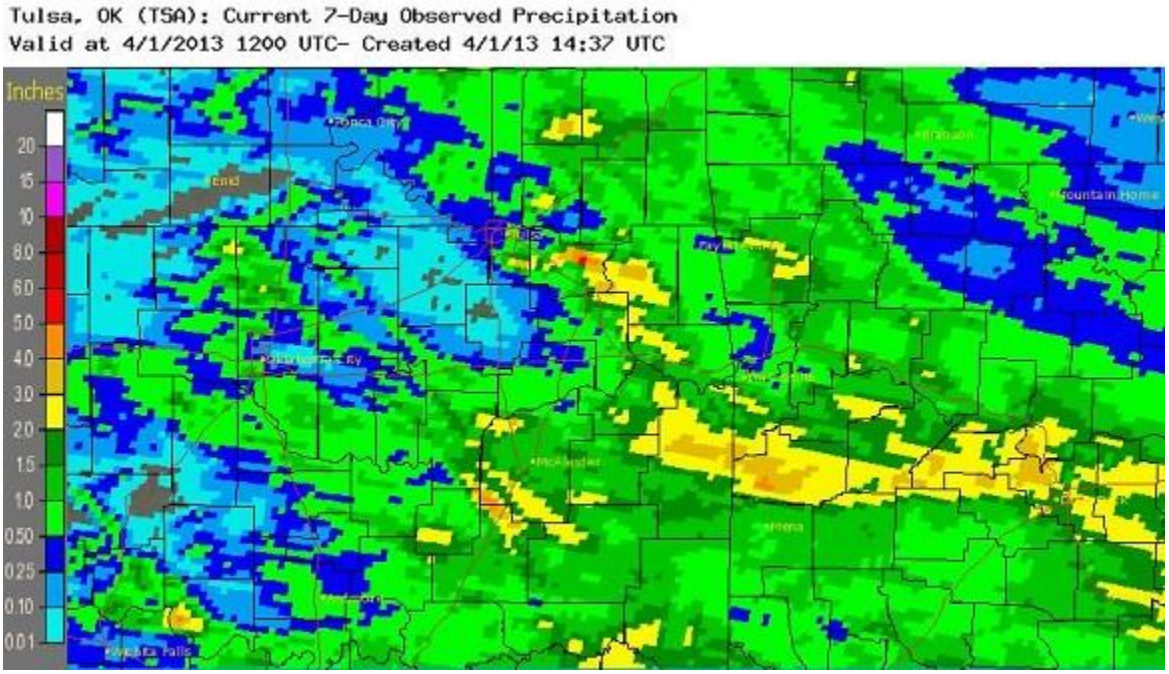

Fig. 10. Estimated 7-day observed rainfall ending 7 am CDT 4/1/2013.

Written by:

Nicole McGavock
Service Hydrologist
WFO Tulsa

Products issued in March 2013:

0 Flash Flood Warnings (FFW)
0 Flash Flood Statements (FFS)
0 Flash/Areal Flood Watches (FFA) (0 Watch FFA CON/EXT/CAN)
2 Urban and Small Stream Advisories (FLS)
0 Areal Flood Warnings (FLW)
0 Areal Flood Statements (FLS)
0 River Flood Warnings (FLW)
0 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)
1 Hydrologic Outlooks (ESF)
2 Drought Information Statements (DGT)

Preliminary Hydrographs:

No river flooding occurred this month.