TEXAS CoCoRaHS OBSERVER

Spring 2019

"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 speaker give a talk to your group or organization about CoCoRaHS, please send us a request with your group's contact information to e-mail texas@CoCoRaHS.org

Inside this issue

Wet Spring Brings More Records

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

You may have heard that the United States experienced its wettest 12 months on record between May 2018 and April 2019. You may also have heard that the United States experienced its wettest 12 months on record between June 2018 and May 2019. Yes, records are falling like dominoes.

If you like math, you may already know that the US will set another "wettest 12 months on record" record if June 2019 is wetter than June 2018.

Texas has been setting records of its own. While the twelve months starting in June 2018 weren't record-setting, the past nine months (September 2018 through May 2019) were indeed the wettest September-May on record for Texas as a whole. Average rainfall across the state exceeded 30", compared to normal of around 20". And while the greatest rainfall was found (as usual) in eastern Texas, the rainfall in parts of west-central Texas was the most unusual.

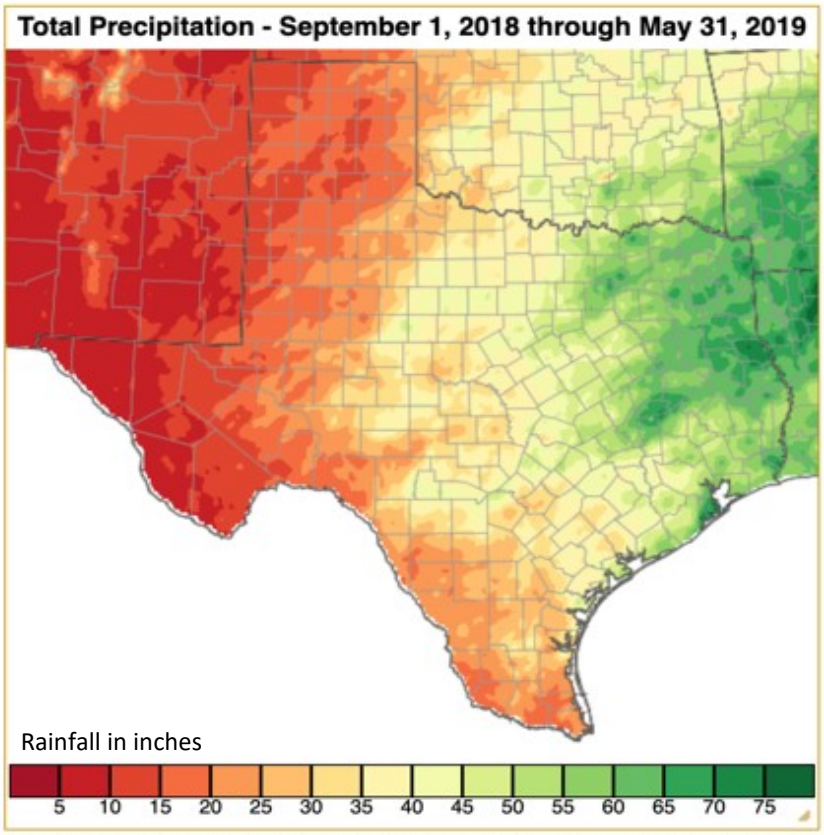

Figure 1: Precipitation analysis using Oregon State's PRISM data. Graphic generated using SC-ACIS.

"Wet Spring Brings More Records (continued)"

The abundance of rain led to a lack of abundance of drought. There was less color on the US Drought Monitor map in mid-May than at any time in over a decade. This is one instance where a boring, mostly blank graphic is actually pretty interesting and informative.

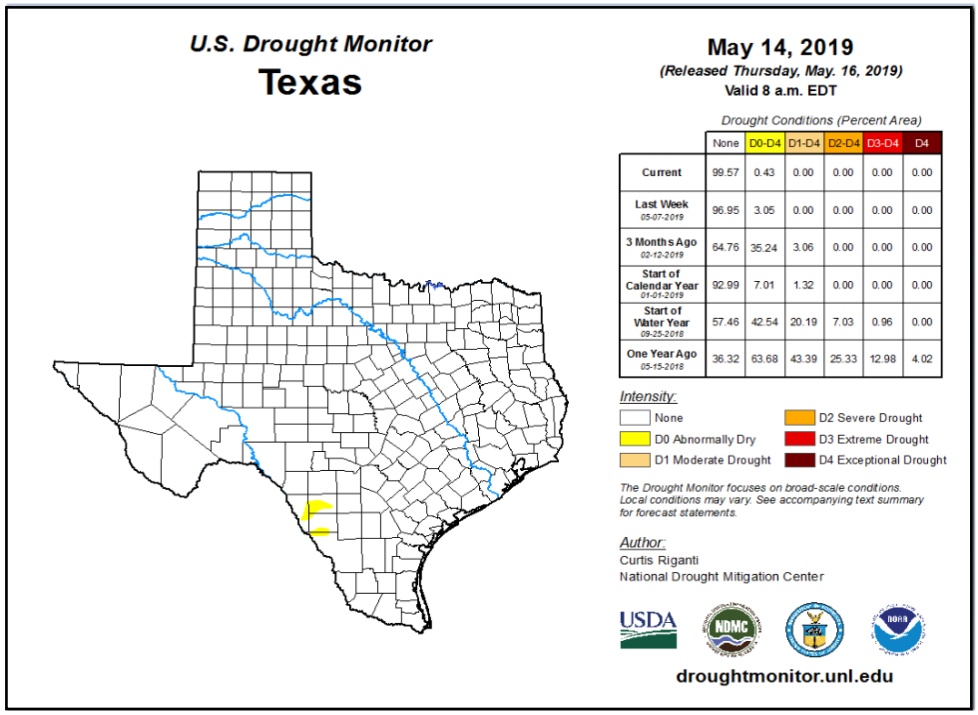

Figure 2: US Drought Monitor map, May 14, 2019. Boring, eh?

Although the past 12 months weren't the wettest 12 months on record, we do find a record if we take a longer view. For Texas, the past five years (60 months) were the wettest five years ever, according to weather records that go back to 1895. Contributing to that is the fact that the four wettest months since 1895 all happened during the past five years. And no, it's not just because Texas has more rain gauges than it used to!

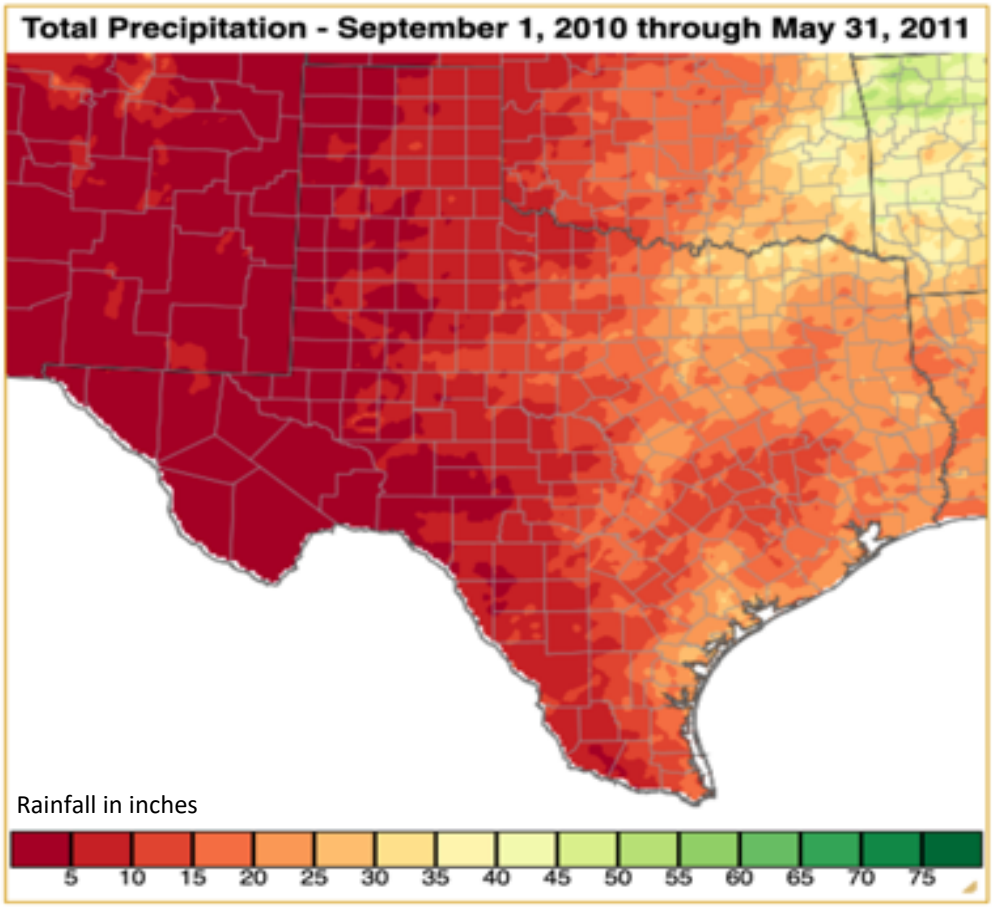

Figure 3: Precipitation analysis using Oregon State's PRISM data. Graphic generated using SC-ACIS.

Just in case you've already forgotten what intense drought looks like, here's a quick reminder: the September 2010 to May 2011 rainfall. Compare that to what we received this year and you'll get a real sense of the feast or famine that is Texas weather.

Texas Panhandle Tornado Outbreak on May 7th

May 7th, 2019 Severe Weather Event

By: Angie Margrave – HMT National Weather Service, Amarillo, TX

Overview:

The May 7th severe weather event was, like all sizeable severe weather episodes, the culmination of multiple meteorological factors coming into place at the same time. In the days leading up to the event, rich moisture was brought northward from the Gulf of Mexico, resulting in showers and thunderstorms on both May 5th and May 6th. On May 7th, an upper low moved into the Four Corners, causing a surface area of low pressure to develop across New Mexico. The Panhandles were on the east side of this area of low pressure, setting up winds out of the south and southeast which brought in additional moisture and warmed temperatures through the morning and afternoon hours. This escalation of both temperature and moisture gave the atmosphere increased energy for storms. Furthermore, the approach of the upper low led to an upsurge in wind speeds aloft out of the southwest. The difference between these southwesterly winds aloft and the southeasterly winds at the ground, known as wind shear, escalated through the daytime hours. Finally, a surface front, augmented by cold air rushing out of thunderstorms over Kansas very early Tuesday morning, pushed south into the Panhandles. This front stalled out and retrograded back to the north under the influence of those southeasterly surface winds. This stalled front would provide an additional focus for thunderstorm development.

Strong storms began to fire around noon and quickly became severe, with the first severe thunderstorm warning issued at 12:33pm. The first report of severe weather, quarter size hail 5 miles south of Masterson, came in at 1:12pm. Storms began to increase in number after 1:00pm, becoming numerous after 2:00pm. The largest hail reports of the event were received at 2:02pm, when baseball size hail fell near Lake Meredith and Fritch. With wind shear increasing through the afternoon, a few of the storms became tornadic, with the first tornado touching down 9 miles south-southwest of Spearman at 3:42pm. Six subsequent tornadoes occurred, two associated with a particularly nasty supercell that spawned multiple tornadoes along a line from between Plainview and Hart northeast through Alanreed. The bulk of the storms pushed eastward into Oklahoma after 9:30pm, although a couple additional rounds formed behind them, which had a few cells become severe. The last of the thunderstorms shifted into western Oklahoma after 2:00am.

Tornadoes:

7 confirmed tornadoes touched down in the Texas Panhandle on May 7th. At this time, all tornadoes were rated EF0. It is important to note that the Enhanced Fujita scale is a damage scale - if a tornado encounters no sturdy well-built structures, a low rating will be issued. Finally, it should be noted that a couple persistent tornado myths, that tornadoes cannot cross river valleys or that tornadoes cannot form in river valleys, were conclusively shown in this event to have no factual basis. The Canadian River Valley tornado formed and traveled entirely within the valley. The Wayside tornado crossed Palo Duro Canyon. If you think your town is protected because it is in a valley, on top of a hill, near a hill, in a small depression, etc., it is not. This, however, is no reason to live in fear – it only takes a few minutes to prepare.

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"Texas Panhandle Tornado Outbreak on May 7th (continued)"

Picture 1: Tornado southwest of Spearman, Texas

(Matt Maynard)

Picture 2: Ground scraping wall cloud near Bishop Hills, Texas at 4:06pm

(Mike Prendergast)

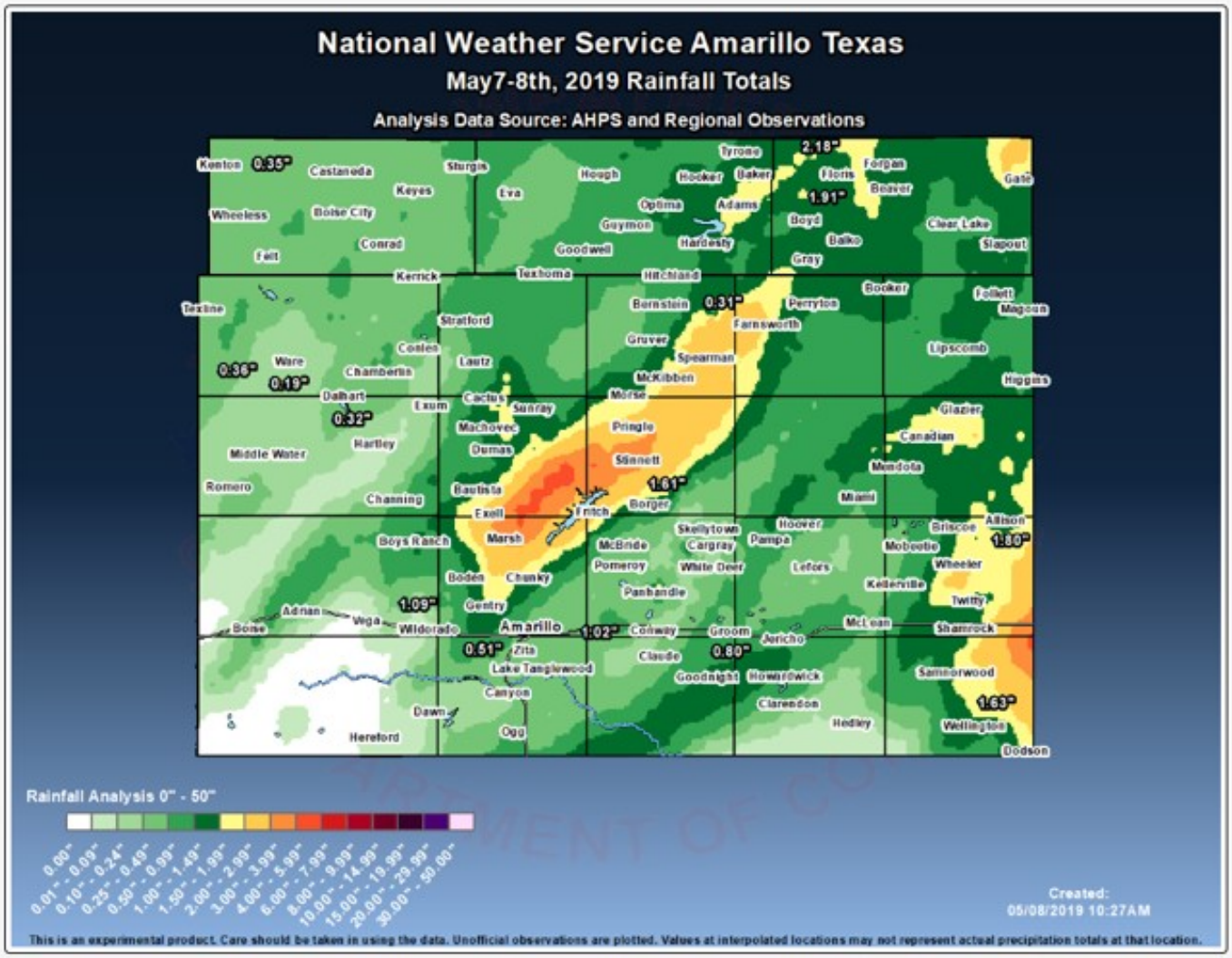
Picture 3: Mesocyclone near Howardwick, Texas 7:37pm

(Quincy Vagell)

"Texas Panhandle Tornado Outbreak on May 7th (continued)"

Rain Reports

On top of generating severe weather, the storms on May 7th were prolific rain producers, with amounts of up to 6 inches of rainfall falling. Highest amounts were seen northwest of Lake Meredith and across eastern Wheeler and Collingsworth Counties. Additionally, a few locations recorded flash flooding.



Estimated rainfall using a combination of point rainfall report and AHPS radar-based estimates.
(Rainfall data: NWS. Map made using GAZPACHO.)

Figure 1: NWS Amarillo Texas radar rainfall estimates for May 7-8th, 2019

Climate Summary for Wichita Falls Region

Busy 2019 Spring for the Wichita Falls Region

By Charles Kuster

CIMMS/NSSL

It was an active spring from a rainfall and severe weather perspective this year in the Wichita Falls region. In total, there were 63 dry days (all CoCoRaHS stations reported less than 0.05 inches) and 29 wet days (at least one CoCoRaHS station reported 0.05 inches or more) this spring. For comparison, last spring had 71 dry days and 21 wet days. Many areas saw rainfall at least 3 inches above normal while average spring temperatures were about 1–3 degrees below normal (Fig. 1).

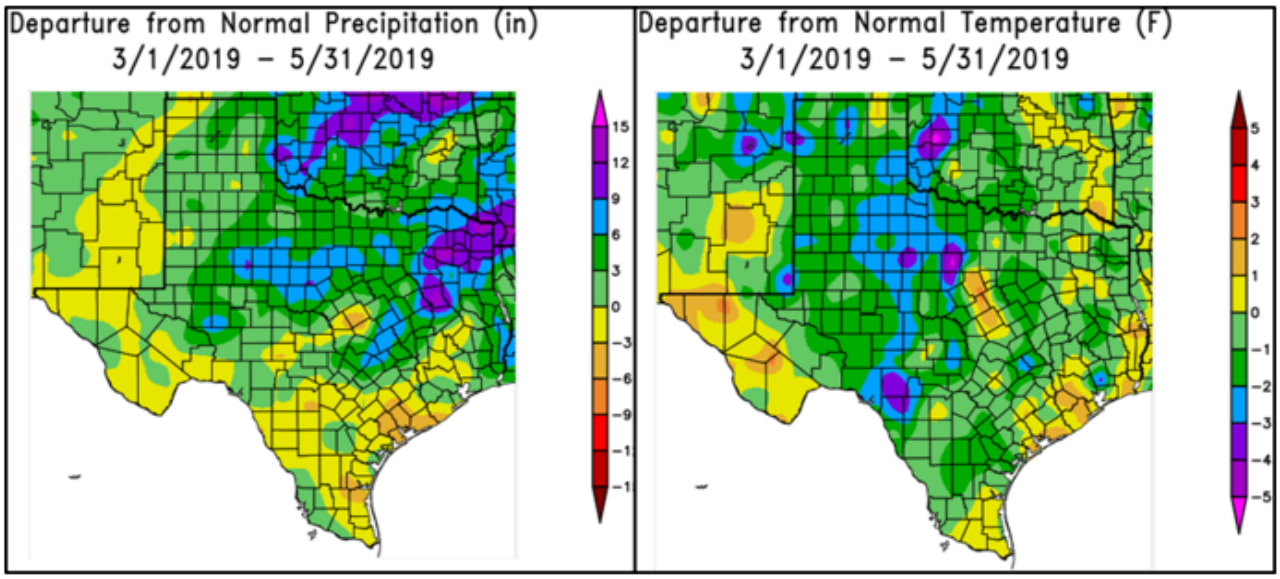


Figure 1: Departure from normal precipitation (left) and normal temperature (right) for March 2019 through May 2019. Warm colors indicate below normal precipitation and above normal temperatures, while and cool colors indicate above normal precipitation and below normal temperatures.

The 29 wet days were marked by several days with heavy rain, severe weather, or both. Widespread heavy rain occurred during the 24 hour period ending on the morning of April 14th with many locations seeing at least 1.5 inches of rain (Fig. 2) and many CoCoRaHS stations reporting at least 2 inches of rain. The most significant severe weather occurred on May 1st, when a supercell thunderstorm produced a tornado in Baylor County (about 13 miles south of Seymour) and up to 3.5-inch hail. Rainfall was much more localized with this event (Fig. 2) and most CoCoRaHS stations only reported between 0.4 and 0.8 inches of rain for the 24-hour period ending on the morning of May 2nd. Significant severe weather also occurred on May 21st and 24th when 89 mph winds were recorded near Knox City and baseball size hail was reported in Hardeman County respectively. Heavy rain also occurred on these days, with the most

"Climate Summary for Wichita Falls Region (continued)"

widespread event occurring during the 24-hour period ending on the morning of May 21st (Fig. 2) where all but one CoCoRaHS station reported at least 1 inch of rain. In total, the seven-county region had at least one severe weather report on six different days. The heavy rainfall also resulted in a drought free region, according to the U.S. Drought Monitor, by Spring's end (https://droughtmonitor.unl.edu).

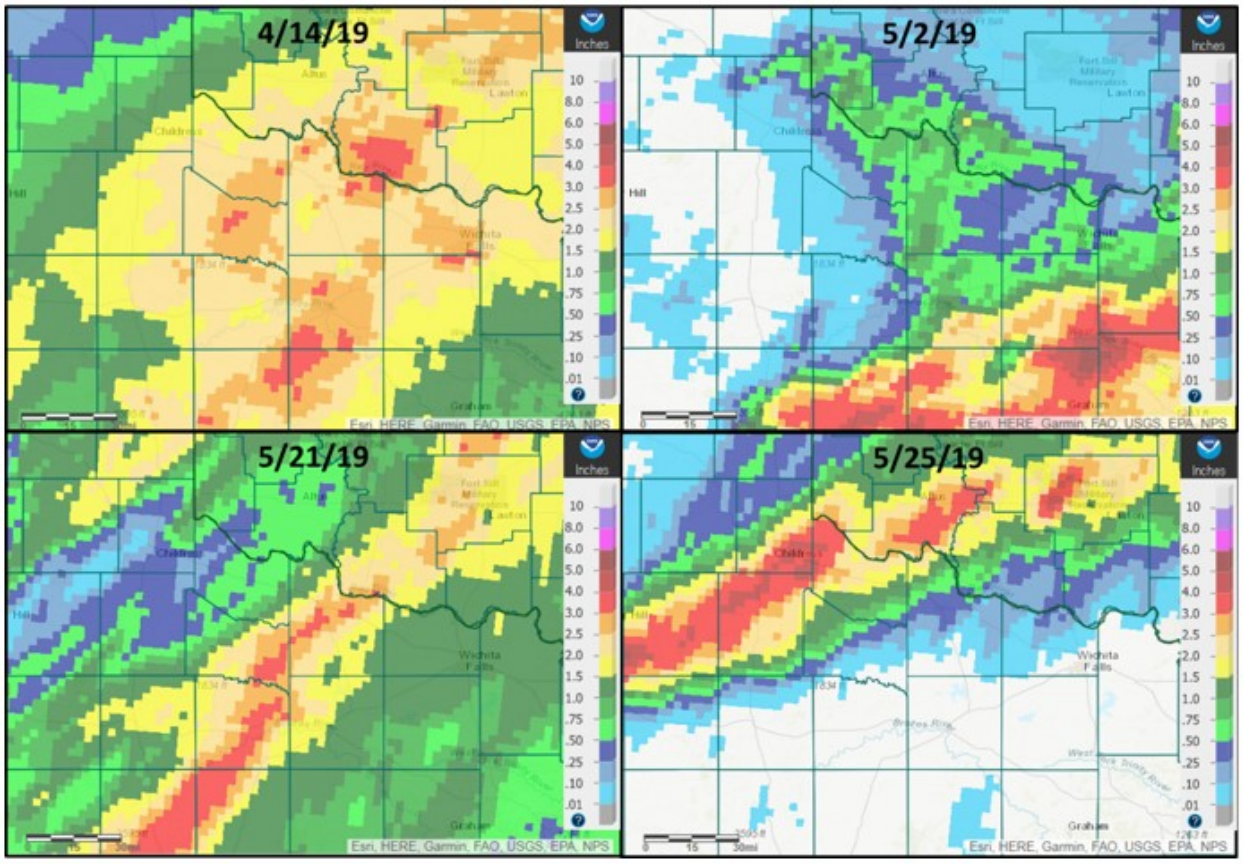


Figure 2: 24-hour rainfall estimates (in inches) for the time period ending at 7am on 4 different days with significant severe weather, heavy rainfall, or both. Dates on each panel correspond to the day on which the 24-hour period ended.

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Climate Summary for West Texas and SE New Mexico

Spring 2019 Summary for West Texas and SE New Mexico

By: James DeBerry

West Texas and Southeast New Mexico had a very active spring, with much severe weather and above-average precipitation most locations.

March

In March, the synoptic pattern began transitioning from winter to spring, and became a little more progressive. A squall line event moved through the HSA during the middle of the month, but moved too fast to allow for any flash flooding. As such, no notable hydrologic events were reported. However, respectable amounts of rainfall began coming back into play. Monthly radar precipitation estimates ranged from no rain in the vicinity of Lajitas, Texas to up to 4" in parts of the West Texas Pecos River Valley. Highest observed rainfall was 2.90" in Kermit in Winkler County. Average rainfall was 0.65".

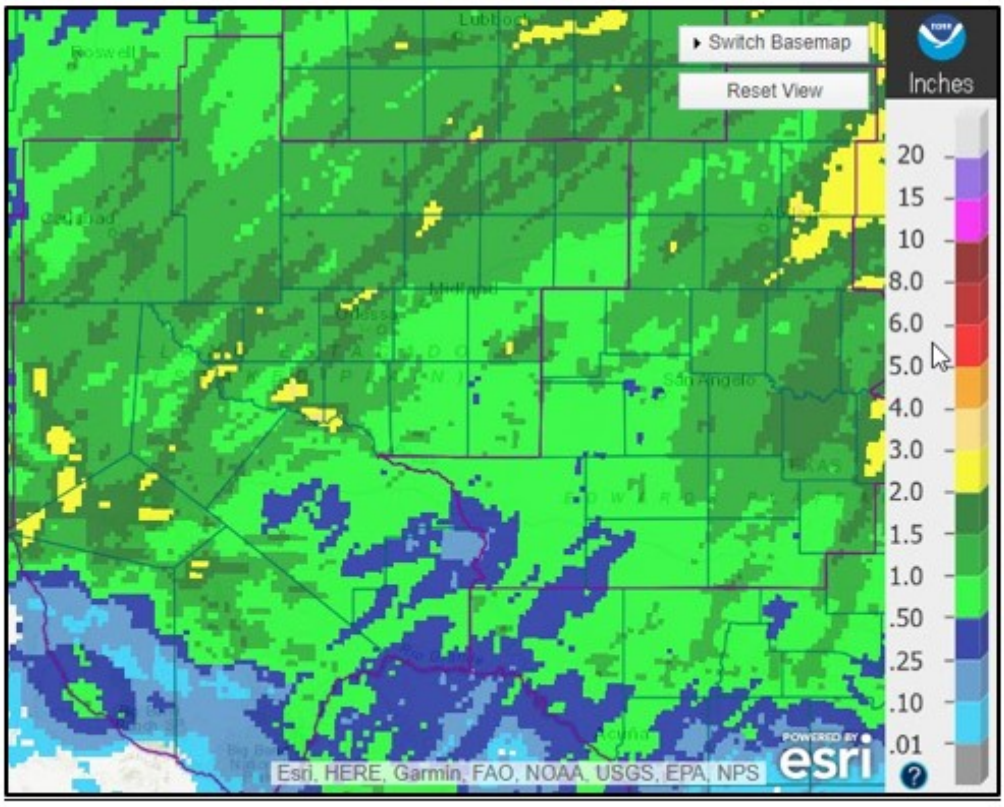

Figure 1: March Precipitation

April

April was a very active month, as the spring severe weather season kicked into high gear. Many hail events were noted, including one that caused widespread damage to west Midland in Midland County, where hail to the size of baseballs fell.

Rainfall ranged from near-normal to abundant, especially along and east of the West Texas Pecos. Only one instance of flash flooding was reported, when thunderstorms flooded vehicles up to their doors east of Seminole in Gaines County.

Monthly radar precipitation estimates ranged from no rain in the vicinity of Lajitas, Texas to up to 10" in parts of the Upper Colorado River Valley. Highest observed rainfall was 5.62" in Big Lake in Reagan County. Average rainfall was 1.35".

"Climate Summary for West Texas and SE New Mexico (continued)"

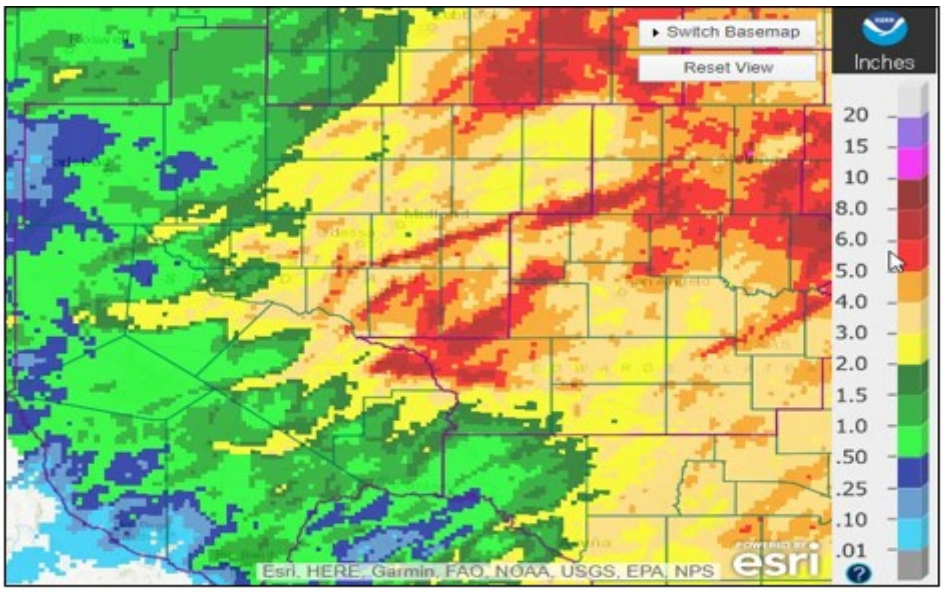

Figure 2: April Precipitation

May

May was another very active month regarding severe weather, perhaps the most active since 2004. Most of the severe weather reported was large hail up to 3" in diameter, straight-line thunderstorm winds to 70 mph, and a few tornadoes, one of which was rated an EF3. Only two reports of flash flooding were received. One occurred on May 13th, when thunderstorms flooded streets in Odessa in Ector County. The other occurred on the 20th, when thunderstorms flooded streets in Midland in Midland County, stalling numerous vehicles throughout town. Rivers saw a few rises but, starting from base flow at the beginning of the month, did not flood. Despite the paucity of reports, much of the HSA saw abundant rainfall. Midland International Air and Space Port tied its record for 5th wettest May ever, at 4.96".

Monthly radar precipitation estimates ranged from no rain in the vicinity of Candelaria, Texas to up to 10" in parts of the Upper Colorado River Valley. Highest observed rainfall was 10.87" in Snyder in Scurry County. Average rainfall was 1.94".

Overall, spring 2019 leaves West Texas and Southeast New Mexico in great shape for the upcoming summer. Area reservoirs are at 57.7% conservation capacity as of June 1st.

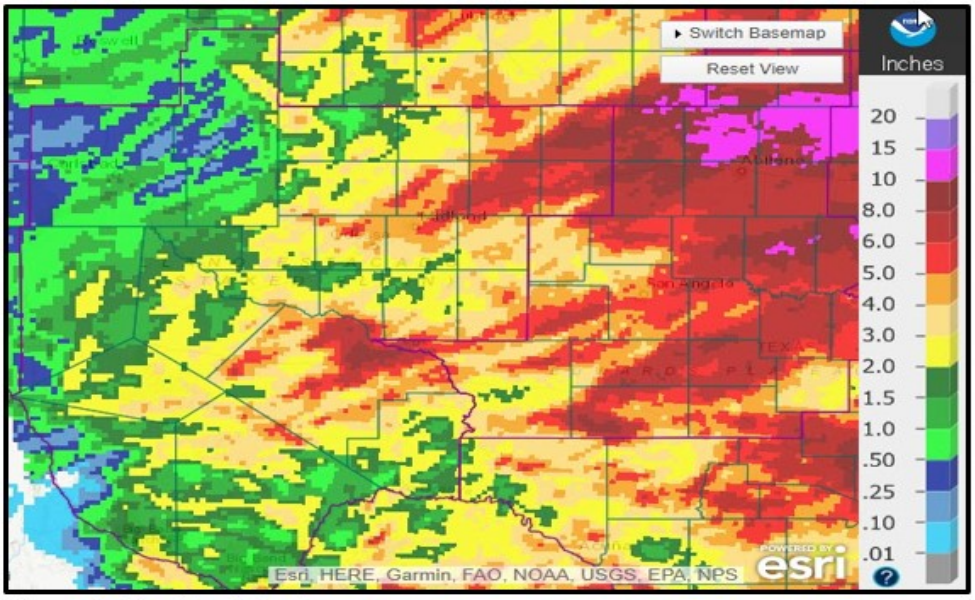

Figure 3: May Precipitation

Climate Summary for Abilene/San Angelo Region

By Joel Dunn
National Weather Service San Angelo

Despite a dry start, West Central Texas experienced a rather wet spring. The City of Abilene received 13.24" between the beginning of March and the end of May, making it the 8th wettest spring on record. Mathis Field in San Angelo received slightly less rainfall during the spring with a total of 9.03", making it the 13th wettest spring on record.

March

With temperatures slightly below normal and dry conditions prevailing, March felt more like an extension of a West Texas winter rather than the beginning of spring. Apart from an upper level system that passed through the area in mid-March, the weather remained quite docile. Monthly precipitation totals of less than 2" were common, with isolated areas seeing between 2-3 inches.

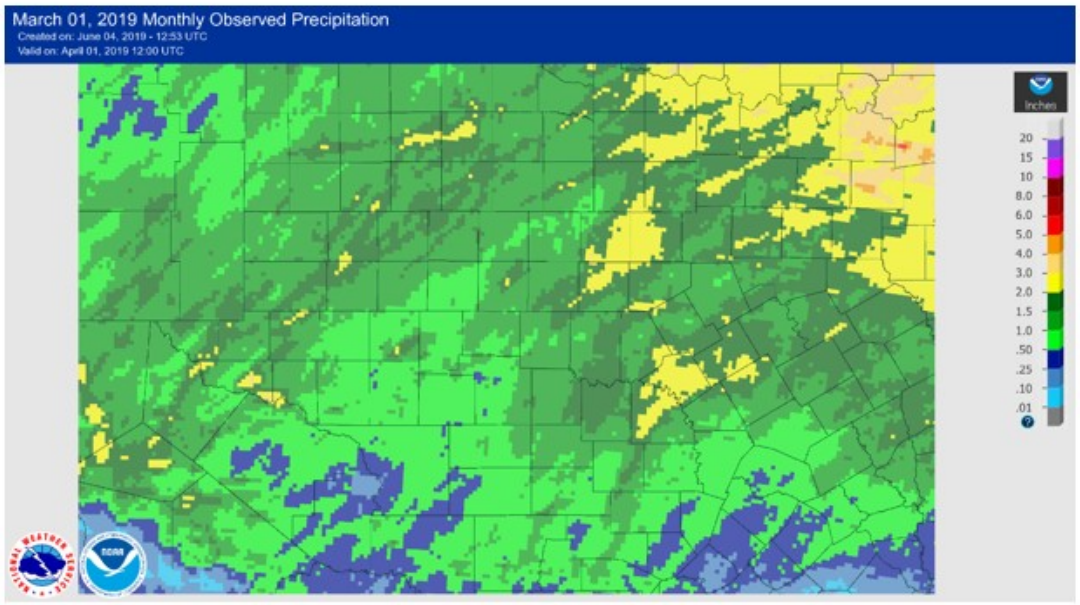

Image 1: March 2019 Observed Precipitation

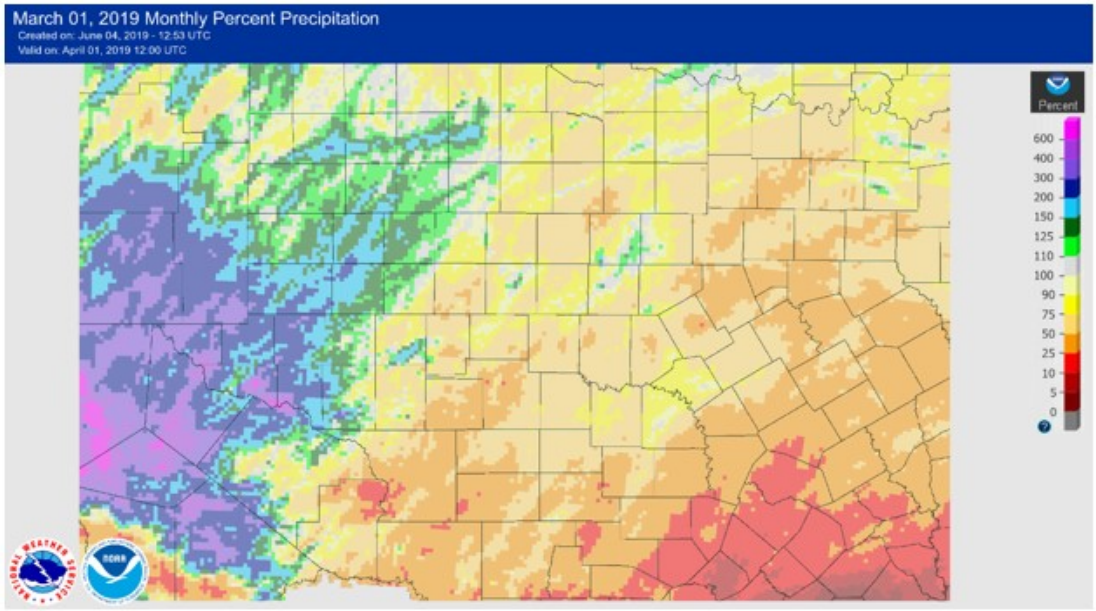

Image 2: March 2019 Percent of Normal

"Climate Summary for Abilene/San Angelo Region (continued)"

April

There was a shift in the weather pattern during the month of April. Though temperatures remained near normal, a wet pattern persisted leading to above normal precipitation across West Central Texas. Most areas saw between 2-4 inches, while a few isolated areas across the Big Country saw monthly rainfall in excess of 8".

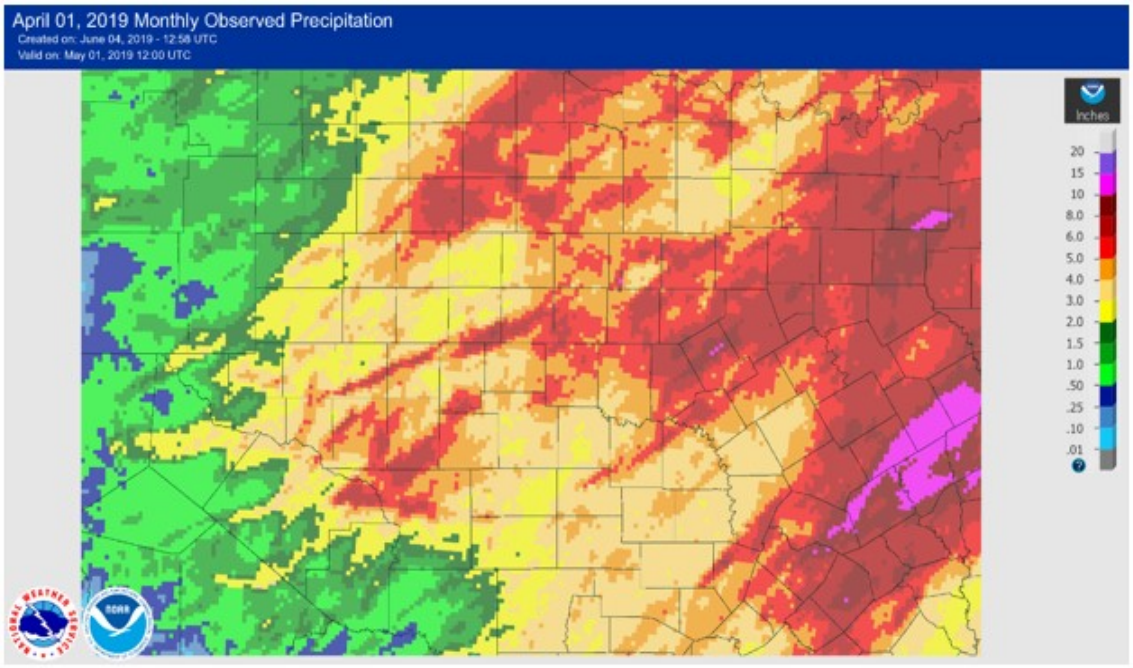

Image 3: April 2019 Observed Precipitation

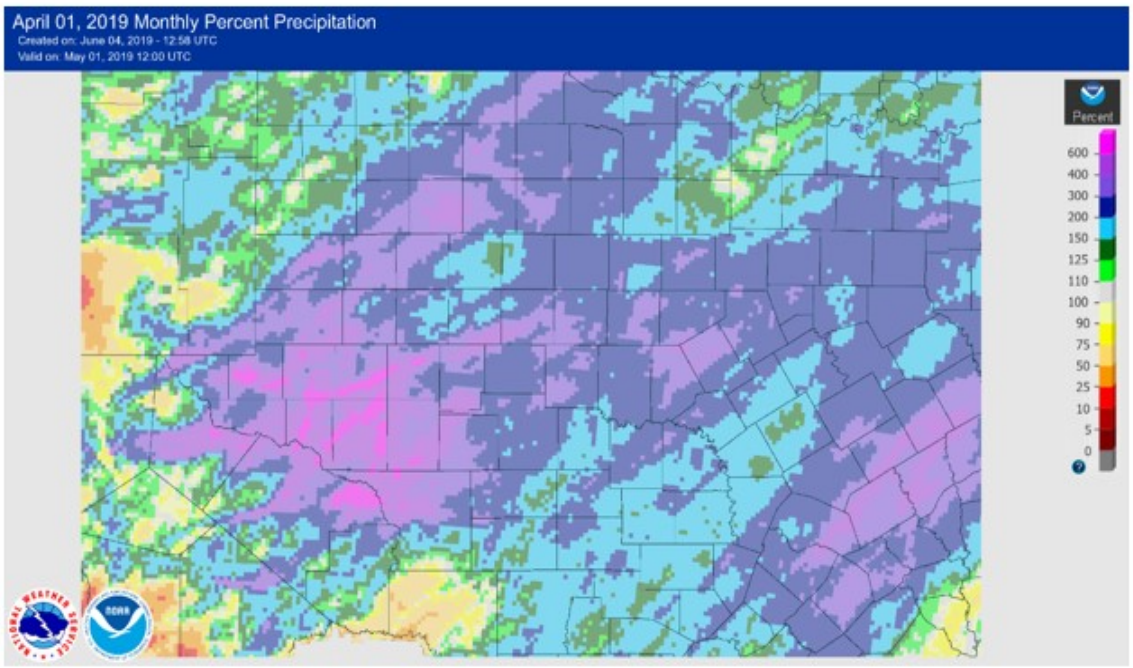

Image 4: April 2019 Percent of Normal

"Climate Summary for Abilene/San Angelo Region (continued)"

May

May continued the wetter-than-normal trend experienced in the month of April, though slightly cooler conditions prevailed due to the regular storm systems and cloud cover. Even higher monthly totals were seen in May with widespread amounts between 4-6 inches and isolated areas seeing totals as high as 10". The City of Abilene received 7.22" of rainfall during the month of May, making it the 11th wettest May on record. The City of San Angelo also experienced the 11th wettest May on record though they received only 5.37" of rainfall.

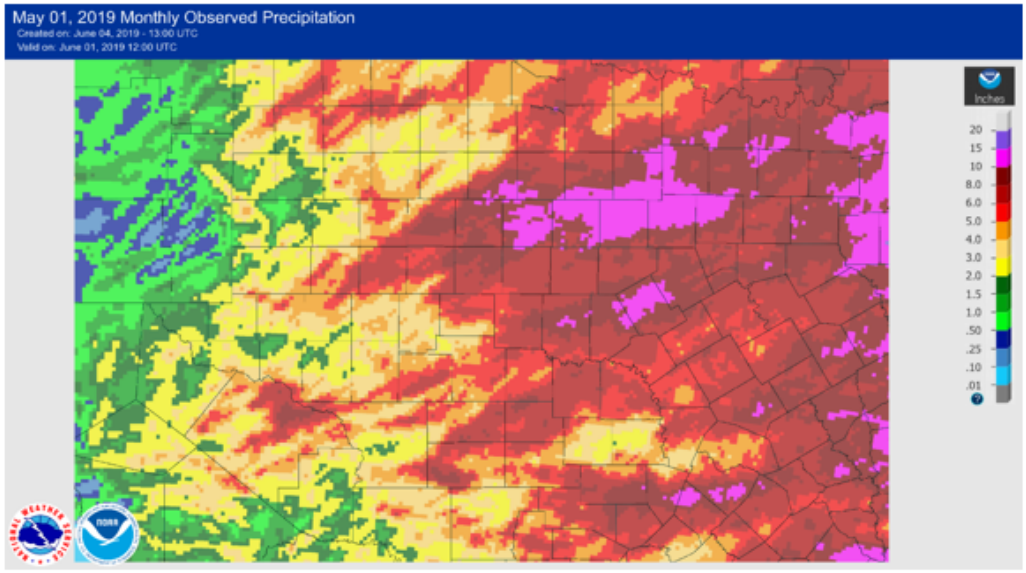

Image 5: May 2019 Observed Precipitation

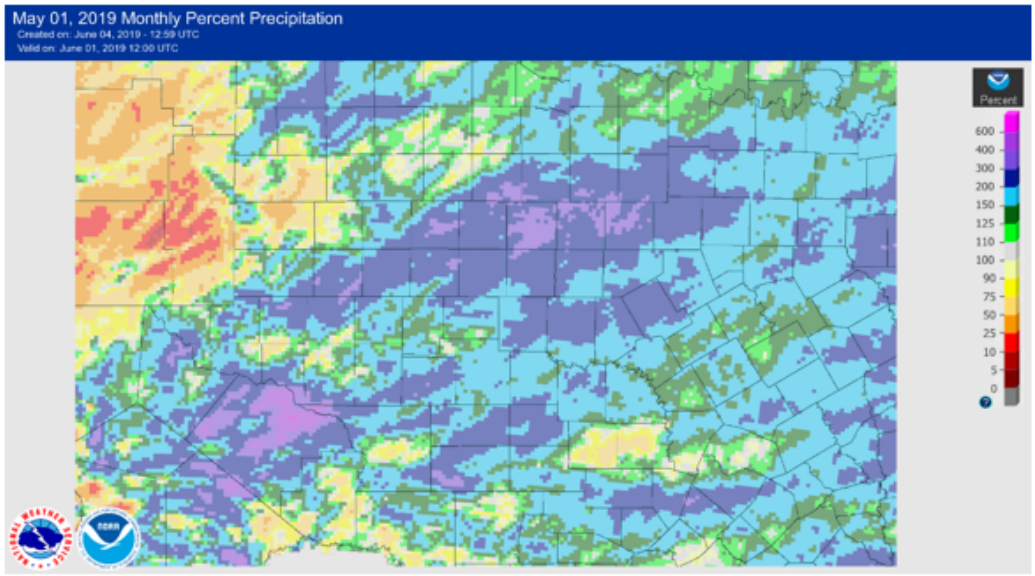

Image 6: May 2019 Percent of Normal

One noteworthy event occurred on May 18th. Isolated supercells began moving across the forecast area during the early morning hours. Four EF2 tornados touched down that morning, two of which passed through the cities of Abilene and San Angelo. Three EF3 tornadoes touched down, hitting the cities of Ballinger and Coleman. These tornados damaged numerous homes and businesses, resulting in displaced residents and widespread power outages. No fatalities occurred, although two injuries were reported.

May 18th San Angelo/Abilene Tornado Outbreak

By Joel Dunn
National Weather Service San Angelo

May 18th Tornado Event

On Friday, May 17, 2019, the Storm Prediction Center (SPC) issued the Day 1 Severe Weather Outlook, and included a portion of the San Angelo County Warning Area (CWA) in an Enhanced Risk and a larger portion of the CWA in a Slight Risk. (image 1) According to SPC's outlook, a surface trough was located along the New Mexico and Texas state-line, with a moist airmass east of a retreating dryline across West Texas. Strong instability was also in place with MLCAPE values between 3000 and 4000 J/Kg, along with 0-6km shear values between 40 to 50 kt.

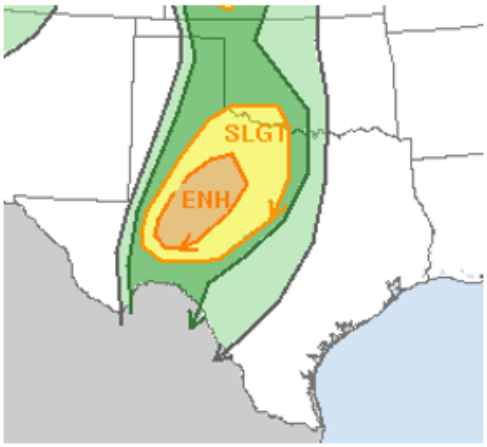

Image 1 - Day 1 Severe Weather Outlook

During the early morning hours of May 18th, a low-amplitude shortwave trough moved east across San Angelo's CWA. At 3:57 AM a Severe Thunderstorm Warning was issued for a storm in Irion County, just west of Mertzon. This storm continued to move east toward Tom Green County. At 4:49 AM, a Tornado Warning was issued for this storm. Within 10 minutes, a second warning was issued and it became clear the storm was headed for the City of San Angelo. The trajectory of this particular storm put it on a path with the Weather Forecast Office (WFO) and the co-located WSR-88D (KSJT).

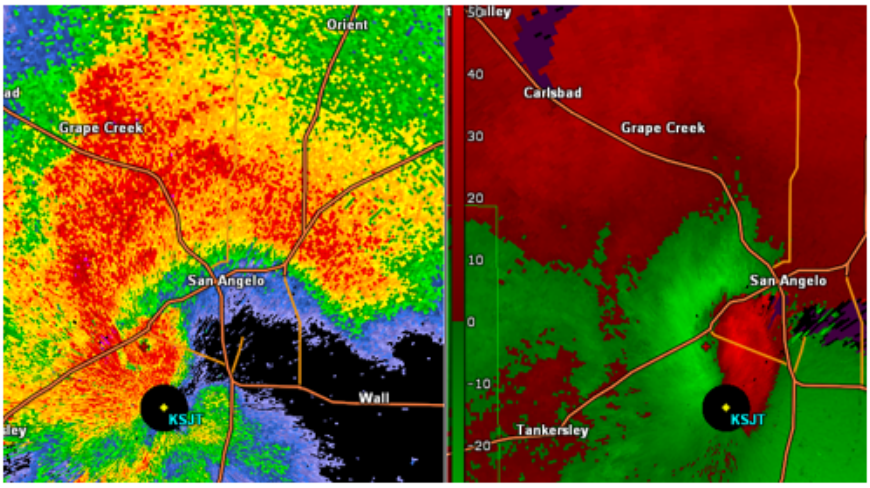

Image 2 - Reflectivity and SRM for San Angelo Storm

This resulted in the hand-off of operations to the Midland WFO while the San Angelo WFO forecasters sheltered-in-place. At 5:40 AM, as the tornadic supercell passed through San Angelo, a thunderstorm was moving northeast toward the city of Abilene, and had become severe. Less than 5 minutes later, that storm would also take on tornadic characteristics and move across the northwestern portion of Abilene. This storm would continue northeast, but lose its tornadic

"May 18th Abilene/San Angelo Tornado Outbreak (continued)"

signatures. The San Angelo storm moved northeast as well and hit the city of Ballinger and also northwest of Coleman. These thunderstorms congealed into a line of thunderstorms and moved east toward central Texas.

Image 3 – San Angelo Damage

The storm surveys revealed the southern storm, which passed through San Angelo, produced four known tornado tracks. The San Angelo tornado was strong enough to produce EF2 level damage, achieved wind speeds up to 125 MPH, and lasted for approximately 18 miles. The storm strengthened before reaching Ballinger and produced EF3 level damage, reach wind speeds of 145 MPH, and tracked for 19 miles. The northern storm, which passed through Abilene produced a 5-mile track, with EF2 level damage, and wind speeds up to 125 MPH. Numerous homes and business were damaged, resulting in displaced residents and widespread power outages. Two injuries were reported, but due to healthy lead times and quick actions taken, no fatalities were reported.

Image 4 - Ballinger Damage

"May 18th San Angelo/Abilene Tornado Outbreak (continued)"

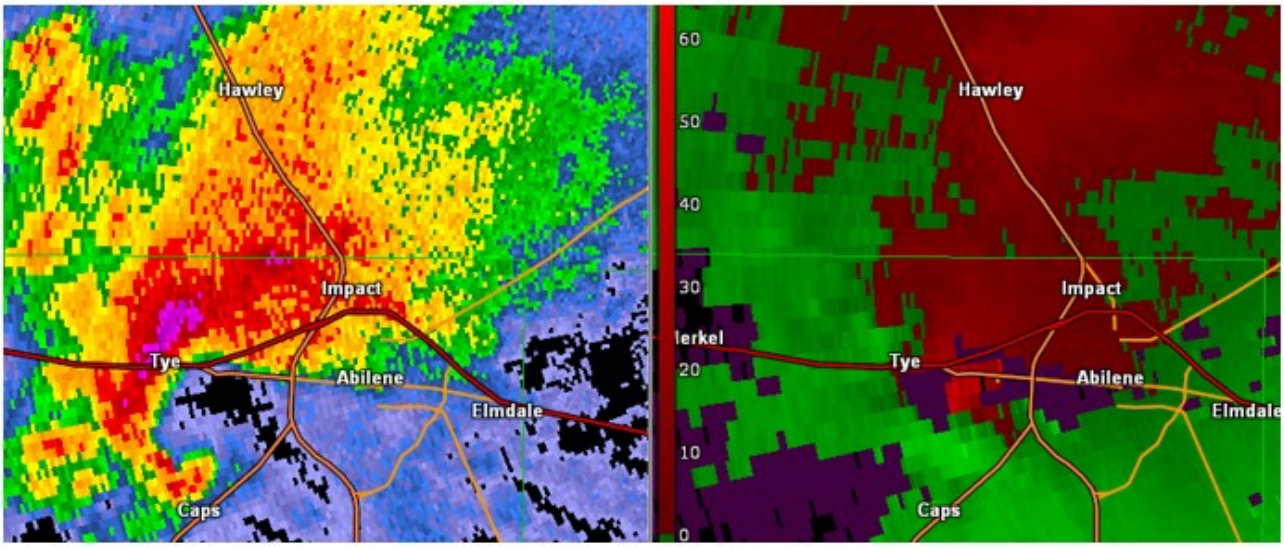

Image 5 - Reflectivity and SRM for Abilene Storm

Image 6 - Abilene Damage

Climate Summary for North Texas/State Hydrology

North Texas Climate Summary & Statewide Hydrology

By: Greg Story, West Gulf River Forecast Center

Greetings from North Texas! We were really on a rainfall roller coaster in north Texas the latter part of 2018 into 2019. Just to review, the autumn season of 2018 was historic. September and October of 2018 were the wettest September and October months of record. Not only that, but October was the fourth wettest month, and the previous month (September) had the seventh highest rainfall total ever for any month. In November, the weather pattern changed to a more normal (drier) autumn regime. Above normal rainfall was limited to portions of northeast Texas, while the remainder of north Texas was near to below normal. December turned wet once again. Above normal precipitation occurred over much of the state including north Texas. January 2019 saw above normal rainfall over central and east Texas, with near to below normal precipitation elsewhere. February turned drier than normal over most of the state.

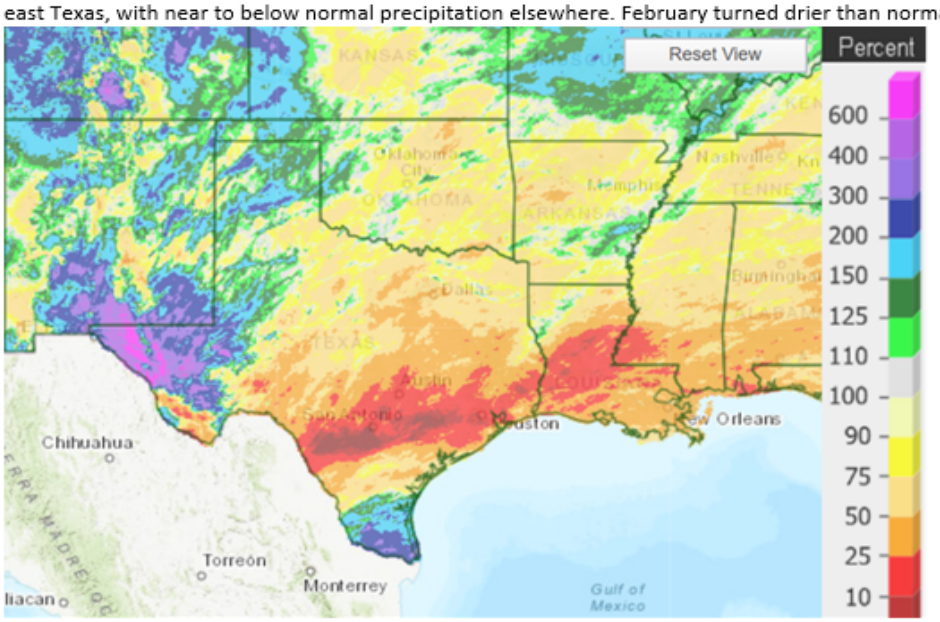

Figure1: Percent of normal rainfall for March 2019.
The green and light yellow colors indicate near normal precipitation, the blue and purple colors indicate above normal, while the red indicates below normal precipitation.

March continued the dry trend that began in February. Only a few areas over Deep South Texas and over far west Texas saw above normal precipitation. But a vast majority of Texas had below normal values, especially from near Del Rio eastward across Austin/San Antonio and Houston to the lower end of Toledo Bend Lake.

At the DFW airport they got 2.01" in March, which was quite a bit below normal. The normal amount for March is 3.49" so they were below normal by 1.48" for the month. And, wrapping up the winter snow season, Dallas-Fort Worth International Airport seasonal snow total amount was a trace, matching that of the winters of 2015-16 and 2017-18. The trace ties a record for the lowest seasonal snowfall total. This was the biggest snow drought at DFW since World War 2 [in the 1940s]. DFW has not received any snowfall total greater than a tenth of an inch since March 2015.

There was a shift in our weather pattern which began in January, and, for the most part, this weather pattern continued through February and March. The upper level air flow was coming more out of the west. This limited the amount of moisture that came off the Gulf of Mexico. Thus, the majority of storms which affected Texas were not big rainfall producers. In fact, very few of the storms produced one inch or more of rain on any given day. There were three large storm systems in March, and most of these passed north of Texas. There were several smaller disturbances through the month. Here are the highlights of the largest storms of the month.

March 1:
March started out with cooler, drier weather conditions. Some overrunning of moisture occurred behind a cold front on the 1st that was left over from the end of February. The heaviest rain was over south Texas.

March 3:
An arctic cold front and a short wave trough passed across Texas on the 3rd, but since atmospheric moisture was limited only light amounts of rain occurred. The more widespread and heavier rain fell just northeast of Texas where the moisture was deeper. High pressure dominated the weather for several days after the front passed with no rain occurring between March 4 and 8.

"Climate Summary for North Texas/State Hydrology (continued)"

March 9:
An upper atmospheric low pressure system passed to the north of Texas. As this occurred dry air was pushed eastward from the desert southwest and a dryline formed. This dryline produced showers and thunderstorms over northern and eastern Texas. Due to the speed of the thunderstorms most areas received 0.33 of an inch of rain or less. The thunderstorms were severe, however. Thunderstorm wind damage occurred to several houses and so was a church in Mesquite, and numerous trees and a back porch were downed in Van Zandt County. It was determined that an EF-0 tornado moved through parts of Mesquite where the damage was found. A statewide highest thunderstorm wind gust of 71 mph was measured in Childress in the Panhandle region. Lake Worth in Tarrant County and Glen Rose in Somervell County reported half dollar-size hail (1.25 inches).

March 12 – 14:
A giant storm system moved into the region from the southwestern U.S. Like the storm on March 9, this storm passed to the north of Texas and produced thunderstorms ahead of a dryline. Over one inch of rain fell over parts of north Texas. On the morning of March 13, a squall line of severe thunderstorms moved through Texas. There were several reports of trees, power lines and fences down across parts of Dallas County and in Fort Worth, as well as a few reports of 18 wheelers knocked over in Dallas. Emergency management reported an 80-mph thunderstorm wind gust in Grand Prairie and a 72-mph wind gust at UT-Dallas in Richardson. There were two confirmed tornadoes from the severe thunderstorms in North Texas. The first was located near Mineral Wells, and the second twister was found in Peaster in Parker County. These two were rated EF-1.

March 24 - 26:
After about 10 days of mostly dry weather, an upper low moved from Arizona and Utah eastward which passed to the north of Texas. There was limited rainfall at least initially. But a dryline did develop which produced thunderstorms, mainly across north central and northeast Texas. Due to the speed of the storms most rainfall reports were under one-half inch. Perhaps the biggest news was not the rain, but the hail which fell. Collin County had the largest hail in the state with sizes ranging from 2.5 inches (tennis ball) in Allen and McKinney to 2.75 inches (baseball) in Frisco. The largest reported hailstone occurred between Frisco and McKinney and was measured at 4.5" (grapefruit).

March 31 – April 1:
A strong late season cold front moved across most of Texas. While the drop in temperatures was the most significant weather news, there was some light precipitation along and behind the frontal boundary. The most significant rainfall was across Deep South into southeast Texas.

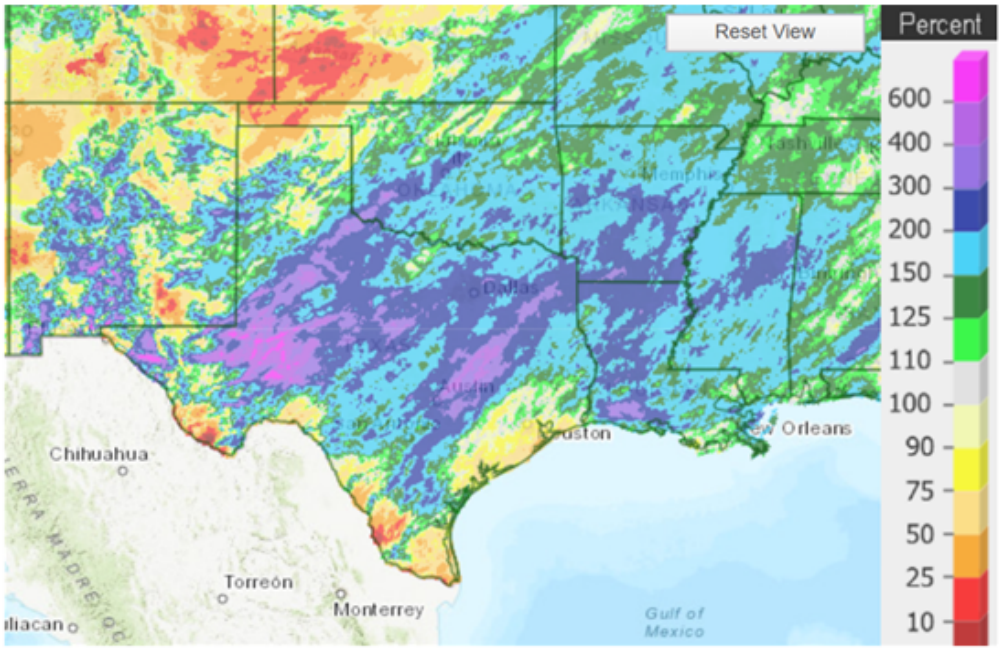

Figure 2: April 2019 percent of normal rainfall.
The red and yellow colors indicate below normal precipitation, while the blue and purple indicate above normal rain.

It turned wet again in April, as above normal precipitation fell over most of the state. Much above normal rainfall was noted in the area from Midland to Sheffield TX, and the Dallas/Fort Worth metroplex had about 3" of rain above normal. A portion of southeast and Deep South Texas had below normal values, especially from near Laredo and Brownsville northeastward up to Houston.

"Climate Summary for North Texas/State Hydrology (continued)"

At the DFW airport they got 6.75" in April, which was quite a bit above normal. The normal amount for April is 3.07" so they were above normal by 3.68" for the month. The rainfall of 6.75" inches at the Dallas/Fort Worth Airport was the 12th wettest April on record, and the wettest April in 24 years (since 1995).

April – Wettest All time

Rank	Amount	Year	Rank	Amount	Year	Rank	Amount	Year
1	17.64"	1922	6	8.63"	1958	11	6.83"	1995
2	16.97"	1942	7	7.73"	1905	12	6.75"	**2019**
3	12.19"	1957	8	7.34"	1900			
4	10.74"	1966	9	6.99"	1916			
5	9.63"	1908	10	6.90"	1990			

April's rainfall also provided an end to the short-term drought or dryness across the Dallas-Fort Worth Metroplex. Other noteworthy monthly rainfall totals included Dallas Redbird Airport with 9.28", Cameron Texas with 8.87", Granbury with 8.84", Dallas Love Field with 8.54", and Hearne with 8.51".

There was quite a change in our overall weather pattern in April, as a couple of long wave troughs of low pressure developed west of Texas which put the state in a favorable rainfall pattern. There were at least four large storm systems in April. There were a couple smaller disturbances through the month as well. Here are the highlights of the largest storms of the month.

April 1 - 4:
April started out with cooler, drier weather conditions. A short wave trough passed across north Texas on the 4th, but most of the rain from this disturbance did not fall over north Texas but fell instead over southeast Texas into southwest Louisiana.

April 6 - 8:
A stronger upper level low pressure system moved through Texas from the 6th to the 8th. Much of the state got some rain, with some locally heavy rain noted from central into southeast Texas. The initial upper air disturbance produced showers and severe thunderstorms over northern and central Texas April 6. There were three brief EF-0 tornadoes in Milam and Robertson counties near Calvert, Cameron and Thorndale in central Texas. The rain should move out on the 8th before high pressure brought dry weather from April 9 and April 11.

April 12 - 14:
A large upper atmospheric low pressure system moved from New Mexico through west Texas. This low combined with a warm front to produce severe thunderstorms and locally heavy rainfall. Rainfall-wise, the heaviest rain was over northern and western Texas, as well as a small part of east Texas. Nearly two inches fell across north Texas. A total of six tornadoes ripped through Texas Saturday, April 13. In north central Texas, an EF-3-rated tornado struck near Hearne and Franklin in Milam County. An EF-1 twister hit Buffalo in Leon County, and an EF-0 tornado occurred in Hearne in Robertson County. In East Texas, an EF-3 tornado struck Alto in Cherokee County. This tornado stayed on the ground for 29 miles.

April 17 – 18:
An upper level low crossed Texas and pushed a dryline eastward. This was followed by a cold front. Thunderstorms occurred ahead of the dryline. Close to an inch of rain fell across north Texas from these thunderstorms.

April 23 - 25:
An upper low formed over southern California, moved southeast into Mexico, and then moved northeast into north Texas. This low produced the heaviest and most widespread rain of any of the storms in April. Around 3.50" fell across many north Texas locations.

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"Climate Summary for North Texas/State Hydrology (continued)"

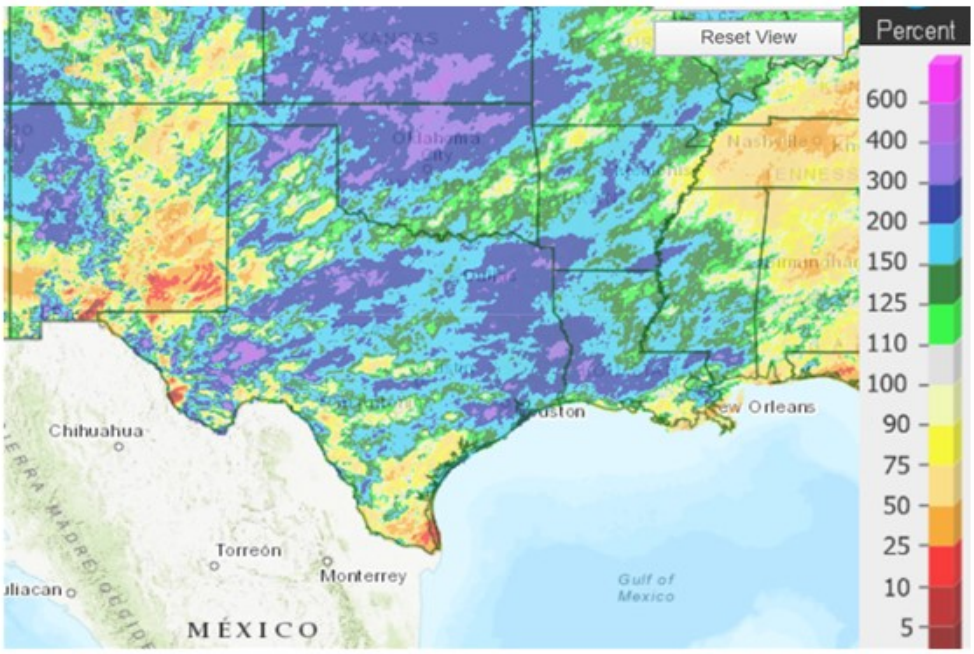

Figure 3: May 2019 percent of normal rainfall.
The yellow and red colors indicate below normal precipitation, while the green, blue and purple colors indicate above normal rain.

The wet cycle continued into May. Above normal rainfall occurred over most of the state, with much above normal precipitation from the DFW metroplex to Abilene, near Fort Stockton, and from Houston to the Toledo Bend Country. Portions of south Texas had below normal values, especially from near South Padre Island to Brownsville.

At the DFW airport they got 8.15" in May, which was well above normal. The normal amount for May is 4.90" so they were above normal by 3.25" for the month. This was the wettest May since 2015. This rain created widespread minor flooding, with isolated moderate flooding on for portions of the Neches, Trinity and Sabine rivers. Action stage flood levels persists on the Brazos River. In addition to the rain, the North Central Texas climate division registered 25 tornadoes. Through May 30, the Storm Prediction Center tabulated 143 tornadoes for Texas - the highest of any state.

A couple of long wave troughs of low pressure developed west of Texas which put the state in a favorable rainfall pattern and triggered an active west Texas dryline in May. There were at least six large storm systems in May. There were a couple smaller disturbances through the month as well. Here are the highlights of the largest storms of the month.

May 1 - 4:
May started out the way April ended with a rainy weather pattern. A long wave trough set up to the northwest of Texas, which caused several short wave troughs to cross the state. These disturbances, combined with an active dryline over west Texas, led to widespread rainfall, some of it significant, from May 1 – 4. Around 1.50 – 2.00" fell across north Texas. This put many of the river systems across east and central Texas into at least the minor flood category.

May 7 – 10
A stronger upper level low pressure system formed over Arizona on the 7th which passed to the north of Texas by the 9th. This storm brought extremely heavy rain to the Houston area, with widespread showers and thunderstorms elsewhere through May 10. On the 7th organized clusters of thunderstorms eventually formed a quasi-linear convective system (QLCS)/squall line and produced heavy rain and tornadoes in the Panhandle and the West Texas Trans Pecos area. Much of north Texas saw around 2" of rain, with much of this falling in a short time period. In DFW flash flooding occurred and multiple high-water rescues were performed in Fort Worth. Outside of north Texas, flooding occurred in southeast Texas. Exorbitant amounts of precipitation were measured in Fort Bend County with Sugar Land getting 10.28", Richmond picking up 9.38" and Buffalo Bayou receiving 8.21".

May 11 – 14

After that last storm lifted out, a new closed low dug south into California. The low then moved slowly east and eventually moved across north Texas. This put Texas in a very favorable pattern for more heavy rain from the 10th through the 14th. Much of the state got some rain, with the locally heavy rain over the eastern third of Texas. Much of north Texas received around 1.50" of rain.

"Climate Summary for North Texas/State Hydrology (continued)"

May 18 - 19:
A strong upper air disturbance moved across central and north Texas. That plus an active dryline produced thunderstorms. On May 18 a daily record rainfall fell at Dallas/Fort Worth Airport where 2.18 inches occurred (previous daily record was 1.89" in 1942). All but 0.04 of an inch fell between 2-4 p.m. Much of north Texas received from 1.50 – 2.25" of rainfall.

May 20 - 22:
Another large upper atmospheric low pressure system moved from New Mexico through west Texas which activated the dryline. Numerous thunderstorms developed from west Texas into Oklahoma. Some of the thunderstorms moved east across the remainder of Texas. There was a tornado located in Wellington in Collingsworth County, and very large hail of 4 to 5.5 inches (softball-to-grapefruit size) also occurred. Rainfall-wise, the heaviest rain was over eastern and western Texas. The heaviest rain this time around missed much of north Texas with amounts of less than 0.50".

May 29 – 31:
An upper level low passed northwest and north of Texas and made the dryline active once again. It also pushed a weak cold front into Texas. Thunderstorms occurred ahead of the dryline and front over north Texas. A series of 11 tornadoes raked north Texas May 29. Additionally, there was hail, with the largest being baseball-size (2.75 inches) at Blossom in Lamar County. Around 1.00" of rain occurred at many north Texas locations.

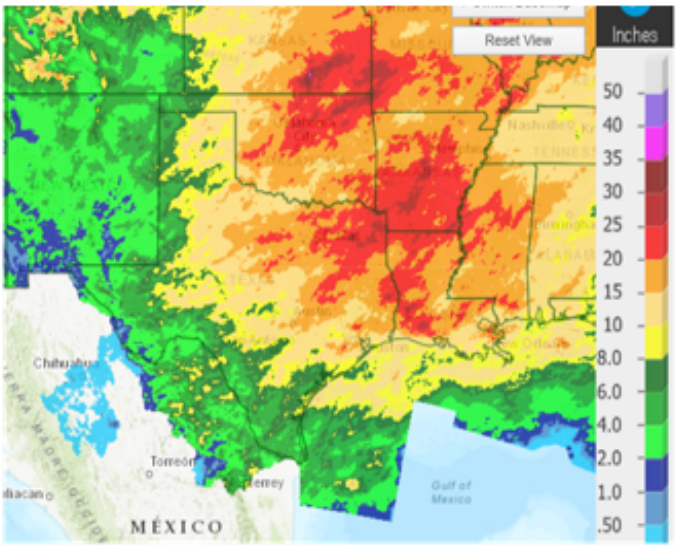

Figure 4: Spring 2019 total precipitation 2019.

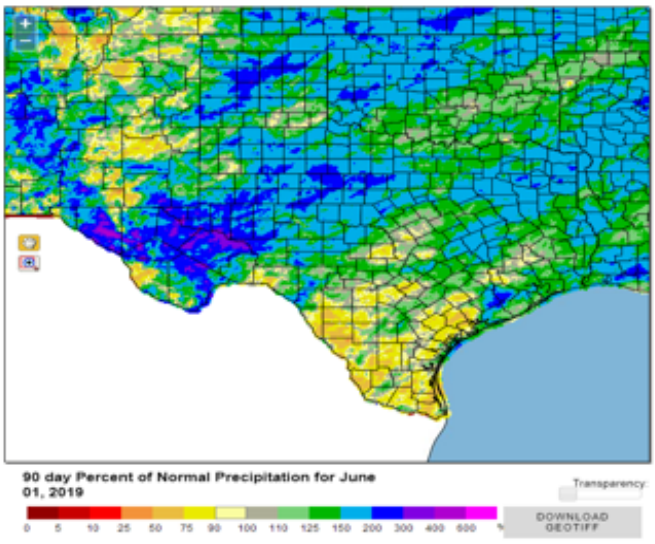

Figure 5: Spring 2019 Percent of Normal Precipitation.

The green and blue colors in Figure 5 indicate above normal rainfall. The orange and yellow colors indicate below normal amounts. You can see that after the April and May rainfall only a small part of Texas is now drier than normal. The area from Eagle Pass through Laredo to Brownsville, and the area around Port O'Connor have seen below normal rainfall. But the area from far west Texas through the Permian basin to Abilene and Dallas/Fort Worth, as well as from central into east Texas, have all had above normal rainfall. The spring temperatures were near-normal, but this was the wettest spring season since 2015. For the spring season DFW got 16.91". In a normal spring they receive 11.46" so they were above normal by 5.45". So far in 2019 the DFW airport has received 19.78". The normal amount is 16.25" inches so they are 3.53" above normal for the year.

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Climate Summary for the Brazos Valley Region

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

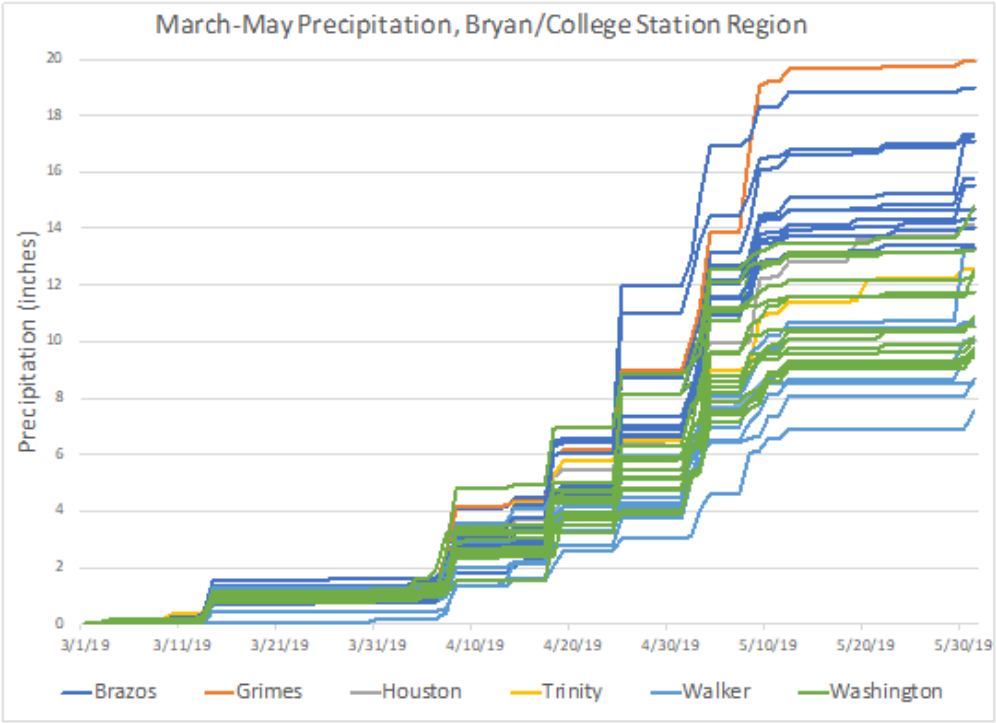


Figure 1: March – May 2019 Precipitation for the Brazos Valley Region

Summary

The spring started off fairly quiet, with just one day of substantial precipitation near the middle of the month. For the most part, this was welcome, as the previous several months had been quite wet. Most of the spring rain fell between early April and mid-May, and was unusually irregular for this time of year. Precipitation totals across the region ranged from less than eight inches to nearly twenty inches, with normal being around ten inches. The glut of rainfall corresponded to an unusually large influx of tropical moisture from the south. Dewpoint temperatures were often in the mid 70s °F, which is more common in June or September. The region then started drying out again, with another hit-or-miss rainfall event at the end of May producing anywhere from 0.06" to 2.66" according to CoCoRaHS observers.

Observer Statistics

There were 42 active CoCoRaHS observers during the spring. Twelve observers during this season reported precipitation values (including zeroes) for the full 92 days, while another 14 missed fewer than ten days. Overall, there were 37 observers with reliable measurements across six counties.

Seasonal Statistics

Wettest day: 5.38", April 25, Brazos County
Driest seasonal total: 7.55", Washington County
Wettest seasonal total: 19.93", Grimes County
Longest spell of days with measurable rain: 7, March 8-14, Brazos County
Longest spell of days without measurable rain: 20, March 15-April 3, Washington County

Climate Summary for Austin/San Antonio Region

South Central Texas Spring 2019 Summary

By: Brett Williams - NWS Austin/San Antonio

Spring 2019 was generally near or slightly below normal in regards to temperatures. Austin recorded its 46th warmest spring on record, but was 0.3 °F below the 1981-2010 climatological normal. San Antonio recorded its 55th coolest spring on record, and came in 0.7 °F below normal. Meanwhile, Del Rio registered its 57th coolest spring on record, coming in at 0.4 °F below normal. For rainfall, Austin tied for its 15th wettest spring on record, with almost 6" of rain above normal. San Antonio was considerably drier, with its 63rd driest spring on record with about 1" less than normal spring rainfall. Del Rio came in right at normal precipitation for the spring. The spring severe weather season was relatively active, especially for an El Nino spring. There were also a few heavy rain and flash flood events over the course of the spring months.

March began with a prolonged cold snap as a strong arctic cold front moved through South Central Texas. Essentially all of South-Central Texas experienced cooler than normal temperatures for March, typically ranging from one to two degrees below seasonal normals. March also was quite dry, with very little rainfall occurring. This created some short-term drought issues across much of the region (Figure 1), with almost all of the region ending the month within D0 (abnormally dry) conditions. Additionally, over half of the region was in moderate drought, and portions of the Rio Grande Plains were categorized by severe drought. There also was a pronounced lack of severe thunderstorms this March.

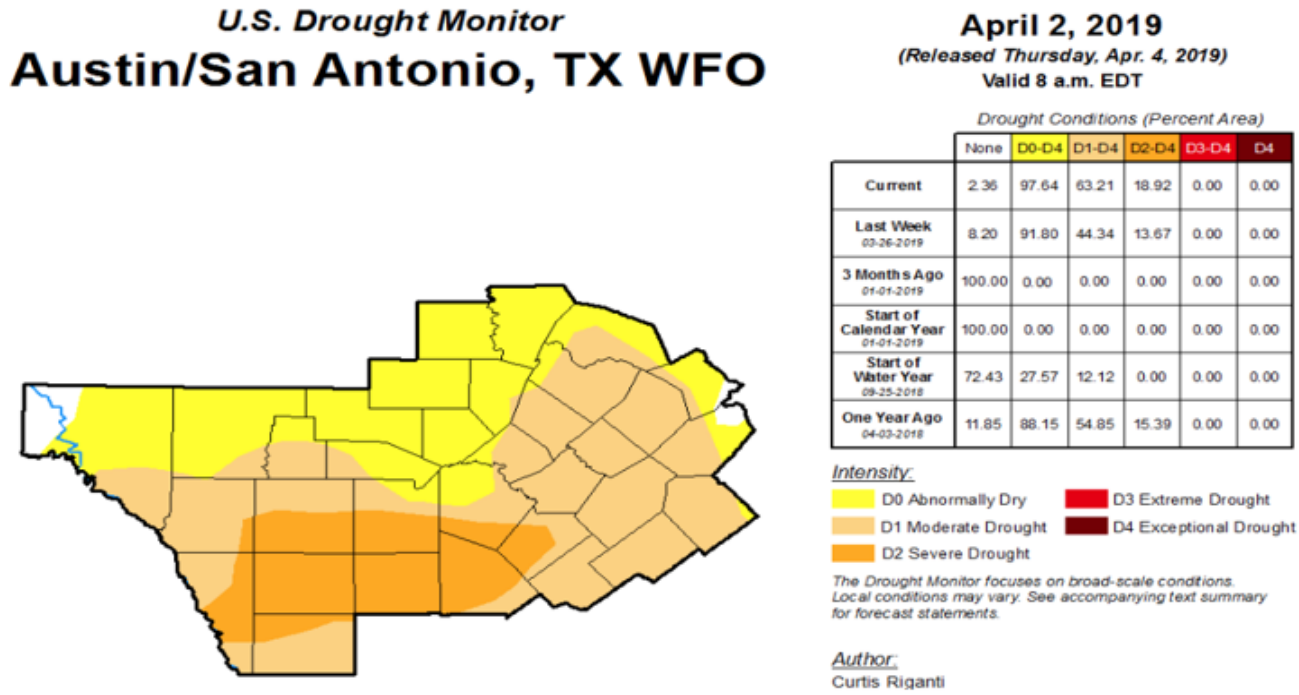


Figure 1: Drought monitor from April 2nd 2019

The weather pattern became much more active as April began. Much of the Austin area received heavy rainfall on April 6th and 7th, with up to 6" of rain recorded. On the early morning hours of April 13th, a large hailstorm impacted the northwest and northern portions of San Antonio, with some hailstones up the size of baseballs. Temperatures for the month of April came in near normal around the region, with Austin, San Antonio, and Del Rio all falling within one degree in either direction from climatological normals. Austin recorded its 9th wettest April on record, with over 7" of rain falling in the month. It was drier elsewhere, with San Antonio and Del Rio registering near or slightly below normal rainfall for the month.

May began with an active weather pattern across much of the country, and this held true for South Central Texas as well. On May 2nd and 3rd, storms traversed from west to east across the region. Hailstones up to the size of baseballs were reported across portions of Val Verde and Edwards Counties on the evening of May 2nd. Three tornadoes occurred near La Grange on the morning of May 3rd, with one of them being rated as a strong EF-2 tornado. Additionally, periods of heavy rainfall fell in the first 10 days of May, with flash flooding and river flooding occurring across the region, especially in the Hill Country and Austin metro area. Up to 10" of rain fell over a ten-day period across portions of Hays and Travis Counties, with

"Climate Summary for Austin/San Antonio Region (continued)"

a minimum of 2" falling across the rest of the region (Figure 2). This rainy period essentially erased all drought conditions that had begun to take hold due to the dry March (Figure 3). Average temperatures came in almost precisely at the climatological normals for Austin, San Antonio, and Del Rio for the month of May. Austin came in at its 19th wettest May on record, with another 7.5" of rain falling in the month. San Antonio and Del Rio came in near normal for rainfall for the month of May.

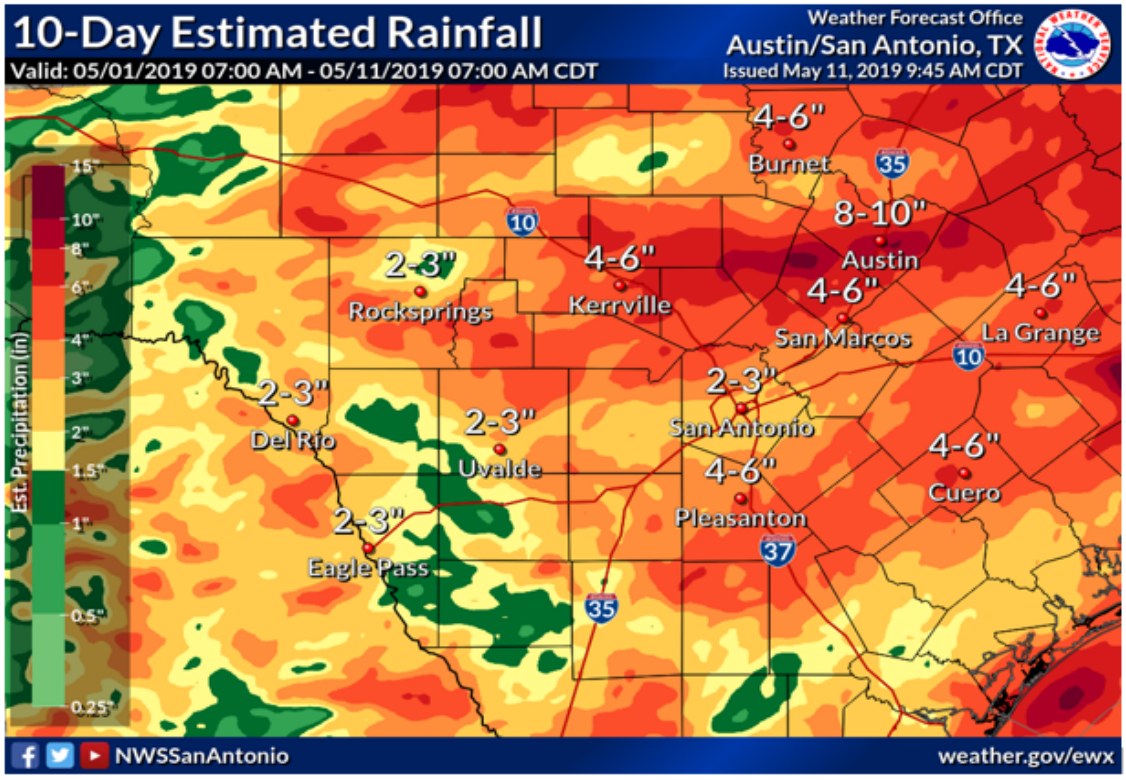


Figure 2: 10 day estimated rainfall from May 1st through May 11th 2019 across South Central Texas

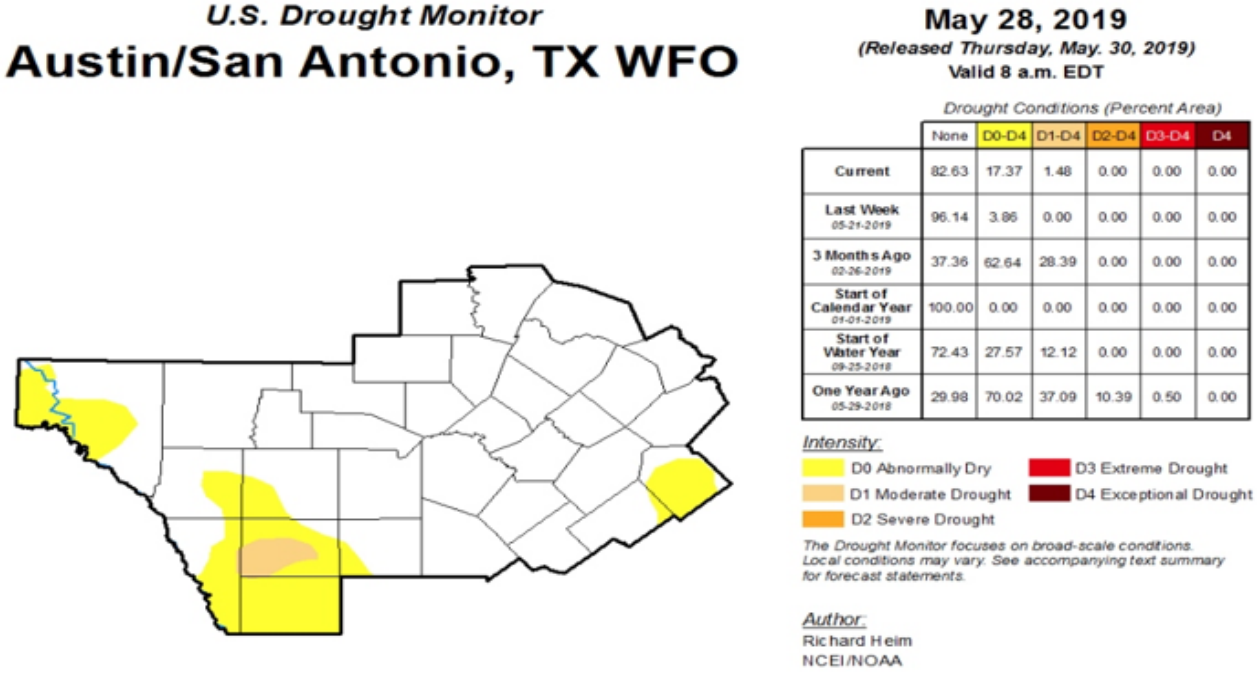


Figure 3: Drought monitor from May 28th 2019

Climate Summary for Houston/Galveston Region

Dry Start to Spring- Stormy May to Finish

By: Ron Havran

CoCoRaHS Assistant State Coordinator, CoCoRaHS Regional Coordinator, Texas CoCoRaHS Newsletter Editor

March

Monthly temperatures averaged slightly below normal. The month started off with morning lows below freezing from the 4th to the 6th. There was abundant sunshine for most of the month which resulted in very mild to warm days followed by cool nights. With all the sunny nice days for the month, rainfall was in short supply. The average rainfall was much below normal region wide with deficits of 1.50" to 3.00". The average CoCoRaHS station county rainfall was only 0.65". Fort Bend County had the lowest CoCoRaHS station average rainfall total in the region with only an average rainfall of 0.25" for the month.

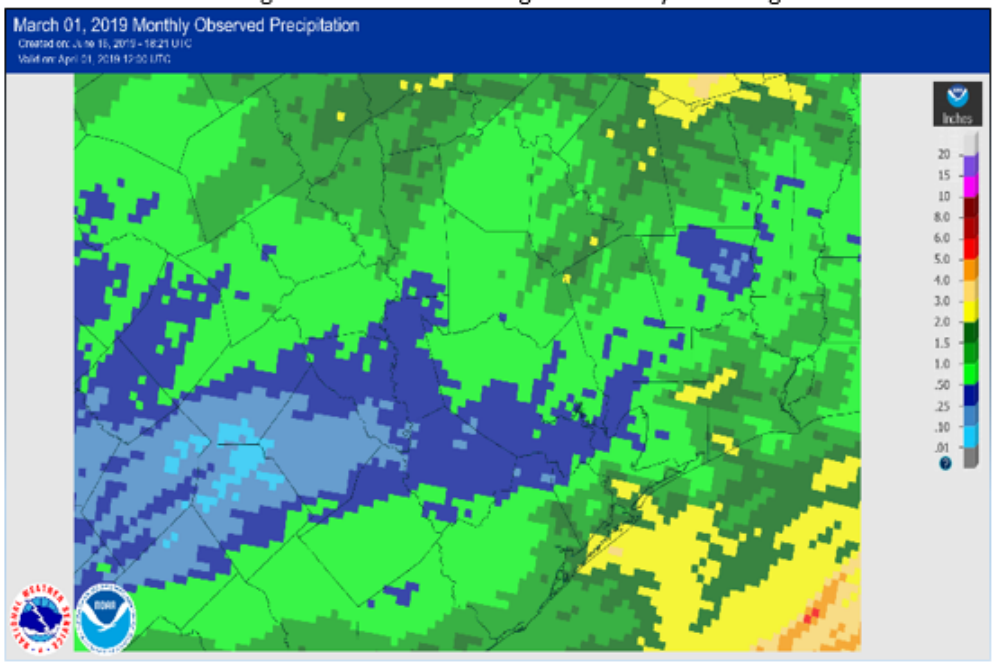


Figure 1: March total radar estimated rainfall

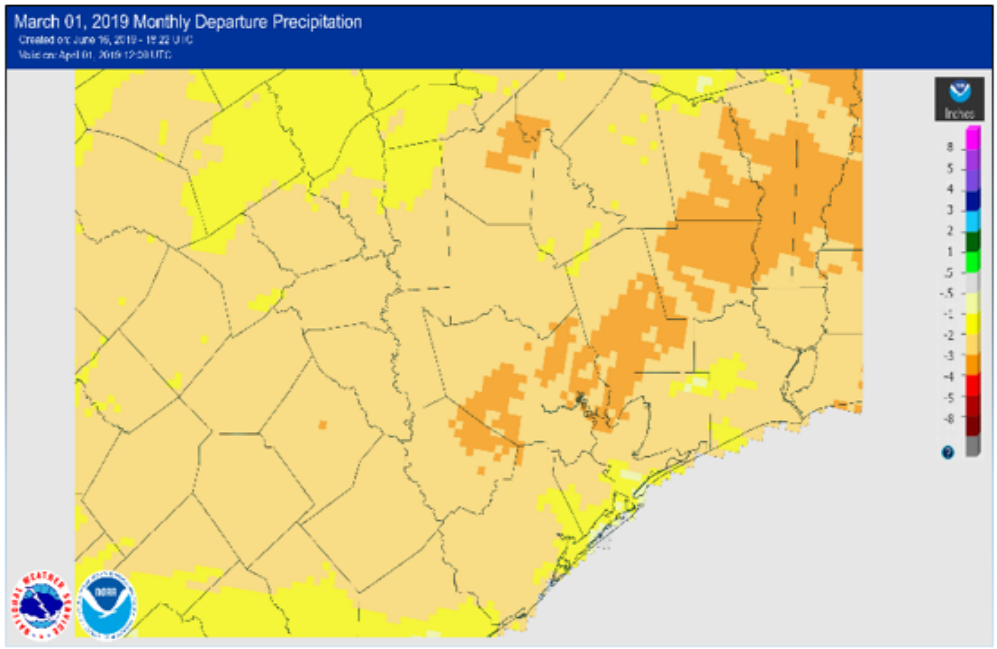


Figure 2: March Rainfall Departure from normal

"Climate Summary for Houston/Galveston Region (continued)"

April

April was very active with severe weather including tornadoes towards northern parts of the region. The northern counties had higher rainfall totals averaging normal in a few spots. Rainfall in the southern counties towards the coast was well below normal. The average CoCoRaHS station county rainfall was 2.85", which is below normal. Most of the heavy rainfall totals just missed the region to the NW. Polk County had the highest station average at 4.37" while Matagorda County had the lowest CoCoRaHS station average rainfall total at 1.45". Temperatures for the month in the region averaged normal. The month started with a few very cold morning from the 1st to the 3rd. Most of the month had very nice sunny to partly cloudy days. Severe weather days included the 6th and 7th with hail and damaging winds. Other dates with significant storms included the 13th, 18th, and the 24th.

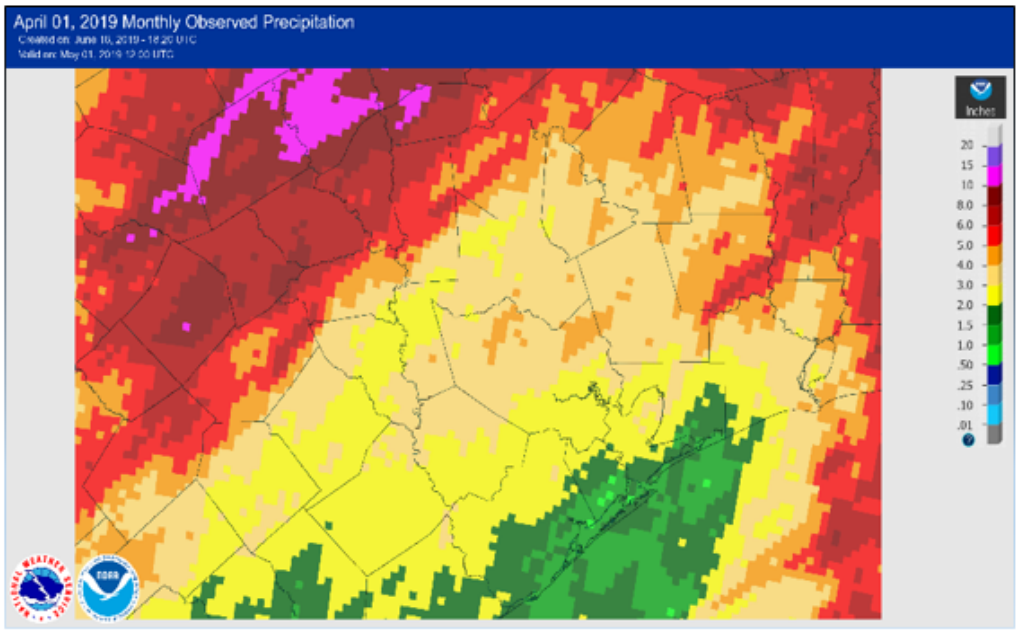


Figure 3: April total radar estimated rainfall

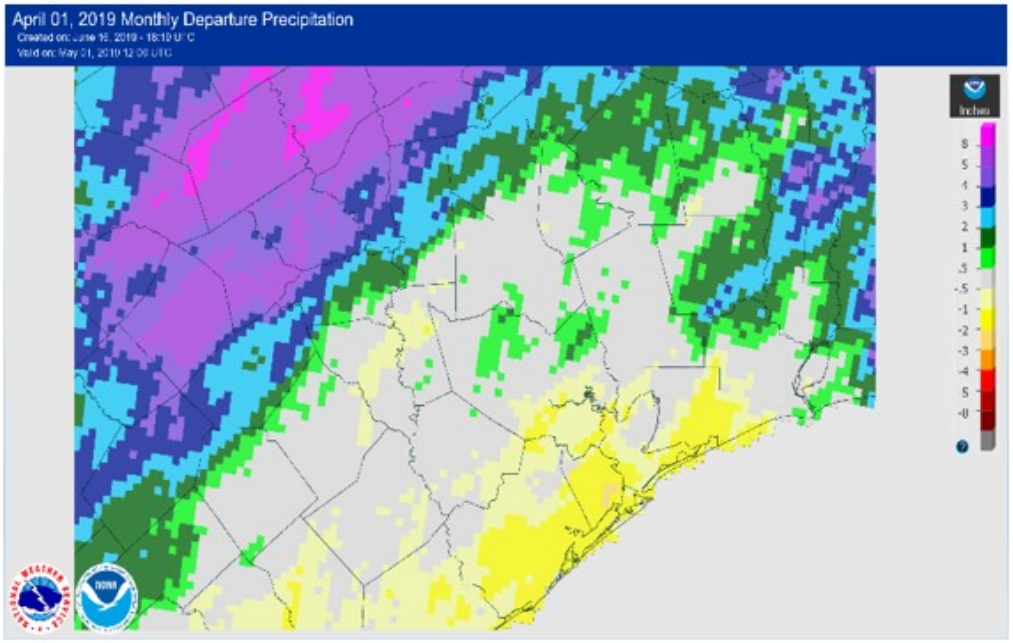


Figure 4: April Rainfall Departure from normal

"Climate Summary for Houston/Galveston Region (continued)"

May

May had temperatures that averaged above normal by 1 to 2 degrees across the region. May was a very wet month across all the region with heavy thunderstorms and severe weather. Most of the rain fell in the first 11 days of the month at most sites. There were many days with Flood Watches, Flash Flood Warnings and Flood Warnings. There were River Flood Warnings as well in the region. The average county CoCoRaHS station average rainfall was 8.52". There were 9 counties in the region that had an average CoCoRaHS station rainfall of over 10.00". Fort Bend County had the highest CoCoRaHS station average rainfall at 12.26". After the months of March and April, the heavy rains in May erased all dry soil conditions across the region.

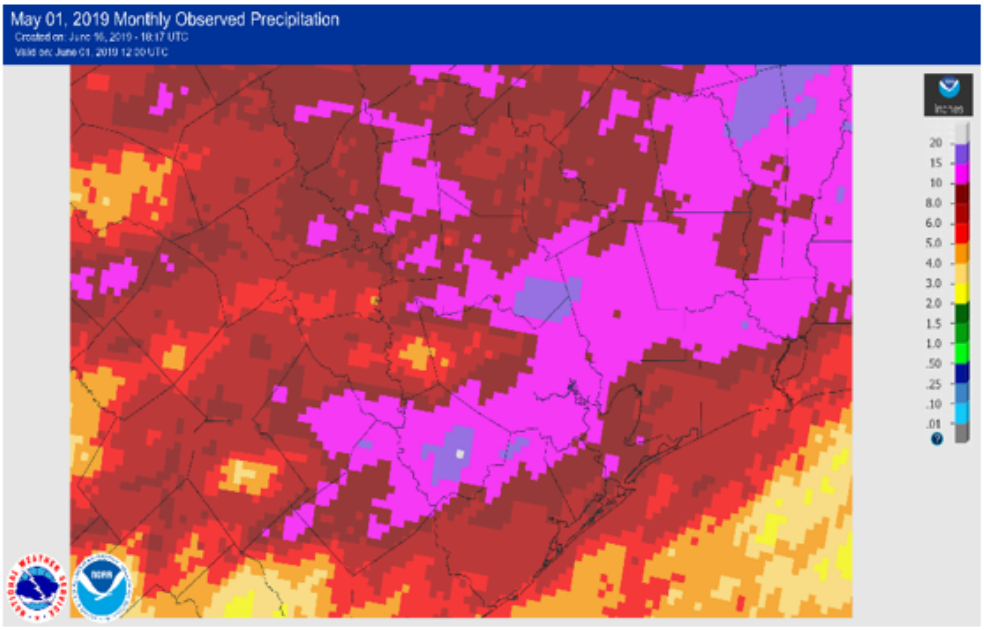


Figure 5: May total radar estimated rainfall

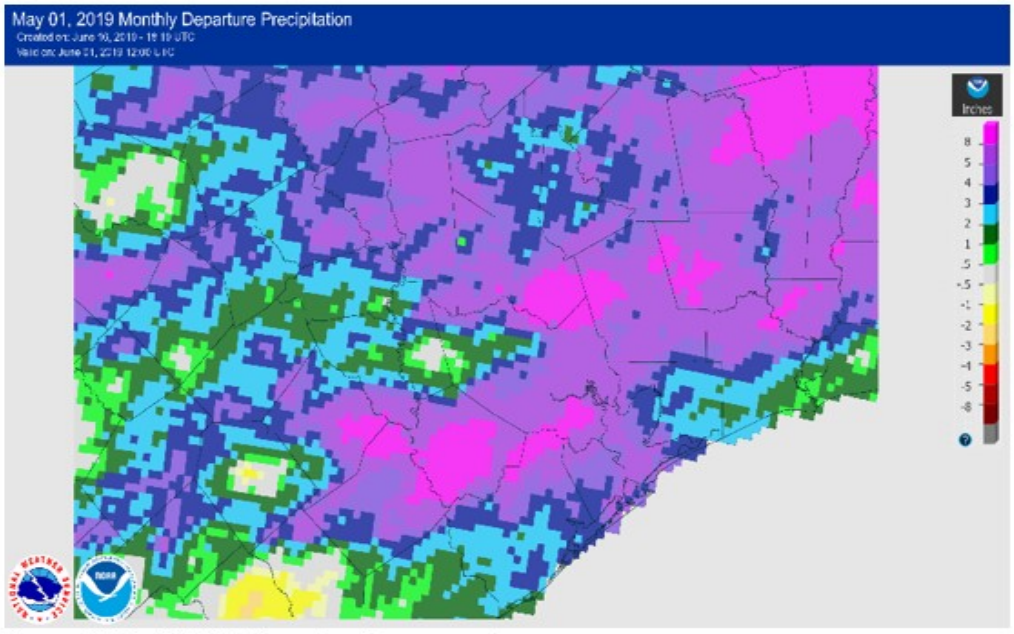


Figure 6: May Rainfall Departure from normal

"Climate Summary for Houston/Galveston Region (continued)"

Actual CoCoRaHS Measured County Rainfall Averages and Measured Station Rainfall Maximum Totals

Spring 2019 CoCoRaHS Houston/Galveston Region Rainfall

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

County	March		April		May		Spring Total
	AVG.	MAX.	AVG.	MAX.	AVG.	MAX.	3-Month Rain Total
Austin	0.55	0.96	2.73	3.15	5.23	6.62	8.51
Brazoria	0.55	0.94	1.98	2.39	7.91	10.52	10.44
Chambers	0.37	0.50	2.52	2.89	9.32	10.18	12.21
Colorado	0.46	0.79	2.68	3.00	5.57	5.82	8.71
Fort Bend	0.25	0.32	2.98	3.45	12.26	16.27	15.49
Galveston	0.93	1.54	1.80	2.74	9.37	12.99	12.10
Harris	0.39	0.73	3.01	4.09	9.63	14.78	13.03
Jackson	0.40	na	1.48	na	4.30	na	6.18
Liberty	0.77	1.50	3.23	3.58	11.16	12.08	15.16
Matagorda	0.46	na	1.45	na	5.01	na	6.92
Montgomery	0.60	0.88	3.19	3.97	9.88	16.06	13.67
Polk	1.11	1.35	3.81	4.37	8.63	11.23	13.55
San Jacinto	1.23	1.25	3.55	4.09	5.80	6.24	10.58
Wharton	0.27	0.38	2.35	2.78	8.25	10.55	10.87
Region Totals	0.65	1.54	2.85	4.37	8.52	16.27	12.01

Denotes wettest month for a category

Denotes driest month for a category

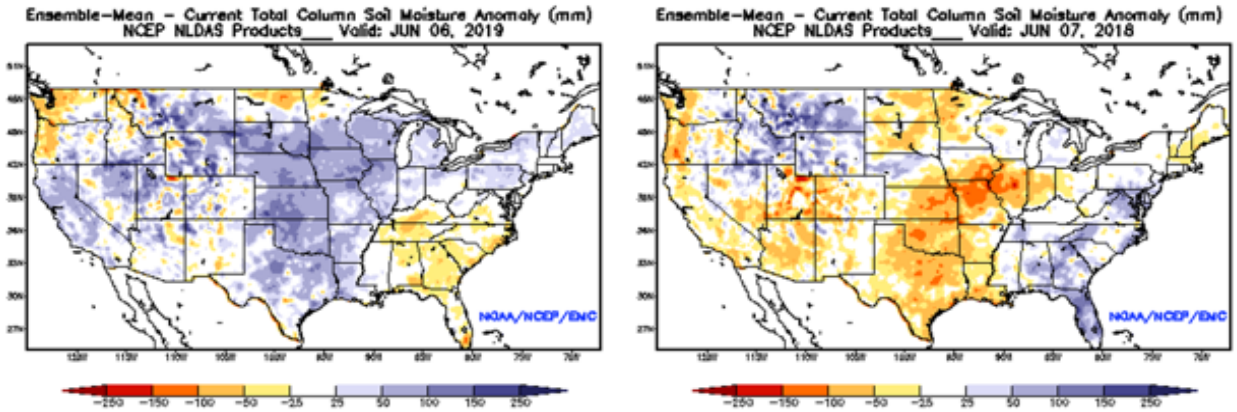
Note: All data taken from the cocorahs website by using the Total Precipitation Summary Report for each county by month.

2019 Summer Weather Outlook

By: Bob Rose
Lower Colorado River Authority

It goes without saying that all summers in Texas are really hot. Blame it on the state's geography and slow-moving summer jet stream patterns. But history shows that some summers are hotter than others due to factors such as prolonged drought and randomly unfavorable jet stream patterns. Summer 2018 ended up being one of those hotter, miserable summers, due to limited rainfall and a persistent ridge of high pressure. For the state as a whole, it was the 5th hottest summer on record. With 2018's very hot summer still in our rearview mirror, will we see similar conditions this summer?

There are several differences in the weather and rainfall patterns heading into summer 2019, compared to the same time last year, chief among them being rainfall and soil moisture. Spring 2018 was the 18th driest spring on record, leading to very low soil moisture levels at the start of summer. Meanwhile, spring 2019 was the 16th wettest spring on record, setting up normal to wetter-than-normal soil moisture conditions across the state.



Comparison of total column soil moisture anomaly between early June 2019 and early June 2018

Soil moisture content is an important factor heading into summer. Low soil moisture content often leads to hotter than normal summer temperatures as the sun's energy heats up the landscape and many times leading to a persistent heat dome over the state. On the other hand, moist soils will often lead to less hot summers as part of the sun's energy is used to evaporate moisture from the ground, leaving less energy available to heat up the landscape. In these summers, the heat dome has a harder time setting up and persisting throughout the summer.

Another difference between this summer and last is the development of El Niño. Last summer, waters in the tropical Pacific were warming, but an El Niño was far from becoming established. This year, a weak El Niño is firmly in place and is forecast to persist into the fall. While El Nino has limited direct influence on Texas weather during the summer months, it does has some influence on the jet stream pattern over North America, often focusing the development of summer heat ridges along the West and East coasts, rather than the central US.

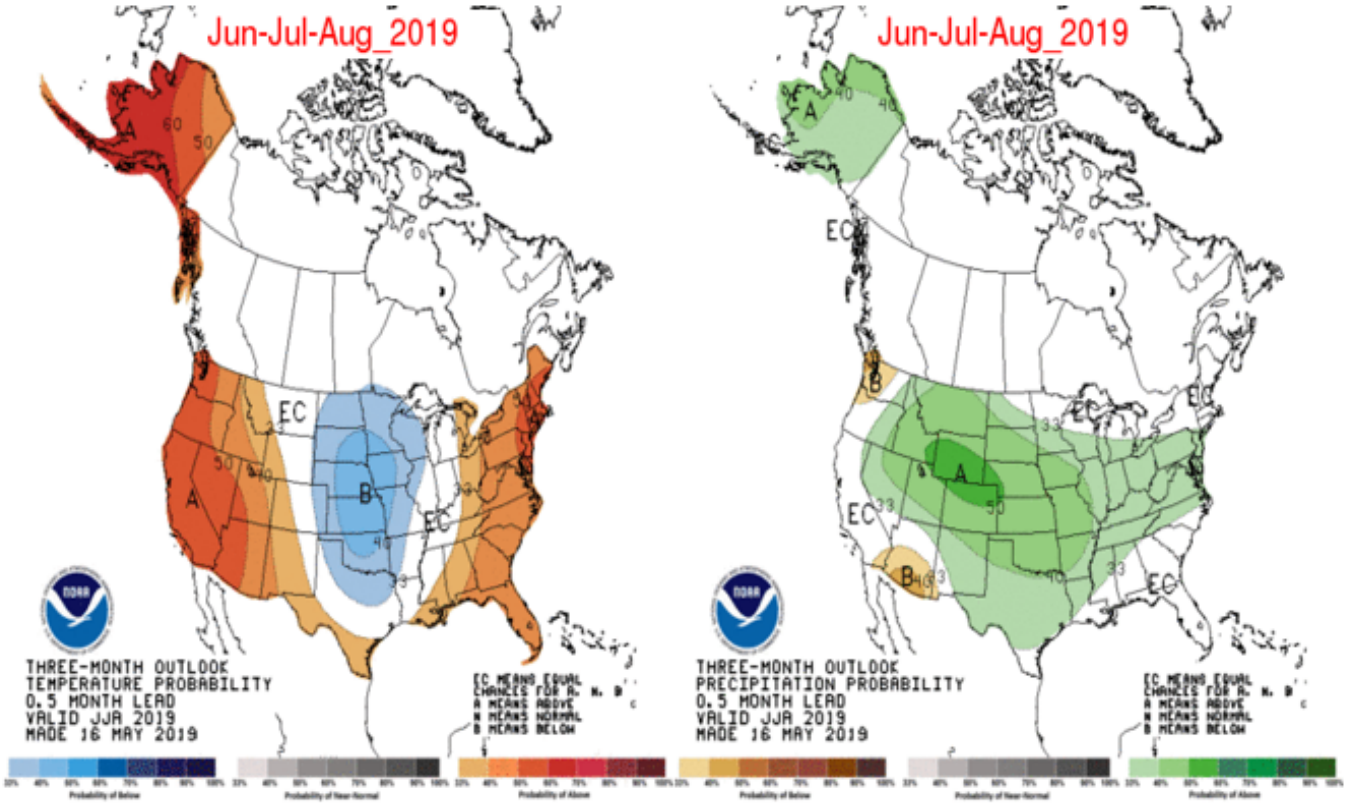
Factors such as adequate soil moisture, a persisting El Nino and subtle influences from water temperature patterns in the Atlantic and Pacific oceans point toward summer 2019 being a bit different than last summer. Temperatures overall are expected to be less hot. With the heat ridge predicted to spend less

"2019 Summer Weather Outlook (continued)"

time over Texas, there should be fewer days with triple-digit temperatures. Rainfall is projected to more plentiful and frequent as storm systems have a better chance of affecting the state, compared to last summer.

NOAA's Climate Prediction Center summer 2019 outlook calls for increased odds the hottest temperatures will occur along the West and East coasts, with less hot weather between the two coasts. In fact, the outlook calls for increased odds temperatures will average below normal through the middle of the county, extending south into North Texas and the Texas Panhandle. There are roughly equal chances the temperature will average above, below or near normal across the central part of the state and slightly increased odds for above normal temperatures across South and Far West Texas.

NOAA's precipitation outlook shows increased odds rainfall will average above normal across almost all of the state, with a bit little less certainty in the outlook across Deep South Texas.



Of course like in any year, this summer's 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. Clouds and rain from these systems can often cause extended breaks from the typical hot dry summer pattern.

While the upcoming summer may be less extreme than many recent summers, it will still be quite hot! Be sure to take the necessary precautions to keep you and your family cool and safe from the Texas sun.

2019 Hurricane Season Outlook

NOAA predicts near-normal 2019 Atlantic hurricane season

Taken from: noaa.gov

El Nino and warmer-than-average Atlantic help shape this season's intensity

NOAA's Climate Prediction Center is predicting that a near-normal Atlantic hurricane season is most likely this year. This outlook forecasts a 40% chance of a near-normal season, a 30% chance of an above-normal season and a 30% chance of a below-normal season. The hurricane season officially extends from June 1 to November 30.

For 2019, NOAA predicts a likely range of 9 to 15 named storms (winds of 39 mph or higher), of which 4 to 8 could become hurricanes (winds of 74 mph or higher), including 2 to 4 major hurricanes (category 3, 4 or 5; with winds of 111 mph or higher). NOAA provides these ranges with a 70% confidence. An average hurricane season produces 12 named storms, of which 6 become hurricanes, including 3 major hurricanes.

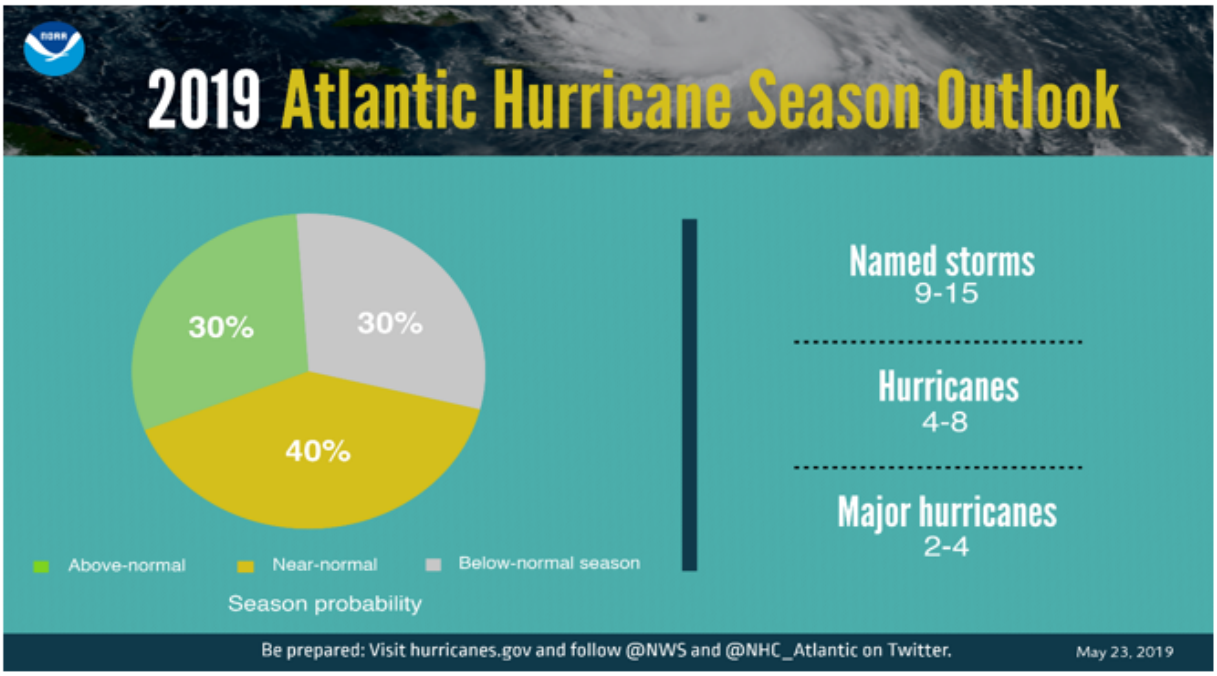


Figure 1: A graphic showing hurricane season probability and numbers of named storms. (NOAA)

"With the 2019 hurricane season upon us, NOAA is leveraging cutting-edge tools to help secure Americans against the threat posed by hurricanes and tropical cyclones across both the Atlantic and Pacific," said Secretary of Commerce Wilbur Ross. "Throughout hurricane season, dedicated NOAA staff will remain on alert for any danger to American lives and communities."

This outlook reflects competing climate factors. The ongoing El Nino is expected to persist and suppress the intensity of the hurricane season. Countering El Nino is the expected combination of warmer-than-average sea-surface temperatures in the tropical Atlantic Ocean and Caribbean Sea, and an enhanced West African monsoon, both of which favor increased hurricane activity.

"New satellite data and other upgrades to products and services from NOAA enable a more Weather-Ready Nation by providing the public and decision makers with the information needed to take action before, during, and after a hurricane," said Neil Jacobs, Ph.D., acting NOAA administrator.

The 2019 hurricane season marks the first time NOAA's fleet of Earth-observing satellites includes three operational next-generation satellites. Unique and valuable data from these satellites feed the hurricane forecast models used by forecasters to help users make critical decisions days in advance.

"2019 Hurricane Season Outlook (continued)"

NOAA's Weather Service is making a planned upgrade to its Global Forecast System (GFS) flagship weather model – often called the American model – early in the 2019 hurricane season. This marks the first major upgrade to the dynamical core of the model in almost 40 years and will improve tropical cyclone track and intensity forecasts. "NOAA is driving towards a community-based development program for future weather and climate modeling to deliver the very best forecasts, by leveraging new investments in research and working with the weather enterprise," added Jacobs.

NOAA's National Hurricane Center and NWS office in San Juan will expand the coastal storm surge watches and warnings in 2019 to include Puerto Rico and the U.S. Virgin Islands. In addition, NHC will display excessive rainfall outlooks on its website, providing greater visibility of one of the most dangerous inland threats from hurricanes.

Also, this season, NOAA's Hurricane Hunter aircraft will collect higher-resolution data from upgraded onboard radar systems. These enhanced observations will be transmitted in near-real time to hurricane specialists at the National Hurricane Center, the Central Pacific Hurricane Center and forecasters at NWS Weather Forecast Offices.

In addition to the Atlantic hurricane season outlook, NOAA also issued seasonal hurricane outlooks for the eastern and central Pacific basins. A 70% chance of an above-normal season is predicted for both the eastern and central Pacific regions. The eastern Pacific outlook calls for a 70% probability of 15 to 22 named storms, of which 8 to 13 are expected to become hurricanes, including 4 to 8 major hurricanes. The central Pacific outlook calls for a 70% probability of 5 to 8 tropical cyclones, which includes tropical depressions, tropical storms, and hurricanes.

NOAA's outlook is for overall seasonal activity and is not a landfall forecast. Hurricane preparedness is critically important for the 2019 hurricane season, just as it is every year. Visit the National Hurricane Center's website at hurricanes.gov throughout the season to stay current on any watches and warnings.

"Preparing ahead of a disaster is the responsibility of all levels of government, the private sector, and the public," said Daniel Kaniewski, Ph.D., FEMA deputy administrator for resilience. "It only takes one event to devastate a community so now is the time to prepare. Do you have cash on hand? Do you have adequate insurance, including flood insurance? Does your family have communication and evacuation plans? Stay tuned to your local news and download the FEMA app to get alerts, and make sure you heed any warnings issued by local officials."

NOAA's Climate Prediction Center will update the 2019 Atlantic seasonal outlook in August just prior to the historical peak of the season.

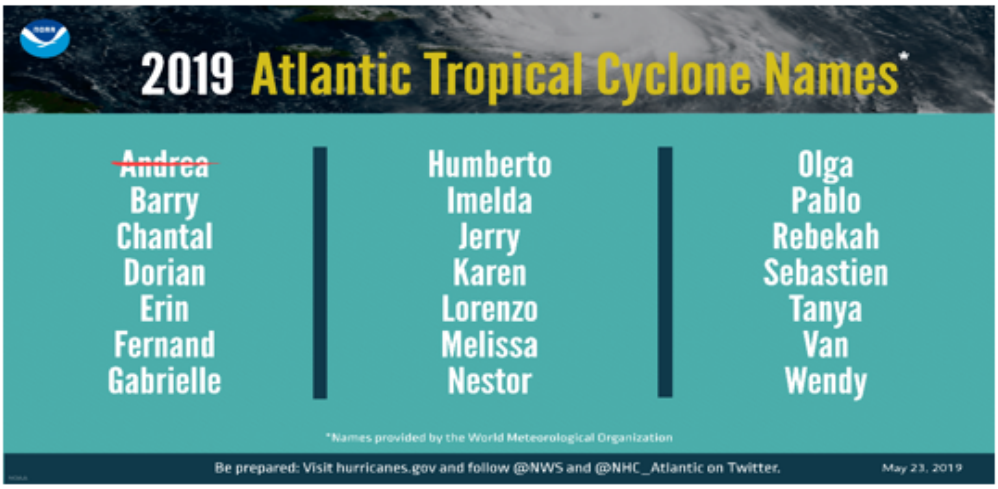


Figure 2: A graphic showing 2019 Atlantic tropical cyclone names selected by the World Meteorological Organization. (NOAA)

CoCoRaHS Observer Training

Importance of CoCoRaHS Observer Daily Reports

By: Greg Story, West Gulf River Forecast Center

I want to thank ALL of you for submitting your rainfall readings to CoCoRaHS during this spring season. They continue to be extremely valuable to us at the National Weather Service. It is critical that we see the magnitude of rainfall events in order to adjust the amounts of rainfall going into our hydrologic flood model. Please continue making your daily weather observations, even when the weather at your site had a low amount of rainfall (or no rainfall). A report of zero rainfall is just as important as a non-zero one!

I would like to share just one occasion where CoCoRaHS observations helped the NWS West Gulf River Forecast Center improve our rainfall estimates. Keep in mind that the first estimate of rainfall we use is radar-based. Radar precipitation estimates do a great job of telling us where it rained, when it started, and when it stopped. However, the estimates themselves can be in considerable error. In fact, the heavier the rainfall rate, the larger the errors in tropical-type rainfall systems. Below is a map of 24-hour rainfall from our NWS rainfall estimating program from June 5, 2019:

Note the excessive rainfall over the middle Texas Gulf coast. My job at the NWS is to determine if these radar-based estimates are too high, too low, or are correct. How do we know? We need an independent set of rain gauge data to confirm these estimates. And that is exactly how your CoCoRaHS observations allow us to do this! The CoCoRaHS reports from that morning are shown below:

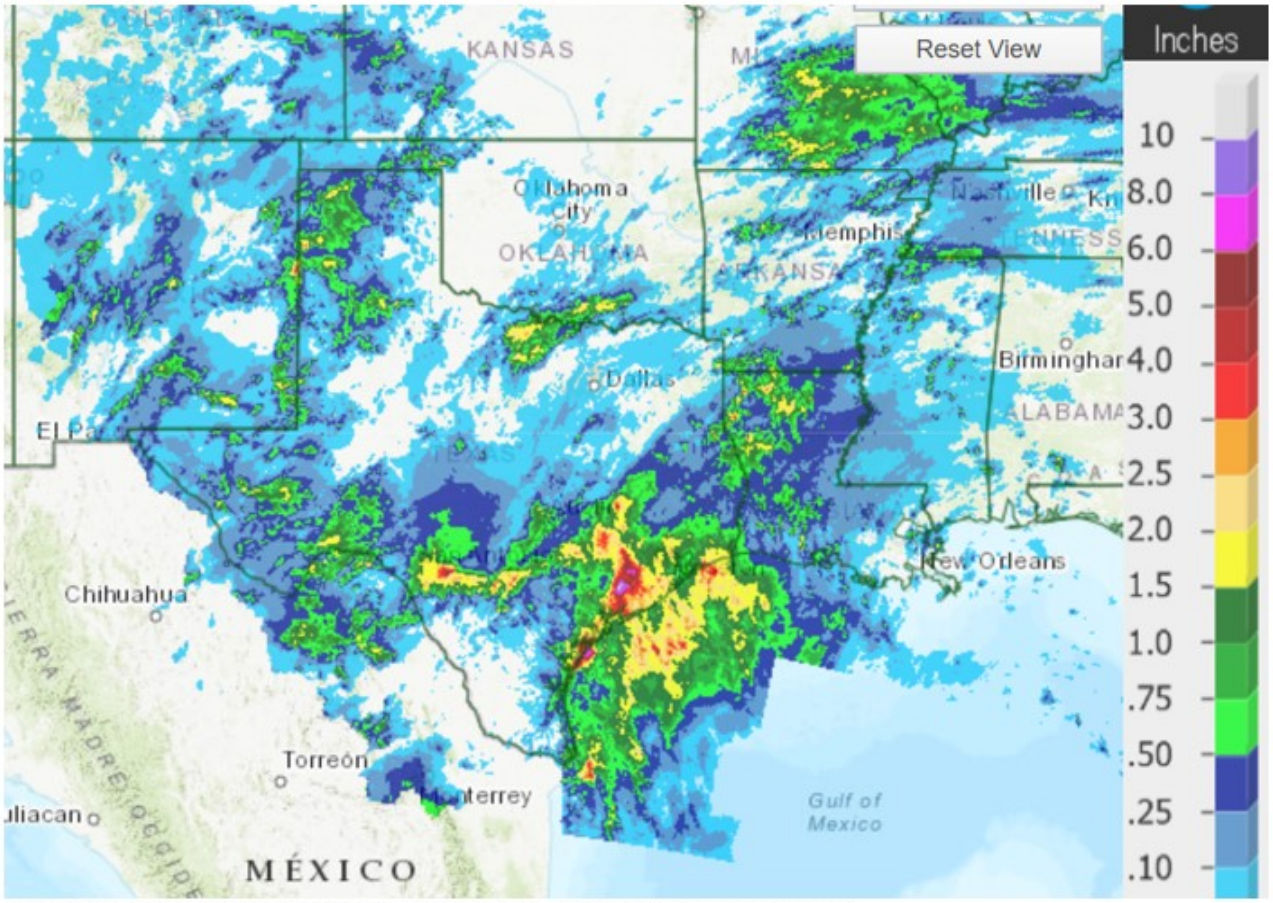


Figure 1: 24 Hour rainfall ending at 7:00am June 5, 2019 for the southern plains.

If you would like to have a speaker give a talk to your group or organization about CoCoRaHS, please send us a request with your group's contact information to e-mail texas@CoCoRaHS.org

"CoCoRaHS Observer Training (continued)"

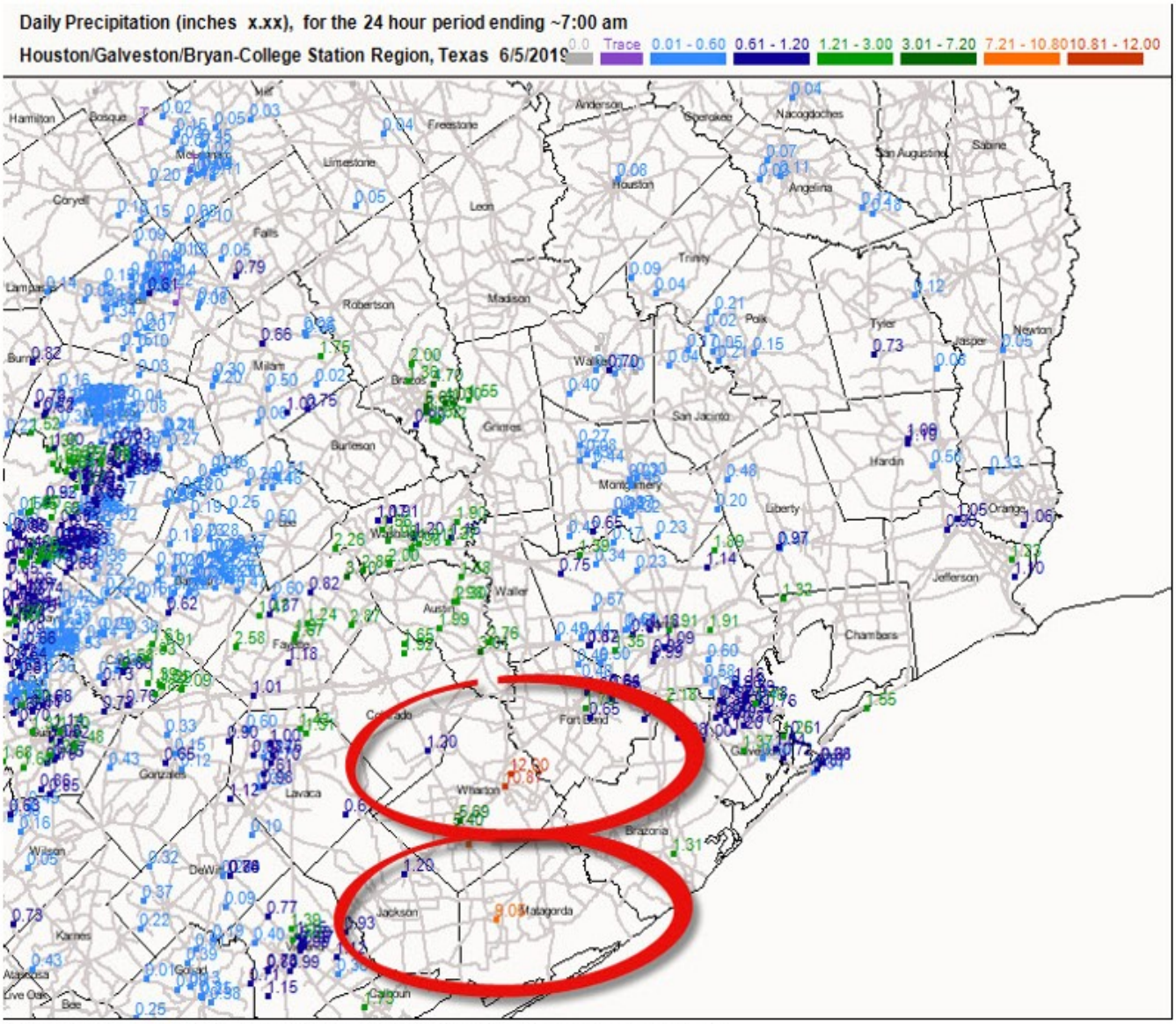


Figure 2: 24 Hour CoCoRaHS rainfall map ending on June 5, 2019 at 7:00am.

Note the 12.00" report at Wharton 3.1 NE, the 11.07" report at East Bernard 7.6 S, and the other 9" reports from Matagorda and Wharton counties. These reports indicated that the initial precipitation estimates at the WGRFC were too low. It allowed us to go back into the precipitation estimation program and increase the amounts of rain in these regions, which were then inserted into our hydrologic model. The end result of our increased rainfall estimates was a forecast of moderate to major flooding on the Tres Palacios and San Bernard Rivers with much better lead time and accuracy.

Your dedication helps us out a lot. Thank YOU so much for your participation in CoCoRaHS. Have a great summer season!

"CoCoRaHS Observer Training (continued)"

Tips & Training Items for Observers

By: H. L. Lovell
CoCoRaHS Texas State Quality Control

1) Now that spring is moving into summer I have seen a few smaller reports in some areas compared to others nearby. After checking over the data it turns out the observers gauges were damaged (cracked or even broken) from hail or maybe even winter freezes.
So it is time for everyone to check their gauges for cracks or leaks. Just fill with water and see if any leaks show up. The leaks can be fixed with super glue or you can buy replacement parts from web sites listed on our main web site.

2) With all of the storms with heavy rain and hail some are tempted to rush home and read your gauge and enter a report... please do not do that! If you would like you can measure the rain and make a note to report along with your normal rain the next morning between 4:30 a.m. and 9:00 a.m. or if there is an unusual amount of rain or flooding. Please enter your heavy rain report on the significant weather form tab and please enter that total along with any other rain that falls in your normal daily report form the next morning at your normal time. Remember that the National Weather Service gets your significant weather reports! (Sorry this is not available on the app yet)

3) Also consider entering a Hail report as soon as you get any hail no matter how small the hail, even pea sized hail! All reports can be entered from your main reporting page!

4) When entering any report, especially your multi-day observation, please be sure to enter your decimal point. I see reports almost daily from around the nation such as 8.00" entered when the report should be .08" or even 0.00" when the 8 was entered by accident on a zero report. Make it a habit of looking at your report after you enter it. When you enter your report via the app you will be given your last several reports so double check your information to make sure your reports are correct. And when you enter your report via the web site you will be given your last week's reports, please make a mental note to check to make sure your report is correct. It will only take a second to look!

5) Please check your gauge each and every day. If you do not, you may have rain while you are gone and not know about it. Then one morning you may have a light rain and check it and report a large amount that reflects a total from the last time you really checked your gauge to that morning. And it could be a sizable amount. I see this all the time and it can be confusing to you (when we contact you and ask you why your total is so much higher than everyone around you). And don't forget if you don't check your gauge every day then please use our Multi-day accumulation tab on the main reporting page and on our App. All are simple to use! (This is on the APP!)

"CoCoRaHS Observer Training (continued)"

6) I had a few people change their times then entered their time as the rain amount. A reminder if you check you gauge daily around your preset time you don't have to change your time. I.e... I check my gauge on the way out at 7:02 a.m. At noon I say oops I forgot to enter my report... I just go in and enter the amount. 0.00" And press enter. No need to change the time as 7:02 a.m. is about the same as 7:00a.m. When we go to changing times we are more prone to make mistakes. Sometimes I leave early say 6:00 a.m. I check my gauge I go in right then and oops... the system will not let me enter my rain at that time without changing the time! Just some things to think about. Be careful when changing the times. Only change if you really need to.

Now we are about to enter the dry months of summer when it is kind of hard to check the CoCoRaHS gauge each and every morning.... Be sure to try to place the gauge where you will see it each and every day. I know that may not be possible for some, but for example mine is beside my driveway so I see it every time I pull my car in and out of the driveway. I also have a security camera I can pan and look at it too. Just a reminder on an extended dry spell to check it out!!!

Regards,

H. L. Lovell
CoCoRaHS Texas State Quality Control

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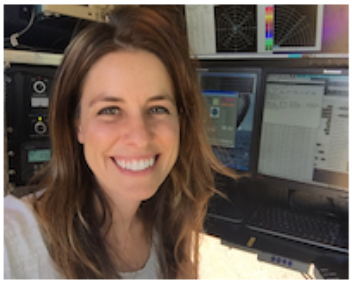
CoCoRaHS Webinars

Webinar #66 - Thursday, October 3, 2019

Dopper On Wheels: Part Two
Karen Kosiba
Center for Severe Weather Research
Boulder, CO



(Biography)

There was so much to cover during our March Webinar regarding the Doppler on Wheels, that we've invited Karen back for a "part two" on this interesting subject. As part of this webinar, Karen will pick up where she left off, with more about tornadoes, hurricanes, winter storms, and other high impact weather from over a decade of field work.

The Doppler on Wheels (DOW) mobile radars have been used, often in tandem with other instrumentation, to study tornado formation and structure, the boundary layer of landfalling hurricanes, the internal structure of lake effect snow bands, the gust front structure of potentially severe-wind producing MCSs, and other mesoscale phenomena. Some key findings include the existence of rear-flank downdraft surges, which may impact tornadogenesis, the existence of strong winds in tornadoes very close to the surface, small scale structures that may impact energy distribution and wind speeds in the near surface hurricane boundary layer, and the existence of misovortices in intense lake-effect snow bands.

Texas CoCoRaHS Observer

The official newsletter of Texas CoCoRaHS

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