

2015 Red River Basin Flood Event: Timeline and Impacts

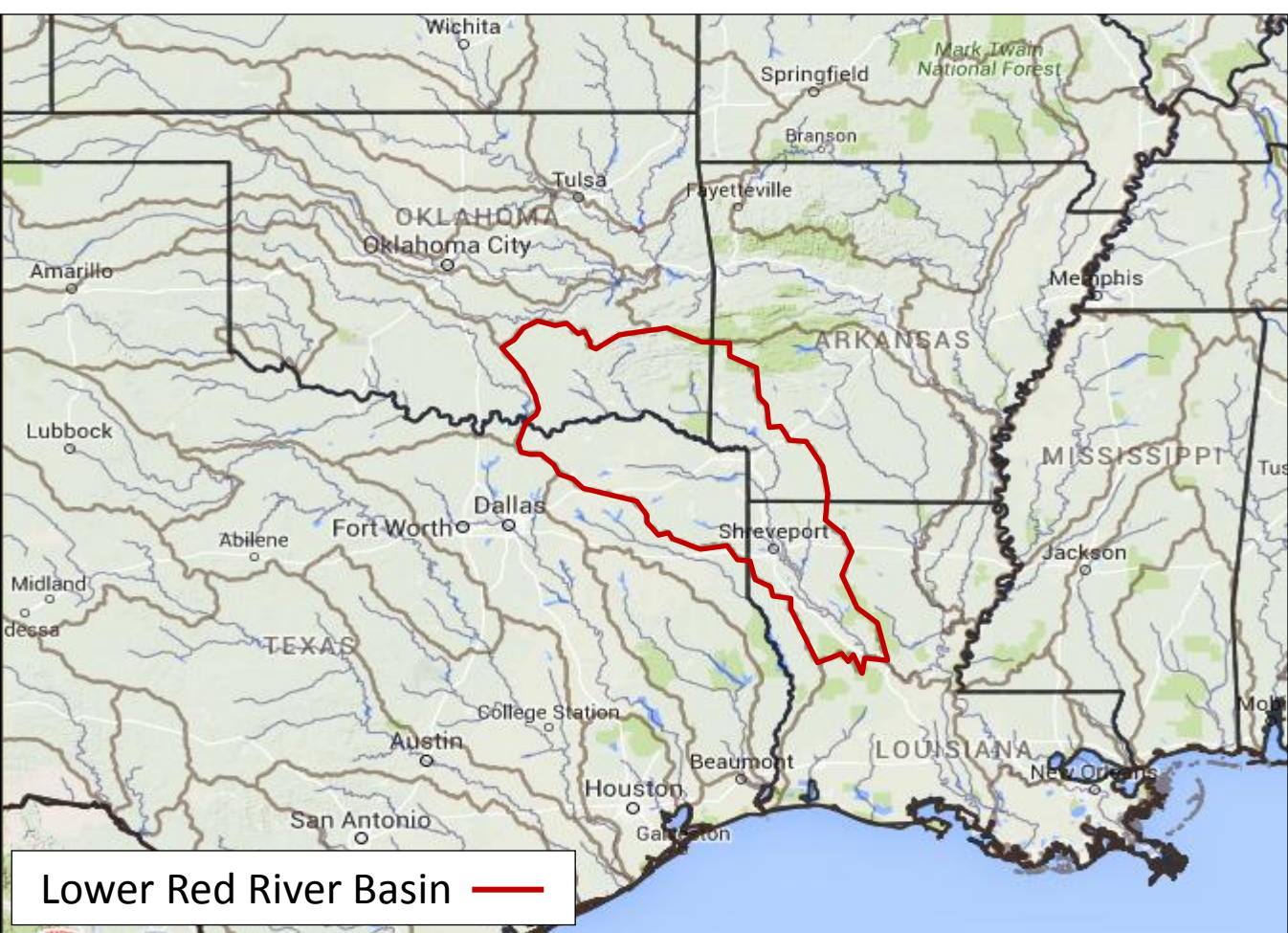
Tony Hurt¹, Julianna Glinskas²

Jackson State University, Jackson, MS¹, LeTourneau University, Longview, TX²

INTRODUCTION

Some of the worst flooding in decades impacted the Red River basin during the latter part of May through June 2015. Despite the fact that a large part of the basin had been experiencing drought conditions spanning the previous four years, historical rainfall which occurred during the month of May throughout Texas and Oklahoma effectively brought the drought to an end, and unleashed the devastating flood event which followed. Multiple locations along the lower Red River basin in northeast Texas, Arkansas, and Louisiana recorded river crests which ranked in the top-three in terms of all-time highest observed water levels.

QUICK FACTS



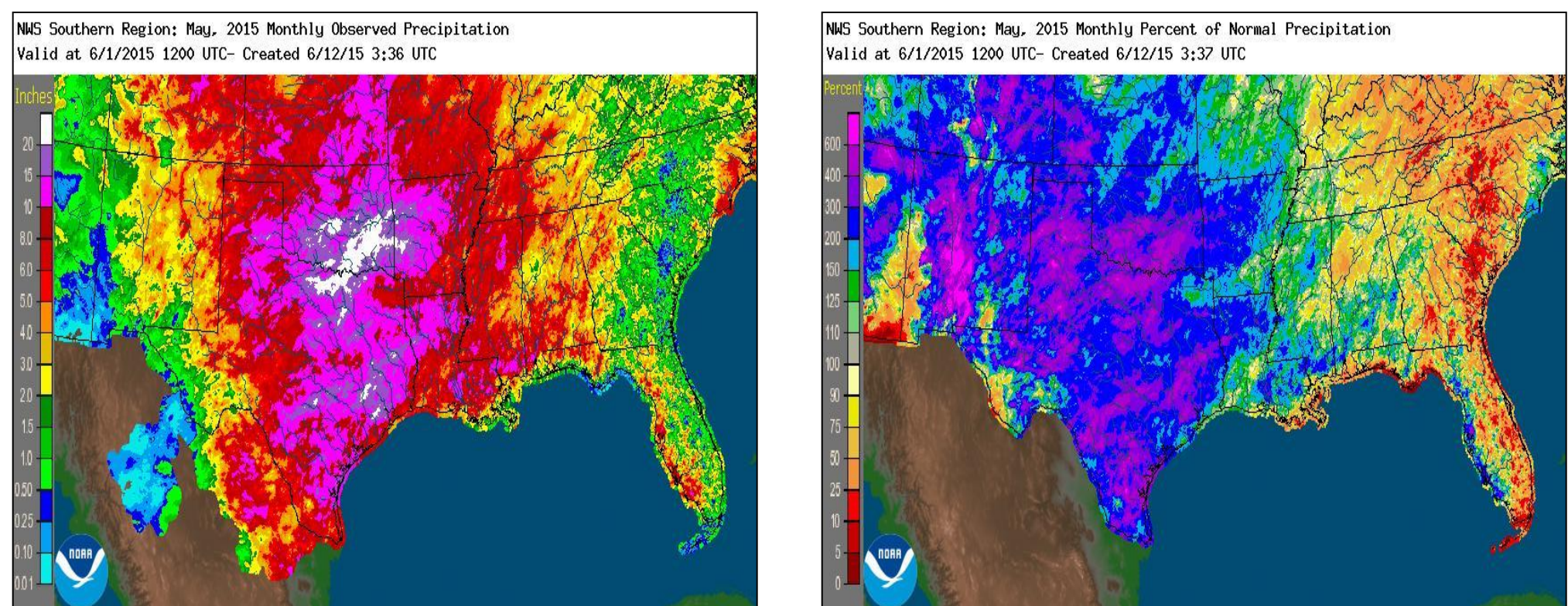
➤ Texas and Oklahoma experienced their wettest May of record in 2015, spanning the 121-year period dating back to 1895.

- Texas received a statewide average of 8.81 inches of rain for the month, and Oklahoma received an average of 14.40 inches. This eclipsed their previous records of 6.66 inches (2004), and 10.75 inches (1941), respectively.

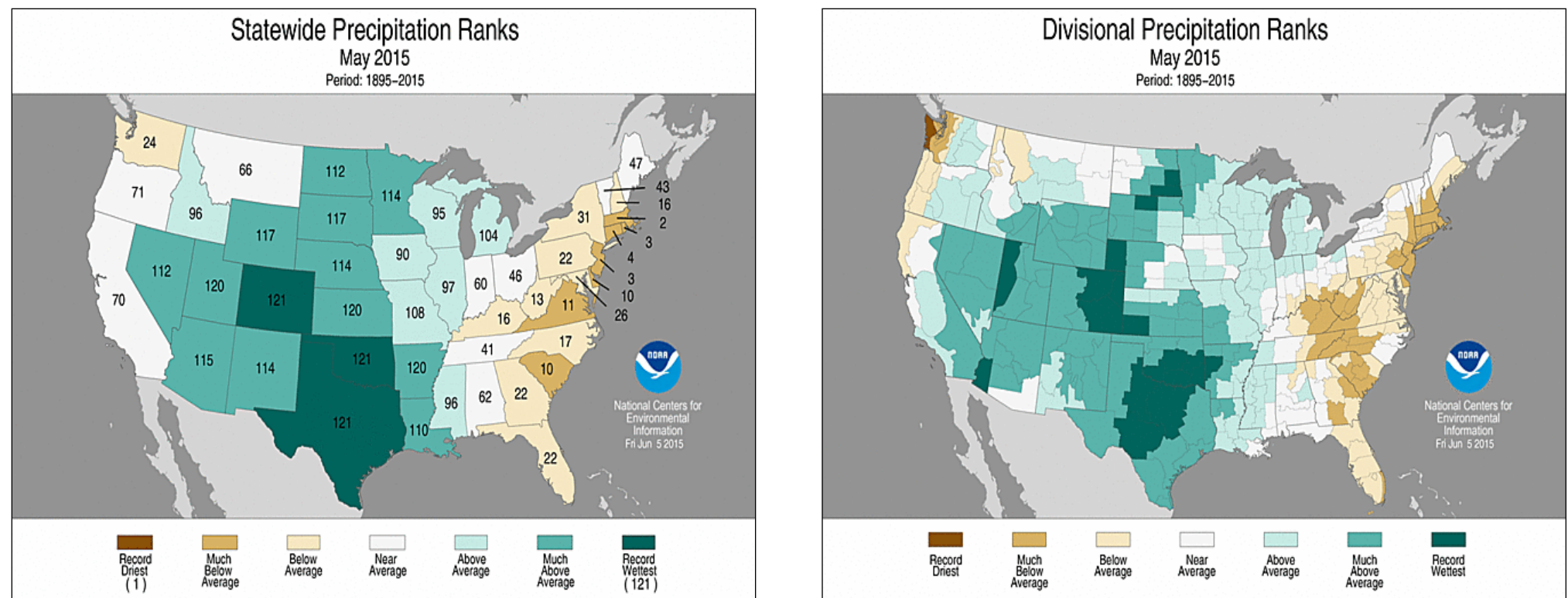
➤ The entire Red River basin across Texas and Oklahoma generally received 10+ inches of rain during May.

- 15 to 25 inches reported over large swath of the basin
- basin accounts for only 15% of total combined area of the two states, indicative of the extreme rainfall amounts observed there

➤ Reservoirs with critical roles in flood control along the Red River filled to, and exceeded, maximum capacity in some cases.



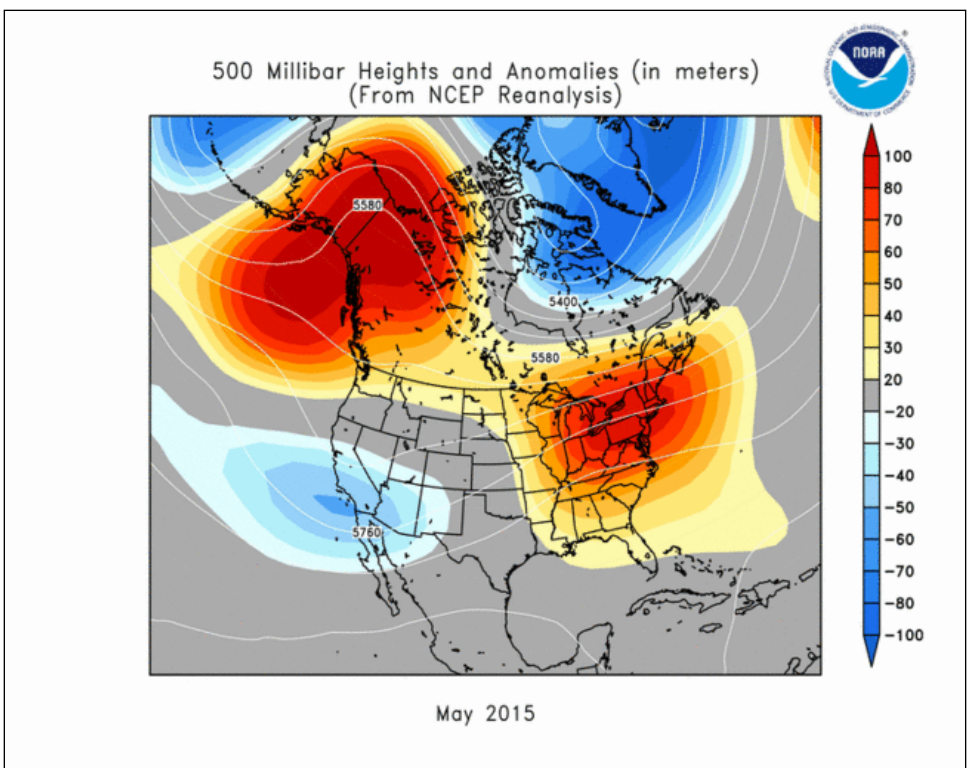
Much of the Red River basin along the Oklahoma/Texas border received 15 to 20 inches of rainfall, with locally higher amounts. Some areas of Oklahoma and Texas along the Red River basin received over 400% the normal amount of rainfall for the month of May.



While the Red River basin states of Texas and Oklahoma observed the wettest May of historical record, Arkansas and Louisiana received precipitation amounts which ranked second and twelfth, respectively.

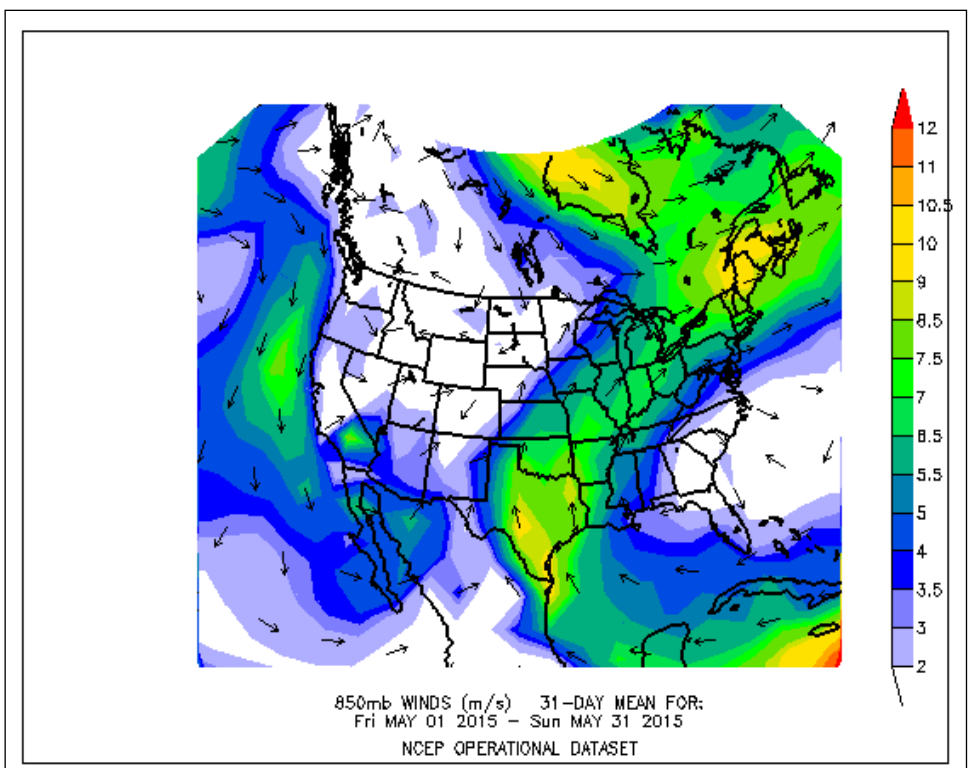
RAINFALL & IMPACTS

MAY 2015 ATMOSPHERIC PATTERN



Upper-level heights and anomalies for May 2015

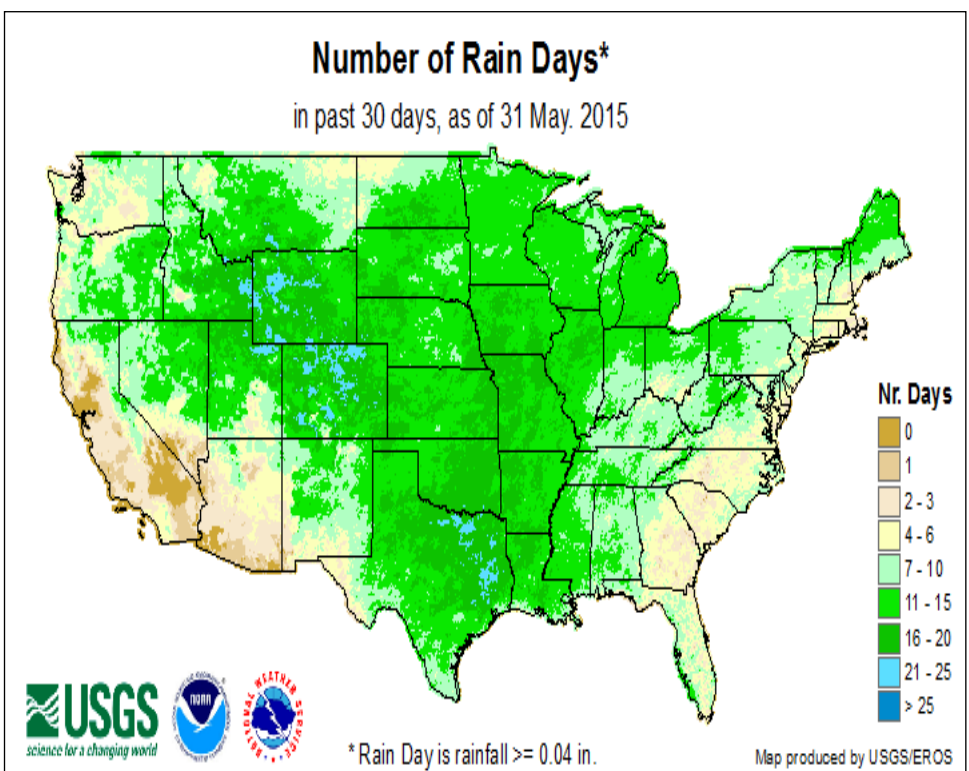
Atmospheric blocking pattern locked into place for most of May due to anomalous ridging over the northeast Pacific into Alaska and northwest Canada.



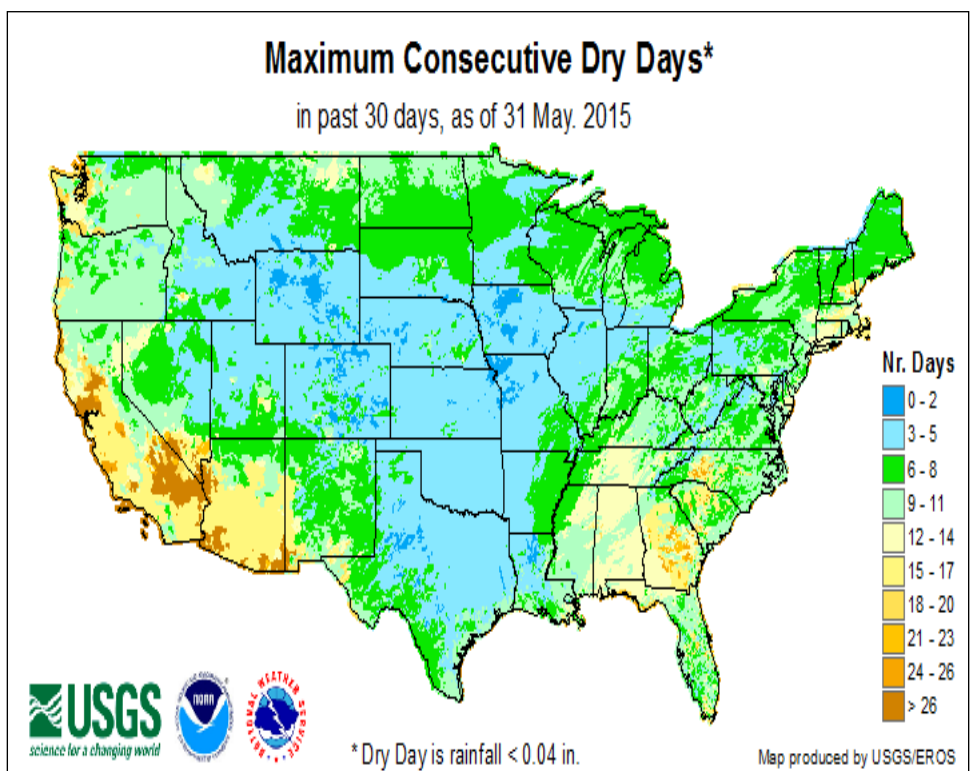
Mean low-level flow for May 2015

Southerly flow favored continued advection of low-level moisture across the Red River basin.

MAY RAINFALL FREQUENCY AND EPISODES



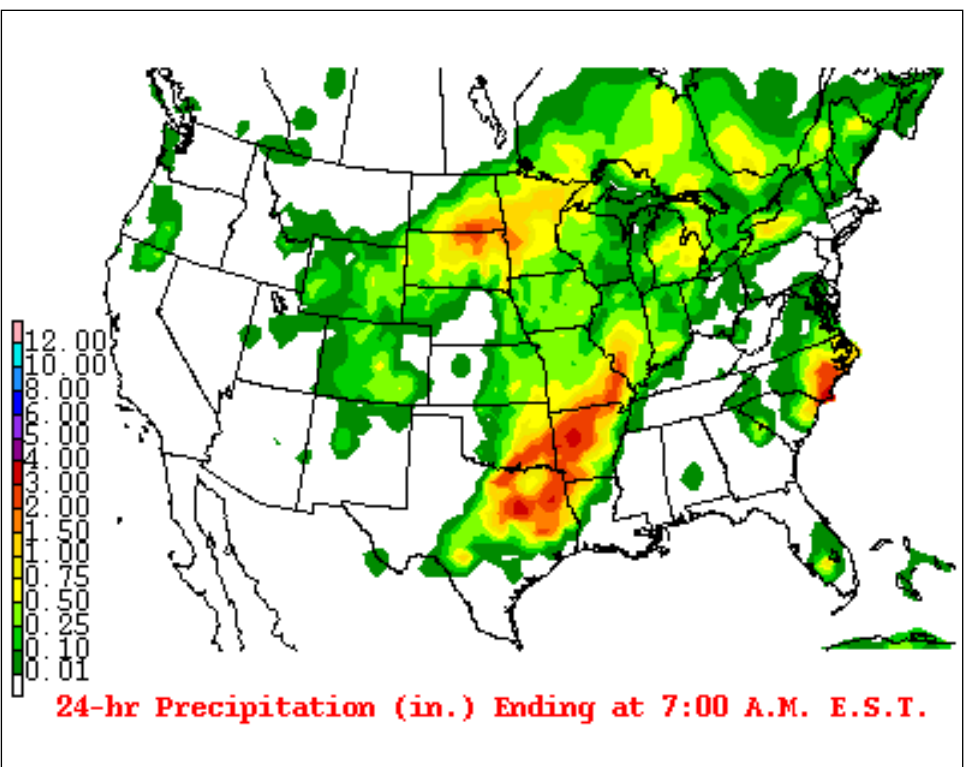
Storminess and rainfall frequented the central United States and Red River basin throughout the month as a result of the persistent weather pattern. Coupled with minimal dry periods, the basin was overwhelmed as natural drainage could not compensate for the influx of water.



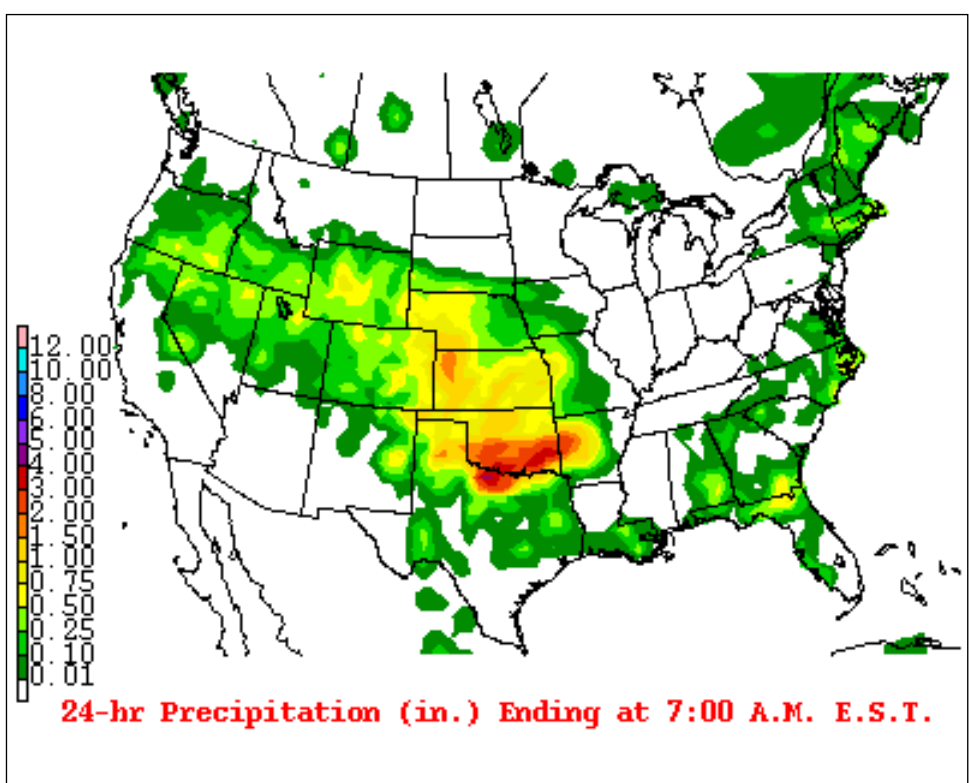
Initial rainfall episode (05-09 May) produced widespread amounts of 5 to 8 inches of rain across the basin, and set the stage for ensuing episodes to exacerbate flooding.

Three episodes were particularly impactful:
➤ 10-11 May
➤ 19-20 May
➤ 23-24 May

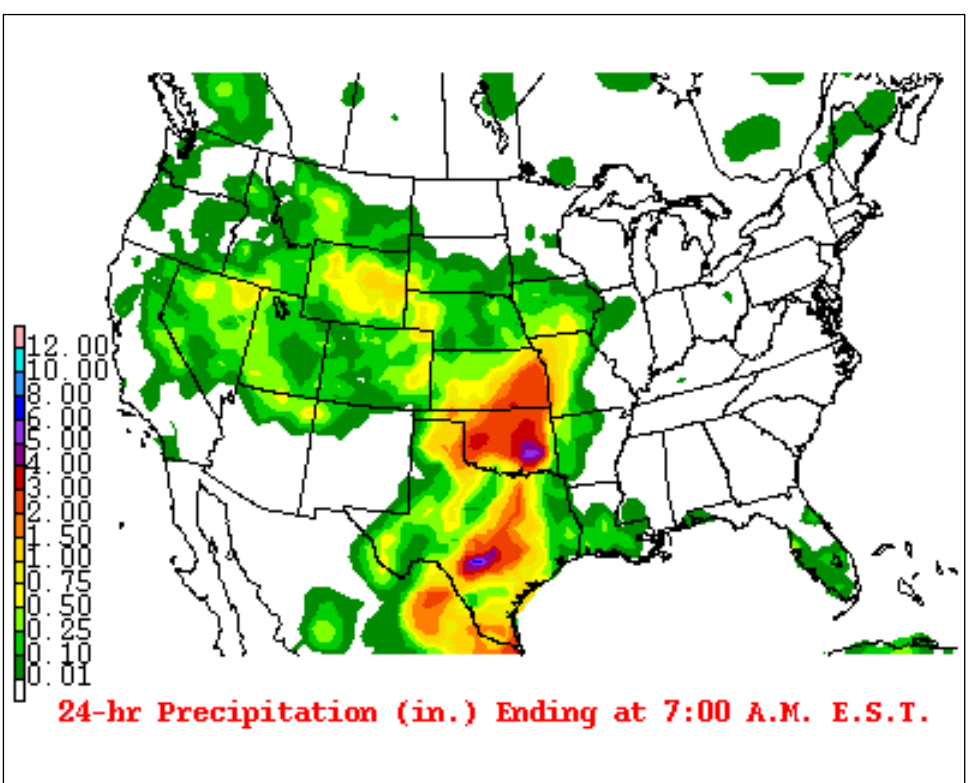
These episodes were critical to basin reservoirs being filled to capacity, triggering water releases which culminated in historical flooding.



24-hour observed precipitation (inches) analysis ending at 12Z on 11 May 2015

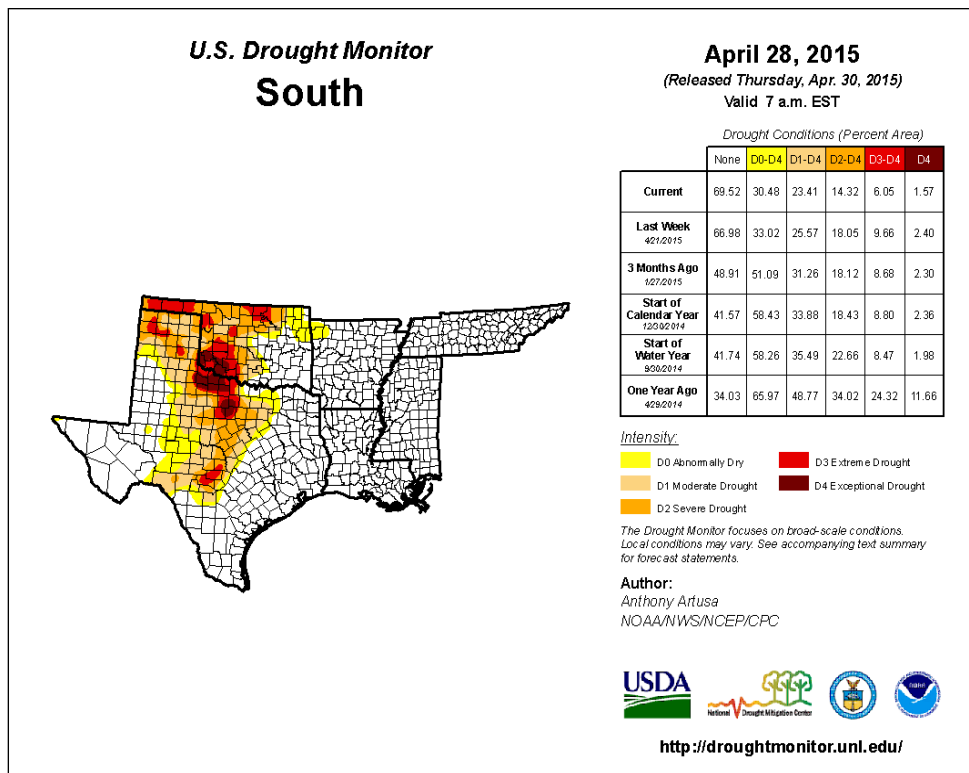


24-hour observed precipitation (inches) analysis ending at 12Z on 20 May 2015

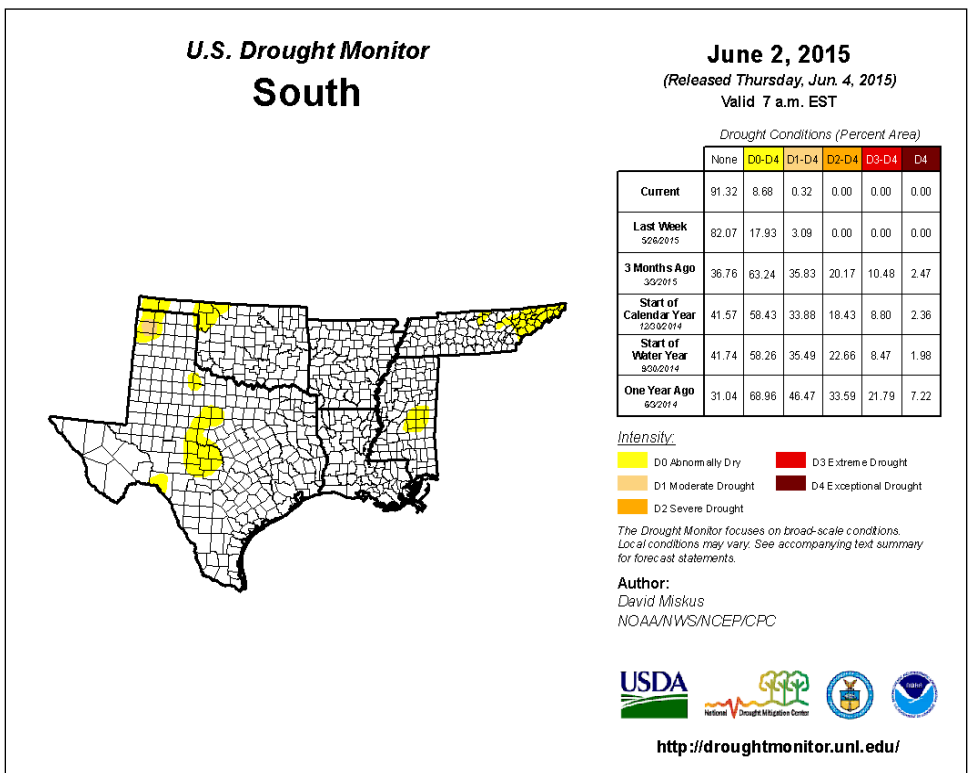


24-hour observed precipitation (inches) analysis ending at 12Z on 24 May 2015

EFFECT ON DROUGHT



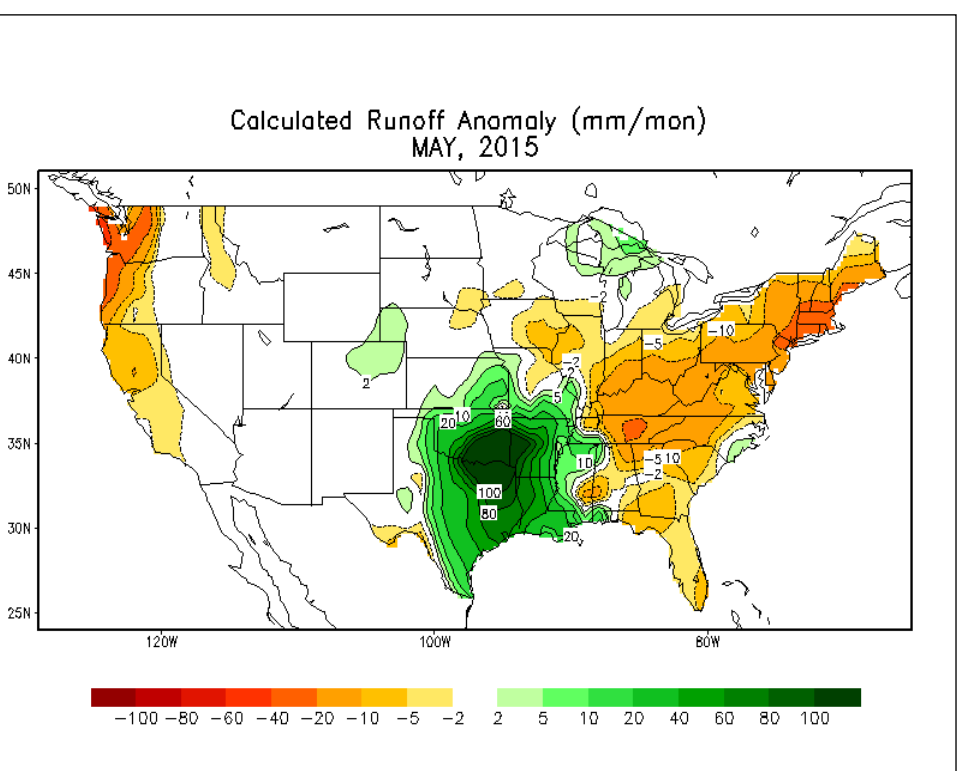
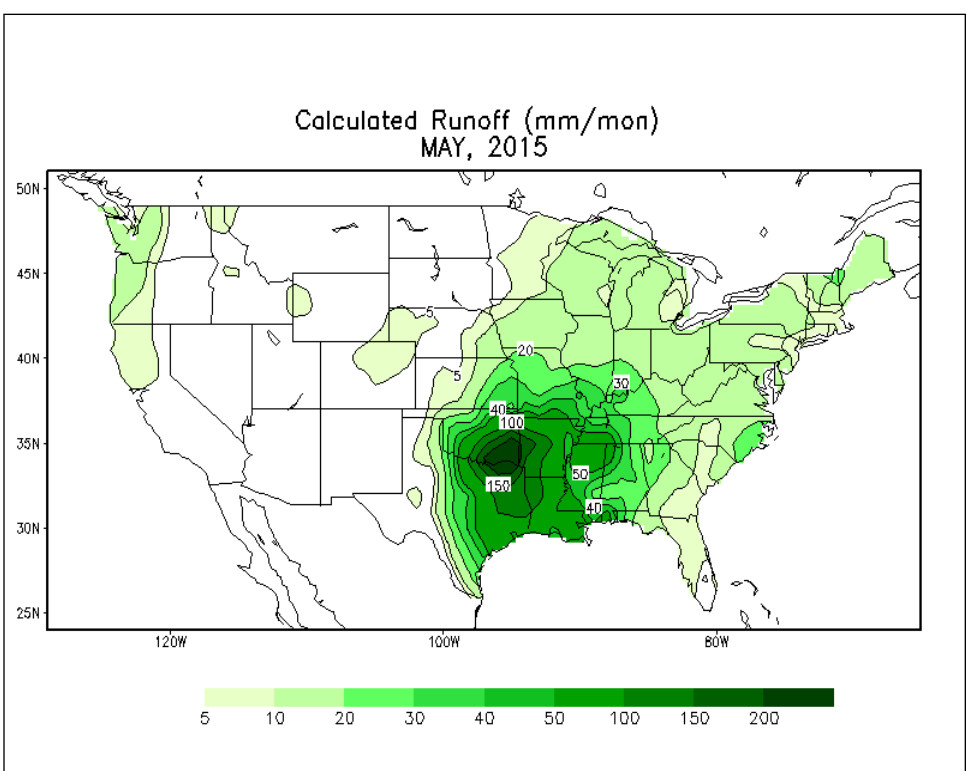
Severe to exceptional drought conditions plagued areas along the upper Red River basin of Texas and Oklahoma as May approached.



Rainfall during the month of May reduced total percentage of the area experiencing drought conditions from 30% to less than 10%.

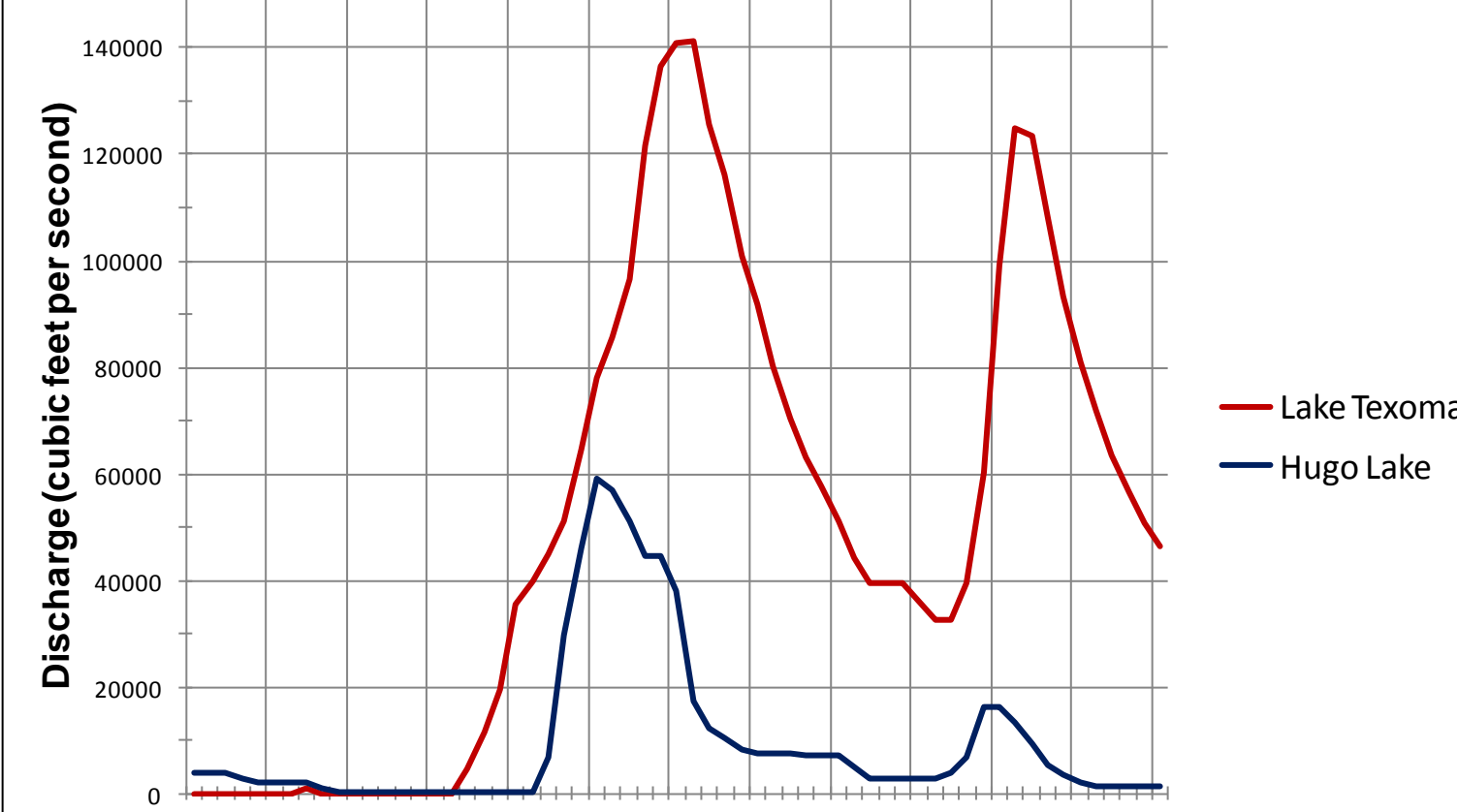
RAINFALL & IMPACTS (continued)

IMPACT ON RESERVOIRS AND DOWNSTREAM RIVER LOCATIONS



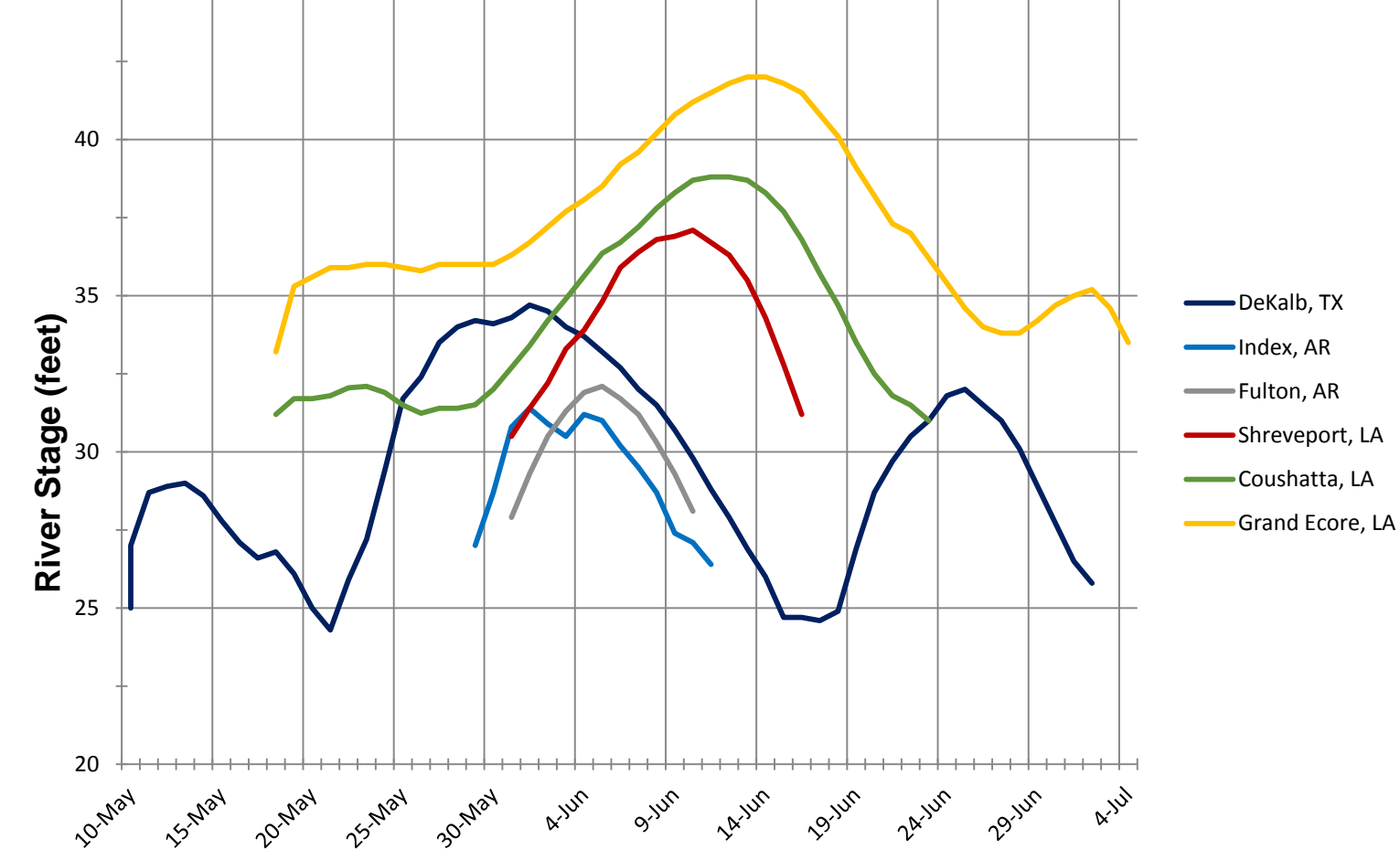
Greatest calculated runoff anomalies were centered over the Red River basin of eastern Oklahoma and Texas. As the ground within the region became increasingly saturated, it allowed for the majority of subsequent rainfall to filter into the river, further compounding the flooding.

Observed discharge at Red River reservoirs

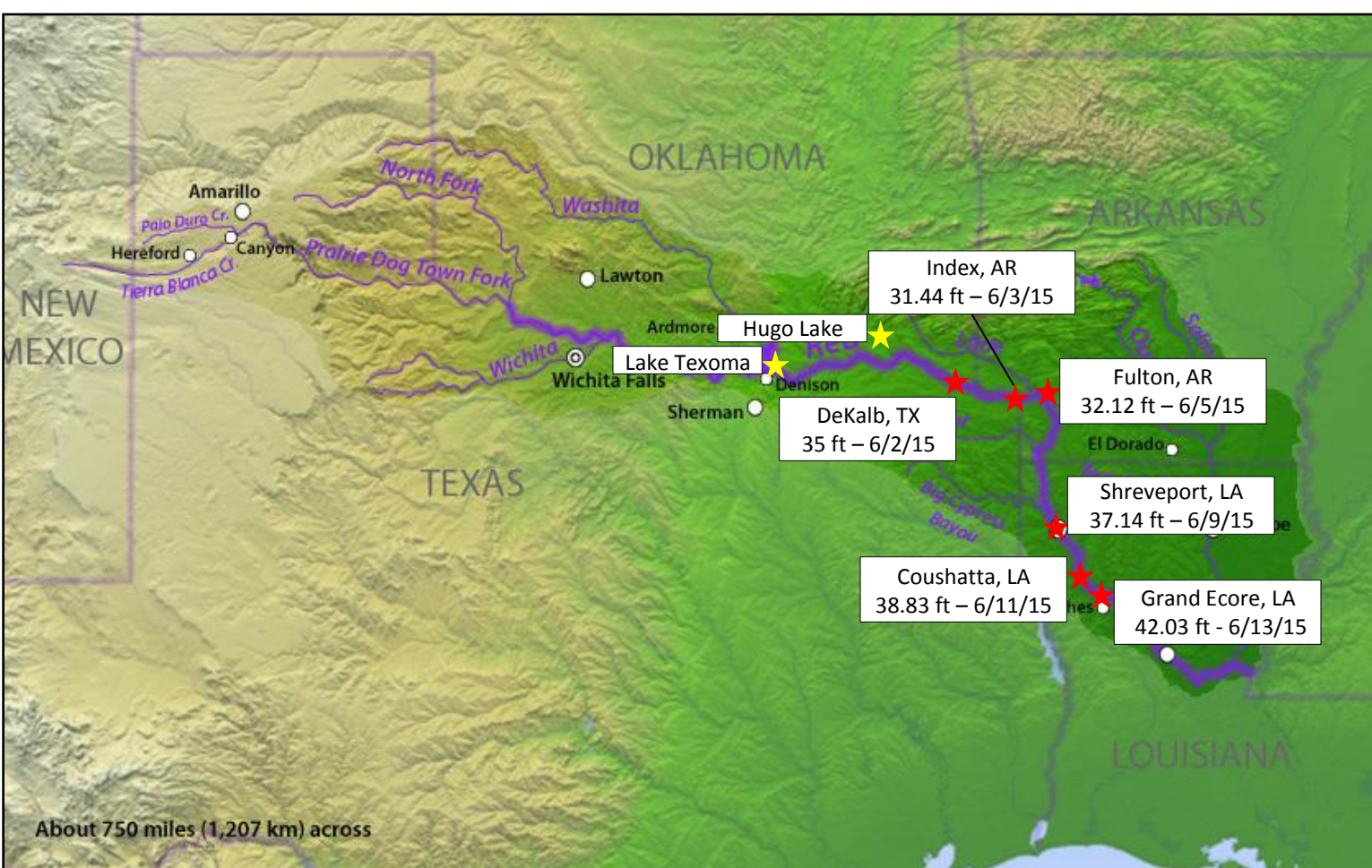


Lake Texoma, along the Texas/Oklahoma border, and Hugo Lake, in southeast Oklahoma, required the largest water volume release of the reservoirs directly impacting the Red River.

Period above flood stage for Red River locations



Following peak reservoir discharge during the final week of May, the accompanying rise of the river occurred as downstream locations crested and began receding over the first half of June. Each location was above flood stage for a minimum of 10 days, with DeKalb, Texas, remaining at or above flood stage for nearly two months.



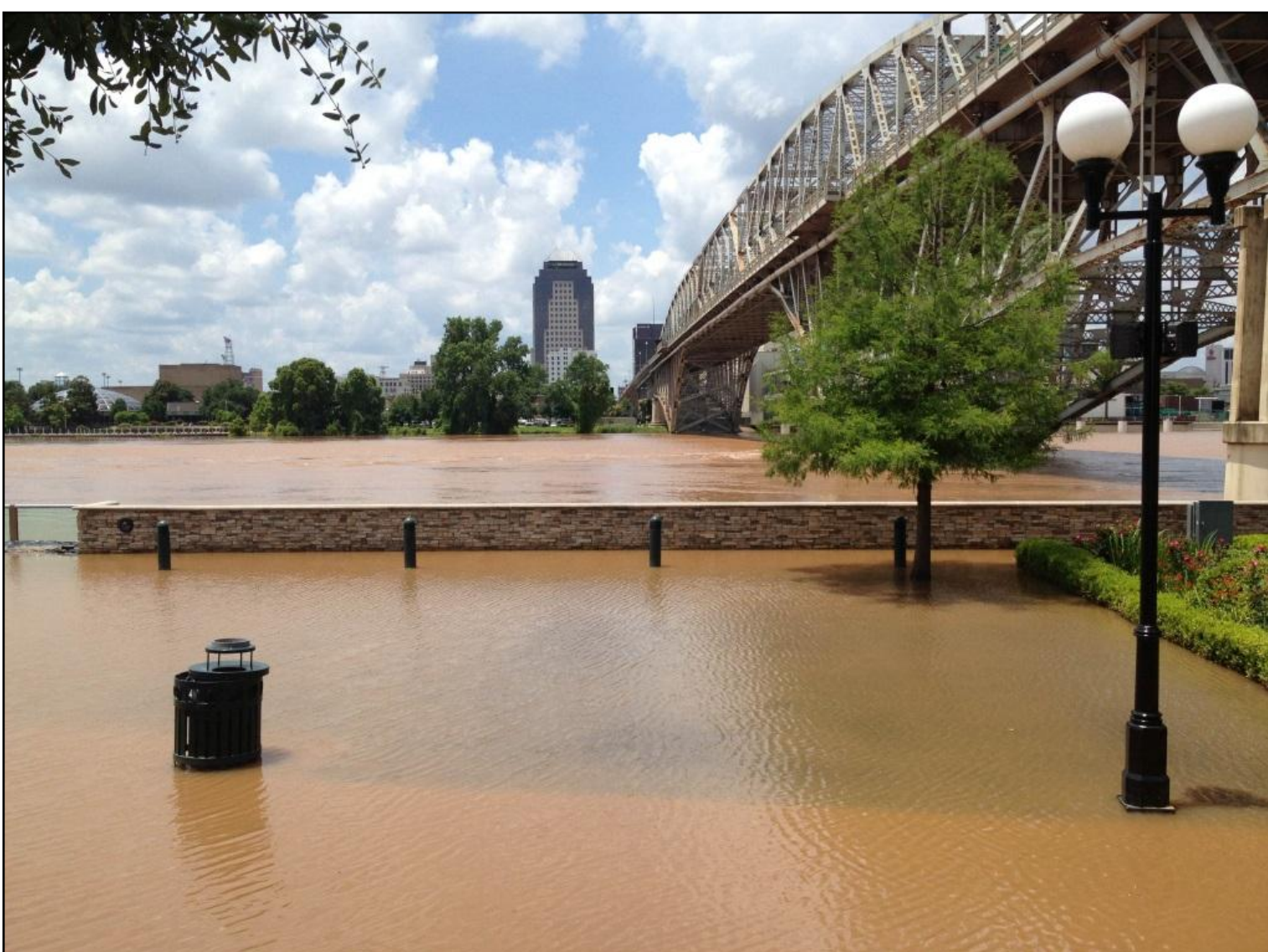
Crest dates and heights along the lower Red River basin

SUMMARY

HISTORICAL REFERENCE

Location	Crest (ft)	Date	Historical Rank	Record (ft)	Date
DeKalb, TX	35	6/2/2015	3	36	2/15/1938
Index, AR	31.41	6/4/2015	3	34.4	2/23/1938
Fulton, AR	32.12	6/5/2015	18	37.4	4/2/1945
Shreveport, LA	37.14	6/9/2015	25	45.9	8/10/1849
Coushatta, LA	38.83	6/11/2015	3	39.9	4/7/1945
Grand Ecore, LA	42.03	6/13/2015	2	44.7	4/10/1945

June 2015 crest heights in comparison to historical record



Southwest-facing view of the Red River at the Texas Street bridge in downtown Shreveport on 11 June 2015. Water level was near 36.5 feet, after cresting at 37.14 feet the previous day. Shreveport-Bossier City was the largest metropolitan area impacted by the flooding along the lower Red River basin, and the river reached its highest level there in over 70 years.

- Although the flooding that impacted the Red River basin throughout much of May and June 2015 was not unprecedented in most locations, the rainfall that preceded the flooding established a new precedent for the states of Texas and Oklahoma.
- Severe to exceptional multi-year drought conditions across the southern plains, notably the upper Red River basin, were returned to normal over the span of approximately one month as a result of historical rainfall.
- The locations of DeKalb, Texas, along with Coushatta and Grand Ecore, Louisiana, all experienced river levels that remained at or above flood stage in excess of one month.

REFERENCES

"AHPS Precipitation Analysis." *AHPS Precipitation Analysis*. Web. 12 June 2015. <<http://water.weather.gov/precip/>>.

"Climate Prediction Center." *Climate Prediction Center* -. Web. 25 July 2015. <http://www.cpc.ncep.noaa.gov/products/Soilmoist_Monitoring/US/Runoff/Runoff.shtml>.

NOAA National Centers for Environmental Information, State of the Climate: National Overview for May 2015, published online June 2015, retrieved on July 24, 2015 from <<http://www.ncdc.noaa.gov/sotc/national/201505>> .

"NOAA - National Weather Service - Water." *NOAA - National Weather Service - Water*. Web. 24 July 2015. <<http://water.weather.gov/ahps/>>.

"Tulsa District Water Control Home Page." *Tulsa District Water Control Home Page*. Web. 19 June 2015. <<http://www.swt-wc.usace.army.mil/>>.

"U.S. Drought Monitor." *Regional Drought Monitor*. Web. 25 July 2015. <<http://droughtmonitor.unl.edu/Home/RegionalDroughtMonitor.aspx?south>>.

"US Rain and Dry Days." *US Rain/Dry Days*. Web. 25 July 2015. <<http://earlywarning.usgs.gov/usraindry>>.

"WPC's Daily Weather Map." *WPC's Daily Weather Map*. Web. 24 July 2015. <<http://www.wpc.ncep.noaa.gov/dwm/dwm.shtml>>.

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Contact Information:
JuliannaGlinskas@letu.edu
tony.o.hurt@students.jsu.ms.edu