



TEXAS CoCoRaHS OBSERVER

Summer 2018



"Because every drop counts, as do all Zeros."

Welcome to the Texas CoCoRaHS Observer newsletter.

The purpose of this newsletter is to keep observers informed of the latest news, events and happenings related to the CoCoRaHS program here in Texas, as well as news about the latest weather patterns affecting each region of Texas.

If you would like to have a presentation done for your group or organization about CoCoRaHS please send an e-mail to Texas@CoCoRaHS.org

Texas Summer Weather Summary

By John W. Nielsen-Gammon
Texas State Climatologist
Texas A&M University

Two aspects of the summer season in Texas were particularly notable: the extreme variability of precipitation and the importance of temperature. Well, okay, it wasn't as variable in an absolute sense as last summer, when precipitation varied from 1.25" in Big Bend to 76.24" near Beaumont, thanks to Harvey. This summer's precipitation variations were on a much smaller scale. For example, in Bexar County, the northwestern outskirts of San Antonio picked up more than 12" of rain, while northeastern parts of the city barely saw 3".

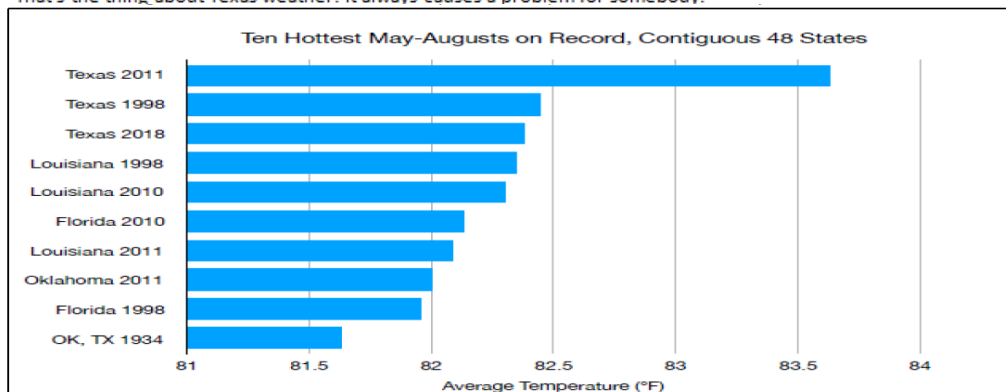
In some sense, that's par for the course. Summer precipitation in Texas comes mostly from thunderstorms and heavy showers. A typical thunderstorm is only a few miles across, and only affects a wider area when it moves across the countryside or merges with other thunderstorms. Also, there is typically very little around that can organize thunderstorms into large-scale weather systems. Occasionally we get a tropical disturbance (again, such as Harvey) that produces widespread rain that can't be avoided. That didn't happen this year; most thunderstorm activity was spotty, with neighbors as winners and losers.

The other notable aspect was the temperature. June through August was the fifth warmest summer on record for Texas, with records going back to 1895. You might be able to guess (2011, nudge, nudge) which summer was the warmest. Combine that with our warm May, and you have the third-hottest May-August on record, not just for Texas, but for any state in the contiguous 48!

Admittedly, most places received less rainfall than normal, but the unusually high temperatures really made drought conditions worse than the rainfall alone would indicate. High temperatures generally mean more evaporation. So lakes, stock tanks, and soil lose water more quickly, at the same time that plants need more water to replenish what they're losing. Drought ended up being common in places from the Panhandle and Far West Texas to West Central Texas, Southwest Texas, and even East-Central Texas.

As of early September, Texas is getting a bunch of tropical moisture. This is good news for most agricultural producers and ranchers. Cotton farmers, though, want the cotton to be free from mud splatter and moisture when they harvest it, so rain this time of year can be a problem for them.

That's the thing about Texas weather: it always causes a problem for somebody.



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West Texas Regional Climate Summary

By James DeBerry
National Weather Service- Midland

Summer 2018 Climate Summary for West Texas and Southeast New Mexico

West Texas and Southeast New Mexico saw an uptick in rainfall over the summer. A repeat of the very dry 2011 had been feared, but rains in June put an end to that. Portions of the Western Low Rolling Plains, the Big Bend, and areas along the Rio Grande are 2-4" below normal, but the rest of the region is near- to above-normal.

June

June had a plethora of severe weather events, but also several rain events spaced out evenly over the course of the month, providing much-needed rainfall to areas that needed it most. While June cannot be called a drought-buster, it did ensure that 2018 will not be another 2011. The highest radar rainfall estimates were up to 10", centered near Cayanosa, Texas, and extending northeast into Gaines County, and southeast to Candelaria. The highest amounts were near the Pecos River, which is very controlled, so no river flooding occurred there. This was also near the sand hills, which are very porous, so little flash flooding was noted, as well. One event that did stand out occurred on June 18th, when thunderstorms developed over Ector County, flooding parts of Odessa. Floodwaters almost made it into some residences, but not quite. Later that morning, some roads flooded in Kermit in Winkler County, deep enough to reach car doors. Highest observed rainfall was around 7". The average of rainfall reported across West Texas and Southeast New Mexico was around 1.75" (Figure 1).

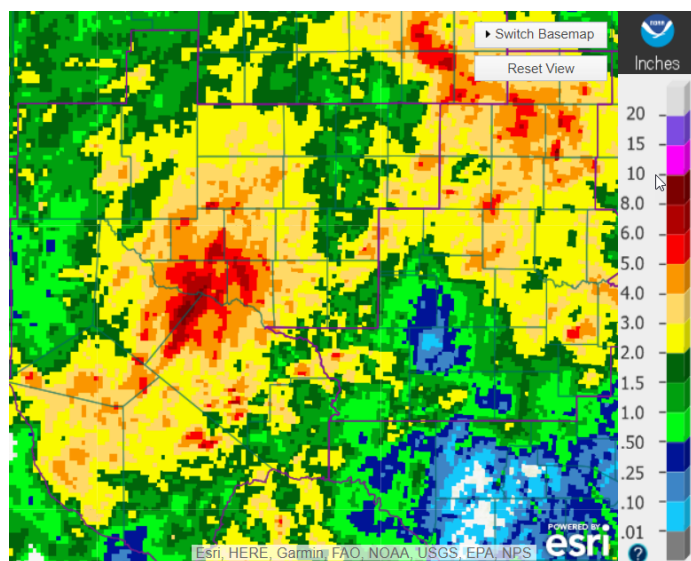


Figure 1: West Texas June Rainfall

July

Rainfall during July averaged right around normal except for the Big Bend and areas right along the Rio Grande, both of which saw less than 50% of average. Drought conditions improved, but reservoirs continued to drop. Although rain events were plentiful, parched soils absorbed much of the rain, and little flooding was reported. Monthly radar rainfall estimates ranged from as little as 0.10" in the Big Bend Area to 8-10" in isolated parts of Eddy, Jeff Davis, Reeves, and Pecos Counties. However, the highest observed rainfall was around 5 1/2" at Mount Locke in the Davis Mountains. The average of rainfall reported across West Texas and Southeast New Mexico was near 1.5". See figure 2 next page.

West Texas Regional Climate Summary

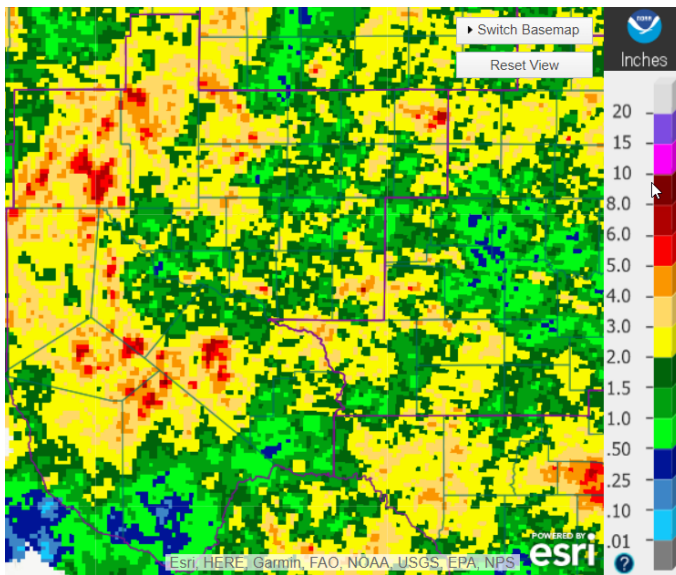


Figure 2: West Texas July Rainfall

August

August was a good month, hydrologically. Radar rainfall estimates ranged from less than 0.10" in the southern Permian Basin to up to 8" in southern Eddy, Lea, and Mitchell Counties. Highest observed rainfall was around 4.5" near Welch in Dawson County. The average of rainfall reported across West Texas and Southeast New Mexico was near 1.65" (Figure 3).

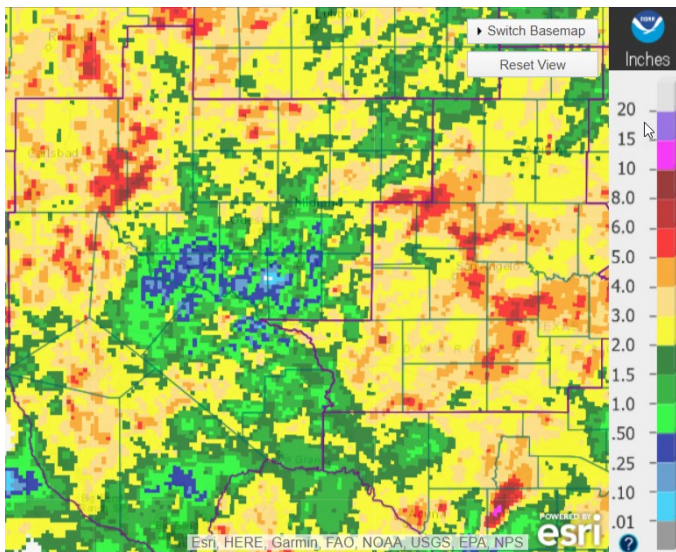


Figure 3: West Texas August Rainfall

A few flash flood events were noted, all of them urban.

On August 20th, thunderstorms hit Seagraves in Gaines County, flooding several vehicles. On the 25th, thunderstorms flooded low-lying roadways in Hobbs in Lea County. Roadways were barricaded, but some vehicles were still stranded in up to 3' of water. On August 27th, thunderstorms moved through Odessa in Ector County and Midland in Midland County, flooding numerous roadways and stranding vehicles.

The Rio Grande flooded several times during the first half of the month, but the flooding was flashy and brief, as is typical of the river here in West Texas.

Overall, summer 2018 leaves West Texas and Southeast New Mexico in good shape for the year, and saved it from being another 2011. Area reservoirs are at an average of 43% conservation capacity.

Wichita Falls Regional Climate Summary

Hot Relatively Dry Summer for Wichita Falls Region

By Charles Kuster

CIMMS/NSSL

This summer was relatively tranquil weather-wise in the Wichita Falls Region, with few widespread heavy precipitation or severe weather events. The most notable precipitation events occurred on June 23 when 2.25" diameter hail fell in Archer County and on August 13–14 when over 1.5" of rain fell over much of Wichita and Archer County (Fig. 1). Three CoCoRaHS stations reported over 2" of rain during this period. Overall, the area saw 60 dry days (all CoCoRaHS stations reported less than 0.05") and 31 wet days (at least one CoCoRaHS station reported 0.05" or more) this summer. For comparison, last summer the area saw 53 dry days and 38 wet days. The region experienced below normal precipitation (Fig. 3a) and above normal temperatures (Fig. 3b) with many areas seeing 3–6" less precipitation than normal and temperatures 3–4 degrees F above normal. Drought coverage and intensity did increase somewhat over the summer and the entire region is now covered by at least moderate drought according to the U.S. Drought Monitor (Fig. 2). Remember, CoCoRaHS observers can contribute important information to the Drought Monitor staff by submitting Condition Monitoring Reports more info at:

https://www.cocorahs.org/Media/docs/ConditionReportingGuide_1.4A/assets/player/KeynoteDHTMLPlayer.html#0.

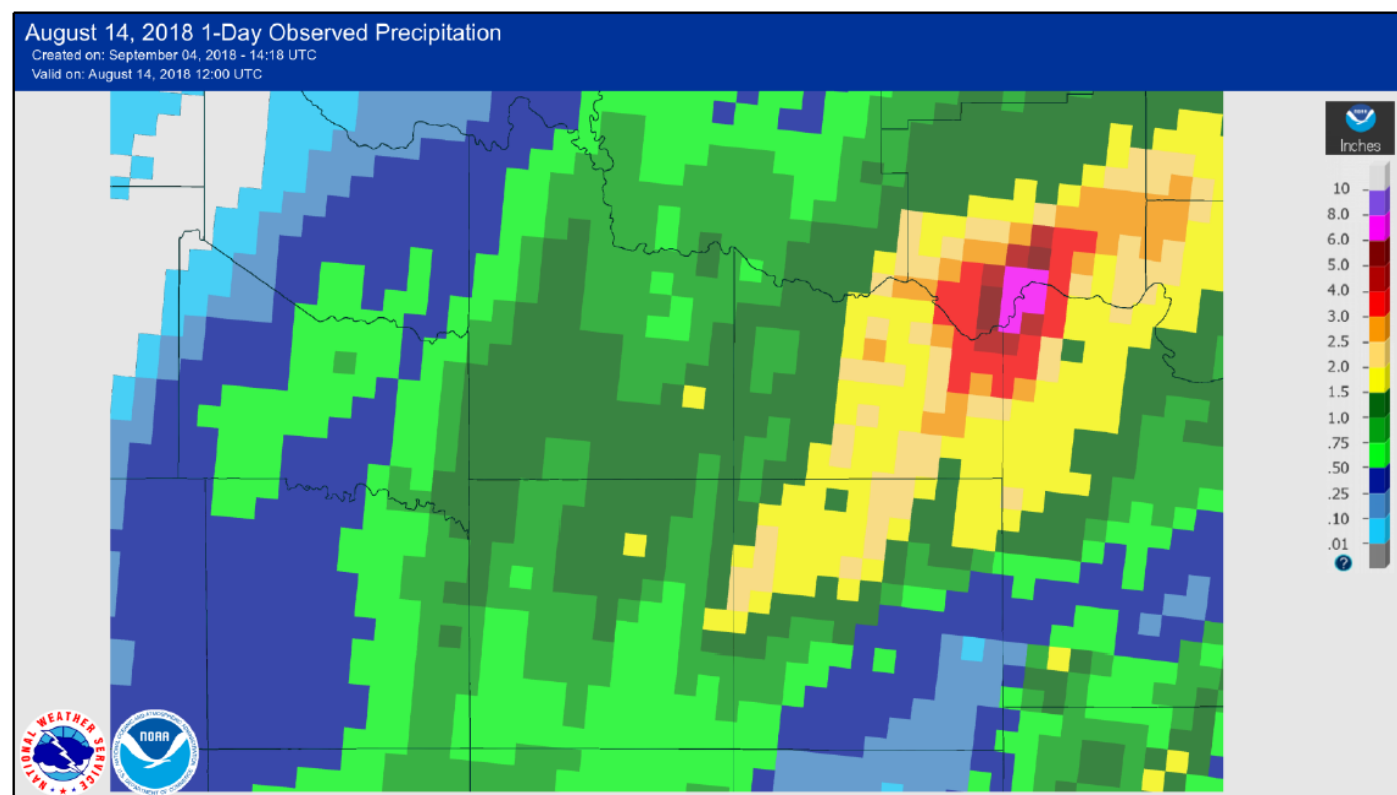


Figure 1: 24-hour rainfall estimates for August 14, 2018.

Wichita Falls Regional Climate Summary

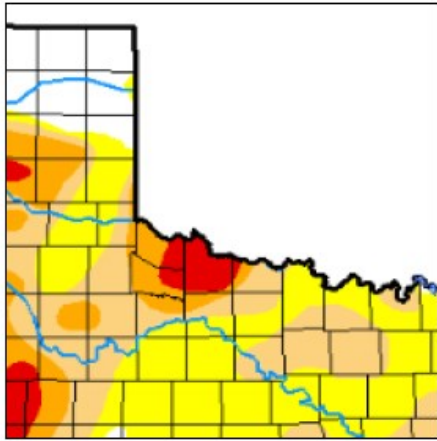


Figure 2: Drought Monitor Map focused on Wichita Falls Region for September 11, 2018.

The biggest weather story of the summer was likely the heat wave that occurred during mid to late July. From July 11–22, the temperature rose to at least 100 degrees F 11 out of 12 days in Wichita Falls and 10 straight days had temperatures above 100 degrees F. The heat wave peaked on July 19–22 when the temperature soared to at least 110 degrees F for 4 straight days with each breaking the existing daily record high temperature. The hottest temperature recorded in Wichita Falls during this stretch was 112 degrees on July 19th, 20th, and 22nd before high temperatures finally fell below 100 degrees F on July 23rd.

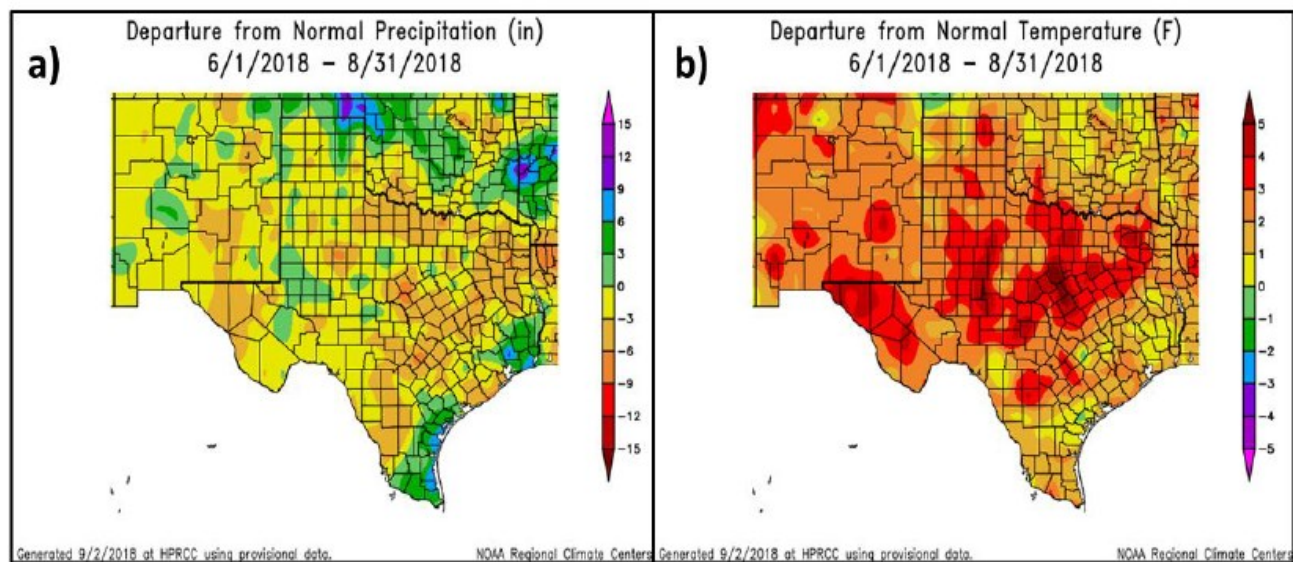


Figure 3: Departure from normal a) precipitation and b) temperature for June through August 2018. Warm colors indicate below normal precipitation/temperature and cool colors indicate above normal precipitation/temperature.

Brazos Valley Regional Climate Summary

Summer 2018 Precipitation Summary

Bryan-College Station/Brazos Valley Region, Texas

John Nielsen-Gammon, Texas A&M University, Texas State Climatologist, Regional CoCoRaHS Coordinator

Jeramy Dedrick, Graduate Assistant for the Office of the State Climatologist

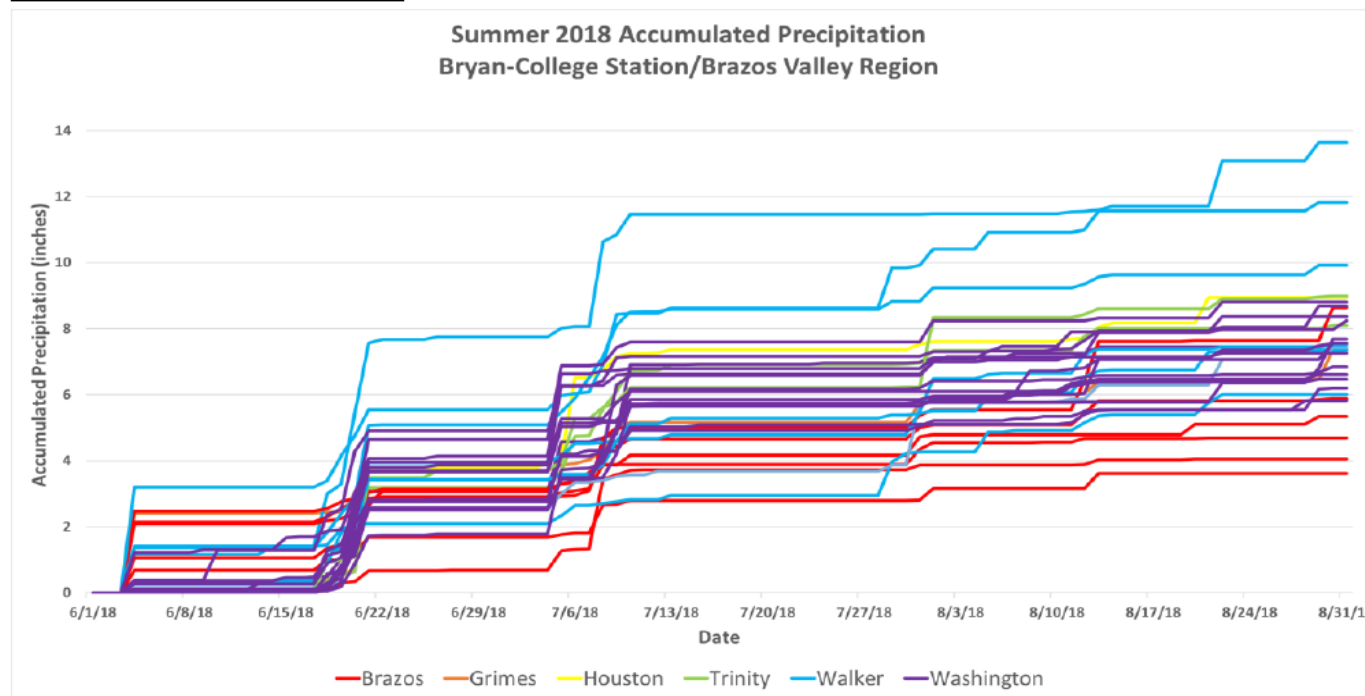
Summary:

Periods of measurable rain during the start of the season followed a relatively weekly pattern in the Brazos Valley. This pattern began in June and continued into the first week of July with rainfall totals measuring 1 to 1.5 inches weekly. Remnants from a tropical wave passing through the Gulf of Mexico in mid-June made its way into the region and allowed for some convective development observable by larger rainfall totals in the third week of June. July was a notably dry month for a large portion of the Brazos Valley with monthly totals staying just over an inch. The relatively dry conditions continued in August with some intermittent rain events during the middle and end points of the month.

Observer Statistics:

There were 45 active CoCoRaHS observers during the Summer season, down just two observers from the spring and three from the winter. 9 observers reported for the full 92 days of the season. Not including these 9 stations that covered the entire period, 22 others reported for at least 75% of the period, providing a total of 31 active observers with reliable measurements across 6 (Brazos, Grimes, Houston, Trinity, Walker, and Washington) of the region's 8 counties.

Accumulated Precipitation:



Brazos Valley Regional Climate Summary

The most significant contributions to the season's rainfall accumulation occurred throughout the month of June, followed by storms produced by tropical moisture at the beginning of July. An observer in Walker County measured the largest spike in accumulation during these storms. No further notable accumulation spikes were observed for the remainder of the season as dry conditions persisted. Total precipitation for the region was on the range of 4 to just under 13".

Season Statistics:

Wettest Day: 3.2", June 4 (Walker County)

Wettest seasonal total: 13.63" (Walker County)

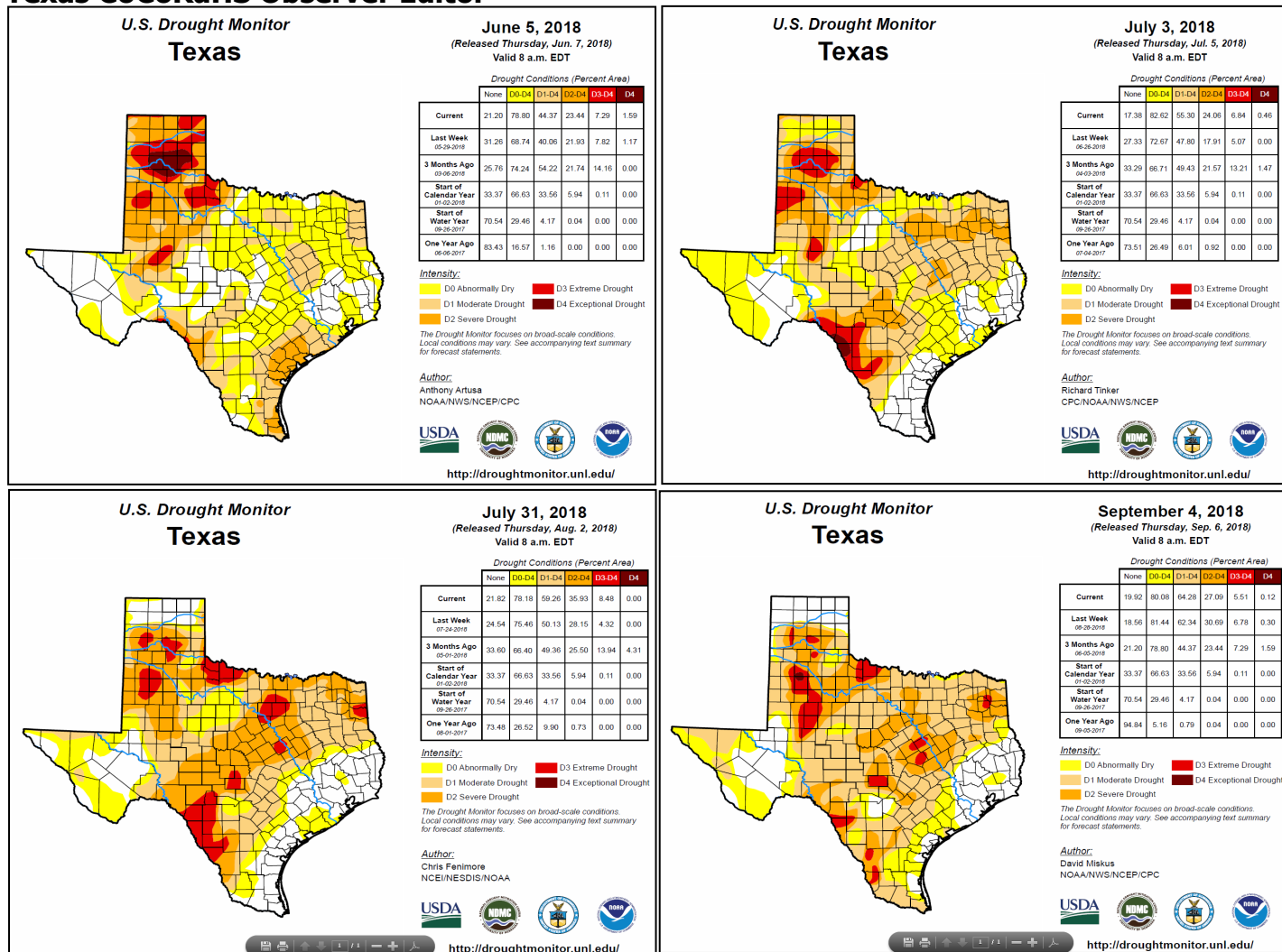
Longest spell of days without measurable rain: 28; July 11 - August 7 (Washington County)

Longest spell of days with measurable rain: 8 (Washington County)

Texas Drought Monitor Maps throughout the summer months

By Ron Havran

Texas CoCoRaHS Observer Editor



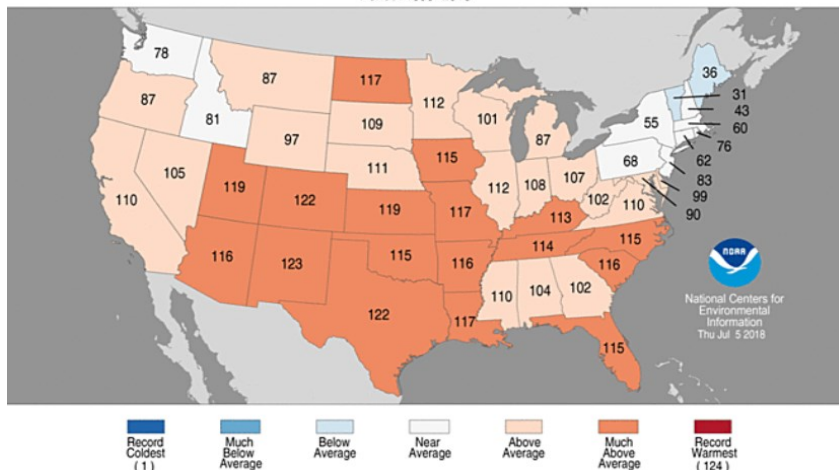
Avg. Temperature and Precipitation Ranks for lower 48 each summer month

By Ron Havran
Texas CoCoRaHS Observer Editor

Statewide Average Temperature Ranks

June 2018

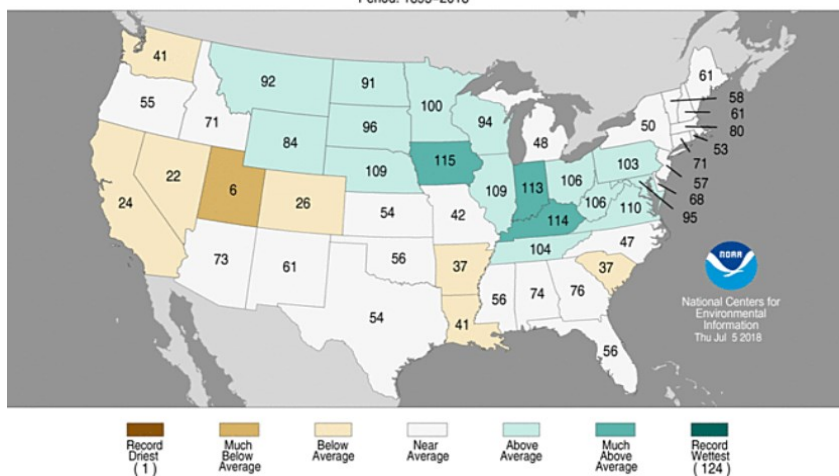
Period: 1895–2018



Statewide Precipitation Ranks

June 2018

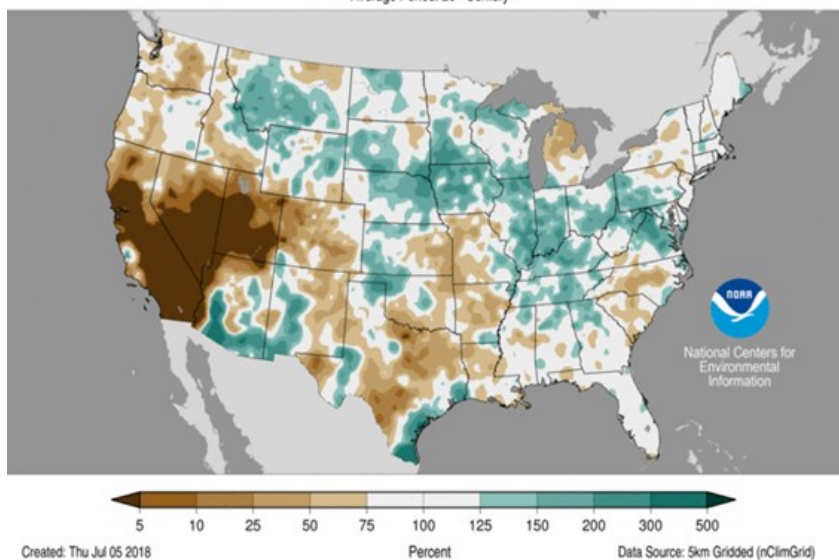
Period: 1895–2018



Precipitation Percent of Average

June 2018

Average Period: 20th Century

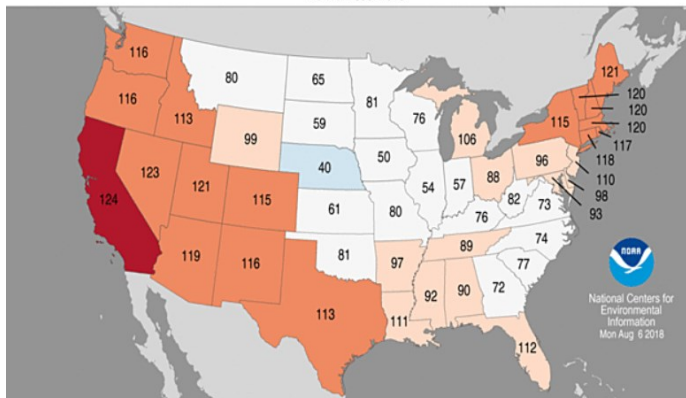


Avg. Temperature and Precipitation Ranks for lower 48 each summer month

Statewide Average Temperature Ranks

July 2018

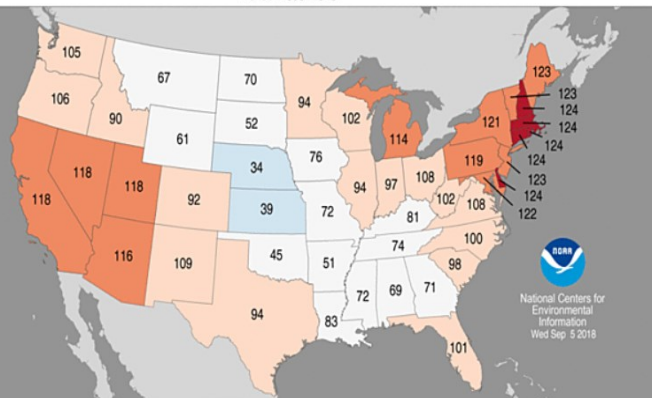
Period: 1895–2018



Statewide Average Temperature Ranks

August 2018

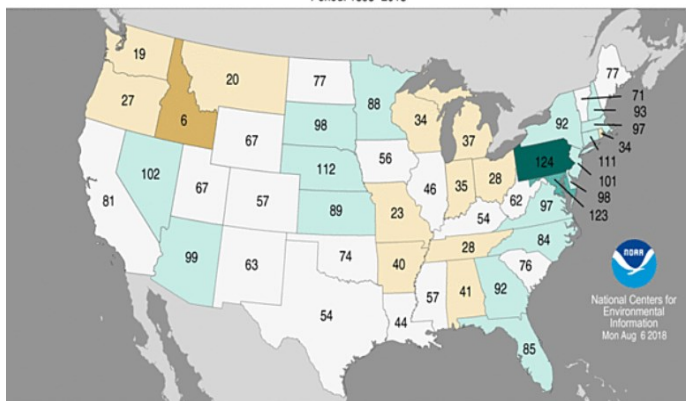
Period: 1895–2018



Statewide Precipitation Ranks

July 2018

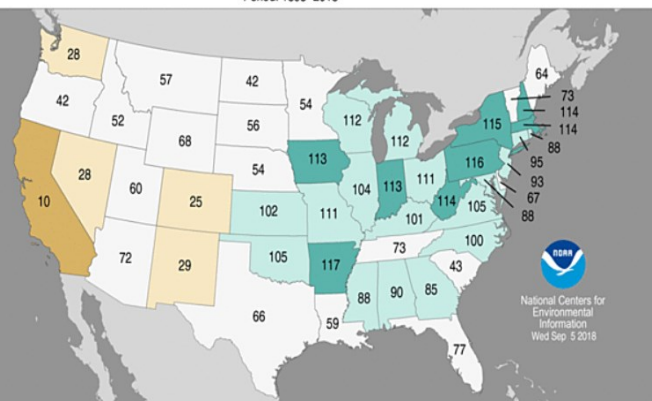
Period: 1895–2018



Statewide Precipitation Ranks

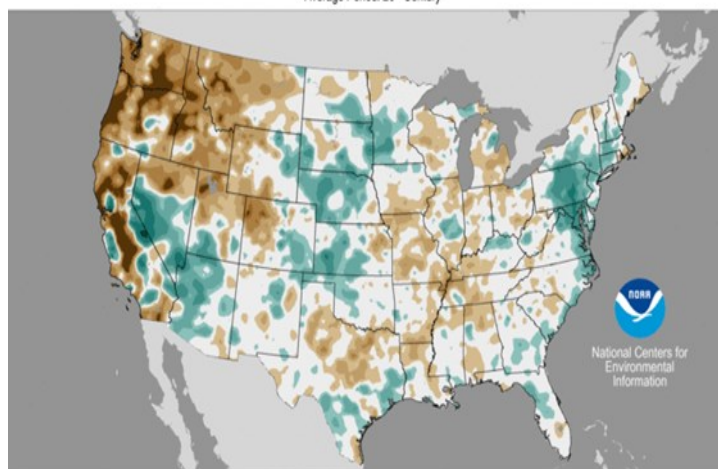
August 2018

Period: 1895–2018



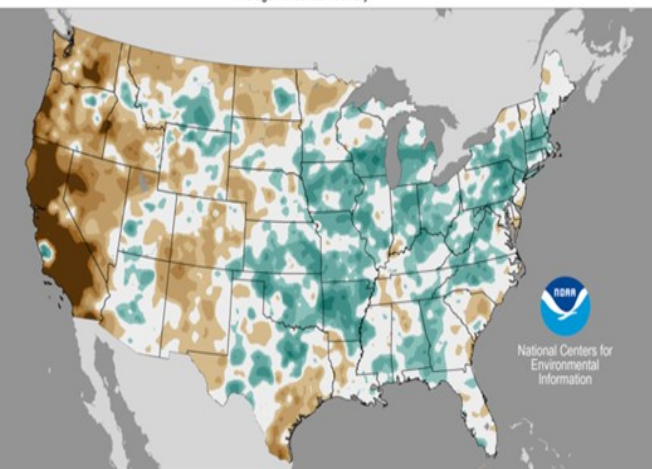
Precipitation Percent of Average

July 2018

Average Period: 20th Century

Precipitation Percent of Average

August 2018

Average Period: 20th Century

Austin/San Antonio/ Del Rio Regional Summer Summary

By Brett Williams

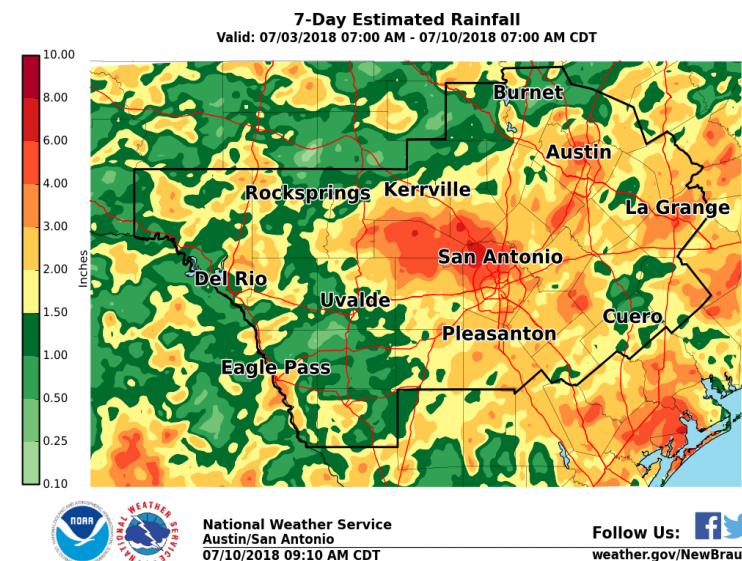
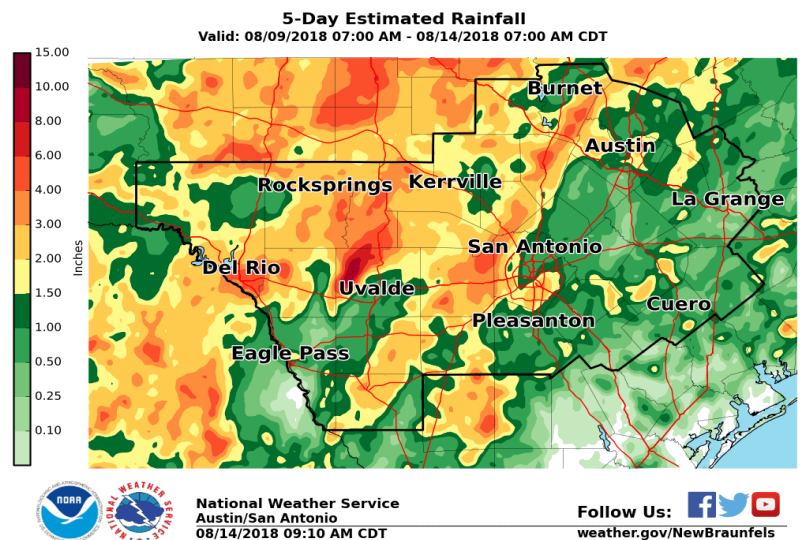
National Weather Service –Austin/San Antonio

Hot and generally dry with drought conditions persisting was the primary story of summer 2018 across South Central Texas. Austin Camp Mabry, the official climate site for the city of Austin, registered its 3rd warmest summer on record, with a total of fifty-one 100+ degree days. San Antonio also experienced their 3rd warmest summer on record, with a total of twenty-one 100+ degree days while Del Rio recorded their 7th warmest summer on record, with a total of fifty-six 100+ degree days. Both Austin and San Antonio experienced slightly drier than normal summers, with Del Rio recording their 30th wettest summer on record.

June was quite warm across South Central Texas. Del Rio registered its hottest June on record. Austin and San Antonio came in at 4th warmest and 3rd warmest, respectively. The month was relatively dry for the majority of the region, however, there was one notable heavy rain event which occurred in the late evening hours of June 3rd and continuing into the early morning hours of June 4th across portions of Williamson, Travis, and Burnet Counties. A CoCoRaHS gauge at Marble Falls 2.7 SE reported 6.90" of rain while a gauge at Pflugerville 4.0 ENE reported 7.12" of rain from this event.

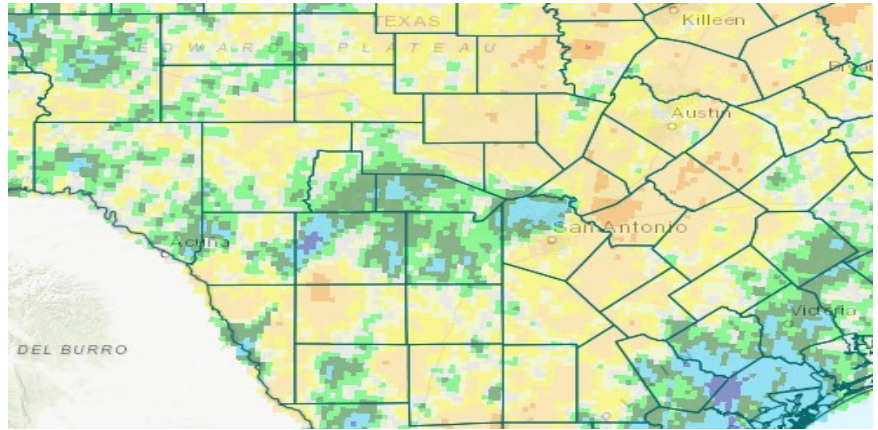
July continued the theme of above-normal temperatures. Austin, San Antonio, and Del Rio recorded their 7th, 14th, and 11th warmest Julys on record, respectively. However, July was relatively wet, with well-placed rainfall to provide some short-term drought relief. Both Austin and San Antonio registered their 17th wettest Julys on record, while Del Rio experienced their 35th wettest July. Most of South Central Texas experienced a rainy period from July 4th through July 9th, which put a damper on many Independence Day celebrations across the region. An extreme heat wave dominated the region during the second half of the month. On July 23rd, Austin Camp Mabry reached 110 degrees. This was the hottest July day on record for the Austin area climate site (period of record beginning on 9/1/1897). It was also the 3rd hottest day ever recorded at Austin. On July 24th, the overnight low temperature at Austin only dropped to 84 degrees. This was the all-time warmest daily minimum temperature on record for the Austin area climate site.

August brought no relief from the summer heat. Austin recorded their 3rd warmest August on record. It wasn't quite as hot at San Antonio and Del Rio, which came in at 12th warmest and 36th warmest Augusts on record, respectively. The month was drier than normal for the majority of the region, with the exception being portions of the southern Edwards Plateau and into portions of the Rio Grande plains. On August 11th, Del Rio International Airport received 3.61" of rain.



Austin/San Antonio/Del Rio Regional Summary continued

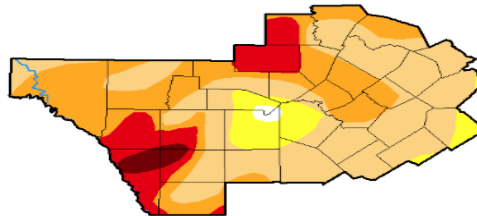
In the early morning hours of August 12th, a stationary thunderstorm located over northwestern Uvalde County dropped up to 12" of rain in a few hours into the Nueces River watershed between Uvalde and Camp Wood. This caused massive flash flooding on the Nueces, and stranded 27 campers near Chalk Bluff.



U.S. Drought Monitor
Austin/San Antonio, TX WFO

August 28, 2018
(Released Thursday, Aug. 30, 2018)
Valid 8 a.m. EDT

	Drought Conditions (Percent Area)					
	None	D0	D1	D2	D3	D4
Current	9.68	7.90	48.93	30.77	11.54	2.19
Last Week	9.68	9.03	50.43	26.31	11.37	2.19
3 Months Ago	29.98	32.93	25.70	9.99	0.50	0.00
Start of Calendar Year	53.20	30.36	7.44	0.00	0.00	0.00
Start of Water Year	69.68	28.04	2.28	0.00	0.00	0.00
One Year Ago	73.82	15.49	4.90	0.00	0.00	0.00



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

Author:
 Jessica Blunden
 NCEI/NOAA



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

Top Right:: Percent of normal rainfall for 2018 Summer—image top right

Right: South Central Texas Drought Monitor for August 28th, 2018



At left: Comparison photo between normal conditions of the Nueces River north of Uvalde vs. the swollen Nueces River from the morning of August 12, 2018

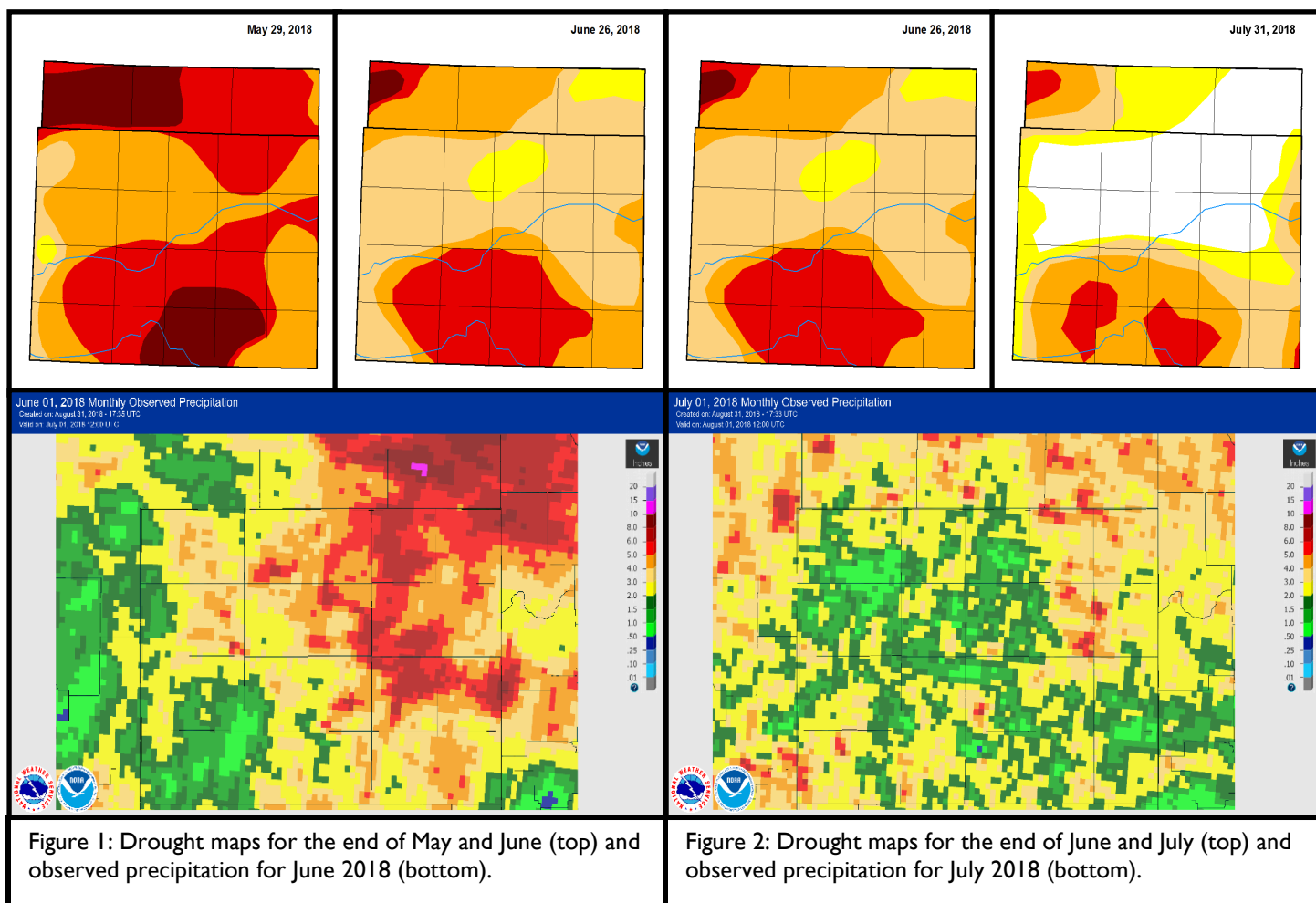
Drought Relief for the Texas and Oklahoma Panhandles

By Kaitlin Rutt

Intern Amarillo National Weather Service

Summer 2018 in the TX and OK Panhandle began with 100% drought conditions across the area. Going into the summer months, the Panhandles were anticipating some rain to add relief to the drought. Following the month of June, the observed precipitation totals (Figure 1: bottom) indicated a high rainfall amount in the northeastern TX Panhandle and eastern OK Panhandle. All other areas of the Panhandles received rainfall above zero that contributed to lessening the drought extremes. By the end of June, the exceptional drought conditions went from 18% to 1% coverage in the Panhandles and the extreme drought conditions went from 39% to 22% coverage (Figure 1: top).

Moving on to July, the precipitation totals (Figure 2: bottom) were not as extreme as June, but there was a similar pattern between the two months. The higher rainfall amounts occurred in the northeastern TX Panhandle and eastern OK Panhandle. Due to the continuation of rain in the northeastern Panhandles and subsequent rain in the central TX Panhandle, the abnormally dry and moderate drought conditions that remained at the end of June were completely cleared by the end of July (Figure 2: top). This left July with a 37% coverage of no drought across the TX and OK Panhandles. Also, since all of the Panhandles received some amount of rainfall in July, the remaining 1% of exceptional drought conditions were eliminated. Therefore the extreme drought conditions became the highest intensity remaining with a decrease in coverage from 22% to 8%.



Drought Relief for the Texas and Oklahoma Panhandles continued

Coming into August, the drought conditions continued to improve as the total percent area of the TX and OK Panhandles covered by any drought intensity decreased below 50% from the end of July to the end of August (Figure 3: top). The extreme drought conditions diminished in the western OK Panhandle and decreased across the southern TX Panhandle. The total extreme drought remaining in the TX and OK Panhandles is 3% area. The greatest amount of rainfall for the month of August (Figure 3: bottom) occurred on both the western and eastern Panhandles, which allowed for a decrease in lower intensity drought areas. The Panhandles ended July with 37% area of no drought and by the end of August this number increased to 56%.

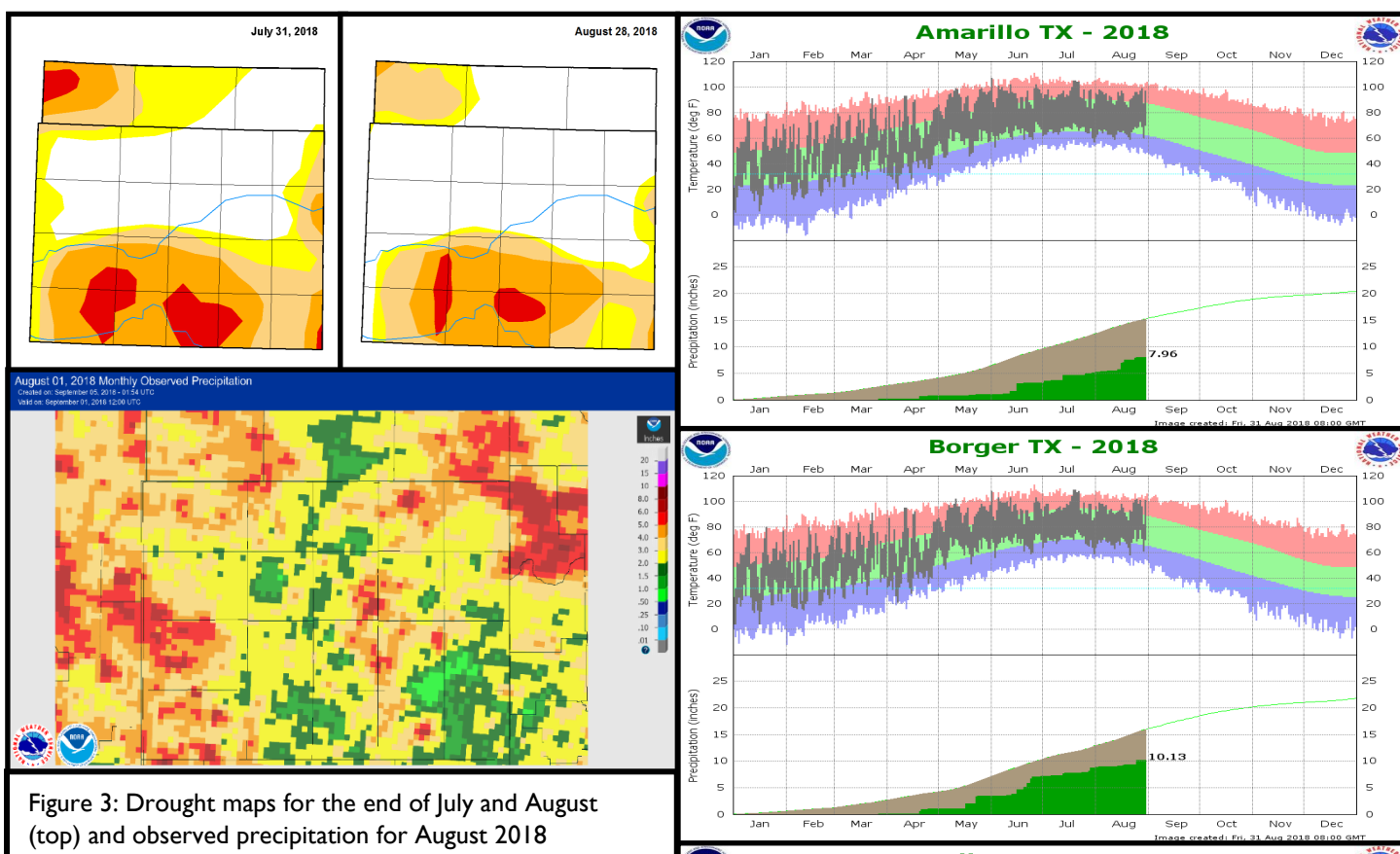


Figure 3: Drought maps for the end of July and August (top) and observed precipitation for August 2018

Overall, the drought conditions from the dry spring slowly diminished with the summer rainfall amounts. Rain was observed everywhere in the TX and OK Panhandles during all three summer months. Even though the Panhandles still have 3% coverage of extreme drought conditions going into September, the summer rain played a huge role in diminishing any exceptional drought conditions and decreasing the extreme drought coverage by 37% since the start of the summer months. Looking at the drought map for August, the main drought conditions still remain over Amarillo, Texas going into fall. According to Figure 4, local measurements of precipitation this year have been below average in Amarillo, Borger, and Dalhart, Texas, which helps validate these drought conditions in the Panhandles. However, there is still time for severe drought conditions in the Panhandles to clear before the end of the year.

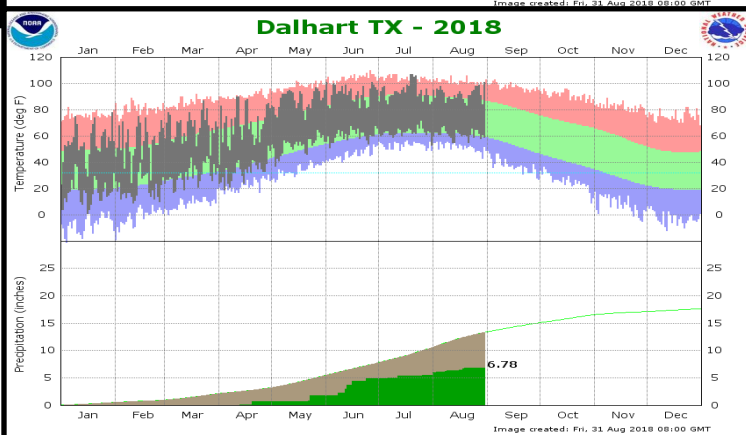


Figure 4: Yearly averages and actual values of temperature and precipitation for Amarillo, Borger, and Dalhart, Texas.

North Texas Summer Climate Summary

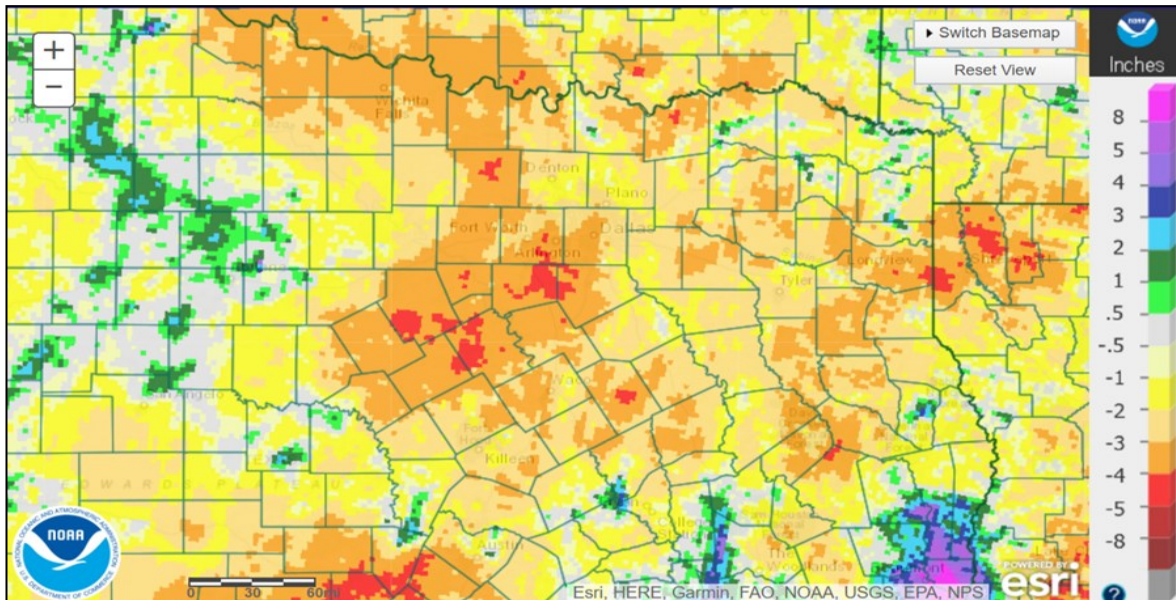
By Greg Story

National Weather Service-Fort Worth

Greetings from North Texas! We really have been on a rainfall roller coaster in north Texas the past several months. Just to review, 2018 started off with dry weather in January. And, after starting off dry in February, most of north Texas got drenched. We had the wettest February on record. The monthly March rain total was slightly below normal, but the southeast portions of North Texas and the Toledo Bend Country had above normal precipitation. In April we had below normal rainfall in north Texas everywhere except for the extreme eastern portions. We had the 7th driest April of record. In May a few spots over central Texas saw above normal precipitation, as did the northwestern parts of north Texas. But below normal rainfall was noted elsewhere, especially over extreme northeast Texas.

In June a vast majority of Texas, including north Texas, continued to see below normal precipitation, especially in the area southwest of the DFW Metroplex. At DFW airport they got 1.27" in June. The normal amount is 3.79" so they were much below normal by 2.52" for the month. With 1.27" of rain at DFW, this was the driest June since 2008 when only 0.84 of an inch was recorded.

The largest rain event in June over north Texas was during the first week of the month. A cold front moved into Texas on June 2nd and ended up stalling and lingering over the state through the 5th. Short wave upper-level disturbances in a northwest flow aloft generated mesoscale convective systems (MCS's) across north and central Texas June 4 - 6. The highest rainfall amounts in the Dallas-Fort Worth Metroplex and surrounding counties were Mesquite with 3.72" Frisco with 3.68" and Farmers Branch with 3.04". A stray supercell thunderstorm pounded Coppell and Carrollton early June 6 with large hail which was 2¾ -3 inches in diameter. A bucket of golf ball sized hail was collected in Carrollton, then the storm drifted southward and Arlington got some tennis ball sized hail.

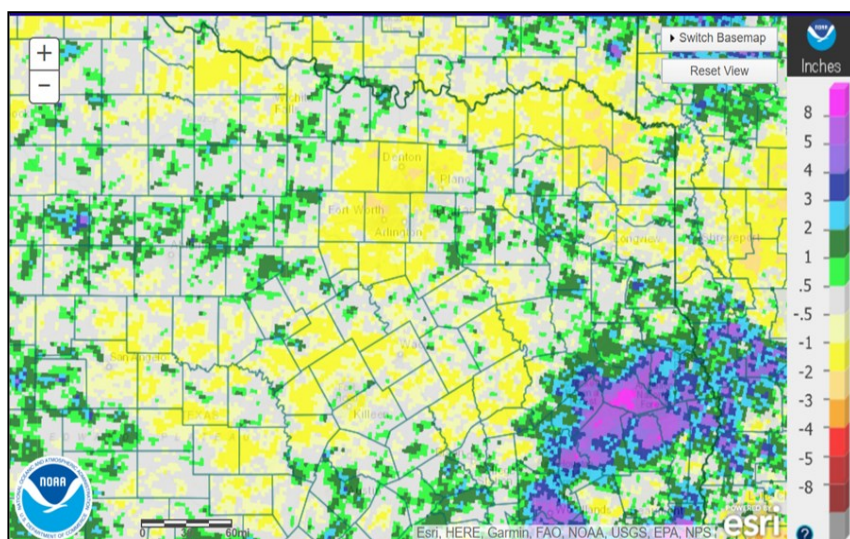


Departure from normal rainfall for June 2018. The red, brown and yellow colors indicate below normal precipitation, while the green and blue and purple colors indicate above normal.

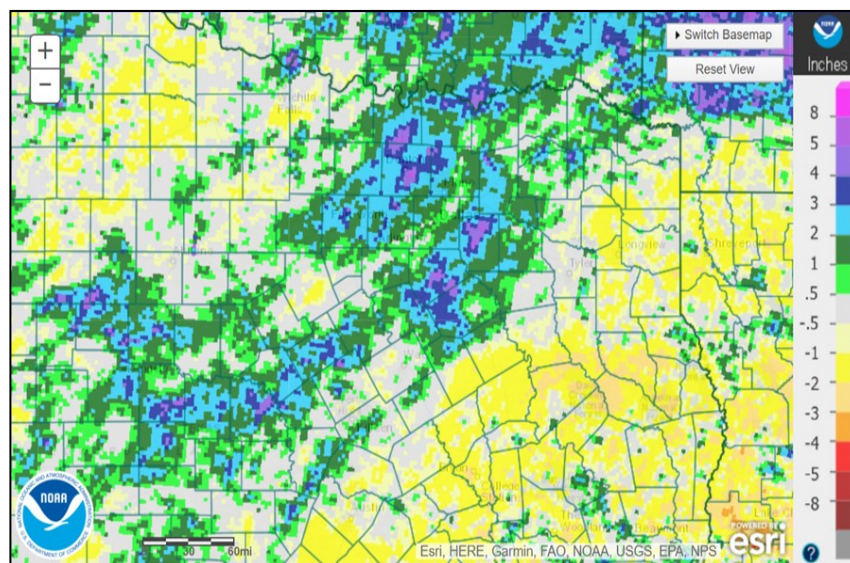
North Texas Summer Climate Summary continued

In July only east central and southeast Texas had above normal rainfall. Below normal rainfall was noted over parts of the Texas Hill Country into the western parts of the DFW Metroplex. At DFW airport they only got 0.25 of an inch in July. The normal amount is 2.16" so they were much below normal by 1.91" for the month. For June and July DFW registered only 1.52"! Through the end of July DFW has not had a month with above-normal precipitation since a record 11.31" fell in February (and a record 16.72" occurred during the past winter of 2017-18). From April through July north Texas had only 40 percent of normal rainfall. The monthly precipitation of 0.25" at DFW equated to the driest July since 2011 (0.09").

There was a series of weak storm systems during the second week of July. The last of these storm systems interacted with the leftover tropical moisture and brought rainfall especially to the eastern parts of the DFW Metroplex and into southeast Texas July 9 – 11. Locally heavy rainfall fell on parts of north central Texas ending on July 11, temporarily dousing the severe drought in the eastern parts of the Dallas-Fort Worth Metroplex. Some of the largest amounts were observed in Rowlett (Rockwall County) with 4.12", Plano - 4.08", Wolfe City (Hunt County) - 3.12", Addison (Dallas County) - 3.08", Forney (Kaufman County) - 2.82", Wortham (Freestone County) - 2.80", Mesquite (Dallas County) - 2.58" and Denton - 2.48".



July 2018 departure from normal rainfall map. The brown and yellow colors indicate below normal precipitation, while the green, blue and purple indicate above normal rain.

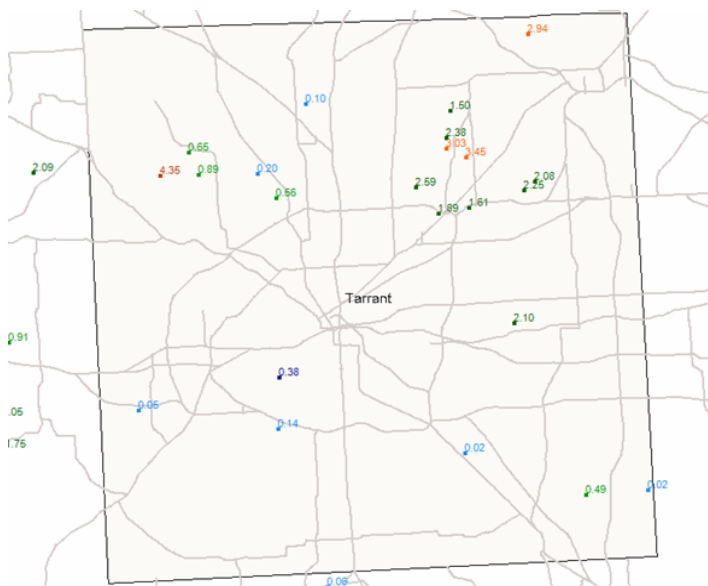
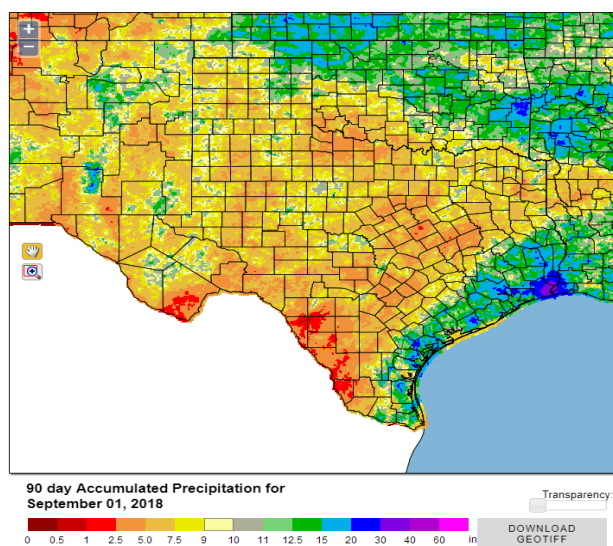


August 2018 departure from normal rainfall map. The brown and yellow colors indicate below normal precipitation, while the green, blue and purple indicate above normal rain.

In August, the pattern changed from the hot, dry regime of July to one that was more favorable for some rain. Above normal rainfall occurred over north Texas except for the southeast portions. At DFW airport they got 2.99" in August. The normal amount is 1.91" so they were above normal by 1.08" for the month.

North Texas Regional Climate Summary continued

The most pronounced weather system to affect north Texas came during the second week of the month. A cold front came into north Texas which then stalled around August 8th. Also, a deep upper-level trough dipped south into Oklahoma, placing north Texas in a favorable environment for showers and thunderstorms as the cold front/outflow boundary remained. An extended period of unsettled weather dominated the region through mid-August. Parts of the Texoma area saw some much needed rain, as Sherman measured 4.74". A mesoscale vortex center (MVC) developed across Dallas-Fort Worth Metroplex August 12. Combined with a closed low that formed over the southeastern New Mexico/Texas Panhandle border, this enhanced the rainfall totals around the region. The largest precipitation totals observed in north Texas included Cleburne (Johnson County) with 10.24", Blue Ridge with 10.67", Frisco with 8.40", Shady Shores (Denton County) with 7.44" and Hillsboro received 7.15". Meanwhile, just down the road west of Cleburne, Glen Rose (Somervell County) only picked up 1.50". Later in the month, on August 19 – 20, a weak cool front moved in and through the region. This front brought some rain to north Texas. Portions of Tarrant County averaged around 1.16".



Example of CoCoRaHS rainfall reports in Tarrant County

Summer precipitation in 2018

The DFW airport received 4.51" for the summer season while the normal amount is 7.86". Thus they were 3.35" below normal. Adding up the totals for 2018, DFW has received 22.21". The normal amount is 24.11" so they were 1.90" below normal for the year. So, in spite of having record rainfall in February we are still behind normal for the year due primarily to the extremely dry month of July. The weather pattern has turned quite tropical, though, with above normal rainfall measured so far in September. More on that in the next newsletter.

So in conclusion, I want to thank you for submitting your rainfall readings to CoCoRaHS. They continue to be extremely valuable to us at the National Weather Service. They have become increasingly important to our daily operations. Please continue making your daily weather observations even when the weather at your site had a low amount of rainfall (or only zero rainfall to report). The variability of the rainfall is important information. Why? Because the National Weather Service needs to know how widespread intense rainfall reports are when considering making river flood forecasts. An example of what I am referring to is shown above right.

In this example, strong thunderstorms brought moderate to heavy rain over northeastern and far northwestern Tarrant County (with 4.35" west of Eagle Mountain Lake and 3.45" in North Richland Hills), while southern Tarrant County got but a few hundredths of an inch. Both types of reports are important. Remember, every drop counts and so do zeros!

Thank YOU so much for your efforts. Have a great autumn season!

Houston-Galveston Region Summer County Rainfall Averages

By Ron Havran

Houston/Galveston Regional Coordinator

Summer 2018 CoCoRaHS Houston/Galveston Region Rainfall

County Rainfall Average and County Station Rainfall Maximum Total in inches per month

County	June		July		August		Summer Total
	AVG.	MAX.	AVG.	MAX.	AVG.	MAX.	3-Month Rain Total
Austin	5.91	7.45	2.84	5.48	1.52	2.88	10.27
Brazoria	3.24	5.98	5.05	8.77	2.11	3.63	10.40
Chambers	N/A	6.04	N/A	4.38	N/A	7.38	N/A
Colorado	3.75	5.42	3.18	3.47	2.00	3.59	8.93
Fort Bend	5.14	6.25	4.14	5.69	2.25	4.30	11.53
Galveston	5.01	7.16	6.17	9.11	2.10	4.09	13.28
Harris	5.22	7.80	6.35	9.29	2.29	6.78	13.86
Jackson	N/A	7.72	N/A	0.49	N/A	3.86	N/A
Liberty	4.71	4.91	3.32	4.95	3.14	3.21	11.17
Matagorda	N/A	7.08	N/A	2.82	N/A	0.60	N/A
Montgomery	4.44	5.54	7.10	10.90	1.99	3.23	13.53
Polk	2.91	4.71	7.32	8.71	2.19	3.17	12.42
San Jacinto	4.49	7.08	7.13	8.10	1.68	2.11	13.30
Waller	N/A	5.98	N/A	2.75	N/A	2.27	N/A
Wharton	5.97	7.48	1.69	2.43	1.86	2.77	9.52
Region Totals	4.62	7.80	4.94	10.90	2.10	7.38	11.66

Denotes wettest month for a category

Denotes driest month for a category

Note: Months with a N/A for avg. county rainfall had only one station reporting in that county.

Note: All data taken from the cocorahs website by using the Total Precipitation Summary Report for each county by month.

Houston-Galveston Regional Summer Climate Summary continued

By Ron Havran

Houston/Galveston Regional Coordinator

June Climate Summary:

Monthly temperature in June averaged between 2 and 3 degrees warmer than normal across most of the region. A strong upper level ridge of high pressure brought very warm temperatures during the first half of the month. The timeframe between June 13th and June 22st had an active period of thunderstorms from upper level disturbances and high moisture levels in lower part of atmosphere. These storms brought a break from the heat with the rain and cloud cover to hold daytime highs in the 80's. Upper level ridging moved back into the region toward the end of the month and temperatures again warmed back into the middle 90's. Overnight low temperatures were higher than normal across many areas of the region with readings on most nights not falling much below 80 degrees. Monthly precipitation values varied significantly across Southeast Texas with generally the heavier rainfall totals closer to the coast with slightly drier conditions further inland. June rainfall totals were between 4" and 6" near the coast and between 2" and 3" further inland. Saharan dust made its appearance in SE Texas at the end of June with dusty and hazy skies. Wharton County had the highest average CoCoRaHS station rainfall with 5.97". Polk County had the lowest average CoCoRaHS station rainfall with 2.91".

July Climate Summary:

The summer heat machine was running very well and hot throughout the month of July with average temperatures approximately 1-3 degrees above normal. Most of the month of July was heavily dominated by a strong upper-level region of high pressure. This allowed for mostly clear skies and very dry conditions especially during the second half of the month, allowing average temperatures to be well above normal. Saharan dust was heavy from the 15th – 18th and from the 25th – 26th. Precipitation values were above normal across the eastern half of the region while the far western and southwestern parts of the region were below normal. An upper-level disturbance moved across the northern Gulf of Mexico and pushed westward into the region during the first week of July. This brought decent cloud cover and precipitation which helped to keep temperatures slightly below normal for a few days. Heaviest rainfall from storms occurred on the 4th in the region. Otherwise, summer-like weather brought daily rainfall through the first half of the month which was mainly attributed to development of showers and thunderstorms along the diurnally driven sea breeze and other outflow boundaries. The month ended with abnormally dry drought conditions due to the lack of rainfall during the second half of the month across the region. The reverse from last month with Polk County now having the highest average CoCoRaHS station rainfall with 7.32" and Wharton County now having the lowest average CoCoRaHS station rainfall with 1.69".

August Climate Summary:

Temperatures were near to below normal for the first half of the month, heavily influenced by precipitation and cloud cover, while the second half of the month was very dry and warm leaving daily temperatures well above normal in most parts of the region. Rainfall was 2" to 3" below normal during the month of August and many locations failed to tally even an inch of rain. The maps in figures 3a and 3b clearly show the scattered nature of summertime convection and how an area can receive an abundant of rainfall for the month and is above normal while an area nearby receives very little rainfall for the month is well below normal. Across the region rainfall was well below normal, with departures ranging from 2"-4". Though we did see some precipitation during the first half of the month, the rainfall totals were not nearly enough to put a dent on drought conditions. The end of the month resulted in severe drought in portions of our northern counties and abnormally dry to moderate drought across a majority of Southeast Texas. Along with the dry weather skies were hazy on a few days with another plume of Saharan dust moving in on the 12th and 13th and the 23rd – 25th. Liberty County had the highest average CoCoRaHS station rainfall with 3.14". Austin County had the lowest average CoCoRaHS station rainfall with 1.52".

Houston-Galveston Regional Summer Rainfall Maps

Summer 2018 Precipitation Maps for the Houston/Galveston Region

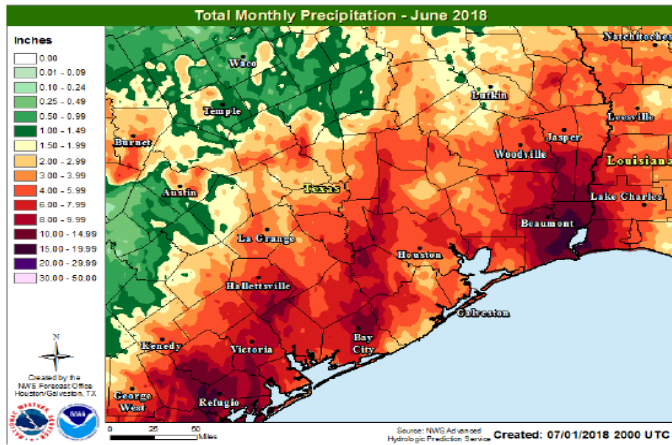


Fig. 1a: June 2018 SE Texas Precipitation

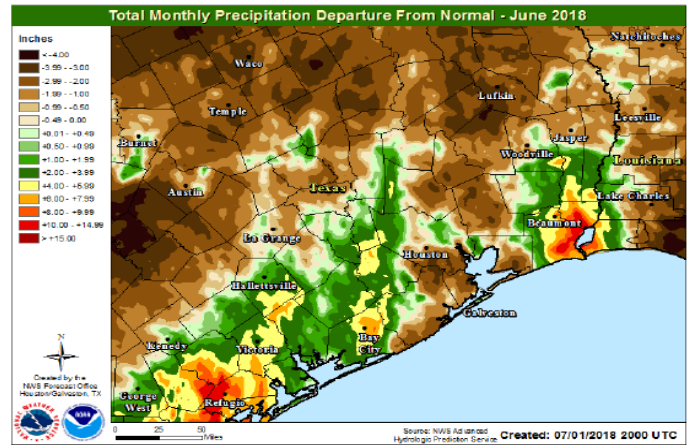


Fig. 1b: June 2018 SE Texas Precipitation Departure from Normal

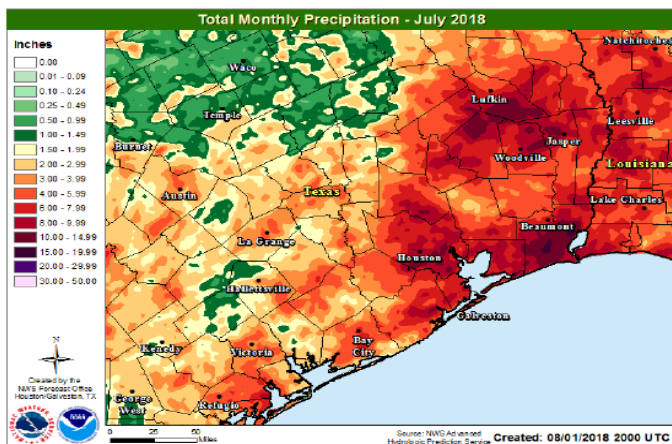


Fig. 2a: July 2018 SE Texas Precipitation

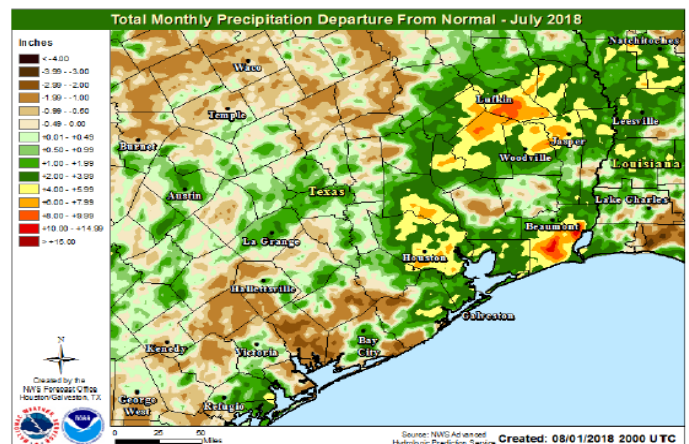


Fig. 2b: July 2018 SE Texas Precipitation Departure from Normal

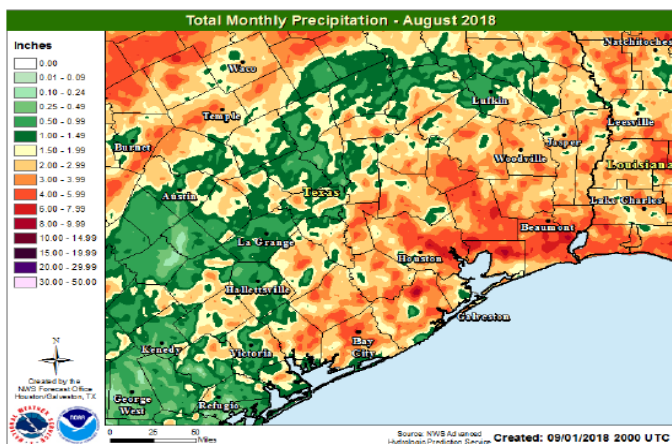


Fig. 3a: August 2018 SE Texas Precipitation

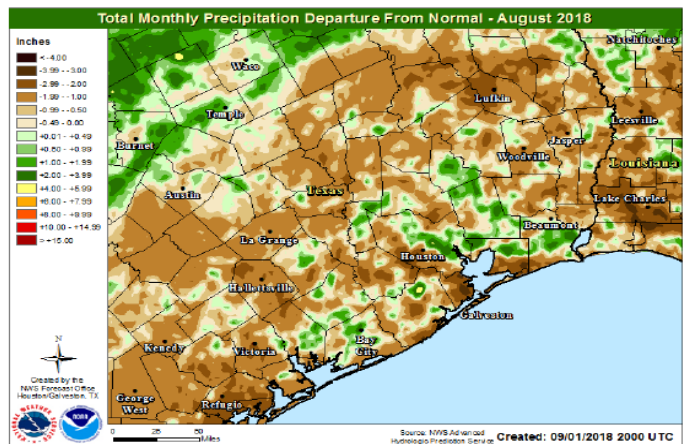


Fig. 3b: August 2018 SE Texas Precipitation Departure from Normal

East Texas Regional Climate Summary

By Davyon Hill

National Weather Service-Shreveport

It was a hot and dry Summer 2018 across East Texas. But despite the overall dry conditions for the summer, heavy rainfall was observed on several different days across the East Texas CoCoRaHS sites.

On June 5th, strong thunderstorms formed and trained along a stationary boundary across northeast Texas just after midnight, dumping heavy amounts of rain. CoCoRaHS sites received 3.65" to 5.54", which were the highest daily amounts this summer. Another heavy rain event took place during the overnight and early morning periods of July 31st across Deep East Texas. A daily record rainfall amount of 3.58" was set at Lufkin Airport that day, breaking the previous record of 1.96" set in 2014. CoCoRaHS sites also received three plus inches.

An active sea breeze front also brought widespread two inch rain totals to the region on June 20th along with three plus inches on July 9th, and on July 10th. These Sea Breeze fronts develop along the Texas/Louisiana coast when strong southerly winds cause a push of cooler air from the ocean inland. As the cooler ocean air interacts with the warmer inland air, a sharp boundary develops due to the large difference between the air temperatures. The Sea Breeze boundary then moves northward from the coast behaving in a similar matter to a cold front. Showers and thunderstorms are usually generated along the boundary with cooler air behind its passage.

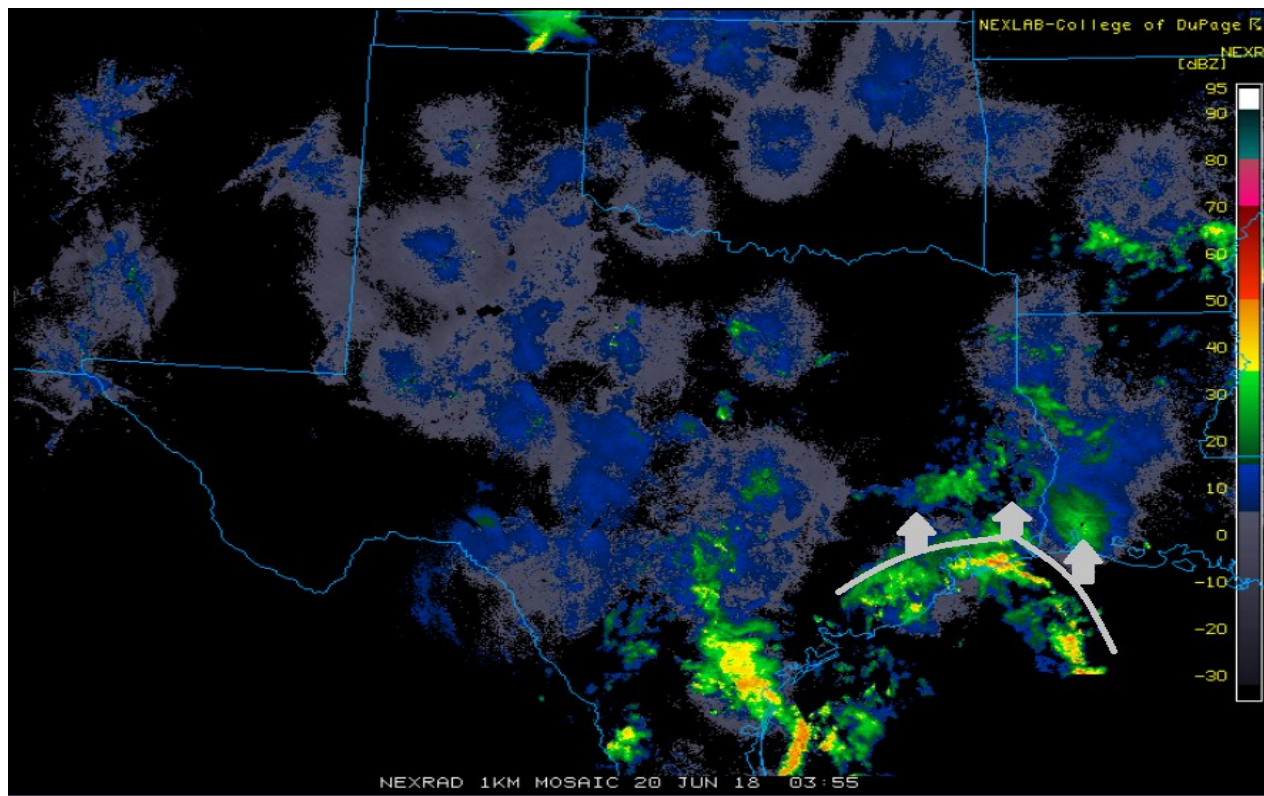


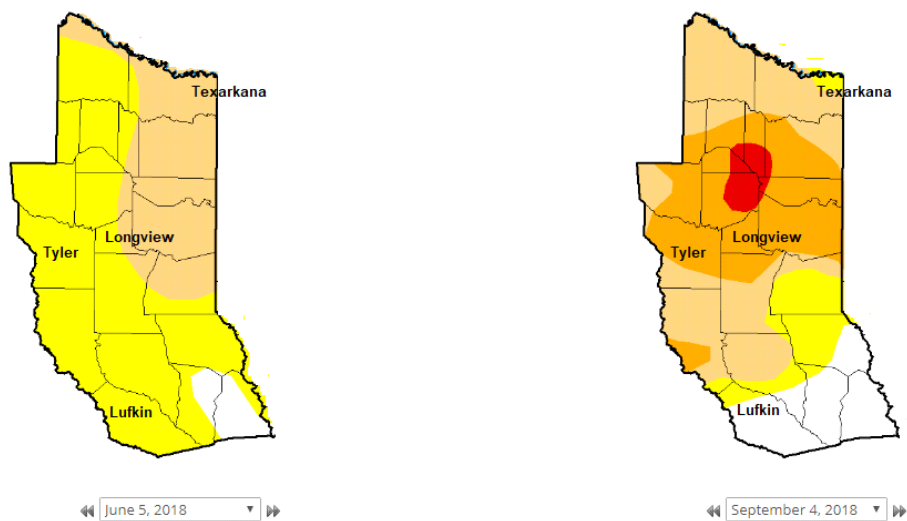
Fig. 1: Sea Breeze Front forming on the Gulf Coast of Texas at 04z on June 20, 2018 (boundary and movement depicted in gray) - Radar image courtesy of UCAR

East Texas Regional Climate Summary continued

Unfortunately, the periods of heavy rain were not enough to prevent drought conditions from developing across the region. Most of East Texas entered the summer months with Abnormally Dry conditions and ended the summer months in Drought conditions. Many locations received less than 75% of its normal rainfall. This resulted in several counties enacting Burn Bans to prohibit or restrict burning for outdoor safety.

Drought Classification

None D0 (Abnormally Dry) D1 (Moderate Drought) D2 (Severe Drought) D3 (Extreme Drought) D4 (Exceptional Drought)



Statistics Comparison

Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4	DSCI
2018-06-05	7.44	92.56	26.71	0.00	0.00	0.00	119
2018-09-04	22.19	77.81	56.84	25.87	3.61	0.00	164
Change	14.75	-14.75	30.13	25.87	3.61	0.00	45

Fig. 2: Drought Comparison Map for East Texas on June 5, 2018 and September 4, 2018

Texas Fall Weather Outlook

By Bob Rose

Lower Colorado River Authority

After trudging through one of the hottest summers on record, I think all of us are anxiously awaiting the cooler temperatures of autumn. In most years, the persistent summertime ridge of high pressure weakens and diminishes in September, allowing cold fronts to become more frequent in October and November. Cooler air spilling south behind these fronts finally puts an end to summer's wrath. High temperatures finally drop to the 70s, with nighttime temperatures 50s and 60s. It can be argued that autumn weather in Texas contains some of the most pleasant temperatures of the entire year.

Rainfall was below normal across much of Texas over the summer as a stable ridge of high pressure remained over the state. By the end of August nearly two-thirds of Texas was in some level of drought caused by the combination of below normal rainfall and hotter than normal temperature. But a wetter pattern appears to be on the horizon for this fall and winter as warmer than normal waters in the tropical Pacific cause frequent periods of wet weather.

For the two past winters, waters in the tropical Pacific have been cooler than normal, producing back to back La Niñas. La Niñas often cause a drier than normal weather pattern across Texas in the fall and winter months. This year the cooler than normal waters have disappeared in May and are now replaced by waters that were slightly warmer than normal. These waters are forecast to warm further this fall and conditions appear to be coming together to produce a weak to moderate El Niño. Forecasters with the National Weather Service's Climate Prediction Center (CPC) are stating there is a 60-70 percent chance for El Niño development.

Historically, El Niños tend to cause the development of a wetter than normal weather pattern across much of Texas during the fall and winter months. Warmer than normal waters in the tropical Pacific will cause a moist subtropical jet flow across the southern US. Frequent storm systems will track east along the jet, moving into Texas bringing periods of rain and storms. (Fig. 1)

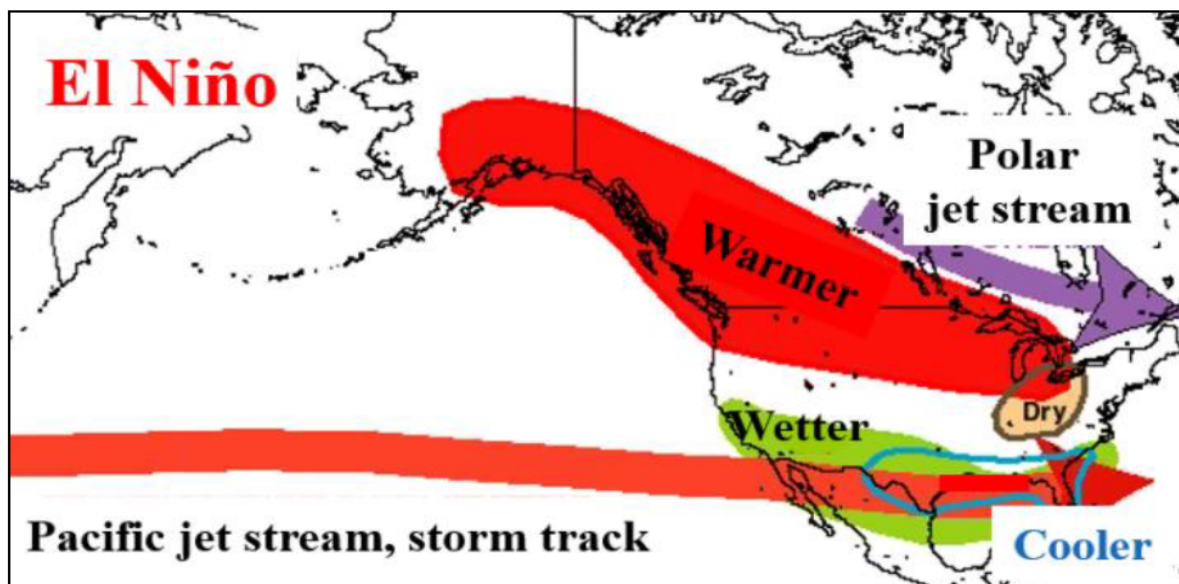


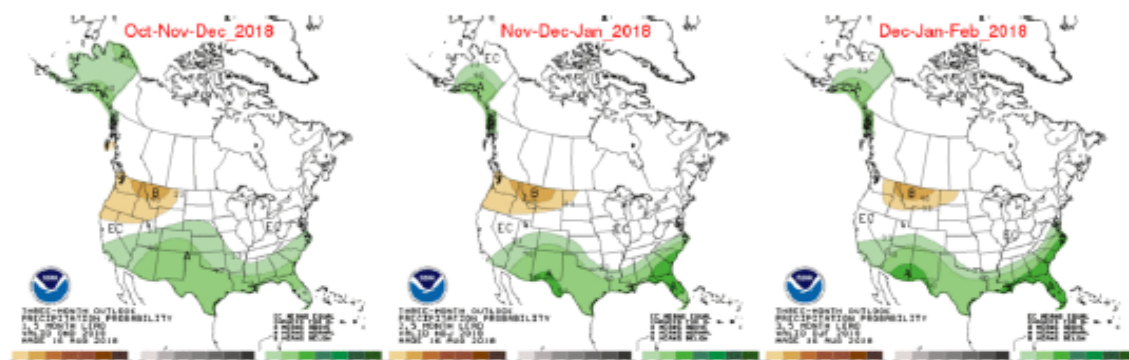
Figure 1: Typical upper-level wind flow across North America during El Niño

Texas Fall Weather Outlook continued

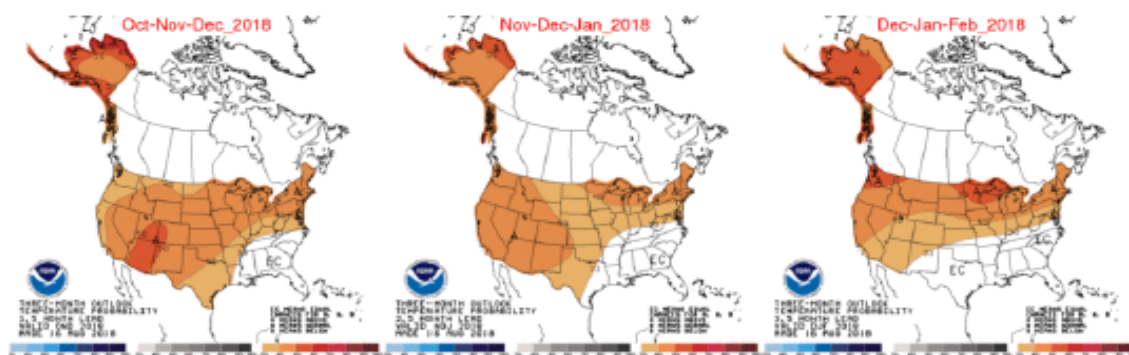
El Niños also have the tendency to cause temperatures to average near to slightly below normal across Texas and the southern US in the fall and winter months. Increased periods of clouds and rain along with occasional cold fronts tend to keep temperatures near normal to slightly below normal.

CPC forecasters have moderately strong confidence a weak El Niño will develop sometime mid to late fall, with the El Niño having a strong influence on Texas weather from late fall through next spring. CPC's seasonal outlook calls for increased odds for rainfall to trend above normal through the period. In regards to temperature, the outlook calls for increased odds for above normal temperatures September through November. However, the odds for warmer than normal temperatures begin to decrease in December, with no clear temperature trend seen for the winter months.

CPC Rainfall Outlook:



CPC Temperature Outlook:



Of course like in any year, this fall's weather pattern could be interrupted or changed by a potential tropical cyclone spreading into Texas out of the Gulf of Mexico or the eastern tropical Pacific. Widespread, heavy rain from these systems will have the potential to cause considerable flooding.

As autumn begins, we can all breathe a sigh of relief as the scorching temperatures of summer fade. Although the fall outlook calls for milder than normal temperatures, these readings will still be significantly lower than what we experienced over the summer. Some cool, crisp nights will certainly be in the mix. And the outlook for wetter than normal weather this fall and winter will be a big help for areas that have been suffering from drought. Enjoy this pleasant change in the pattern.

Tropical Wave erases drought across the Rio Grande Valley

By National Weather Service
WFO Brownsville-Rio Grande Valley

A broad tropical wave originating in the western Caribbean Sea moved across the Yucatan peninsula on June 15th and 16th, 2018. The slow moving but persistent system approached the Texas coast on Sunday, June 17th before finally arriving on June 18th. As the center axis of the wave passed the longitude of the coastline, the gates opened to repeated surges of tropical moisture deep into the atmosphere with origins in the western Caribbean Sea. A series of upper level disturbances interacted with this wave throughout its life cycle and helped to maintain a broad area of low pressure at all levels of the atmosphere for the period from June 18th through June 22nd across Rio Grande Valley and the adjacent Gulf waters. Several surface-based boundaries and convergence along the coastline also aided the production of heavy rainfall. Individual convective "systems" spun in place at several points during the event, including:

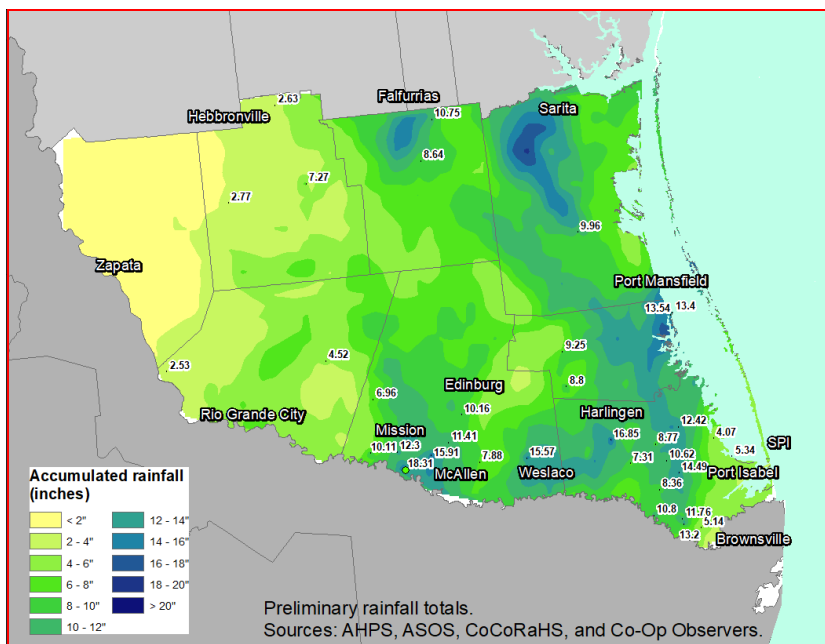
- Tuesday morning (June 19) in Brooks County
- Tuesday afternoon over Cameron County
- Early Wednesday (June 20) in Hidalgo, Cameron, and Willacy County
- Wednesday afternoon again in Cameron and Willacy County
- Thursday morning (June 21) in Starr and Hidalgo County
- Thursday afternoon in Cameron, Willacy, and Kenedy County
- And finally, Friday morning (June 22) in southwest Hidalgo and southern Starr County along the Rio Grande.

The wave and upper level disturbances finally exited southwest into north central Mexico on June 22nd, bringing a weekend of rain-free but oppressively hot and humid conditions to conduct broad recovery activity across the region.

Bout after Bout after Bout Ends the Drought but Wreaks Memorable Havoc

A wise Texas meteorologist from the early 20th Century aptly stated: "Texas is a State of perpetual drought, broken by the occasional [devastating] flood". How right he was, nearly 100 years later. Severe-level drought, which had turned grass and rangeland crispy and yellow-brown and burned up non-irrigated crops by mid June, was replaced in days with scenes of several feet of water that flooded thousands of vehicles, inundated several thousand homes and businesses with 18" to more than 3 feet of water, and hundreds of rescues of persons and pets. As of June 25, state Emergency Declarations were declared for Cameron, Hidalgo, and Willacy County. Damage estimates were likely to run into the hundreds of millions of dollars, and the breadth of impact was perhaps even *greater* than that of Hurricane Dolly in 2008.

The first bout of heavy rain was more welcome than anything else: A pre-dawn roaring downpour that dropped 2 to more than 3" between Los Fresnos and Harlingen on June 18th. The morning rain, which spared many other locations, was a teaser of much more to come. The first serious flooding event developed during the late night and early morning hours of June 19th across the South Texas Brush Country of Duval, Jim Wells, and Brooks County. Torrential rains of more than 12" by midday west of Falfurrias, and flooding of at least 1 to 2 feet of water covered the streets of the city, closing many of them. Soon after, Palo Blanco Creek over-spilled its banks and contributed additional water flows, and Los Olmos Creek spiked quickly and by evening reached flood stage by late afternoon and would crest just over moderate stage (12.32 feet) around 745 PM June 19th - the third highest crest in the modern record and highest since 1971 (remnants of Hurricane Fern).



Tropical Wave erases drought across the Rio Grande Valley continued

The second flooding rain event struck Cameron County from Brownsville to Los Fresnos when a slow moving line of thunderstorms from west to east intersected the sea breeze and stalled, dumping 3 to 5" of rain over a 2 to 3 hour period and caused significant street flooding and some road closures in the area. The "big one" followed just 12 hours later, when the peak of the tropical moisture plume was lifted by an embedded upper level disturbance parked between the central Rio Grande Valley and the South Texas Brush Country. Incredible rainfall rates of up to 5 or more inches per hour struck the highly populated mid Valley between the east side of the McAllen Metro region to Harlingen, with peak rainfall just north of Weslaco and Mercedes. 11" to 13" fell in just a few hours at and near the Mid Valley Airport in Weslaco, though amounts may have been a couple inches higher in the heaviest rain core several miles northeast of this location. ***The cooperative observing station on the Mid Valley Airport grounds reported 11.36" in 3 hours!*** Drainage was unable to handle the deluge, and widespread flooding with photo and video evidence of at least 3 to 5 feet of water depth in many streets of each town ensued. The number of homes, businesses, and vehicles impacted by the floodwaters exceeded that from the October 22-24 Atmospheric River Event. As of this writing, Weslaco City estimates were more than 2500 homes, 100+ businesses, and at least 2500 vehicles with various degrees of damage. The homes and businesses had a minimum of 18" of floodwater depth inside portions of each. Data from Mercedes had not been received as of June 26th.

The third event struck Cameron County - again - in nearly the same locations between Brownsville and northeast of Los Fresnos that same afternoon. This time, 4" to 6" fell, making for two day totals of 6" to 10" in the area and triggering additional flooding, especially in and northeast of Los Fresnos where several neighborhoods were inundated by a foot or more of water, with estimates of 3 feet or more of standing water in poor drainage locations as well as open fields. Parts of Harlingen were dealt a "triple" blow with rain during the afternoon of the 19th, morning of the 20th, and afternoon of the 20th. 10" fell there as well.

By evening of the 20th, a defined swirl of upper level energy - in part due to the interaction of the earlier thunderstorm system with the broader tropical wave - settled over the four corners of Brooks/Hidalgo/Starr/Jim Hogg County. The system would drift little overnight; another complex of thunderstorms would spin in from the northeast overnight and reach Starr County, eventually dropping more than 7" from the ranches north of Rio Grande City to Rio Grande City itself, where local arroyos reached and overtopped their banks and at least one swift water rescue was required during the pre-dawn hours of the 21st. The big story of that day was just beginning, however, as a "fire hose" of moisture on the immediate east side of the swirl was lifted into a persistent band of torrential rains that began in western Hidalgo County before daybreak, where estimates of 6 to 8" fell, to the McAllen metro area between 7 AM and Noon, where estimates of another 6 to 10" fell, based on radar and ground truth observations. At least 2700 residences and businesses were estimated to be flooded in many neighborhoods in Mission and McAllen, as the additional rain fell on previously saturated ground from 3 to 6" that fell during the pre-dawn hours of June 20th.

For Cameron County, one more act was to come, as multiple shorter-lived bands of torrential rains rolled through Brownsville to Los Fresnos (again!) dropping another 1 to nearly 3" from late morning through mid afternoon of the 21st, which aggravated ongoing high water and flood conditions as well as recovery operations. The final act of the entire event occurred during the pre-dawn hours of June 22nd, when a final cluster rotated from the central Tamaulipas coast to the Mission/McAllen area as the tropical wave wheezed to its demise while moving south-westward into north central Mexico. An additional inch or two of rain aggravated ongoing flooding in these areas, as well as in Starr County near the Rio Grande.

In general, between 12 and more than 18" fell in the McAllen/Mission area, up to 16" fell near Weslaco, with the potential of 18 inches between Weslaco and Mercedes; 8 to 17" in Harlingen; 10 to 15" between Brownsville and Los Fresnos, 10 to 15" in Port Mansfield and through the King Ranch of Kenedy County, 12 " near Falfurrias, and more than 8 inches in parts of Starr County.

In addition to arroyos, drainage canals and ditches, resacas, and arroyos that filled to the brim and in some cases over spilled, gaged creeks and a portion of the Rio Grande also swelled to flood levels. The following crests were noted at three locations across the Rio Grande Valley and Deep South Texas:

- Los Olmos Creek near Falfurrias crested at 12.32 feet (moderate flood condition) during the evening of June 19th. This was the highest level observed since 1971, when Tropical Cyclone Fern dropped more than 10 inches of rainfall in a short period of time across the South Texas Brush Country.
- The Arroyo Colorado crested at 23.98 feet, the highest level since the Hurricane Alex Flood Control System (Floodway) event. This time, there was no release of water along the Rio Grande basin (i.e. from Falcon International Reservoir), just run-off from the rainfall listed above.
- The Rio Grande near San Benito crested at 51.6 feet, the highest since the Flood Control System event of July 2010.

Tropical Wave erases drought across the Rio Grande Valley continued

Tale of the Tape - Initial Impact Statistics

The Great June 2018 Flood of the Rio Grande Valley will be remembered for a long time to come, not just for its damage which is likely to run at least \$250 million, with the potential for \$500 million or more - but also for the challenges faced by the region for potentially much more rainfall from an organized tropical cyclone that decides to sit and spin over the region for a few days - perhaps worse than Beulah, but in a region with five times the population and exponential infrastructure growth. The following information is from initial reports from Emergency Management partners across the Rio Grande Valley. *This summary will be updated as additional information is received.*

- More than 7,400 residences and businesses in Cameron and Willacy County with flood damage defined as minor to destructive by FEMA Standards.
- At least 20,000 residences and businesses considered "affected" by the floods. This includes the 7,400 listed above.
- More than 600 persons in at least ten shelters at the peak of the area-wide flooding
- Several thousand vehicles with varying degrees of flood damage
- Dozens to hundreds of roads, from neighborhood streets to major thoroughfares and frontage roads, closed during and after peak flooding
- More than 2,000 rescues from vehicles and homes were conducted
- 21,000 meals served by the American Red Cross
- Public infrastructure damage of at least \$50 million in Cameron and Willacy County alone



Heavy rainfall between June 18 and June 22 left many areas of the Rio Grande Valley under water:

Above: Los Fresnos

At Right: McAllen



Observer Training Section

“My rain gauge overflowed! What should I report?”

It's been raining all night, and in the morning you come out and find that inner tube is full and the outer tube is full and overflowing. Now what?

Most CoCoRaHS observers will never have to deal with this situation, but if you live in an area prone to very heavy rain it's a definite possibility. Most likely if you receive that much rain in a 24-hour period or less there will be more important things to worry about, like flooding and keeping your home dry.

The best way to prevent your gauge from overflowing is to make periodic measurements during the storm if you are able to. Empty your rain gauge at these times and write down the amount. Total up these amounts and report this as your precipitation at the next observation. If you are able to submit a **Significant Weather Report** for these intermediate amounts if you have the time and means. It will help keep the National Weather Service informed about what is happening.

Sometimes, however, lightning or something else may prevent you from getting out to your gauge and it fills up and overflows. We don't want you to run out in the middle of a thunderstorm to take a measurement. The CoCoRaHS 4-inch rain gauge hold approximately a total of 11 inches of water. It will be a little more if the tube and/or funnel are not in place. How should you report this?

- 1) Once the gauge overflows you no longer have a measurement, but an estimate. Enter 11.00 inches as your precipitation amount.
- 2) In the comments include a statement about your gauge overflowing and any other information that you feel might help determine how much rain fell. *Our quality control procedures will set any observation of 11.00 or 12.00 with no observation comments to NA until a coordinator can follow up with the observer.* Also, when the gauge is nearly full, or full and overflowing, we encourage you to take a photograph of your full gauge.

The screenshot shows a web-based form titled "Precipitation Report Form" with "Submit Data" and "Reset" buttons. The form is pre-filled with the following information:

- Station Number: LA-BY-1
- Station Name: Bayou Bay 1.0 N
- Observation Date: 7/15/2016
- Observation Time: 7:00 AM
- Precipitation Amount: 11.00 in.

Below the form fields, there is a section for "Observation Notes" with a text area containing the following text: "Rain gauge overflowed sometime during the night - continuous heavy thunderstorms. More than 11 inches of rain fell. Still raining lightly at ob time. So far we are staying dry."

Please print out and keep by your computer as a reference when reporting data.

CoCoRaHS Webinar Schedule

CoCoRaHS WxTalk Webinars



The CoCoRaHS WxTalk Webinar Bi-Monthly Series

In December 2011 CoCoRaHS kicked off a new and exciting monthly Webinar series called **CoCoRaHS WxTalk** (wx is shorthand for weather). CoCoRaHS WxTalk consists of a series of monthly one-hour interactive Webinars featuring engaging experts in the fields of atmospheric science, climatology and other pertinent disciplines. These easy to follow presentations are live and approximately sixty minutes long. The audience is given the chance to submit questions which the experts answer live on the air.

Topics have included: Snow, Satellites, Hurricanes, Lightning, Clouds, Tornadoes, Flash Floods, Fire Weather, Weather History, Radar and How to become a Meteorologist, just to name a few.

There are many exciting Webinars on the agenda in the months ahead, so please tell your friends to join us. All WxTalk Webinars are free and most are recorded for later viewing.

**Although headphones are a good way of listening to the Webinars, only a set of speakers is required to hear the Webinar. The audience will be muted so there is no need for a microphone. All incoming correspondence during the Webinar should be in typed form.*

Thursday, November 8, 2018 - 1:00PM EST

The National Weather Service: Building a Weather Ready Nation

Paul Schlatter
Science and Operations Officer
NOAA/National Weather Service
Boulder, CO



(Biography)

This webinar will highlight how and why the National Weather Service (NWS) is building a Weather-Ready Nation. In terms of the why, Paul will explain why we need to be Weather-Ready and how it's becoming more difficult given the increasing vulnerability in many parts of the country. In terms of the how, he will discuss recent changes to some of the products and services provided by the NWS, and how you can make the best use of them. New and interesting weather products will be shown and explained, including where you can find them for your local area and how you can best apply them.



Texas CoCoRaHS Observer

The official newsletter of Texas CoCoRaHS

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