



TEXAS CoCoRaHS OBSERVER



Spring 2021

Vol. 7 - 1



Welcome to The Texas CoCoRaHS Observer Newsletter

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

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Texas Spring Summary 2021

John Nielsen-Gammon, Texas State Climatologist

Figure from the PRISM group, Oregon State University, generated using SC-ACIS

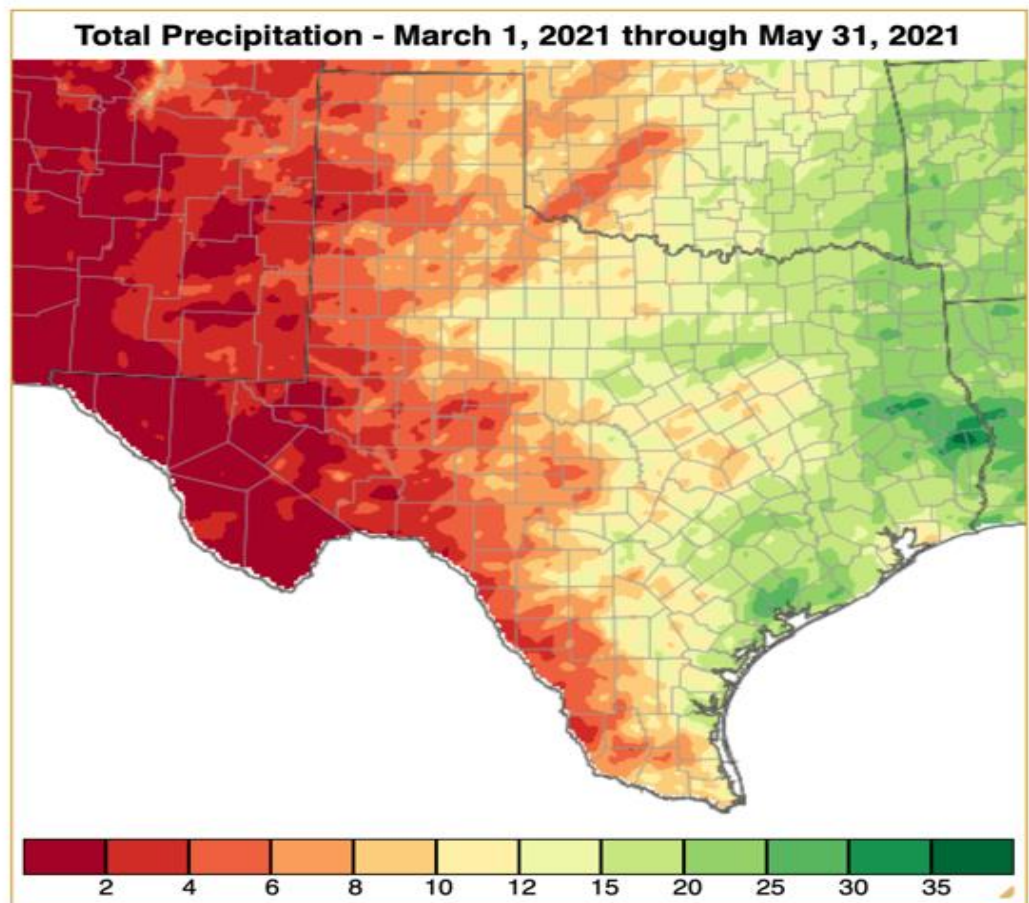


Figure 1: Texas Spring Precipitation across the state for 2021.

It was a fairly wet spring across most of Texas. On the whole, drought, which had been spreading dramatically across Texas in much of the spring, went into full-scale retreat during May, except for most of the Trans Pecos region. Some parts of East Texas received more than thirty inches, which is well over double the normal amount in those areas.

Continued page 2 >

“Because Every Drop Counts, As Do All Zeros”

Texas Spring Summary (continued)

Is that a new normal? You often hear that phrase in the context of climate change. But in this case, good old-fashioned climatology says yes! You see, every decade, what's normal gets recalculated based on what happened during the previous three decades. In case you haven't heard, it's now the year 2021, which means that a complete three-decade period, 1991-2020, is now in the record books and it's time to calculate the new climate normals.

Too late, they're already done. The National Centers for Environmental Information (NCEI) released the updated climate normals in early May. A lot of the news coverage was focused on how the new normals were different from the old normals from 1981-2010. Understandable, I guess. If the normals were the same, there wouldn't be a news story.

There are two basic reasons for the new normals to be different from the old normals. First, obviously both normals share the years from 1991 through 2010. So if the weather in 1981-1990 (used in the old normals) was different from the weather in 2011-2020 (used in the new normals), the new normals will be different from the old normals. Some people like to use that as an indication of climate change, but frankly, comparing the average temperature in two random decades a few years apart is a poor way to measure climate change. We have lots better ways of doing that.

The second reason is more technical. The basic idea of climate normals is to tell us what to expect. As Robert Heinlein once wrote, "Climate is what you expect, weather is what you get." Well, "expect" in this context means expect at a particular weather station. If something about the station, like the location, the exposure, or the instrument itself, is different now than it was in 2010, then what you'd expect the instrument to record might be different than what would have been expected in 2010, even if the climate wasn't changing. So a change in the climate normals at a station may reflect a change in the climate or a change in the station, or both.

Some of you folks have been observing precipitation for a long time. Maybe you even feel like climate observers. Guess what, the NCEI thinks so, too. For CoCoRaHS stations with sufficiently complete information over at least ten years, they actually calculated the climate normals. There are now official climate normals based exclusively on CoCoRaHS observations at 45 Texas CoCoRaHS stations. Congratulations! That's the second largest total of any state in the country. The only state with more observers sufficiently reliable over a long enough period of time is Colorado, where CoCoRaHS started. So yeah, they had a head start. Lots of other stations, with shorter periods of data, have had normals estimated for them, but these 45 are the only ones with normals based primarily on their own data.

CoCoRaHS Normals stations are distributed across the entire state, from El Paso County to Collin County to Cameron County. The top county by far, with five CoCoRaHS Normals stations, is Kendall County. I'm looking at the official normals for one of those stations right now: 35.39" annual precipitation, with a maximum of 5.25" in May. That station actually received 10.48" of precipitation in May. What do you know, officially 198% of normal!

Great job, long-term CoCoRaHS observers! You're truly adding to the official climate records for Texas.

Austin/San Antonio Regional Summary

An Active Spring Decimates Drought; Brings Minor Flooding and Lots of Hail

By: Keith White, Meteorologist – NWS WFO Austin/San Antonio

After the most impactful winter in memory this February, meteorological spring began about as expected for a year in which we came off the heels of a moderate La Niña event. The month of March and the first half of April were relatively quiet for most of the region, and were drier and warmer than normal across south-central Texas. The most notable weather events in March were on the evenings of the 22nd and 24th when scattered showers and thunderstorms impacted primarily northern and eastern portions of the region. Several of these storms were severe, with the first tornado of 2021 confirmed at Canyon Lake on the 22nd. Several storms also produced large to very large hail that impacted parts of the Hill Country and I-35 Corridor during this period, including one CoCoRaHS report of 3" hail in Burnet County. This was only the beginning of a spring full of very large hail events (Table 1).

Date	Hail Size	Locations Impacted
3/22 - 3/23	2-3'	Burnet County (2.5-3"), Leakey (3"), 7 NNE New Braunfels
3/24 - 3/25	2"	Edwards/Real counties + Northeast Austin
4/12	3"	7 W Llano
4/15	2-2.75"	Burnet, South Williamson, North Travis counties
4/28	2-3"	Del Rio, Brackettville, Uvalde County, San Marcos
4/28 (cont'd)	4-6.4"	Medina County (largest near Hondo)
5/3	2-2.75"	Boerne (2.75"), Lakehills (2"), New Berlin (2")
5/3 (cont'd)	3-5.5"	Bexar County (up to 3" reports in San Antonio and 4-5.5" in China Grove Area)
5/9	3"	2 WSW Willow City (Gillespie County)

Table 1: Hail events with confirmed Very Large Hail (diameter ≥ 2 ")

Conditions across the region quieted down for the remainder of March and beginning of April. A single, powerful supercell moved into western Llano County on the evening of the 12th and produced hail up to 3" in diameter just west of the city of Llano, then that storm quickly fizzled out as it moved across the county, before even reaching Burnet. Just a few days later on the 15th, however, yet another very strong storm developed just to the west of Burnet and quickly strengthened, with hail of 2-2.75" reported from Burnet all the way across northern portions of the Austin Metro area before the storm finally began to weaken between Pflugerville and Elgin.

Another quiet and seasonally cool week followed, but the first hints at a pattern change arrived on April 23rd with the first heavy rainfall event of the season for locations north of I-10 and east of I-35 between eastern Bexar and southern Lee Counties. Many areas in Bastrop and Caldwell counties reported 3-4.5" of rain. The rest of south-central Texas had continued to see drought status worsen and expand through the spring (Figure 1), but relief (and a little too much of it!) would be on the way soon.

Austin/San Antonio Regional Summary (continued)

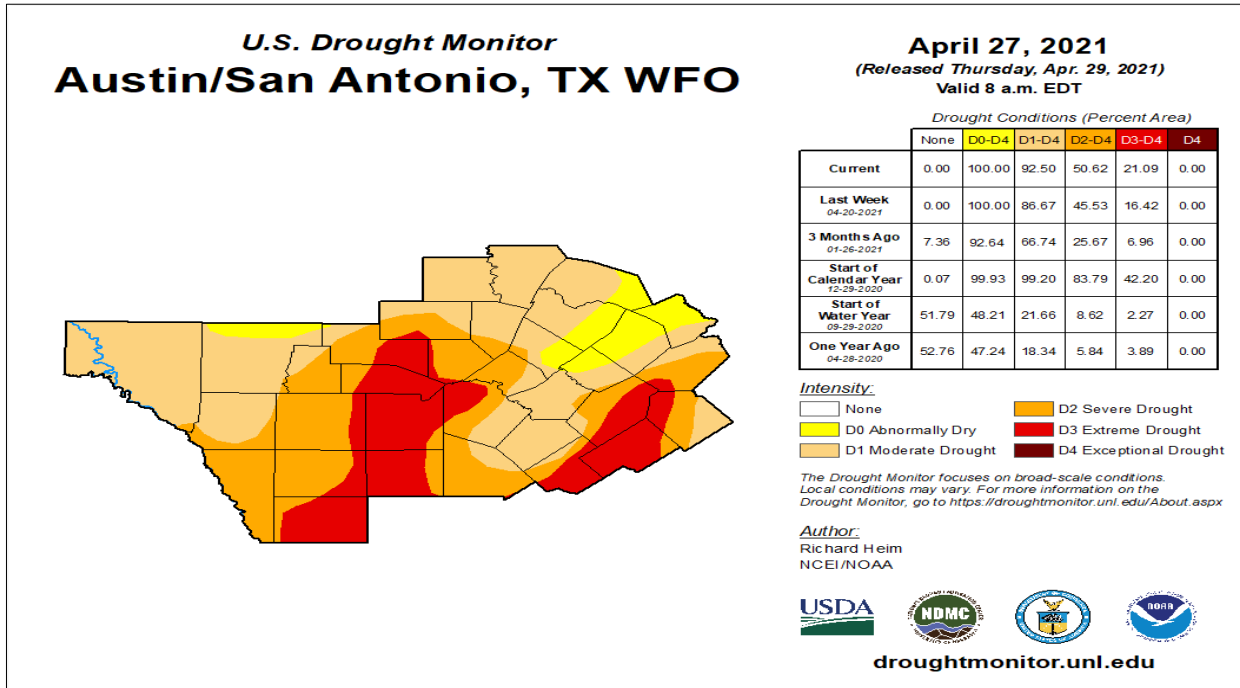


Figure 1: U.S. Drought Monitor valid April 27th.

On the evening of April 28th, storms initially developed across our western counties and produced 2-3" hail near Del Rio and Laughlin AFB. This storm continued eastward across Kinney and Uvalde counties, producing sporadic very large hail, but it continued to strengthen as it moved across Medina County. It produced straight line wind damage with wind estimates potentially topping 100 mph, a brief tornado, and, around the same time, a hailstone that was later measured to be 6.4" in diameter! This stone is now being considered for a potential state record (Figure 2). As if we needed another indicator of just how impressive this storm was, cloud-to-ground lightning was observed nearly 70 miles away in northern Hays County around this time. It then slowed as it moved into the San Antonio area and much-needed rainfall amounts of 3-6" fell on western and northwestern portions of the city which led to some flash flooding. It then took a jog to the northeast, and briefly produced 2" hail one last time over San Marcos before finally dissipating.

Hondo, TX Hailstone - April 28th, 2021

Measured 6.4 Inches in Diameter and 1.26 Pounds in Weight

Radar Imagery of Supercell that Produced the Giant Hail



Hailstone Just After it Was Found in Hondo



Insurance Institute for Business & Home Safety Scanning & Measuring the Hailstone



The 6.4 inch diameter measurement will be presented to a State Climate Extreme Committee in the coming weeks, who will be tasked to verify and determine what, if any, records were broken.



NWSSanAntonio



weather.gov/ewx

Figure 2: A 6.4" hailstone fell near Hondo, Texas on the evening of April 28th. There has not been a determination at this time as to whether the hailstone set a state record.

Austin/San Antonio Regional Summary (continued)

As the parent system responsible for this event stalled, we were left with a few days of continued beneficial rainfall through May 1st, thankfully sans severe weather. Areas along and east of I-35 got a good soaking on April 30th with as much as 4-6" of rain across some areas of the Coastal Plains. On May 1st, the focus for heavier rain shifted to the Hill Country. But nearly everyone got at least some rain that week and a large chunk of the area saw more than 3" (Figure 3).

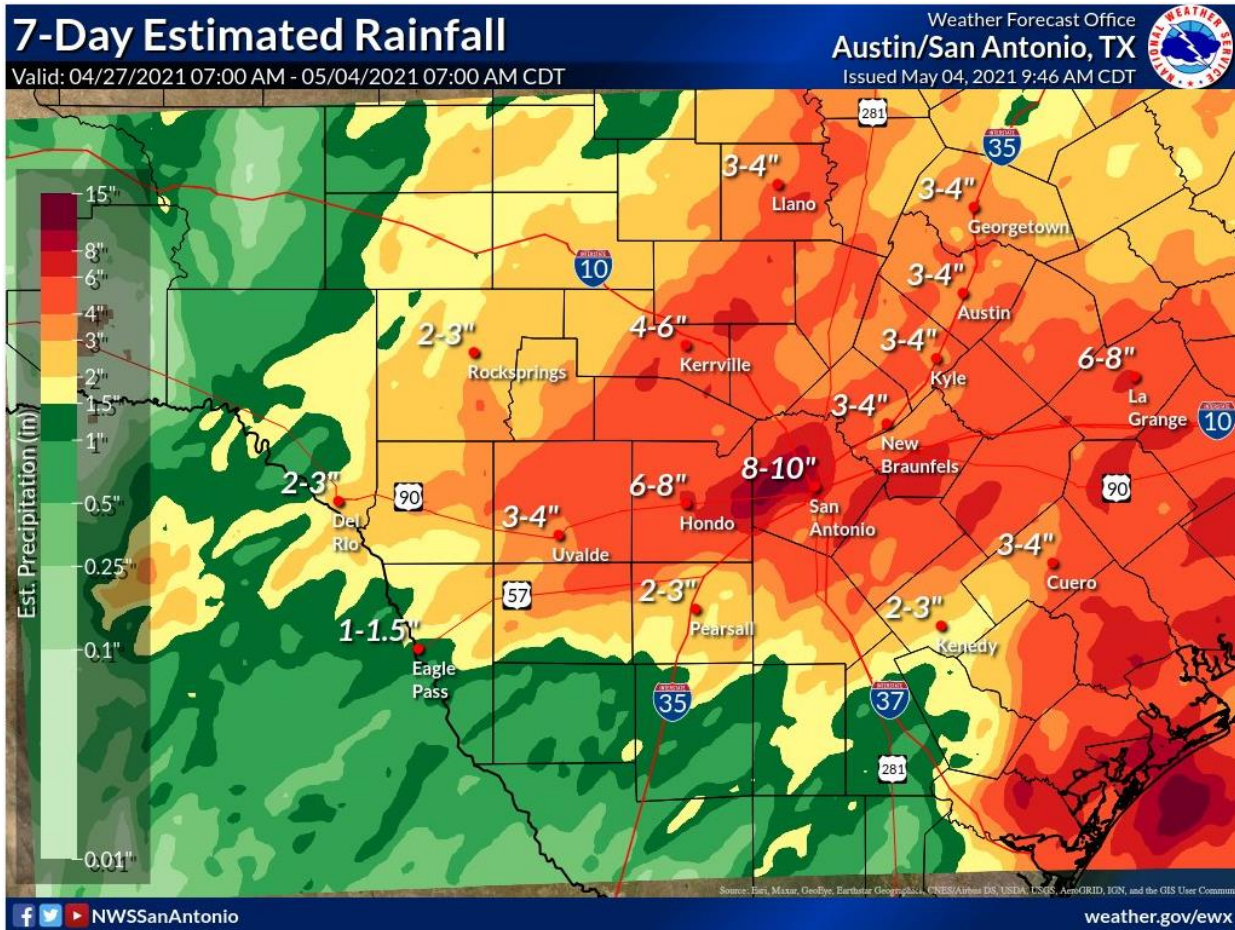


Figure 3: Seven Day rainfall totals April 27th-May 3rd.

Yet another significant hail event followed on May 3rd, this time right across the San Antonio area with hail as large as 5.5" reported near China Grove! Then on May 9th, we had one last hurrah on the hail front with a storm near Willow City in Gillespie County dropping 2.5" hail. In all, over 75 hail reports were received by NWS Austin/San Antonio this spring from CoCoRaHS observers alone! This valuable data helps our warning program in real time as well as our verification program after-the-fact.

Rainfall deficits remained across much of the region. But the wet pattern continued across the area through the rest of May. Notably, on May 18th strong storms produced two EF1 tornados in Lavaca and Fayette counties as well as 3-6+" of additional rainfall. As we headed into the following weekend, a weak tropical low developed over the gulf and brought even more rain to the eastern half of our region, with some flood/flash flood issues primarily across the Coastal Plains due to the unrelenting rain. Additional rounds of widespread showers and storms followed on the 28th, including more localized flooding as well as severe weather with damaging wind gusts impacting both Austin and northern portions of San Antonio. San Antonio International Airport recorded a 77 mph wind gust, the highest at the site in over 75 years. There were still more showers and storms, some producing locally heavy rainfall, on the 30th as well as late on the 31st.

Austin/San Antonio Regional Summary (continued)

In all, much of our Coastal Plains counties as well as portions of Bexar and Travis received 15-20" of rain this spring, with 9 CoCoRaHS observers reporting more than 20" across Fayette County and one each in Bastrop and Lavaca Counties by the morning of June 1st. Rainfall amounts near the Rio Grande were much less impressive, generally in the 2-5" range, but these areas only average 4-6" of rain in the spring anyway. As we enter meteorological summer, drought status has all but disappeared, with only 7% of the area now under Moderate Drought (D1) status per the U.S. Drought Monitor, stretching from near Del Rio South along the Rio Grande and encompassing all of Dimmit County (Figure 4). In terms of seasonal average temperatures, much of the Hill Country, Austin metro, and Coastal Plains finished the spring near to slightly below 30-year normals while locations along the Rio Grande and across the Winter Garden region into the San Antonio area averaged out to above normal.

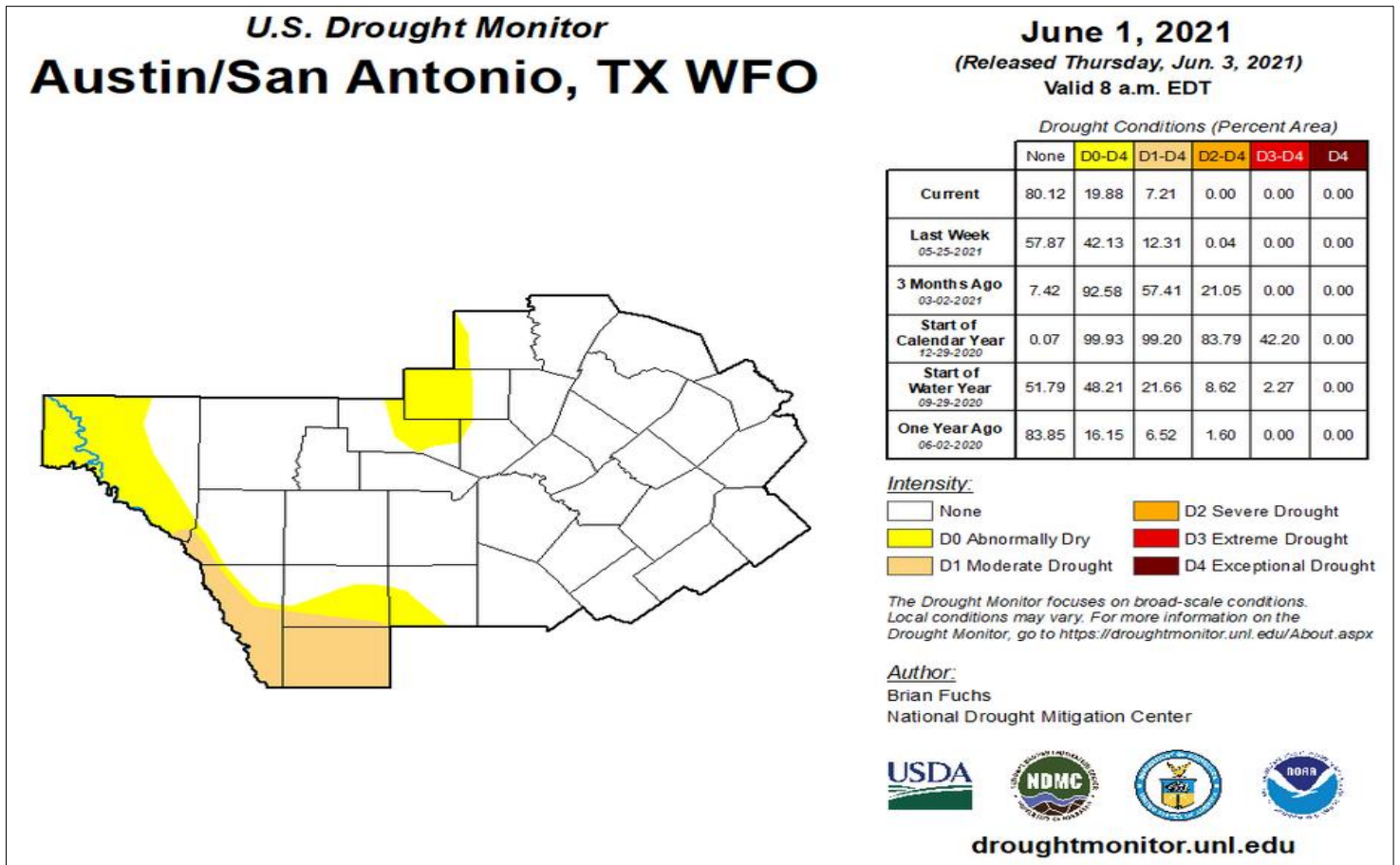


Figure 4: U.S. Drought Monitor valid June 1st.

Corpus Christi Regional Summary

A Dry Start to Spring Ended with Flooding Rains

By: Juan Carlos Pena Jr., Meteorologist - NWS Corpus Christi

Other than a few days with spotty rainfall, March was a dry month across South Texas with most of the rainfall occurring across the Coastal Bend and Victoria Crossroads. Most of the rain occurred at the beginning of the month as a cold front swept across the area. Observers across Calhoun and Refugio Counties reported as much as 1.5" of rain while observers in across the rest of Coastal Bend and Coastal Plains reported near 0.25" of rain. Apart from spotty showers associated with cold front throughout the middle of the month, the next shot of rain occurred at the end of the month as the last cold front of the month swept across the area. The majority of all observers reported minimal rainfall, however, the big winners were across northern Webb County along with Nueces and San Patricio Counties. Observers across those counties reported amount of 1 to 2" of rain. Despite the two shots of rain, March was dryer than normal with all locations reported with 1 to 2" below normal rainfall.

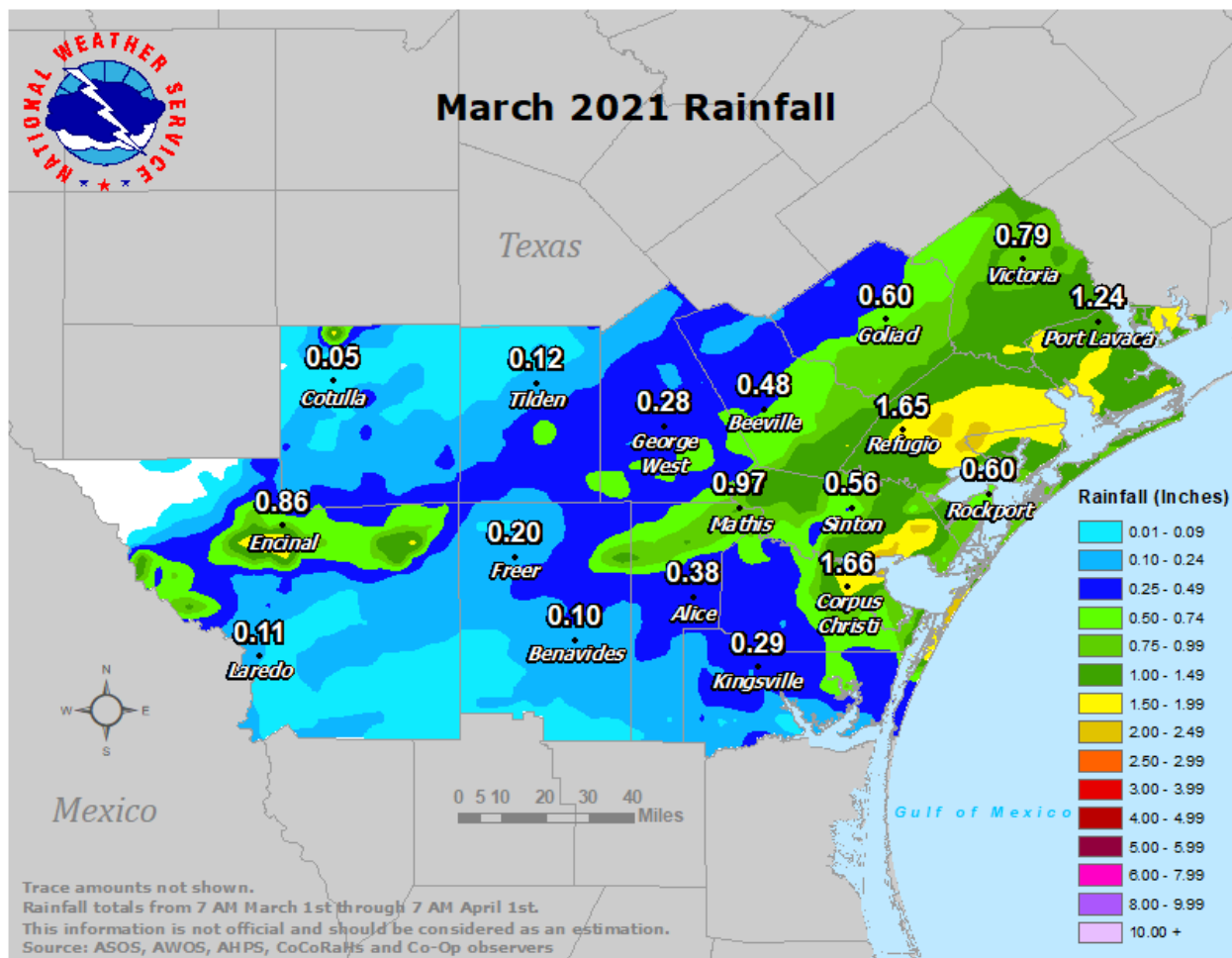


Figure 1: March preliminary precipitation totals for South Texas.

Corpus Christi Regional Summary (continued)

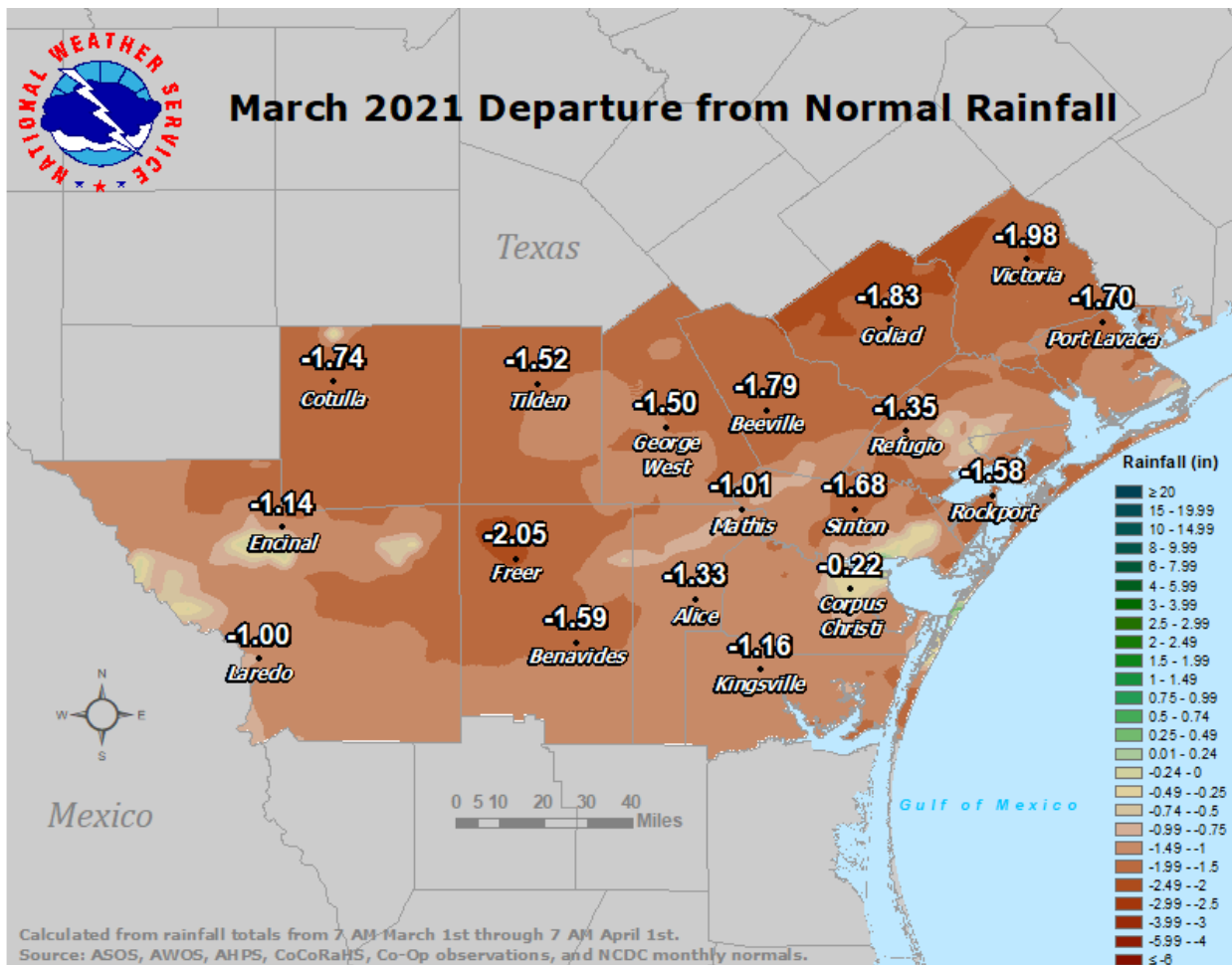


Figure 2: March preliminary departure from normal rainfall for South Texas.

The month of April was dry for the majority of the month. There were a couple of disturbances that resulted in rain across South Texas, however, the bulk of the activity came at the end of the month. The first disturbance occurred at the beginning of the month with average rainfall amounts of 0.10" with only a couple of observers reporting 0.25" of rain. During the middle of the month, a few mid-level disturbances and a couple of fronts impacted South Texas. These disturbances lead limited rain activity, with the most of the rain occurring in Kleberg County. Observers in Kleberg reported between 1 to 2" of rain while all other observers only reported up to 0.50" of rain. A few isolated observers across Webb, Duval, Jim Wells and Victoria Counties did report accumulations just north of 1". The main rain event in April started April 29th and continued into May. With deep moisture, an approaching mid-level disturbance and a warm front, this setup led to numerous showers and thunderstorms across the area. Across the coastal counties, observers reported between 2 to 6" of rain with a couple observers reporting up to 7" as much of the rain stayed near the coast. Despite some impressive accumulations near the coast, observers across the Brush Country and Rio Grande only reported accumulations between 0.5 to 1" with isolated amounts up to 2".

Corpus Christi Regional Summary (continued)

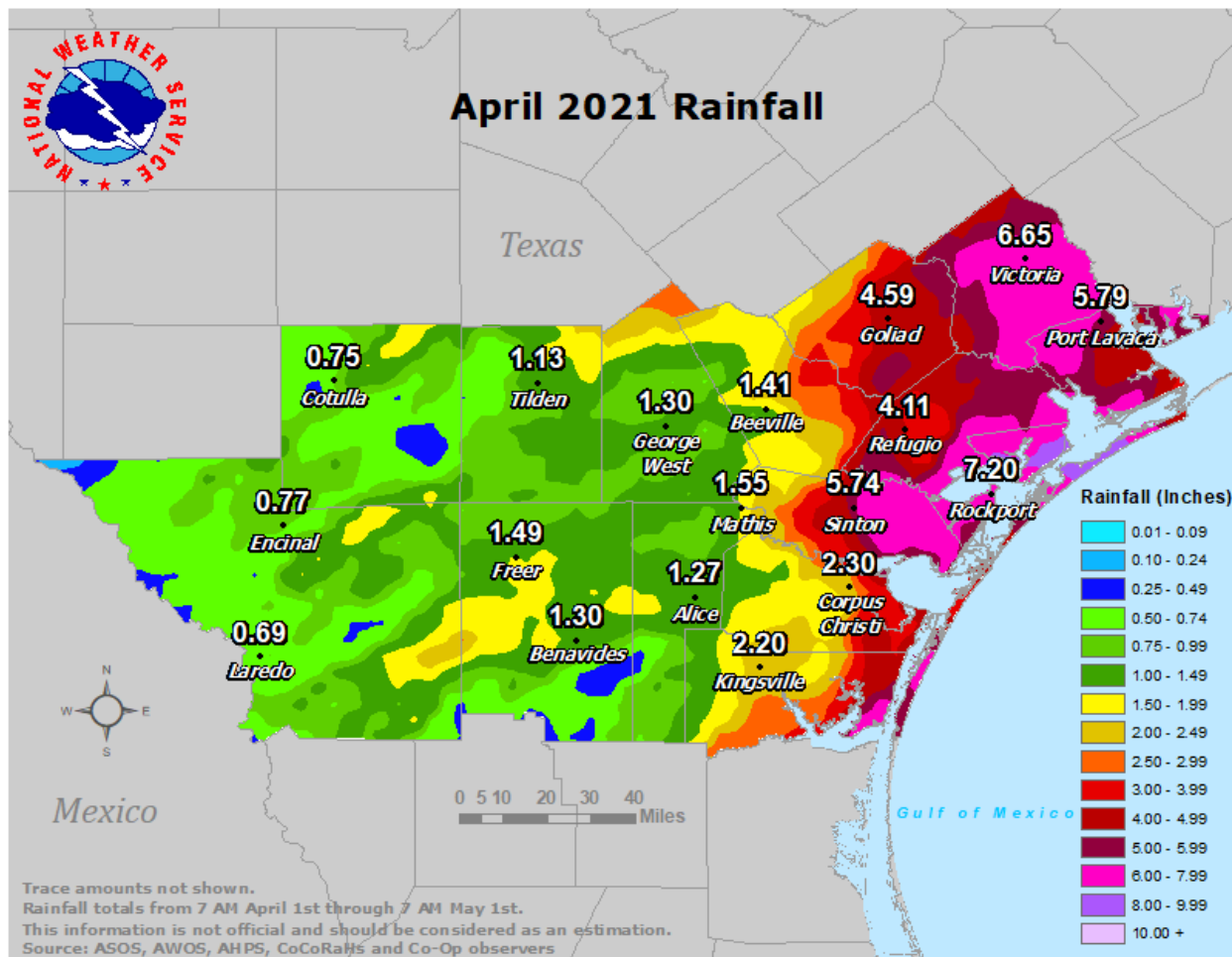


Figure 3: April preliminary precipitation totals for South Texas.

Multiple heavy rain events occurred during the month of May, enough so that the Coastal Bend and northern Brush Country are no longer in drought with other areas improving significantly. The much-needed beneficial rain fell throughout the first three weeks of May. The first rain event was remanence of the late April event, the second rain maker involved another approaching front and mid-level disturbance from May 10th to May 11th. The majority of the activity from this event originated out west across northeastern Mexico and moved east across South Texas. Some of these storms did become strong too severe with gusty winds and hail. The majority of observers reported between 1 to 2" of rain while couple isolated observers reported close to 4". The next, and most significant rain event occurred during a 5-day period with the storms occurring on back-to-back days. A slow-moving mid-level trough along with an abundance of moisture due to onshore flow and daytime heating were the main driving factors. After this event, observers across La Salle and Webb Counties reported 1 to 3" of rain while the rest of South Texas reported 4 to 8", with some observers across Calhoun, Victoria, Aransas, Refugio and Kleberg Counties reporting up to 10 to 12" of rain. It was with this rain event that the greatest improvements with the drought conditions. A few areas of South Texas were affected by Flash Flooding and took a few days to dry out. This rain event and the associated flooding was significant enough that a story map was made about the contributors to the event as well as the result, including images of flooding across several cities in South Texas.

Corpus Christi Regional Summary (continued)

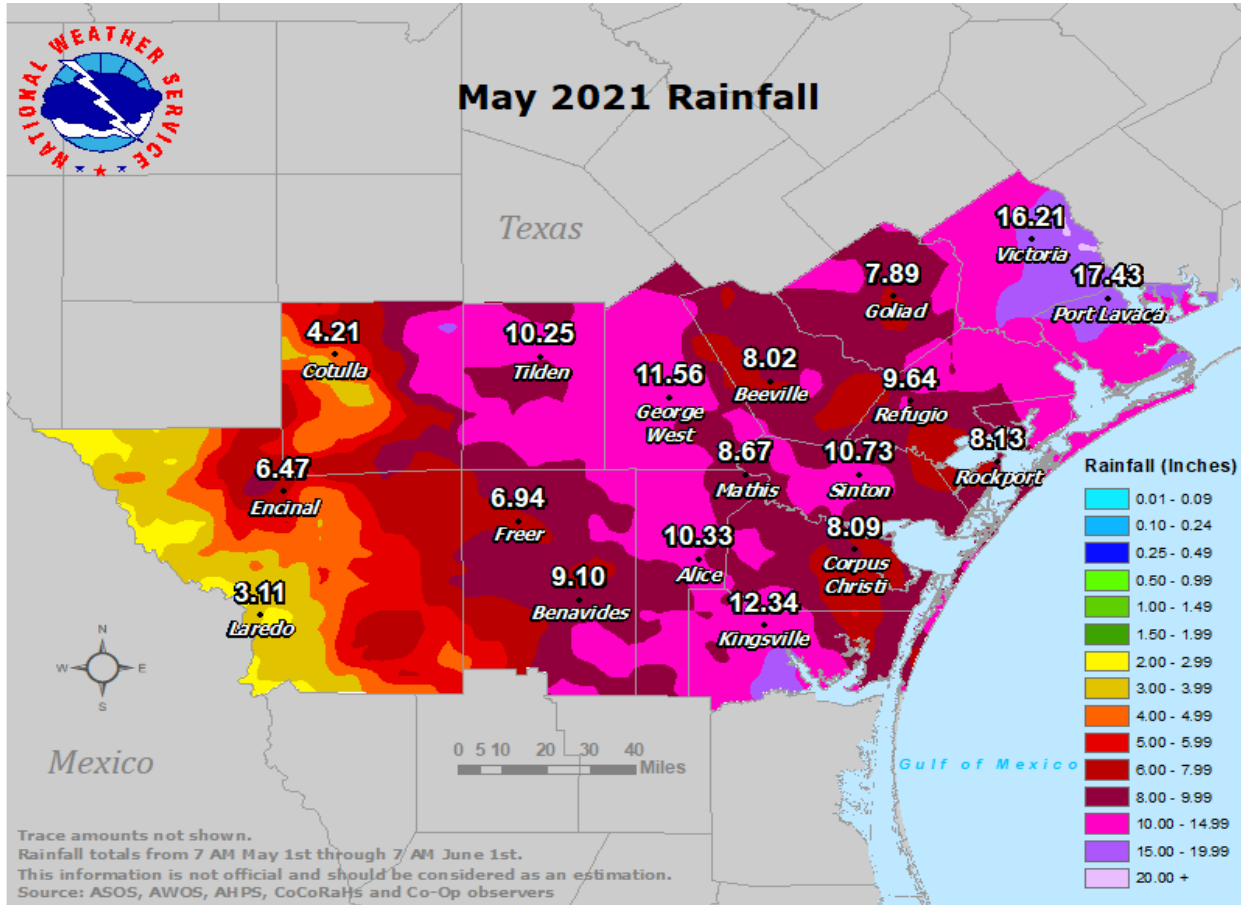


Figure 4: May preliminary precipitation totals for South Texas.

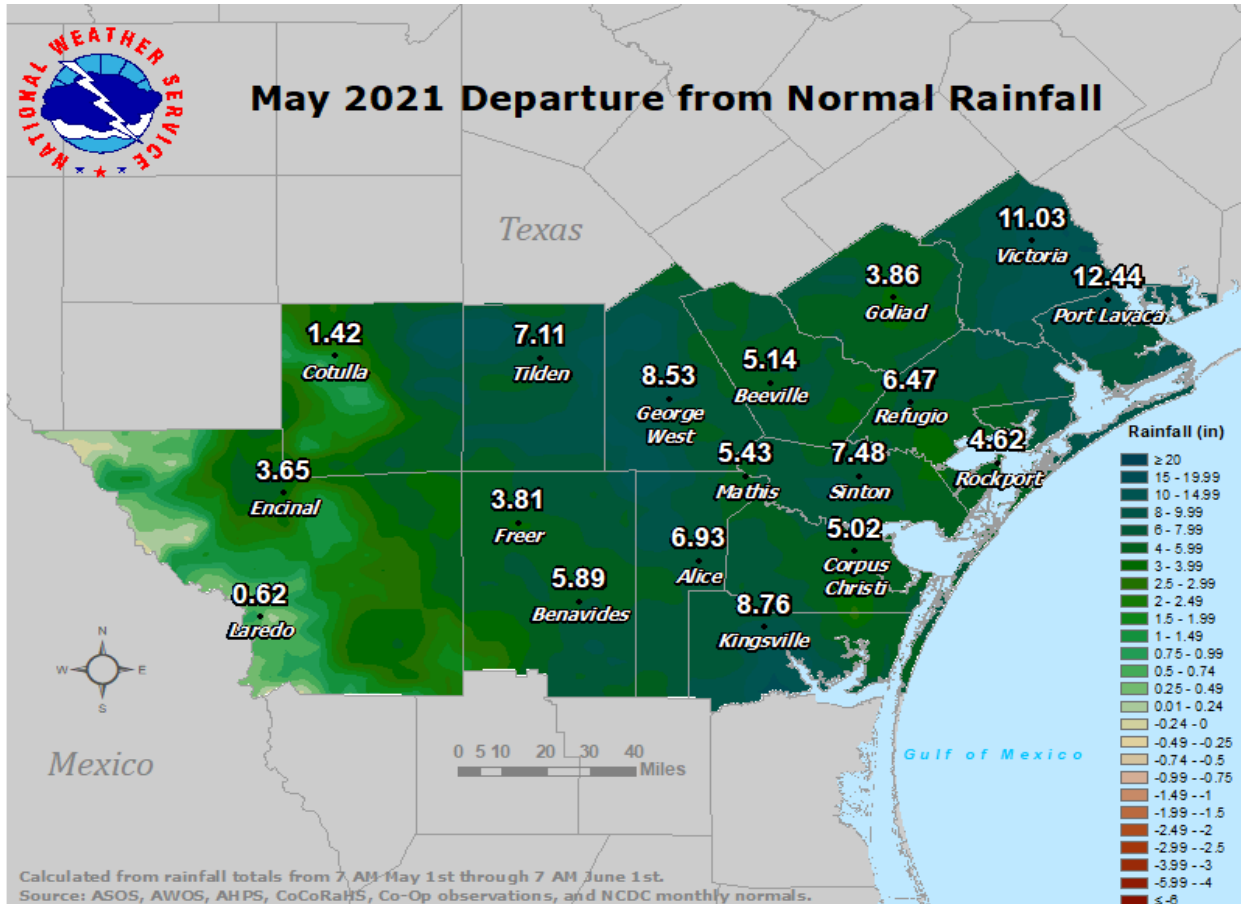


Figure 5: May preliminary departure from normal rainfall for South Texas.

Far West Texas Regional Summary

Springtime Dust and the Importance of Reporting Zeroes

By: Connor Dennhardt, Meteorologist - National Weather Service El Paso

Spring time in far west Texas is usually a dry and windy season as low-pressure systems shift north with the warming temperatures, leaving the U.S. southwest in a dry and very windy pattern. The 2021 spring season was no different. Precipitation amounts were mostly limited to the mountainous terrain of southern New Mexico, but a few days of rainfall did occur in El Paso, TX. Multiple high wind days occurred, bringing blowing dust to the desert floors and wildfires to the mountainous terrain of New Mexico. The windiest day this year occurred on March 15th, with most of west Texas being covered in blowing dust that afternoon.



Climatologically, the March-May timeframe averages 0.75"-1.00" of precipitation for El Paso and Hudspeth Counties. This springtime average for El Paso International Airport (KELP) is 0.84". This makes up only 9% of the region's annual precipitation. The majority of precipitation in this region falls during the summer monsoon, where winter and spring are typically the drier seasons due to the scarcity of moisture sources. Precipitation chances in spring are typically limited to instances of late-season winter storms and upper lows allowing moisture to flow from Baja California up into the region.

Far West Texas Regional Summary (continued)

Snowfall is extremely rare past February for far west Texas, but El Paso has recorded snowfall as late as early April. In fact, El Paso’s all-time record snow event occurred on April 5th and 6th, 1983 with 16.5” of snow accumulation.

The 2021 spring season featured below normal precipitation in El Paso and Hudspeth counties. The La Nina ENSO pattern experienced last winter has returned to a neutral phase, indicating a slightly more favorable chance at near normal precipitation.

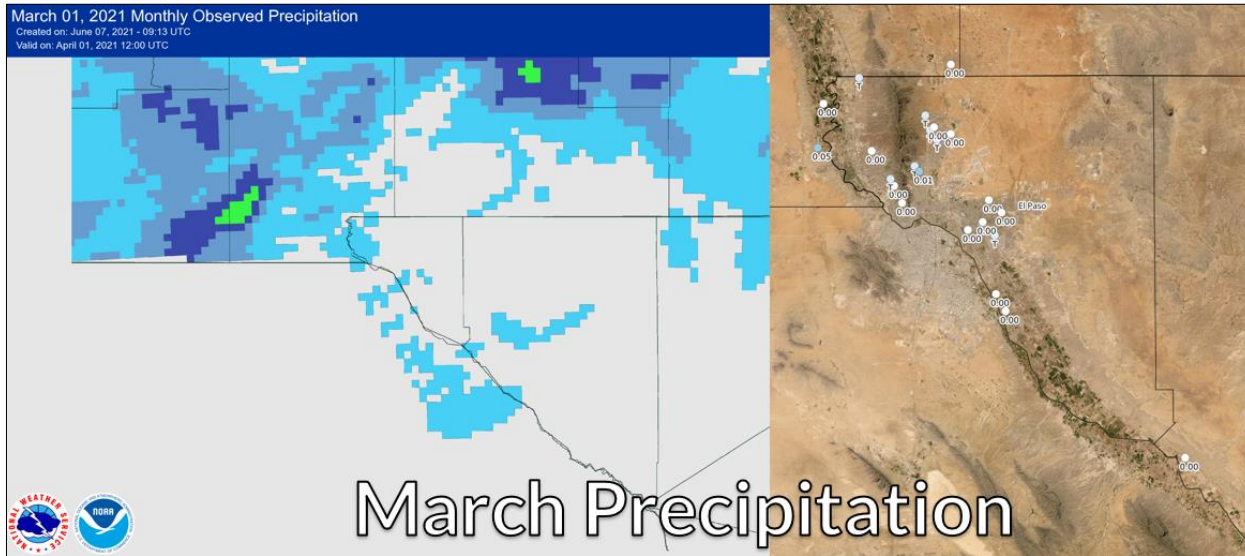


Figure 1: Monthly Observed Precipitation for March 2021 focused on far west Texas

March featured almost no precipitation for the area, with most of our CoCoRaHS observers ending the month with 0.00”. A snowfall event occurred over the New Mexico Mountains on March 22nd, however no rainfall reached the Rio Grande valley. Drought conditions intensified during this month, and our CoCoRaHS observers confirmed the dryness with 585 “zero” observations. These zero reports can be just as vital as any other rainfall amount. Latest information from the U.S. Drought Monitor places most of west Texas in a severe drought, and reporting the special and temporal extents of dry conditions help climate managers better predict trends and understand how drought affects the local environment.

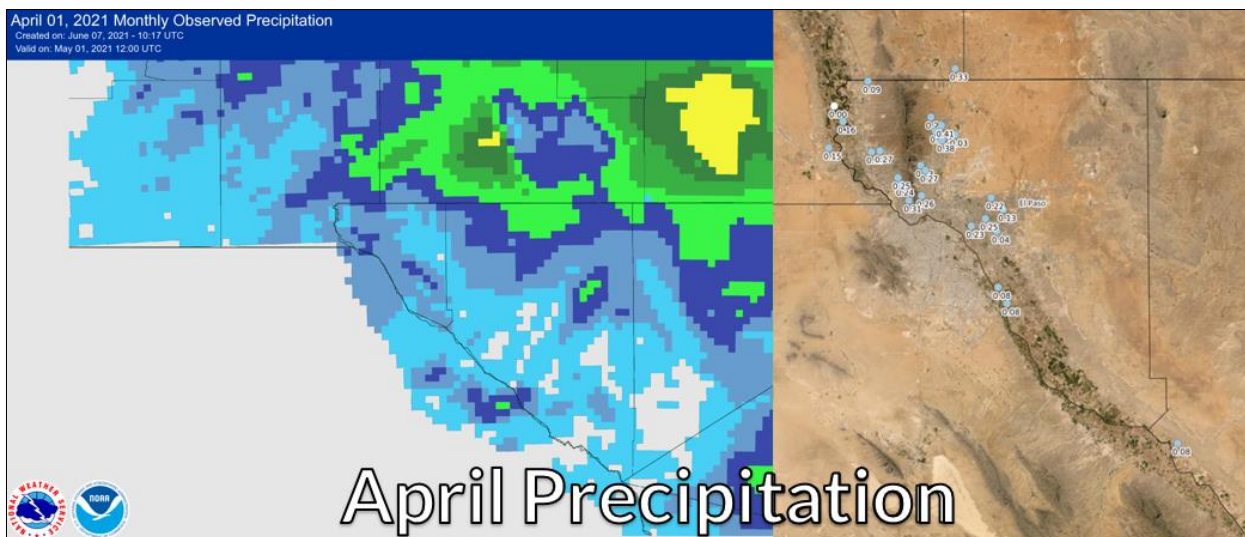


Figure 2: Monthly Observed Precipitation for April 2021 focused on far west Texas

Far West Texas Regional Summary (continued)

The first couple weeks of April were similar to March, very dry. It wasn't until April 29th when a late-season winter storm arrived in the form of an upper low-pressure system directly over the borderland. This event brought 0.10-0.30" of much-needed rain amounts to El Paso and Hudspeth Counties. Snowfall was limited to the higher elevations of southern New Mexico.

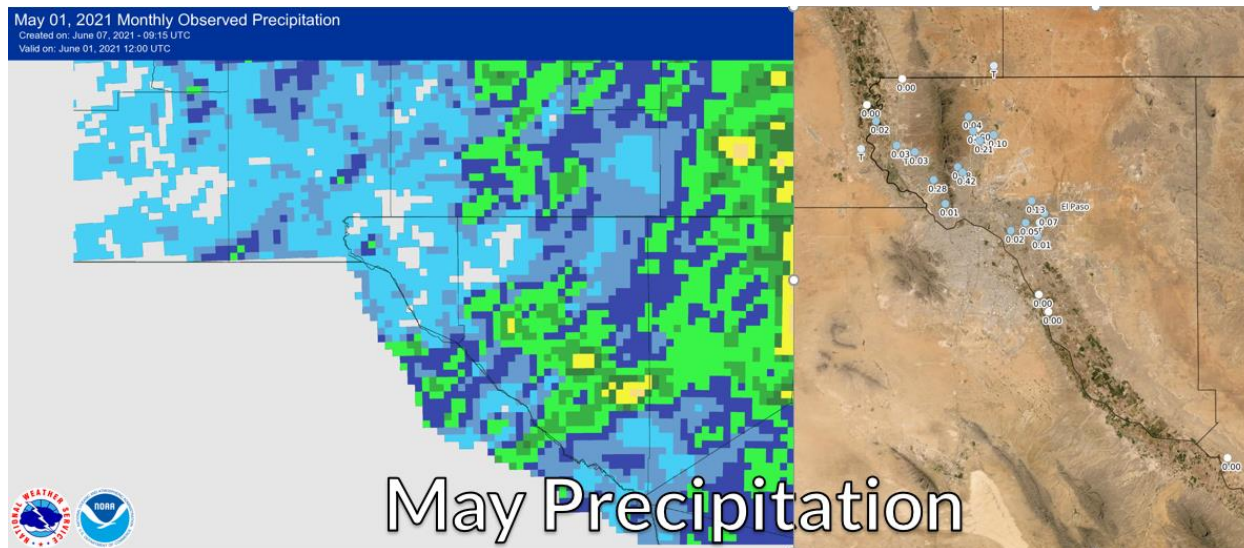


Figure 3: Monthly Observed Precipitation for May 2021 focused on far west Texas

Yet another dry month occurred in May, with only a couple days of measurable precipitation in the area. On May 14th and May 15th, scattered showers and thunderstorms occurred and brought heavy rains to rural portions of central Hudspeth County, along with a few showers along the Rio Grande valley. Rain totals ranged from T-0.50". The heaviest precipitation totals occurred over unpopulated areas. These storms originated in northern Chihuahua, Mexico before moving across the border in the late afternoon hours. Even with added moisture, the primary impacts from these storms were gusty outflow winds and more blowing dust.

The spring season featured 32 active observers in El Paso County, and 2 in Hudspeth County. Despite the dry and quiet season, a total of 1,650 daily reports were submitted, along with 27 multi-day reports. 92% of all reports were 0.00", which is an incredible effort by the CoCoRaHS volunteers of far west Texas to report zeroes. No Significant Weather or Condition Monitoring reports were submitted this season. Thanks again to all our local observers who participated in the 2020-2021 spring season!

East Texas Regional Summary

By: Davyon Hill (Meteorologist-National Weather Service-Shreveport)

Overall, it was a very active weather pattern this spring. Above normal precipitation fell over most of East Texas. This resulted in the region becoming drought free for the start of summer 2021.

Drought Classification

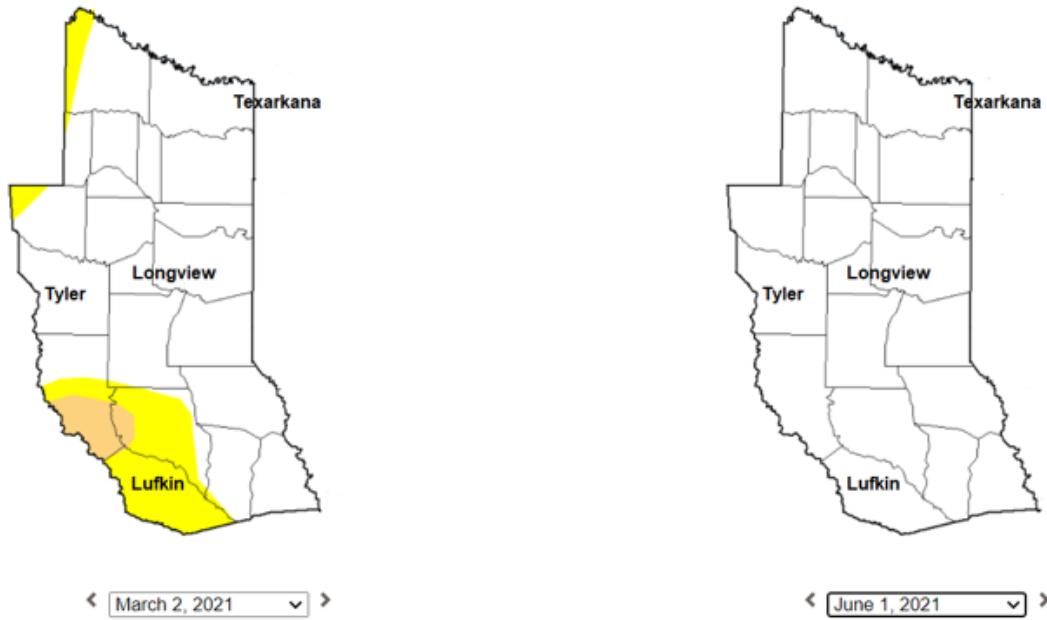


Fig.1: Drought Monitor
Image Courtesy of NDMC/USDA/NOAA

Although March was the driest month of the season, it was still fairly active. A series of troughs and frontal boundaries moved through the region during the month, bringing sufficient rain. Precipitation amounts varied across the region. CoCoRaHS sites across Deep East Texas and across the Tyler area only received 2” to 3”, while sites in Cherokee, Rusk, and Harrison Counties saw totals in the 6” to 7” range. There was also a return in severe weather. Storms brought golf ball size hail on the 17th and 24th to areas of northeast Texas near the Interstate 30 corridor. On the 27th, a supercell produced 3 long track tornadoes that moved through Cherokee, Rusk, and Panola counties. Golf ball size hail was also observed with storm around the Carthage area in Panola County.

East Texas Regional Summary (continued)



**Fig.2: Yantis, TX (Wood County) Hail
March 24, 2021**

Photo Credit: KLTV Viewer - Debbie Tribelhorn Womble



**Fig.3: Tornado between Carthage and Gary City, TX (Panola County)
March 27, 2021 |**

Photo Credit: Darla Townsend

East Texas Regional Summary (continued)

Sufficient rain continued into the month of April. Most of the region saw near normal totals, with the exception of Deep East Texas, where monthly amounts exceeded 10" in some locations. Severe weather also continued during the month, with several reports of golf ball size hail or larger across the entire region on the 9th and quarter to golf ball size on the 13th around the Nacogdoches area. On the final day of the month, a surface low developed along a stall cold front in Deep East Texas. Very heavy rainfall developed across the area, with CoCoRaHS sites in Angelina and Nacogdoches counties reporting amounts ranging from 4" to 6". This resulted in widespread flash flooding and several road closures in the Nacogdoches-Lufkin area.



Fig.4: Large hail near Henderson, TX (Rusk County)

April 9, 2021

Photo Credit: Pammy Gossett

East Texas Regional Summary (continued)



Fig.5: Flooding on FM Road 324 (Angelina County) April 30, 2021 Photo Credit: TXDOT Lufkin

Rainfall amounts continued to increase for the month of May, as several slow-moving troughs and frontal boundaries moved across the region. Record rainfall totals were reported by National Weather Service climate sites on the 9th (Lufkin), 18th (Tyler), and the 26th (Texarkana). In each event, the record rainfall amounts were generally between 3" to 4". For the month, nearly all of the East Texas CoCoRaHS sites reported over 10" of rain, with some sites reporting almost 18". According to National Weather Service climatology, the average rainfall for May across East Texas is generally between 4" to 5". As a result of the heavy rainfall, there were several road closures across the region during the month. Also, many area waterways ended the spring above flood stage.



Fig.6: Flooding on State Highway 87 near Fairmount (Sabine County) May 17, 2021 Photo Credit: Sabine County Reporter

Wichita Falls Regional Summary

Cold and Snow Stole the Show

By: Charles Kuster

CIMMS/NSSL

This spring unfortunately featured several rounds of damaging severe thunderstorms across the region. After a slow start, severe weather picked up during the final week of April when storms produced an EF2 and EF1 tornado south of Vernon and near Lockett (Fig. 1). These tornadoes damaged power poles, outbuildings, and a few homes. Several instances of 3" hail were also reported across the region. Then, only 4 days later, an EF3 tornado caused damage near Truscott. Heavy rain also fell on this day with multiple CoCoRaHS volunteers reporting 2–4" of rain in Wichita County. Several days in May also saw severe weather with the most notable event occurring on May 27th when 2.5" hail was reported near Quanah and 1.5" hail was reported near Sheppard Air Force Base.

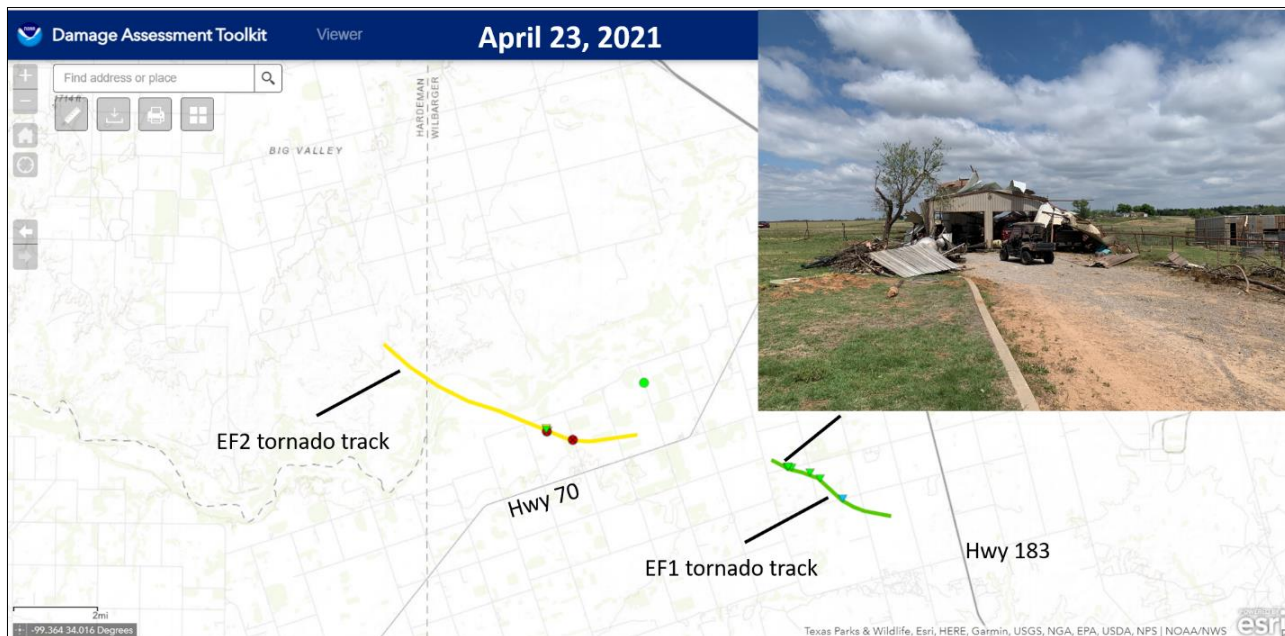


Figure 1. Damage survey of two tornadoes that occurred on April 23, 2021. The colored lines are the tornado tracks. One picture of damage along the EF1 tornado's track is also included. Information available at:

<https://apps.dat.noaa.gov/StormDamage/DamageViewer/>.

While it was a relatively active spring in terms of severe weather, rainfall was quite close to normal with most of the region experiencing slightly above normal rainfall and portions of Hardeman, Foard, and Wilbarger Counties experiencing slightly below normal rainfall (Fig. 2a). Drought conditions have generally improved across much of Texas but there has been little change in the Wichita Falls Region with low-intensity drought persisting across the northwestern quarter of the area (Fig. 3). In total, we experienced 62 dry days (all CoCoRaHS stations reported less than 0.05") and 30 wet days (at least one CoCoRaHS station reported 0.05" or more). For comparison, the region experienced 64 dry days and 28 wet days last spring. Despite being near normal in terms of precipitation, temperatures were generally 1–3 degrees Fahrenheit below normal in part thanks to persistent cloudiness and rainfall (Fig. 2b).

Wichita Falls Regional Summary (continued)

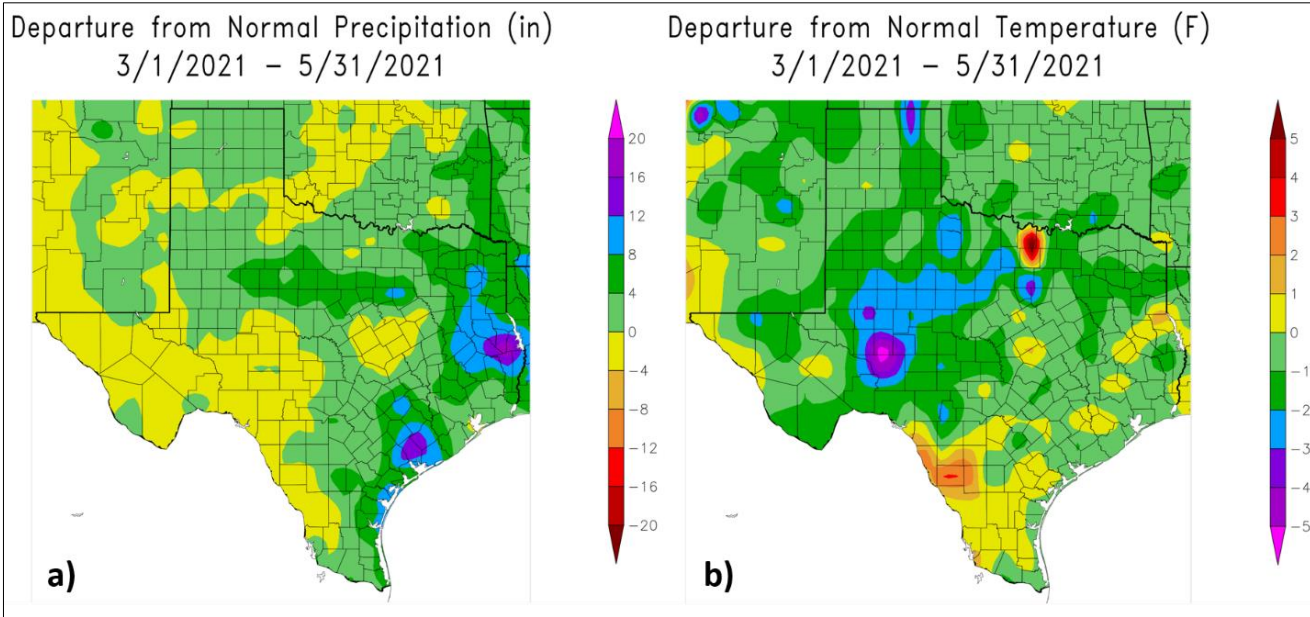


Figure 2. Departure from normal a) precipitation and b) temperature for the beginning of March through the end of May. Warm colors indicate below normal precipitation (a) and above normal temperatures (b), while cool colors indicate above normal precipitation (a) and below normal temperatures (b).

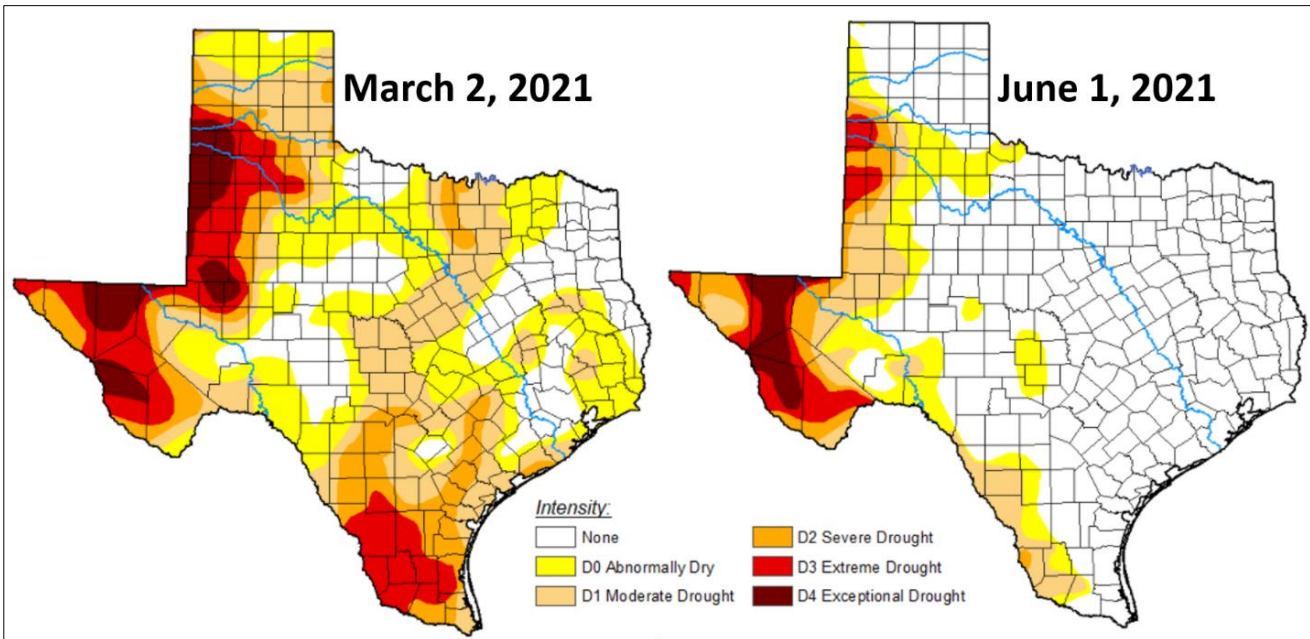


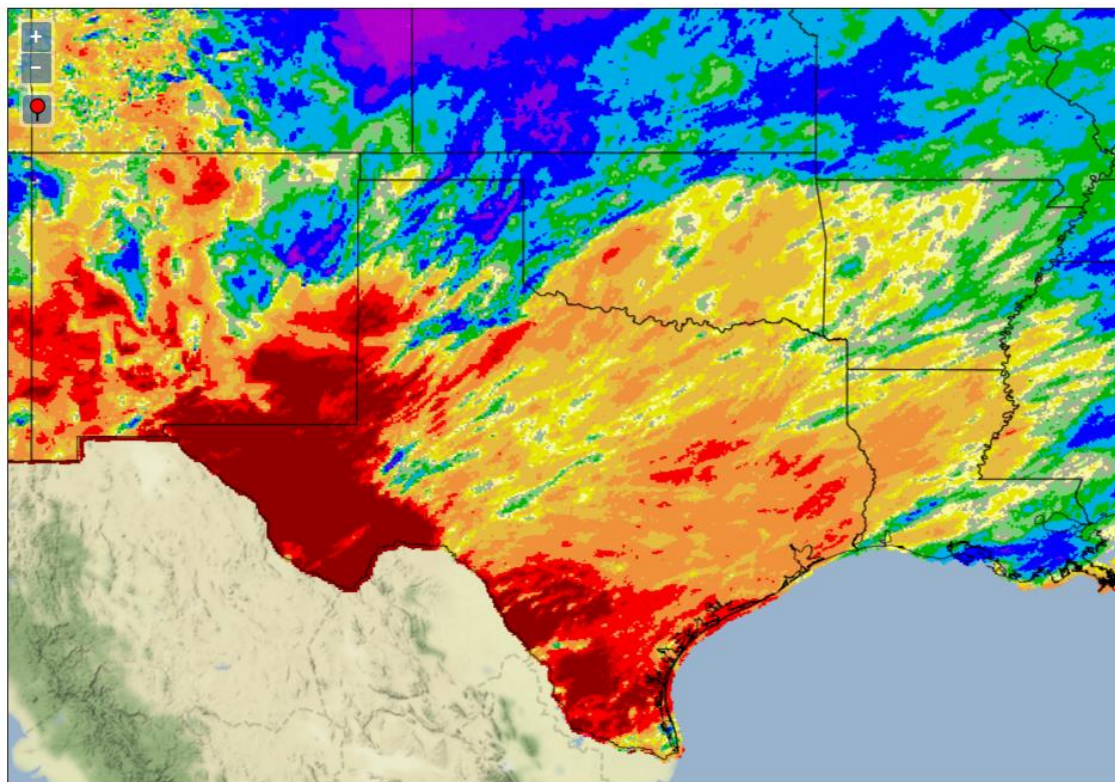
Figure 3. Drought conditions according to the U.S. Drought Monitor (available at <https://droughtmonitor.unl.edu/>) for Texas on March 2 (left) and June 1 (right). Warmer colors indicate more intense levels of drought.

North Texas Regional Summary/Hydrology

By: Greg Story, NWS, Retired

Hello and greetings from North Texas! I am thankful to each and every one of you for reporting your rainfall via CoCoRaHS! With rainfall as important as it was in 2020 (and 2021 has started off where 2020 left off), your reports continue to be invaluable to the National Weather Service (and other entities) to determine both locations of flooding and drought.

Over the past several months, back in December 2020 it was quite wet over roughly the southeast third of the state, as was southwest Texas, while Deep South Texas and the panhandle region were dry. Overall, near normal precipitation was recorded. In January 2021 it was a dry month. In February 2021 we experienced some pretty significant storm systems, one in particular Texans won't forget anytime soon. But in spite of that, Texas actually ended up with below normal precipitation state-wide. In March 2021 it was a very dry month, with only the Texas panhandle region having above normal precipitation. The majority of the state had below normal precipitation. In April we began a wet cycle, one that continued through May. April saw above normal rainfall in most locations. Only the Rio Grande valley regions and the Texas panhandle saw below normal precipitation. In May it was very wet. Like April, most locations saw above normal rainfall, with only the Texas Big Bend region having below normal rainfall readings.



Apr 1, 2021

Percent of Normal Precip. (%)

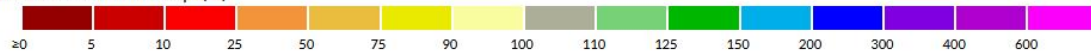


Figure. 1: Percent of normal precipitation map for March 2021. The dark green, blue and purple colors indicate above normal precipitation; the light yellow and light green colors indicate near normal, while the orange and dark red indicates below normal precipitation. March was a very dry month, with only the Texas panhandle region having above normal precipitation. The majority of the state had below normal precipitation, with little or no precipitation over the far west.

At DFW Airport in March 2021 they received 3.03". The normal amount of rain in March is 3.49" so they were -0.46" below normal for the month.

At Waco for March 2021, they received 1.05". The normal amount for March is 3.15" so Waco was -2.10" below normal for the month.

North Texas Regional Summary/Hydrology (continued)

For each month, I will highlight the more significant weather events. I know there is a lot of information given, and it is intended for you to pick your "favorite" storm to see what happened. Which days did you report your heaviest precipitation amounts? You can read about them here. There were about eight storm systems which affected our weather in March. Here are the highlights of the weather for the month.

March 1 - 2:

An upper low moved across north Texas and Oklahoma on the 1st to early on the 2nd. Most of the rain with its passage was over east Texas. The heaviest rain of 1.50" to 2" was near Beaumont and Orange, and also near Tyler.

March 4 - 5:

A large low pressure system passed north of Texas. While most areas stayed dry, there was some rain over northeast Texas. All amounts were less than 0.25".

March 11 - 15:

A deep closed low pressure system developed off the California coast. It didn't start moving east until the 13th. Initially the rain with this system was north of Texas. A few severe thunderstorms occurred over west Texas the afternoon and evening of the 12th. The deep low moved east into Utah and Arizona. Numerous showers and severe thunderstorms developed in the afternoon and evening over west Texas. The thunderstorms weakened as they moved east into central Texas. The rainfall amounts were 1" to 1.50" over west Texas on the 13th. Then the strong low continued moving over the Colorado/Kansas border. Tremendous snowfall amounts occurred over the Rockies. Additional rainfall amounts of around 0.50" occurred over southeast Texas. The low weakened on the 15th over Kansas with only residual light showers over southeast Texas.

March 16 – 18:

A new storm system dug in behind the first one and became a closed low over New Mexico. Thunderstorms developed very late on the 16th into the 17th along and ahead of the dryline and a cold front. The upper low moved northeast into northern Oklahoma on the 17th. As this occurred a line of thunderstorms, a few severe, moved rapidly from west to east. Parts of Dallas, Johnson and Tarrant counties received 1" to 1.80". A major severe weather outbreak occurred east of Texas. The upper low continued to move away to southern Missouri, and the showers and thunderstorms moved east of the state on the 17th. Additional rainfall was 1" or less and was confined to the southeast third of the state, with a maximum report of 1.37" at Center, TX.

March 22 - 23:

A new upper air low pressure system formed over Utah and Arizona and began moving eastward. Showers and thunderstorms developed. The upper low moved from Utah across western Oklahoma to Kansas. As this occurred numerous lines and clusters of thunderstorms formed over a good part of Texas. The heaviest rain of 2.32" was near Galveston. In north Texas the heaviest rainfall of 1.90" was southwest of Fort Worth down to Benbrook. A daily record rainfall amount of 1.13" was set at Dallas Fort Worth on the 22nd. This broke the old record of 0.99" set in 1993. Lingering rain the morning of the 23rd brought another 0.75" to Galveston and High Island Texas. Meanwhile, a new storm system developed over Arizona and New Mexico.

March 24 - 25:

The new storm system from the southwestern U.S. produced showers and strong thunderstorms over roughly the southeast half of Texas later on the 24th to early on the 25th. Large hail fell over the northern DFW metroplex. Maximum rainfall of 2.50" to 3.50" fell due to a long lived supercell thunderstorm from Meridian through Blum to Waxahachie. Lingering rainfall on the 25th was less than 0.20", centered over Collin County.

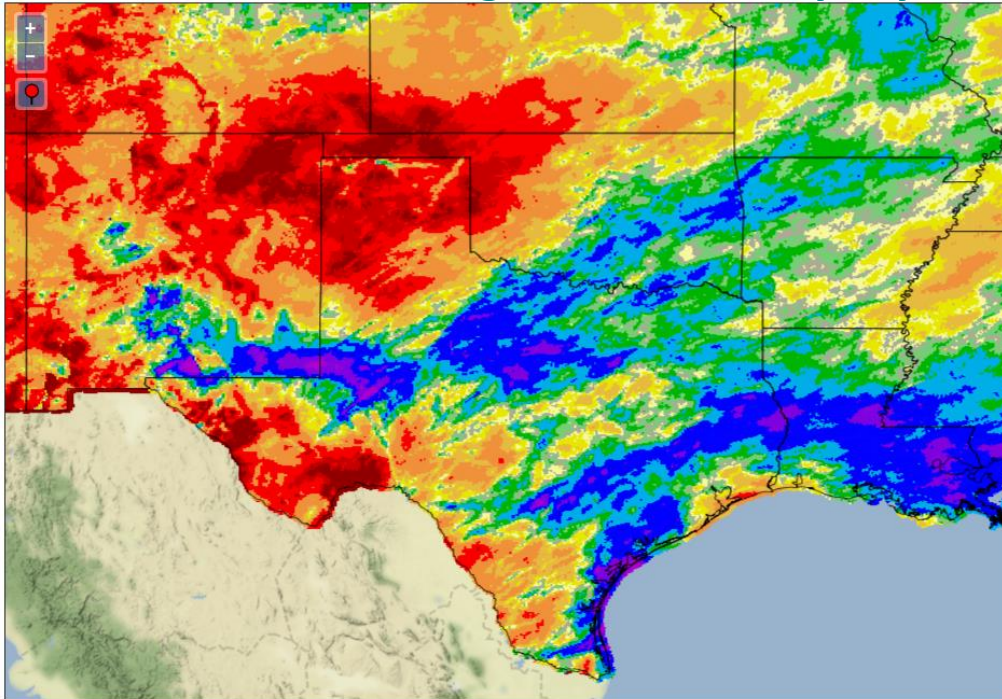
March 27 – 28:

A cold front moved across Texas. Showers and thunderstorms developed over east Texas, with severe thunderstorms and tornadoes occurring from Rusk and Mount Enterprise to Carthage. Maximum rainfall was just over 3" from Neches to Carthage. Post frontal showers continued across southern and eastern Texas. Maximum rainfall was 2" at Corpus Christi.

March 30 – 31:

A cold front moved through during the evening on the 30th into the nighttime hours and into the 31st. It brought showers and a few thunderstorms with its passage. Maximum rainfall was 1.25" to 1.50" from Celeste to Blue Ridge in Collin County. Showers continued on the 31st over south Texas, with rainfall amounts of 1" or less.

North Texas Regional Summary/Hydrology (continued)



May 1, 2021

Percent of Normal Precip. (%)

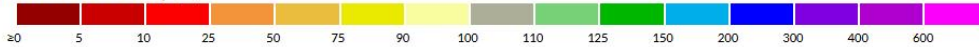


Figure 2: April 2021 percent of normal precipitation map. The dark green, blue and purple colors indicate above normal precipitation; the light yellow and light green colors indicate near normal, while the orange and dark red indicates below normal precipitation. In April we saw above normal rainfall in most locations. Only the Rio Grande valley regions and the Texas panhandle saw below normal precipitation.

At DFW airport in April 2021 they received 4.50". The normal amount for April is 3.07" so DFW was +1.43" above normal for the month.

In Waco for April 2021, they received 1.59". The normal amount for April is 2.69" so they were -1.10" below normal for the month.

There were about six storm systems which affected our weather in April. Here are the highlights of the weather for the month.

April 2 - 3:

A minor short wave trough, combined with moisture returning from the Gulf of Mexico, produced showers and a few thunderstorms over mainly South Texas late on the 2nd into the 3rd. Initial rainfall early on the 2nd was 0.50" or less over the Hill Country. The heaviest rainfall on the 3rd to early on the 4th was a 0.50" to nearly an inch in and around Austin.

April 7 - 9:

A big upper air low pressure system passed north of Texas. This pushed a cold front across the state and produced showers and thunderstorms over especially east Texas. Maximum rainfall on the 7th was 2" to 2.50" from Jasper to Zavalla. A supercell thunderstorm developed along a warm front near Hico and moved near Waco to Bryan/College Station on the 8th. Aside from dropping big hail, this storm produced a maximum rainfall amount of 0.75" to 1.25" around Lorena. Then, another upper level low pressure system passed north of Texas on the 9th. This pushed the dryline east and a cold front southeast. This resulted in showers and thunderstorms across primarily east Texas. Maximum rainfall was 1.25" to 1.50" around Lufkin. Rainfall fell in northeast Texas but was 0.50" or less.

April 12 - 15:

A weak short wave trough moved across Texas. Additionally, a cold front moved slowly from northwest to southeast. Initially, severe thunderstorms occurred across the Hill Country and the Edwards plateau. Thundershowers also developed along and behind the front over north Texas. The heaviest rain on the 12th to early on the 13th was nearly an inch to 1.30" from Granbury and Cresson to Burleson. Then on the 13th to early on the 14th there was 1" to 1.50" from Evadale and Lumberton to Beaumont.

North Texas Regional Summary/Hydrology (continued)

The cold front then stalled along the Gulf coast on the 14th. Thunderstorms formed and produced heavy rain over southeast Texas. Maximum rainfall was around 2" from Pasadena to Lumberton. The front began returning northward as a warm front on the 15th. The moist air rising up and over the cool air produced widespread showers and thunderstorms. Maximum rainfall was 2.50" to 3" from Gordon through Granbury to Cleburne.

April 16 - 17:

A new cold front moved across Texas. Showers and thunderstorms continued to be widespread on the 16th before shifting into south Texas on the 17th. Maximum rainfall on the 16th was 2.80" to 3.50" from Henderson, Longview and Tyler to Ben Wheeler. Rain was limited to Deep South Texas later on the 17th with maximum rainfall amounts of over 1" from Kingsville to Edinburg. Accumulated maximum rainfall report in north Texas from Wednesday April 14 through Friday April 16 was Yantis with 3.52".

April 23 - 24:

A short wave trough began moving toward Texas from the four corners region. It strengthened as it moved across Texas and Oklahoma. The combination of a dryline and a warm front resulted in showers and thunderstorms, initially west of the I-35 corridor. Then, widespread showers and thunderstorms occurred across northern and eastern Texas. Rainfall of around 3" to 3.50" fell from Sanger through Denison to Cumby TX. Outside of north Texas, Huntsville received 5.50" to 6".

April 26 – 30:

A new storm system formed over California on the 26th and became a progressive closed low over Nevada on the 27th. Initial showers and thunderstorms developed along the dryline over the western parts of north Texas. The heaviest rain was 3" to 3.80" from Abilene and Clyde to Throckmorton. The closed low moved slowly eastward to near El Paso by late on the 28th, then stalled through the 30th. Widespread showers and thunderstorms occurred on the 28th. The heaviest rain over north Texas was around Midlothian with around 5.50". Further south the San Antonio area received 4" to 4.80". Most notably was the giant hail which occurred across the northern DFW metroplex and near San Antonio the evening of the 28th. On the 29th they had 6" to over 7.50" from Montgomery and Lufkin to Dodge TX. The heaviest rain in north Texas was around 2.50" near Sanger. On the 30th 7" to almost 9" fell from Corpus Christi to Rockport and Victoria. The maximum amount in north Texas was nearly 3" southeast of Midlothian.

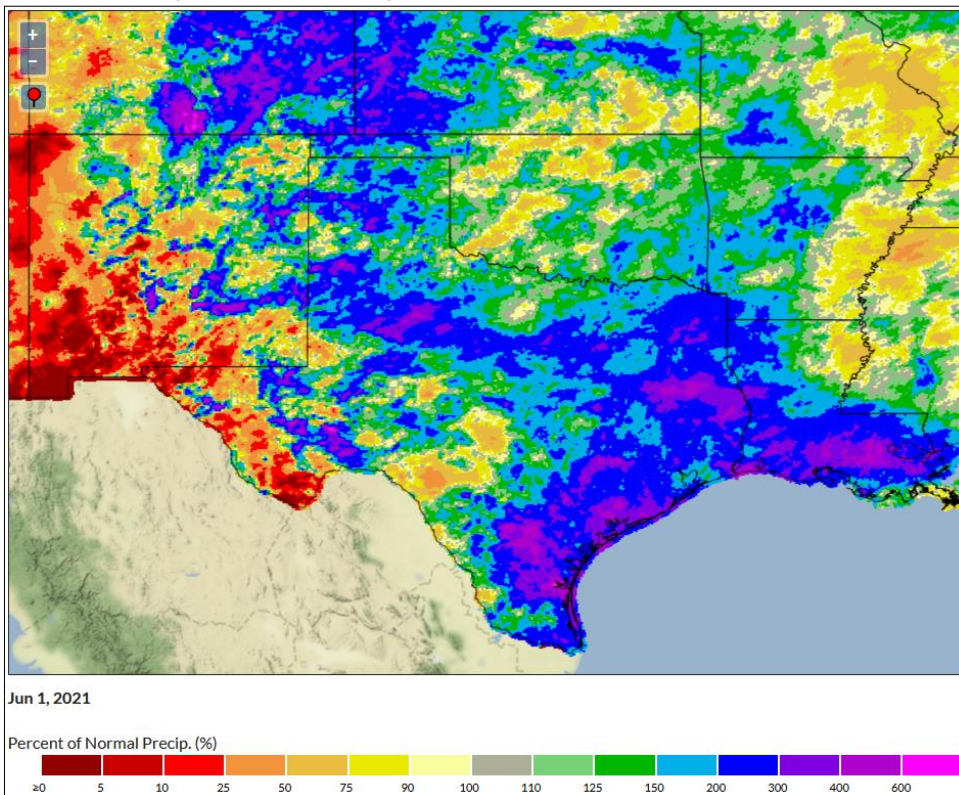


Figure 3: Percent of normal precipitation map for May 2021. The dark green, blue and purple colors indicate above normal precipitation; the light yellow and light green colors indicate near normal, while the orange and dark red indicates below normal precipitation. In May it was very wet. Like April, most locations saw above normal rainfall, with only the Texas Big Bend region and the Del Rio area having below normal rainfall readings.

North Texas Regional Summary/Hydrology (continued)

At DFW airport in May 2021 they received 7.77". The normal amount is 4.78" so they were +2.99" above normal for the month. In Waco for May 2021, they received 8.00". The normal amount for May in Waco is 4.44" so they were +3.56" for the month.

There were about six significant storm systems which affected our weather in May. Here are the highlights:

May 1 – 2:

The closed low that was south of El Paso at the end of April finally started moving northeast on the 1st and cleared Texas late on the 2nd. Additional rainfall on the 1st was heaviest over the Hill country where 4" to 5" fell from Hunt to Ingram and San Saba. Rainfall amounts were lighter further north in north Texas. Then on the 2nd the rainfall shifted over to east and southeast Texas with 2" to 3" from Longview to Nacogdoches.

May 3 - 4:

A new short wave trough moved in to replace the storm from late April and early May. This storm combined with a cold front to produce showers and thunderstorms. Some storms were severe, with tornadoes noted just south of the DFW metroplex. The heaviest rain was 2.50" to 2.80" from Granbury through Maypearl to Waxahachie on the 3rd.

May 9 - 12:

A cold front moved across north Texas on the 9th. Showers and thunderstorms developed along and ahead of the front. Locally heavy rain occurred across east Texas. Maximum amounts of 5" to 7" fell from San Augustine and Lufkin to Nacogdoches. Warm, moist air ran up and over the cold frontal boundary which was stalled across south Texas on the 10th. Numerous showers and thunderstorms occurred. The heaviest rain was again over east Texas, with 4" to 7" near Longview and Marshall, as well as near Livingston. An upper air disturbance approached Texas from the west and interacted with the old frontal boundary on the 11th. Widespread showers and thunderstorms developed. The heaviest rain in north Texas was south of Grand Prairie with nearly 4".

May 15 – 20:

A large upper atmospheric closed low pressure system formed over California and moved very slowly east. Repeat showers and thunderstorms occurred. Initial thunderstorms from a short wave trough ahead of the low were primarily over west and south Texas on the evening of the 15th. The heaviest rain in north Texas was around 0.50" around Waco and Killeen. But over south Texas 6.67" fell near Yancey. The upper low moved over Arizona and Utah by the 17th. As this occurred widespread showers and thunderstorms occurred on the 16th. Heavy rains led to flash flooding around Dallas, with the University Park area receiving nearly 6". Further south in southeast Texas, Ganado received over 13", while the area from Jasper to Colmesneil got 7.50" to almost 9.50". The low continued to move slowly over Colorado and New Mexico on the 18th. Showers and thunderstorms again were widespread on the 17th, with some tornadoes over west Texas. Very heavy rainfall occurred over extreme southeast Texas into the Lake Charles area. From 4.50" to 6.50" fell from Port Arthur to Nederland. The heaviest rain in north Texas was nearly 3" near Cedar Hill. This upper low moved over northeast New Mexico on the 19th. Showers and thunderstorms continued, with a large MCS moving across south central and southeast Texas the evening of the 18th. The heaviest rainfall of 10" to 11" occurred from Port Lavaca to Victoria. In north Texas the heaviest rain was 3.75" around Tyler, and around 2" from Mineral Wells to Weatherford. The upper low finally weakened and moved across the Texas panhandle on the 20th. Heavy rain occurred over Deep South Texas the morning of the 19th, then residual rain occurred later on the 19th into the 20th over east Texas. Heaviest rainfall on the 19th was 4" to 6" from Corpus Christi and Kingsville to Harlingen.

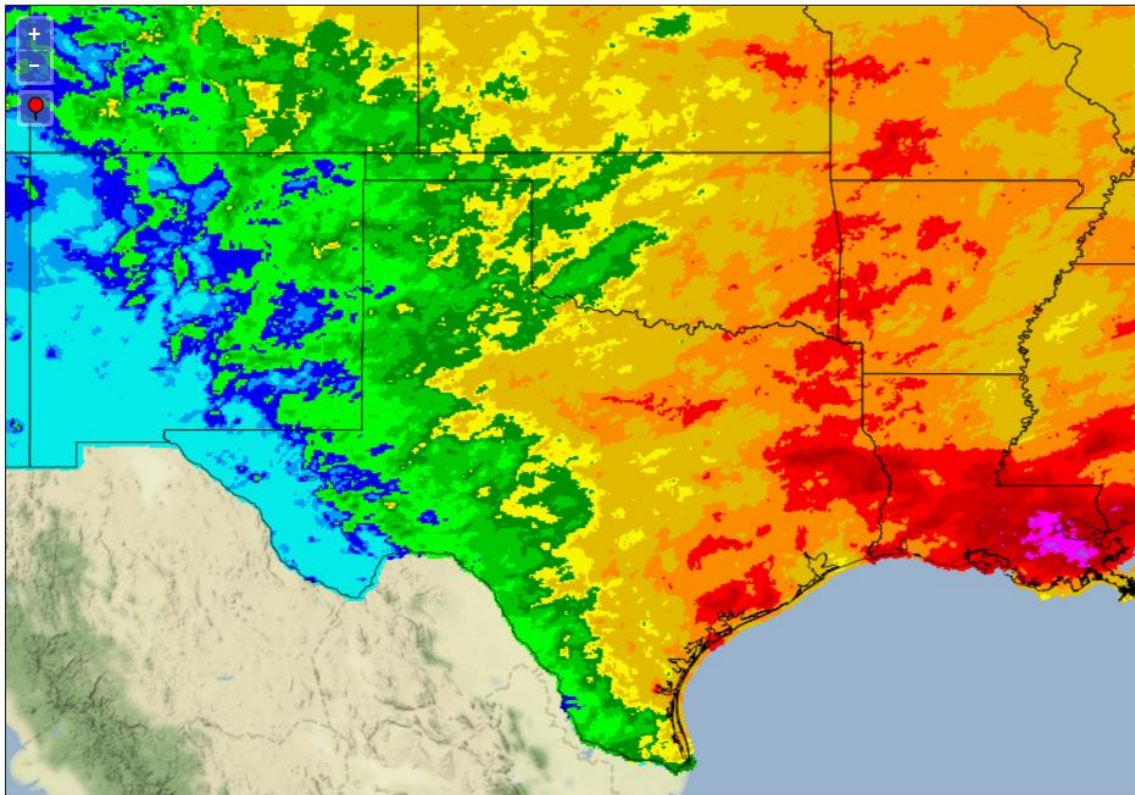
May 21 – 26:

A mesoscale vorticity center formed over the northwest Gulf of Mexico. This low moved inland over south Texas early on the 22nd. Ahead of this low, rain fell over east Texas on the 21st, and over much of Texas on the 22nd. Maximum rainfall on the 21st was over Orange where nearly 3" fell, and further north over Kilgore they got almost 2.50". On the 22nd, widespread 1" to 2" occurred over south Texas and rainfall was mainly less than 0.50" in north Texas. Tropical moisture continued to move northward from the Gulf on the 22nd into the 23rd, resulting in pockets of heavy rain. The area from Fort Worth Alliance to Roanoke received 2.70" to 2.80". Meanwhile, Gold in central Texas got slightly over 3". Areas of rain continued for a couple more days. On the 23rd the heaviest rain fell downstate around Austin (3.25" to 3.50") and around Cuero (3" to 4"). On the 24th very heavy rains fell in many locations. The maximum amount was near Houston with over 6" near Humble. In north Texas nearly 5.50" of rain fell near Burleson and just under 5" fell southwest of Weatherford. On the morning of the 25th the remnants of an MCS rolled across primarily north Texas into east Texas. The heaviest rain from this MCS was around Lufkin with nearly 2.50". The long-lasting rain finally moved east of Texas on the 26th. Later on the 26th, the dryline produced thunderstorms over west Texas. Olton Texas got around 3.50".

North Texas Regional Summary/Hydrology (continued)

May 27 – 31:

Thunderstorms which developed along a cold front in Oklahoma moved south as a squall line into north Texas late on the 27th into the 28th and produced up to 2" to 2.50" from Red Oak to Waxahachie. Thunderstorms formed on the 28th along old outflow boundaries from the previous nights' thunderstorms. The maximum rainfall total was 4.50 to 5.00" at Comanche. The cold front which produced the rain stalled and the rain shifted to Deep South Texas on the 29th, with rainfall amounts being the heaviest around Harlingen and Alice. The stalled front began returning northward as a warm front on the 30th. The heaviest rain of 4.00" to 4.25" was in the Austin area. On the 31st the warm front interacted with a short wave trough and produced widespread showers and thunderstorms. A maximum rainfall total of about 9.00" was recorded near Oakwood. Further north, rainfall amounts of over 4.00" occurred near Cisco and Weatherford. On May 31st a new daily rainfall record was established at DFW airport. They received 1.70". The previous record for the date was 1.60" set back in 1986. A daily rainfall record was also set in Waco. They received 1.64". The previous daily record for May 31 in Waco was 1.28" set in 1946.



90-day AHPS Precip. (in)

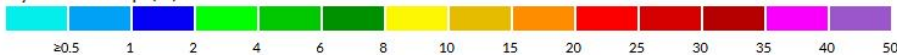
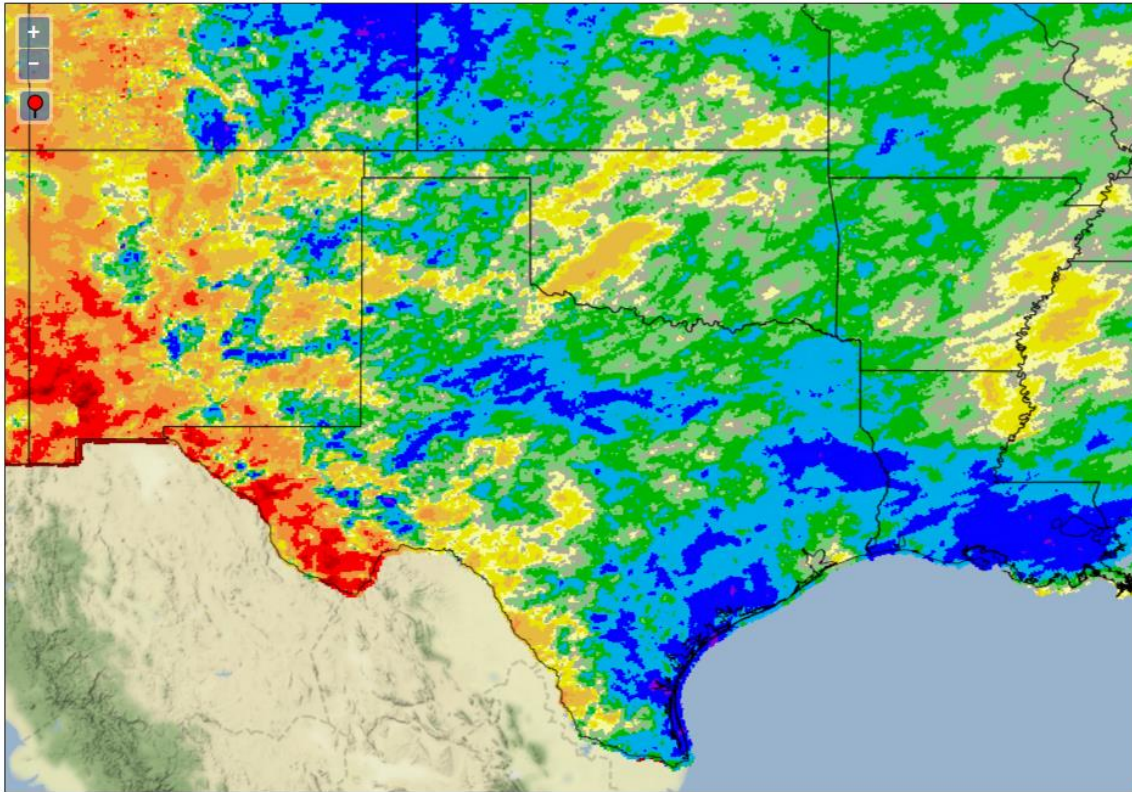


Figure 4: Spring season precipitation for 2021. The bright red and brown colors indicate the largest precipitation totals while the light green and blue colors show light amounts.

North Texas Regional Summary/Hydrology (continued)



Jun 1, 2021

Percent of Normal Precip. (%)



Figure 5: Percent of Normal Precipitation for spring 2021.

The dark blue and green colors indicate above normal precipitation. The brown, yellow and red colors indicate below normal amounts. Note the prolonged dryness over far southwest and far west Texas into southern New Mexico along the Rio Grande. But also of note was the isolated spots along the middle Texas Gulf coast that received much above normal amounts (almost 300% of normal for spring).

For the spring season (March through May 2021) DFW airport received 15.30". The normal spring amount is 11.30" so they were exactly 4.00" above normal for the season.

For the spring season in Waco, they received 10.64". The normal amount is 11.05" so they were pretty close to normal, only -0.41" below normal for the season.

So far for the calendar year 2021 through May at DFW airport they received 18.37". The normal amount is 16.59" so they are +1.78" above normal for the year.

So far in 2021 through May, Waco has received 12.35". The normal amount is 16.32" so they are -3.97" for the year.

Thanks to all of you for your weather observations! We concluded a spring that led to quite a bit of flooding across Texas. It wasn't close to a record (remember 2015?), but was significant nonetheless. The amount of the rainfall which fell at your station is extremely important and valuable information to the National Weather Service, especially the West Gulf River Forecast Center. And remember, now that we are approaching vacation season, on days you are not home or unable to report for any reason, you can make a multi-day accumulation report upon your return. This is important information as well.

Please consider inviting your neighbors, relatives and friends to join CoCoRaHS! The more rainfall observers we have, the better our chances are of observing the highest rainfall totals in storms.

I realize that this has been a difficult year plus for many of you due to COVID-19. Your faithfulness in submitting your rainfall readings to CoCoRaHS during this spring season has not gone unnoticed. Your dedication to observing helps the users of CoCoRaHS data a great deal. Have a great summer, stay well, and happy observing

Abilene/San Angelo Regional Summary

By: Joel Dunn, Observation Program Leader- San Angelo NWS WFO

Edited by Katie Dedeaux

Spring across West Central Texas was, overall, unseasonably cool and wet. Though March started out mostly windy and dry, April brought an increase in rainfall, especially across the Big Country, and May was the rainiest month of spring. Along with the highest rainfall amounts, May also brought a fair amount of severe weather.

March 2021

March was rather uneventful, with above normal temperatures and below normal rainfall, there was little remarkable about the month, save how windy it was. Though, given the frightfully cold temperatures that the area experienced in February, these temperatures were not unwelcome.

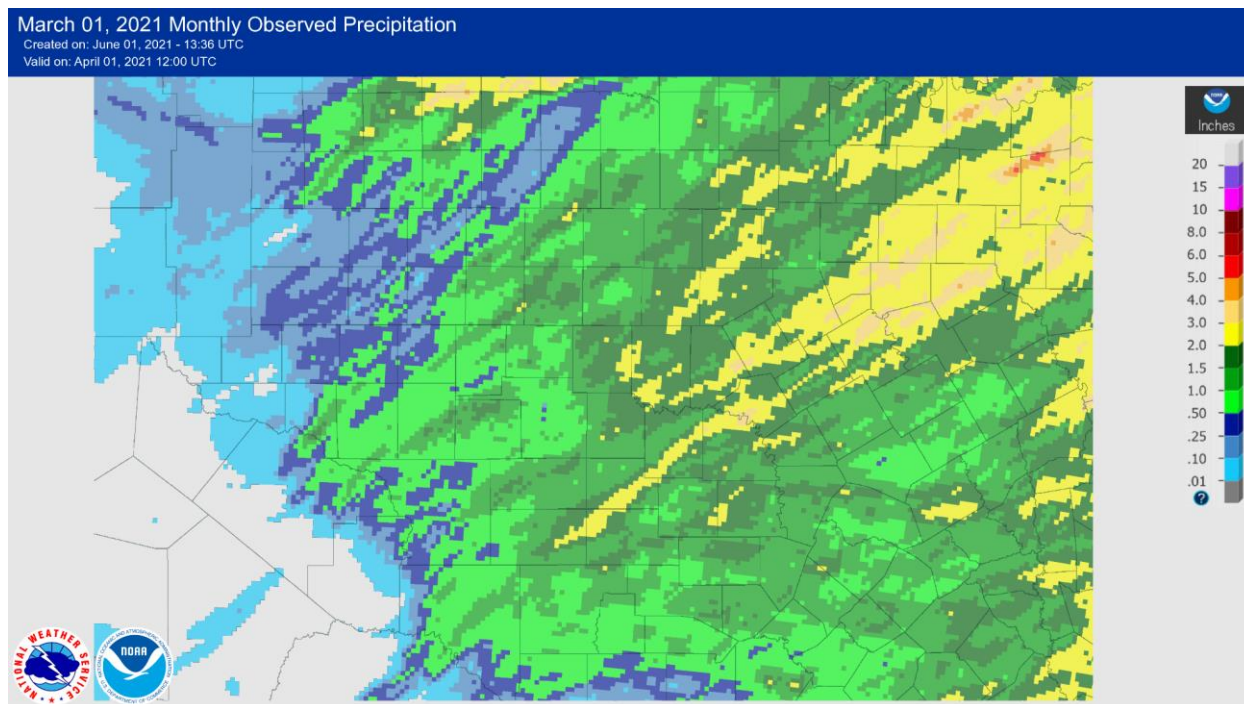


Image 1 - March Observed Precipitation

As can be seen in the image showing observed precipitation (Image 1) most of the area received between 0.50 - 2.00" of rainfall, with a few isolated areas receiving closer to 3 - 4". Though these totals seem healthy for early spring, when analyzing the percent of normal precipitation (Image 2), we see that although some areas received high totals, the majority of the area was still drier than normal.

Abilene/San Angelo Regional Summary (continued)

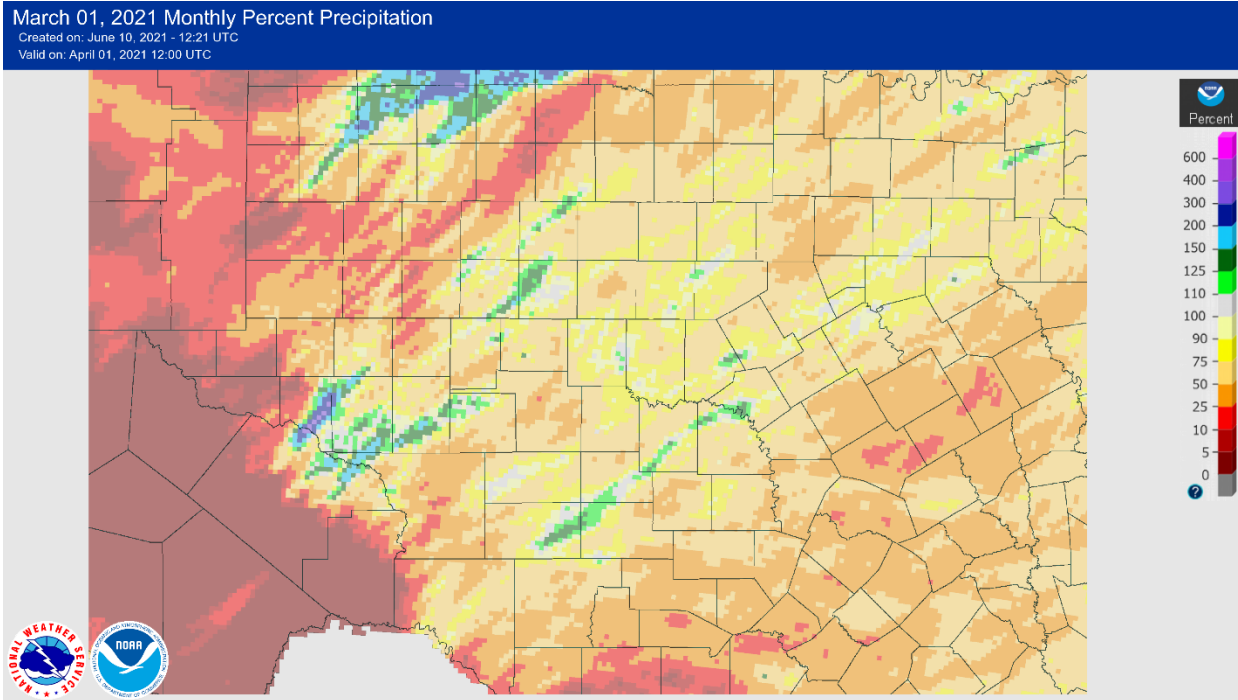


Image 2 - March Percent of Normal

Note in the above image (Percent of Normal for March 2021) the areas of high percent of normal rainfall. Now also note how isolated these areas are and it's no wonder the month ended below normal for rainfall.

City	Precipitation (inches)	Departure from Normal (inches)
Abilene	1.27	-0.47
San Angelo	0.50	-1.00
Junction	1.37	-1.04

Table 1 - March rainfall total and Departure from Normal

April 2021

April marked a noticeable increase in precipitation, as several storm systems passed across the Big Country and portions of the Heartland near Brown County. Though San Angelo finished the month just above normal, some areas south of the Concho Valley, such as Junction along I-10, did not fare as well.

On April 6th, the first 90 degree day was recorded. This would begin a warming trend, however, it would be cut short as series of cold fronts pushed south across West Central Texas. These cold fronts kept afternoon highs in the 60s and 70s and overnight lows even dipped into the 50s and low 60s.

In fact, one piece of San Angelo weather lore is cold and rainy conditions occur during the Rodeo. Typically, San Angelo's Rodeo is in February, and the cold and rainy conditions are more common, yet this year due to COVID, the Rodeo had been postponed until April and thus it's no surprise the residents of San Angelo were touting the belief that the Rodeo brought cold and rainy conditions. Either way, it was an anomalous change for April.

Abilene/San Angelo Regional Summary (continued)

April 01, 2021 Monthly Observed Precipitation

Created on: June 01, 2021 - 18:49 UTC
Valid on: May 01, 2021 12:00 UTC

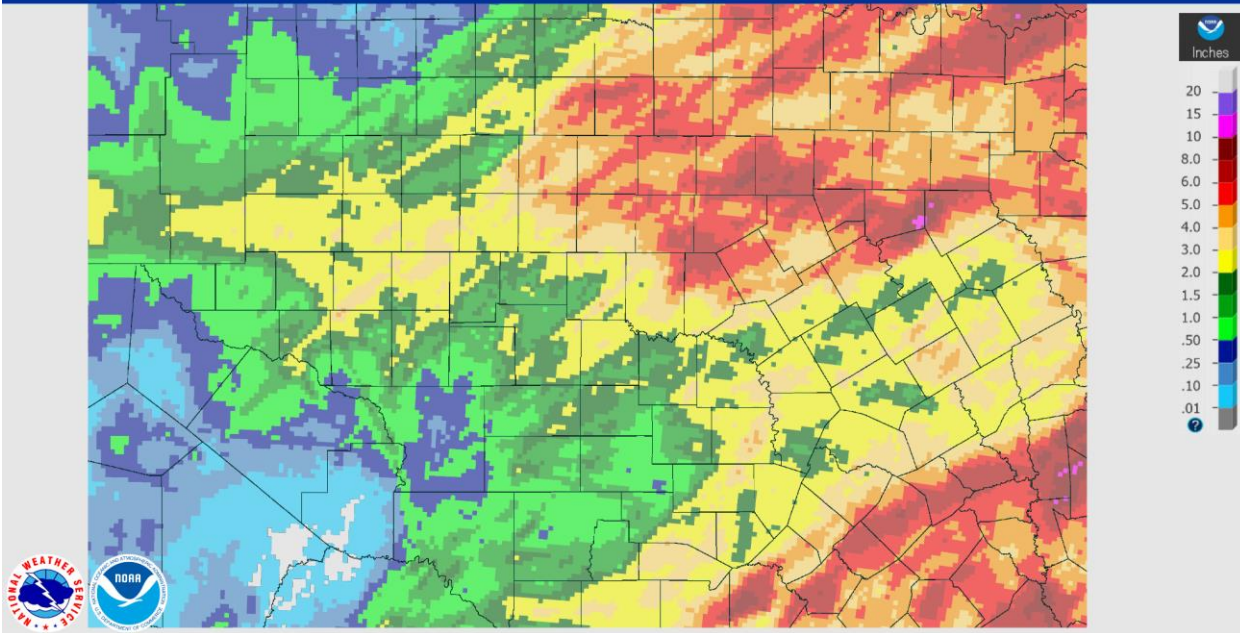


Image 3 - April Observed Precipitation

April 01, 2021 Monthly Percent Precipitation

Created on: June 01, 2021 - 19:10 UTC
Valid on: May 01, 2021 12:00 UTC

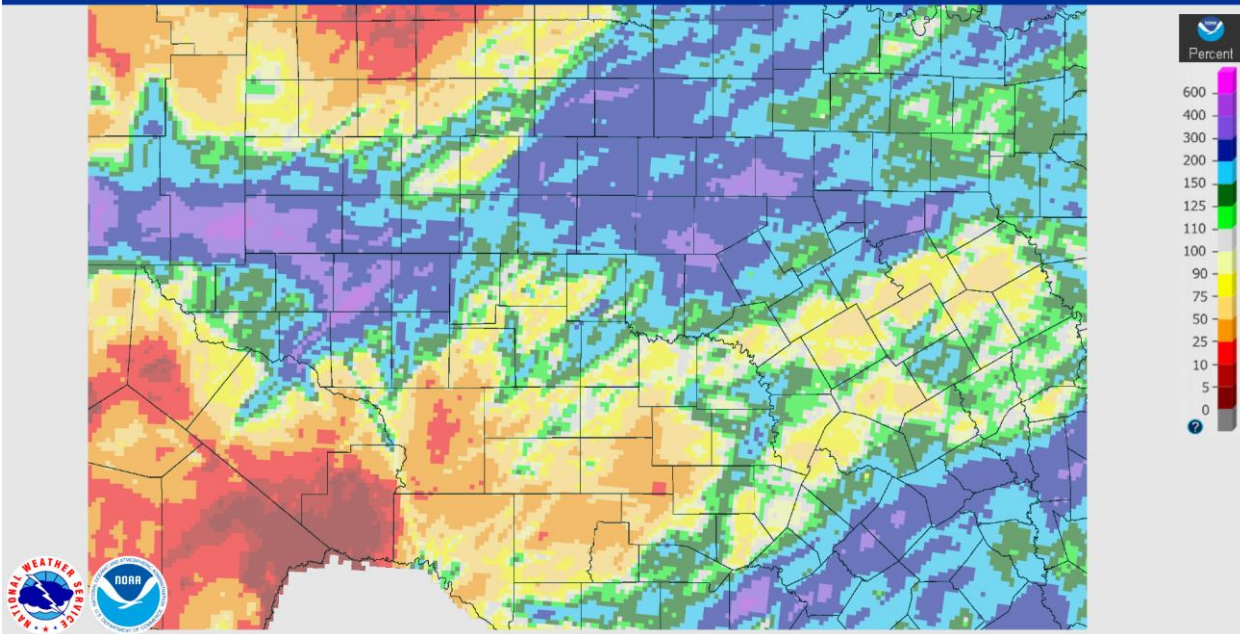


Image 4 - April Percent of Normal

Though rainfall is always welcome in West Central Texas, it can be accompanied by hail, damaging winds and even tornados. Severe weather season typically begins in May, though it is not unheard of for April or even March to see the occasional hail storm or damaging winds. Mid-April saw several severe thunderstorms, most of them across the Big Country, though the Concho Valley and portions of the Heartland saw a few as well. One such storm moved through the Concho Valley on April 12, where hail as large as grapefruit (2.75") was reported in McCullough County.

Abilene/San Angelo Regional Summary (continued)

City	Precipitation (inches)	Departure from Normal (inches)
Abilene	4.88	3.24
San Angelo	1.79	0.37
Junction	0.54	-1.58

Table 2 - April rainfall totals and Departure from Normal

May 2021

The month of May not only saw more rainfall than March or April, but had far more occurrences of severe weather. Heavy rainfall, damaging winds, hail and even tornadoes are a common occurrence during the month of May and this month was no exception.

On the morning of May 17th, the National Weather Service issued a graphical forecast indicating severe thunderstorms, as well as tornadoes were likely. The graphic portrayed this threat using the Storm Prediction Center’s severe categories. Most of West Central Texas was in an Enhanced threat, while portions of the Concho Valley and Big Country were in a Moderate threat.

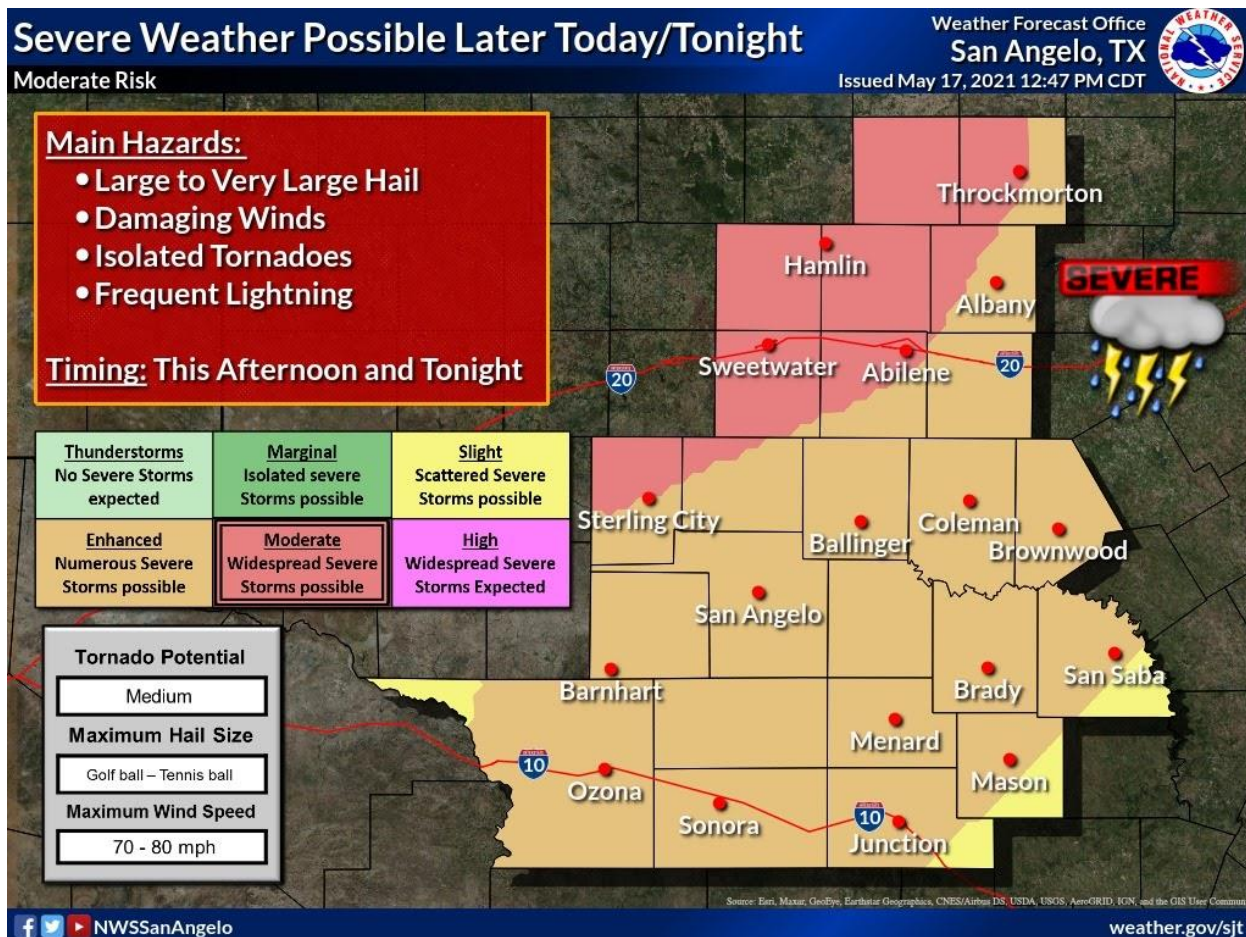


Image 5 - GraphiCast issued during the afternoon of May 17th

Abilene/San Angelo Regional Summary (continued)

Just after 7 PM, a tornado warning was issued for northern Sterling County and 5 minutes later a storm chaser recorded video of a tornado and reported the sighting to the National Weather Service. It was moving southeast at 20 mph. After a storm survey was performed, the tornado was rated an EF2.

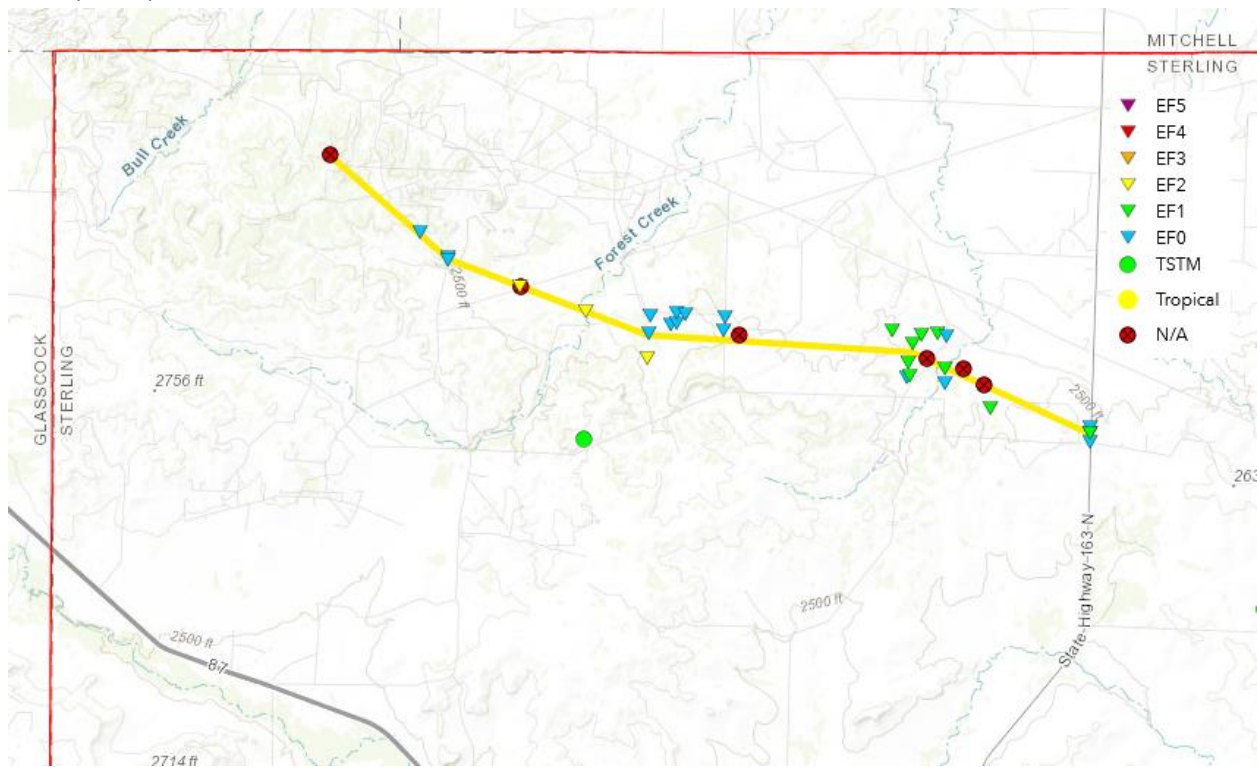


Image 6 - Storm Track of Sterling County Tornado

URL: <https://apps.dat.noaa.gov/StormDamage/DamageViewer/>

The rest of the month would produce several rounds of severe weather, and heavy rainfall, resulting in 5 tornado warnings, 72 severe thunderstorm warnings, and 12 flash flood warnings.

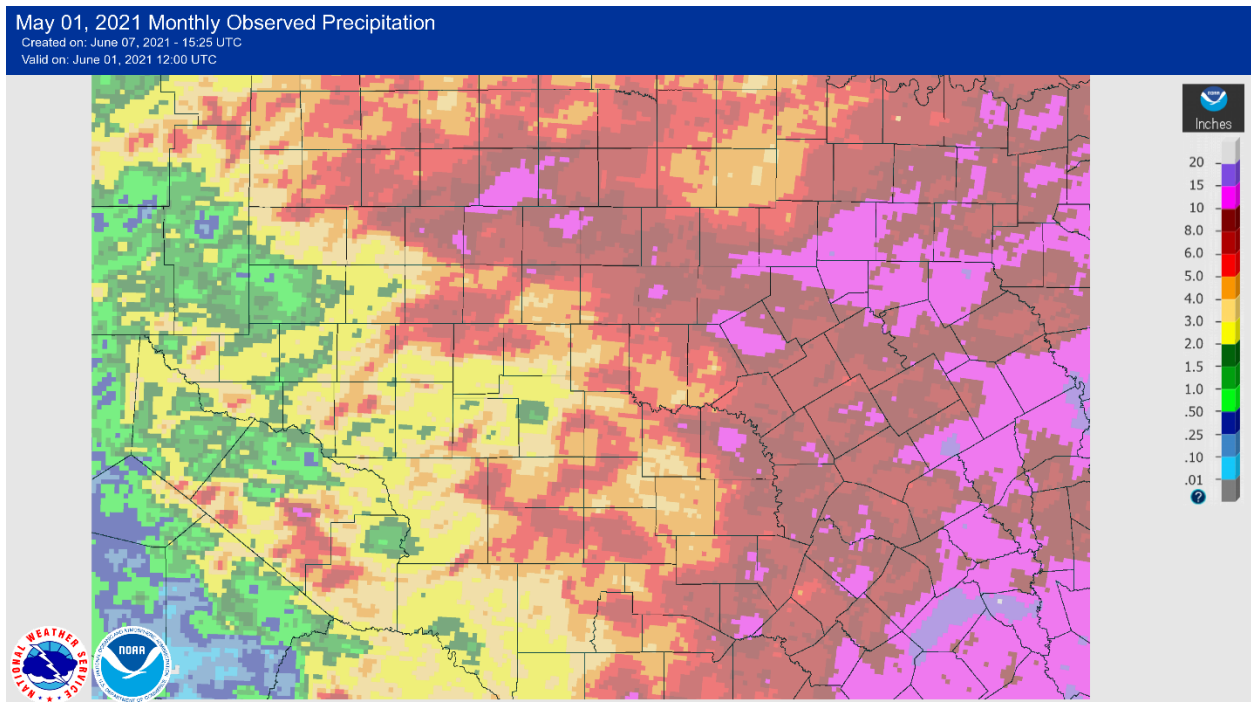


Image 7 - May observed precipitation

Abilene/San Angelo Regional Summary (continued)

At the end of the month, it was clear that portions of the Concho Valley and Northern Edwards Plateau missed out on the generous amounts of rain the rest of the area partook in. As can be seen in Image 7 above, the city of San Angelo had a noticeable precipitation minimum. It should also be noted that Abilene’s departure from normal was higher than the total amount of rainfall Abilene received during the month of April. It was certainly a wet spring for the Big Country.

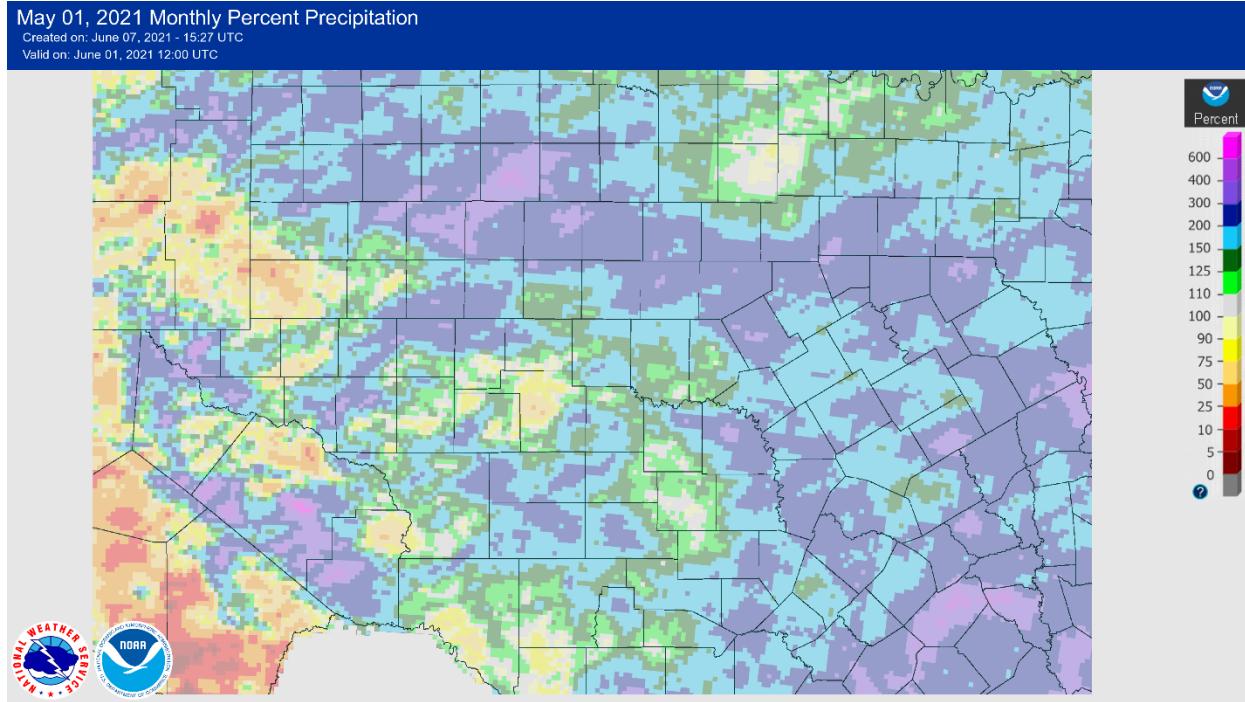


Image 8 - May Percent of Normal

A few notable records were broken in Abilene. The first was on May 25th, Abilene received 1.58” of rainfall, though not an extraordinary amount, it broke the previous record of 1.54” set in 1919 over 100 years ago. What’s more, on May 31st, Abilene Regional Airport received 3.50” of rainfall, breaking the even longer standing record of 2.24” set in 1894. The large amount of rainfall Abilene received lead to the 8th wettest May and the 5th wettest spring on record.

City	Precipitation (inches)	Departure from Normal (inches)
Abilene	8.20	4.99
San Angelo	1.43	-1.62
Junction	3.29	0.13

Table 3 - May Rainfall Totals and Departure from Normal

Houston/Galveston Regional Summary

Impressive May Rainfall after Dry Start to Season

By: Ron Havran - CoCoRaHS Regional Coordinator Houston/Galveston Region

March Highlights

Temperatures 1.5 to 3.0 higher than normal.

Highs topped out in the mid 80's with mostly sunny conditions prevailing throughout the month.

Moderate drought was being experienced in parts of every county in the region.

Rainfall deficits running 1.50" to 2.00" below normal for most counties in the region. See Figure 1.

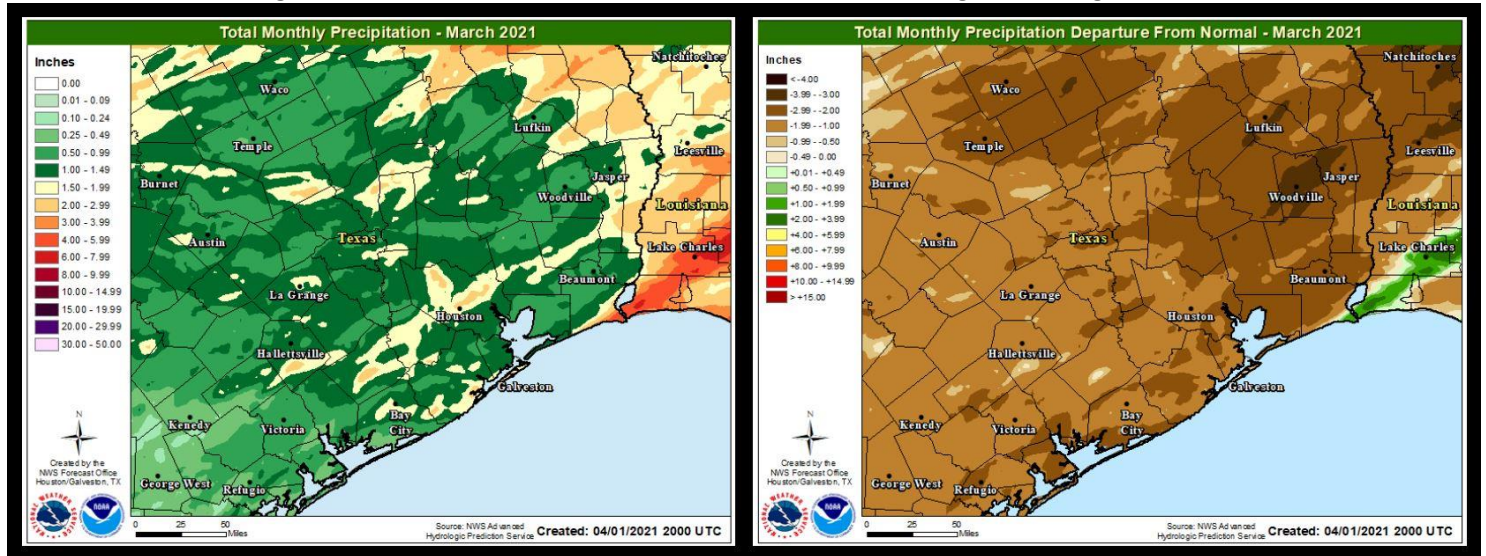


Figure 1: March Precipitation maps Houston/Galveston Region with monthly total and departure from normal.

April Highlights

SE region coastal areas much below normal rainfall. See Figure 2.

Inland areas west and north had higher rainfall totals. (San Jacinto, Montgomery, and Polk County above average).

Galveston and Brazoria counties had below average rainfall.

Counties with plentiful rainfall had slightly below normal temperatures while counties with below normal rainfall had higher than average temperatures.

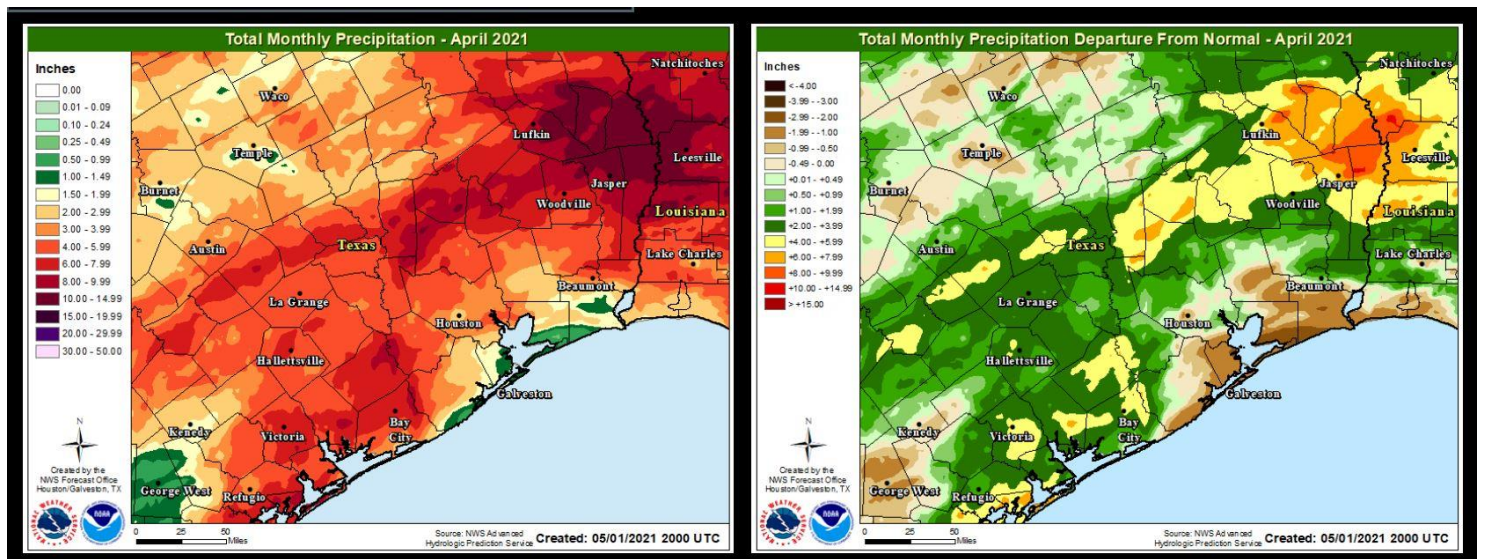


Figure 2: April Precipitation maps Houston/Galveston Region with monthly total and departure from normal.

Houston/Galveston Regional Summary (continued)

May Highlights

Very wet region wide with extreme amounts of rainfall in some counties. See Figure 3.

Cloudy days with rainfall occurring frequently kept temperatures below normal region wide.

Localized river flooding and flash flooding occurred frequently across the region at times.

Most counties averaged over 10.00" of rain for the month with Austin and Jackson over 15.00". See Table 1.

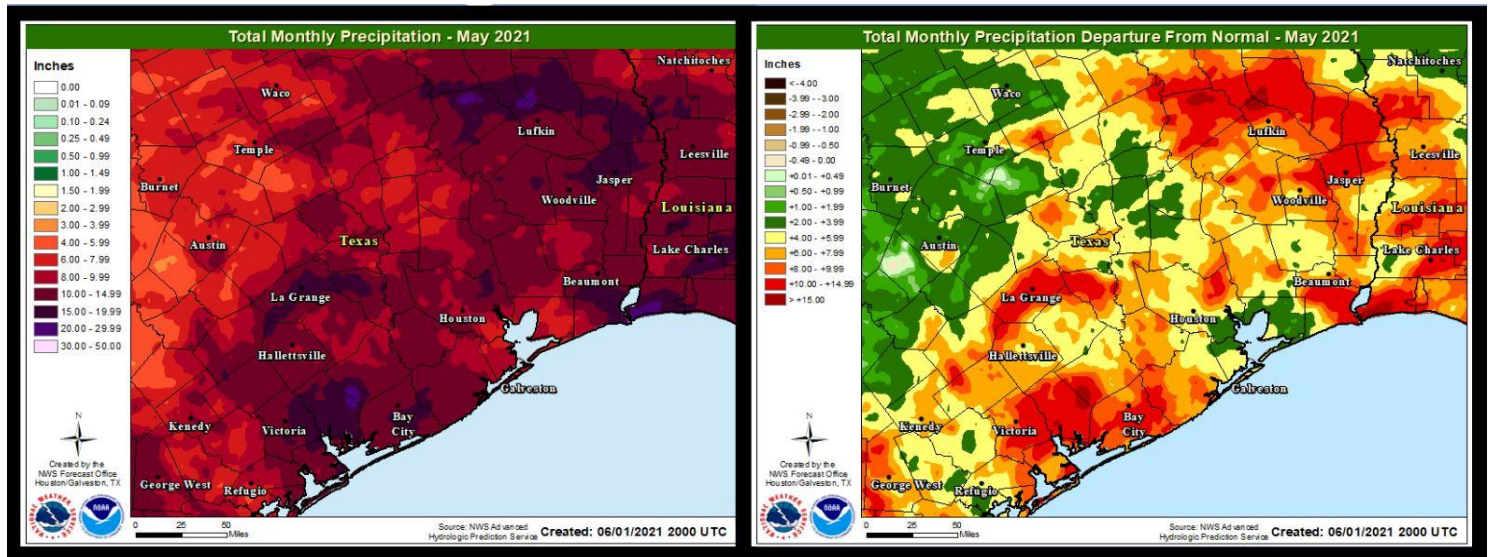


Figure 3 May Precipitation maps Houston/Galveston Region with monthly total and departure from normal.

Spring 2021 CoCoRaHS Stations Houston/Galveston Region Rainfall

Actual Station Measured County Rainfall Averages in inches per month

County	March	April	May	Spring Total
	AVG.	AVG.	AVG.	Mar.- May
Austin	1.66	2.09	15.73	19.48
Brazoria	1.70	1.98	12.35	16.03
Chambers	1.29	3.28	10.17	14.74
Colorado	1.31	3.11	13.85	18.27
Fort Bend	1.92	2.08	13.47	17.47
Galveston	2.09	1.67	7.81	11.57
Harris	1.65	3.41	9.47	14.53
Jackson	1.91	6.19	20.21	28.31
Liberty	1.73	3.09	10.48	15.30
Montgomery	1.57	6.46	9.69	17.72
Polk	2.18	7.71	12.80	22.69
San Jacinto	1.92	7.95	13.06	22.93
Wharton	1.73	6.64	11.23	19.60
Region Totals	1.74	4.28	12.33	18.36

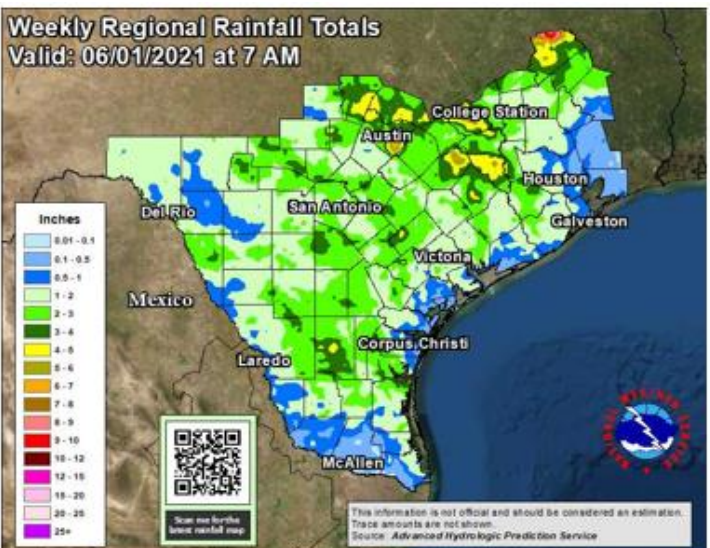
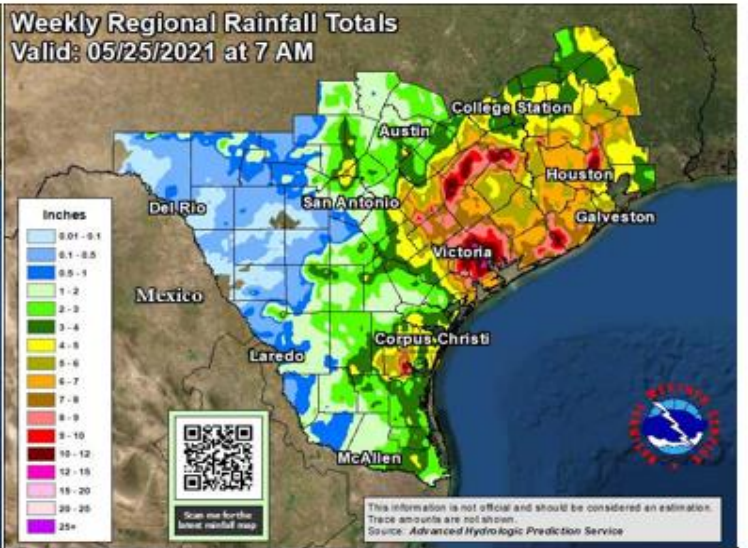
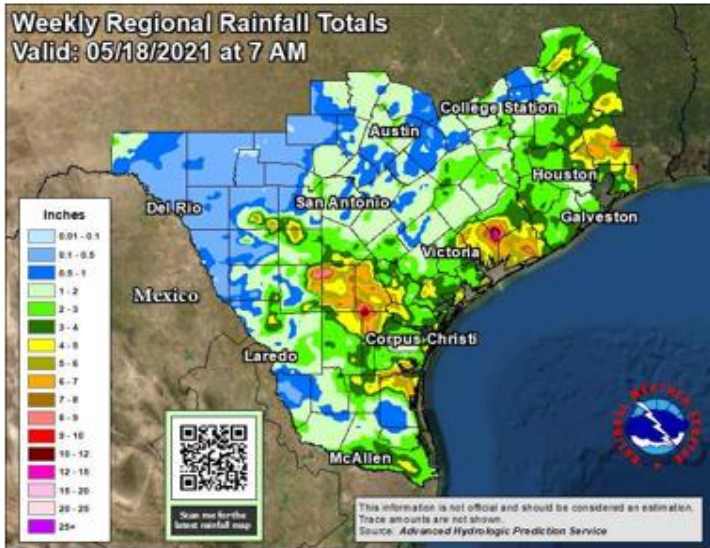
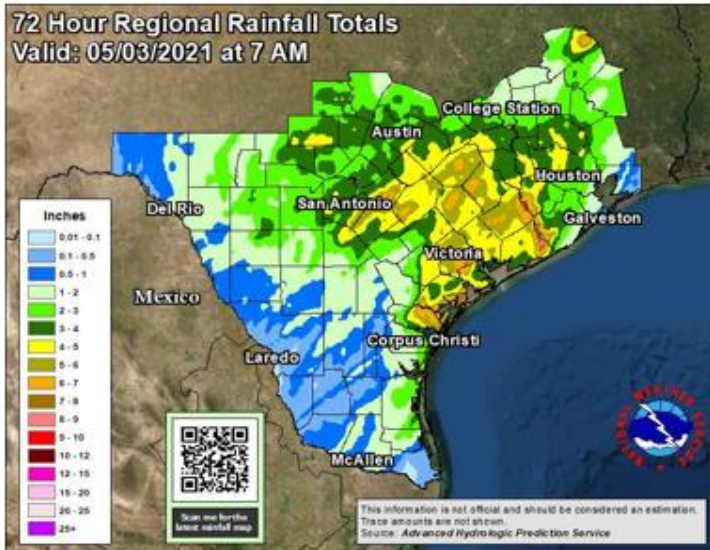
Highlights wettest month for a category
 Highlights driest month for a category

Note: All data taken from the CoCoRaHS website in Total Precipitation Summary Report
 Note: Only counties with 2 or more active observers reporting are displayed in this chart.

Table 1: Houston/ Galveston Regional rainfall averages by county for the spring season March – May.

Houston/Galveston Regional Summary (continued)

South and SE Texas Weekly Rainfall Totals for May Showing Storm Systems Amounts and Locations



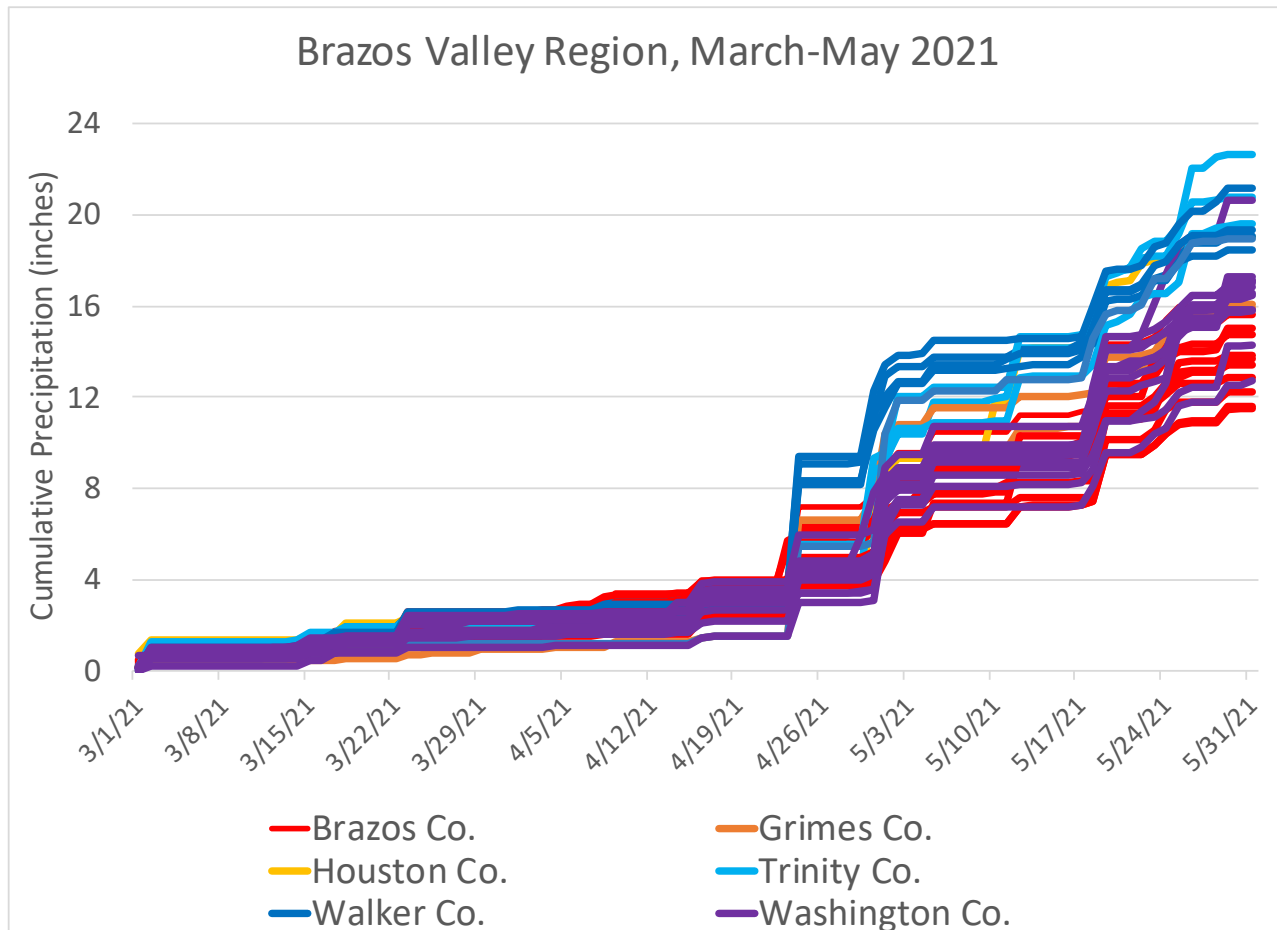
All rainfall maps are a combined output of data from the following sources: ASOS, AWOS, AHPS, CoCoRaHS, and Co-Op observers. Credit to Juan Carlos Pena Jr. with the CRP NWS WFO for compiling data and producing all the maps displayed here on this page.

Brazos Valley Regional Summary

Spring 2021 Precipitation Summary

Bryan-College Station/Brazos Valley Region, Texas

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



It was as though the atmosphere shut down water service after the February winter storm, just like many water suppliers were in danger of doing. The lack of precipitation since the middle of February continued until nearly the end of April, with those two months producing 2"-5" across the Brazos Valley region. Then, in late April, water service was restored. Between 7" and 18" were recorded by CoCoRaHS observers between April 23 and May 31. As usual, the wetter conditions tended to be found farther east, except that Washington County managed to keep up with many of their neighbors to the east after giving them a head start in late April. While, climatologically, precipitation normally increases between March and May, it's not usually by a factor of four!

Observer Statistics: We were thrilled to see 57 active observers this spring, an increase of 11 over the previous fall. Of those, 15 recorded precipitation observations for all 92 days and another 8 had fewer than ten days missing. In all, 34 observers reported usable precipitation spanning the entire season.

- Wettest day: **6.03"**, April 24, Walker County
- Wettest season: **22.64"**, Trinity County
- Driest season: **11.50"**, Brazos County
- Dusty Soles Award: **23 days without 0.01"**, March 24 thru April 15, Walker County
- Soggy Socks Award: **13 days with measurable rain**, May 17-29, Houston County

West Texas/SE NEW Mexico Summary

West Texas and Southeast New Mexico had a very dry spring.

By: James DeBerry, Meteorologist/Hydrology Program Manager, NWS Midland

March

The drought continued in March, despite the synoptic pattern changing with the season. No notable hydrologic events occurred.

Monthly radar precipitation estimates ranged from nothing over most areas west of the Pecos to up to 3" in far eastern Mitchell County. However, the highest observed rainfall was 0.96" in Snyder in Scurry County. Average rainfall was a whopping 0.17".

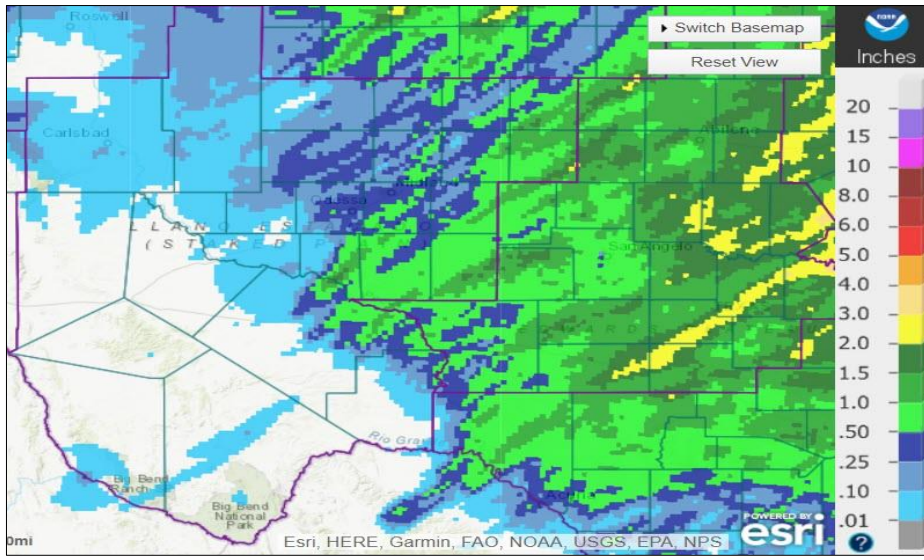


Figure 1: March Regional Precipitation

April

April would have otherwise been another dry month for West Texas and Southeast New Mexico, were it not for a slow-moving upper trough that moved through the region at the end of the month. This storm system brought more rainfall in a couple of days to many locations than they've seen in months. Rivers even rose a little from base flow.

Monthly radar precipitation estimates ranged from nothing along parts of the Rio Grande Valley to up to 5" in eastern Scurry County. Highest observed rainfall was 4.67" in Andrews in Gains County. Average rainfall was 1.04".

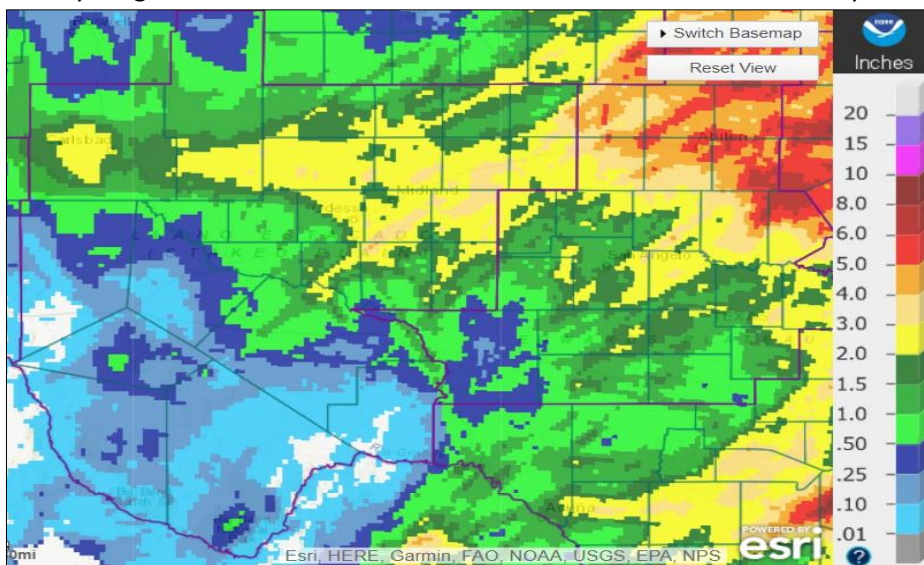


Figure 2: April Regional Precipitation

West Texas/SE NEW Mexico Summary (continued)

May

May was fairly uneventful until the last week, when an upper-level trough parked itself over Baja, sending multiple shortwaves into West Texas and Southeast New Mexico. This resulted in a week of mostly severe activity. However, heavy rainfall factored in, especially the last of day of the month.

On May 31st, thunderstorms flash flooded Odessa in Ector County, deep enough that water got into some residences. Vehicles were submerged up to their hoods, and as many as 27 swift water rescues were made. Flash flooding also stalled many vehicles in Midland in Midland County. Deep Creek went into minor flood stage, and the Colorado River came out of its banks.

Monthly radar precipitation estimates ranged from no rain in southwest Brewster County to up to 15" in the upper Colorado River Valley. Highest observed rainfall was 9.04" in Fluvanna in Scurry County. Average rainfall was 2.09".

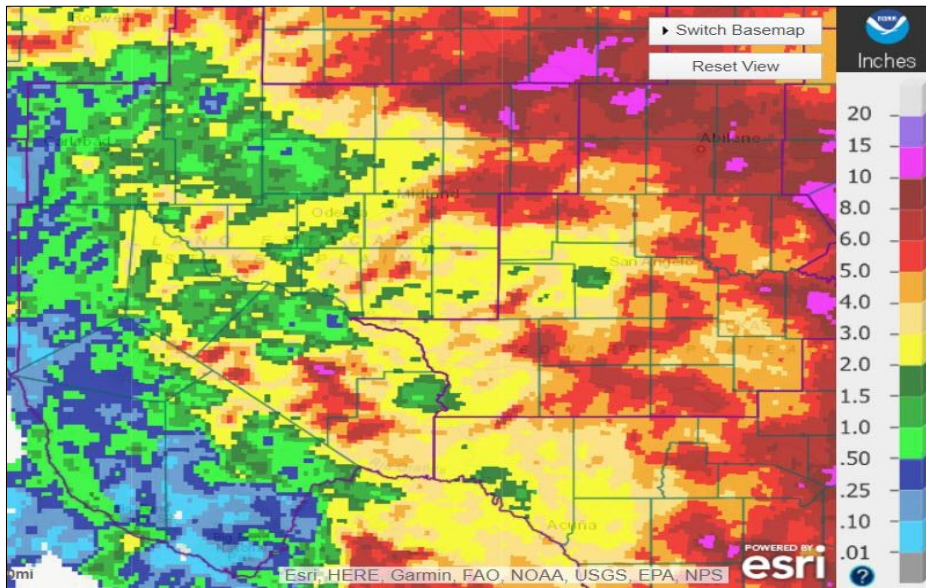


Figure 3: May Regional Precipitation

Overall, Spring 2021 leaves West Texas and Southeast New Mexico in pretty good shape east of the New Mexico/Texas border, but in extreme to exceptional drought in areas farther west. Area reservoirs are at 39.0% conservation capacity as of June 1st.

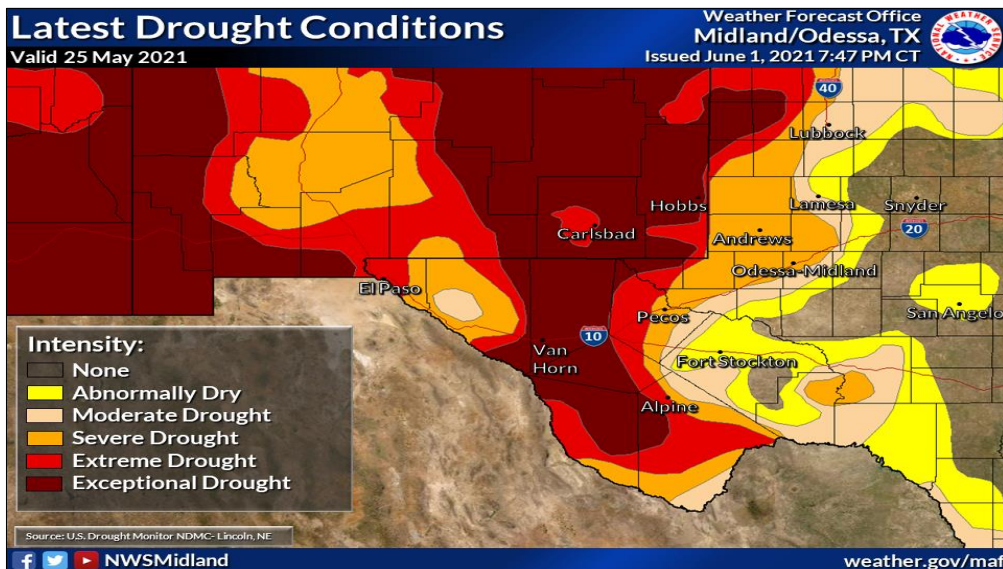


Figure 4: Drought Conditions at the end of spring.

March 13, 2021 Panhandle Tornadoes

March 13, 2021 - Eight Tornadoes in the Texas Panhandle

By: Angela Margrave, NWS Amarillo

Overview

On the second anniversary of the bomb cyclone (https://www.weather.gov/ama/March13_2019_HighWinds), we were dealt another very potent upper level system which produced widespread hazards from heavy snow across the front range/Rockies to severe weather across the Southern High Plains. For us here in the Panhandle, we issued 13 tornado warnings and 10 severe thunderstorm warnings. This was the first tornado day of the 2021 convective season in our area, with eight confirmed tornadoes. We also saw three separate instances in which two tornadoes were in progress from the same parent thunderstorm at the same time.

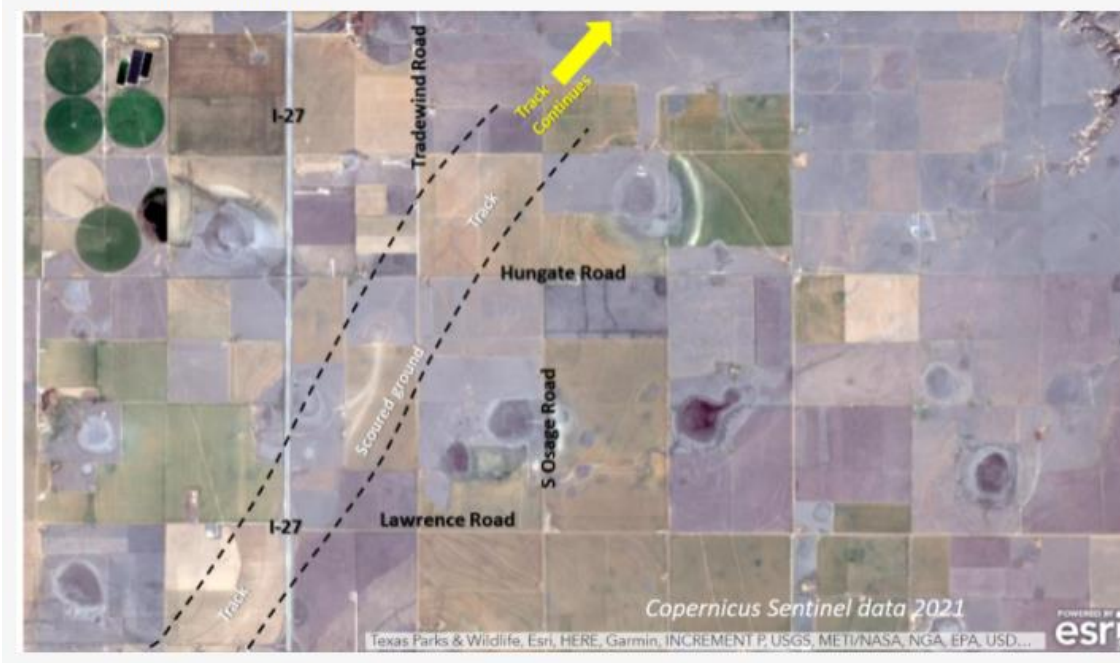
A vigorous closed upper low was approaching the Four Corners region from the west. A warm front lifted north and northwest across all but the Oklahoma Panhandle and the northwest Texas Panhandle while a sharpening dryline was located over eastern New Mexico. The dryline preceded a Pacific cold front which was also located in eastern New Mexico and swept eastward later in the evening. A broken line of thunderstorms developed ahead of the dryline in eastern New Mexico and tracked north and east into the western and southwestern Texas Panhandle before continuing to move east across the remainder of the eastern Panhandles during the evening hours, growing upscale as the Pacific cold front swept eastward and overtook the dryline. Complete article can be found at:

https://www.weather.gov/ama/March_13th_2021_Texas_Panhandle_Tornadoes
(By WFO Amarillo Forecasters)

Copernicus Sentinel Data

Satellite data from the Copernicus Sentinel satellite revealed scoured ground from the large tornado on either side of I-27 (Copernicus Sentinel data 2021). Our survey tracks are overlaid on photo 2 and 3

Photo 1: Wide view with annotations.



March 13, 2021 Panhandle Tornadoes (continued)

Photo 2: Scoured ground shows where tornadoes merged with overlaid survey track east of I-27.

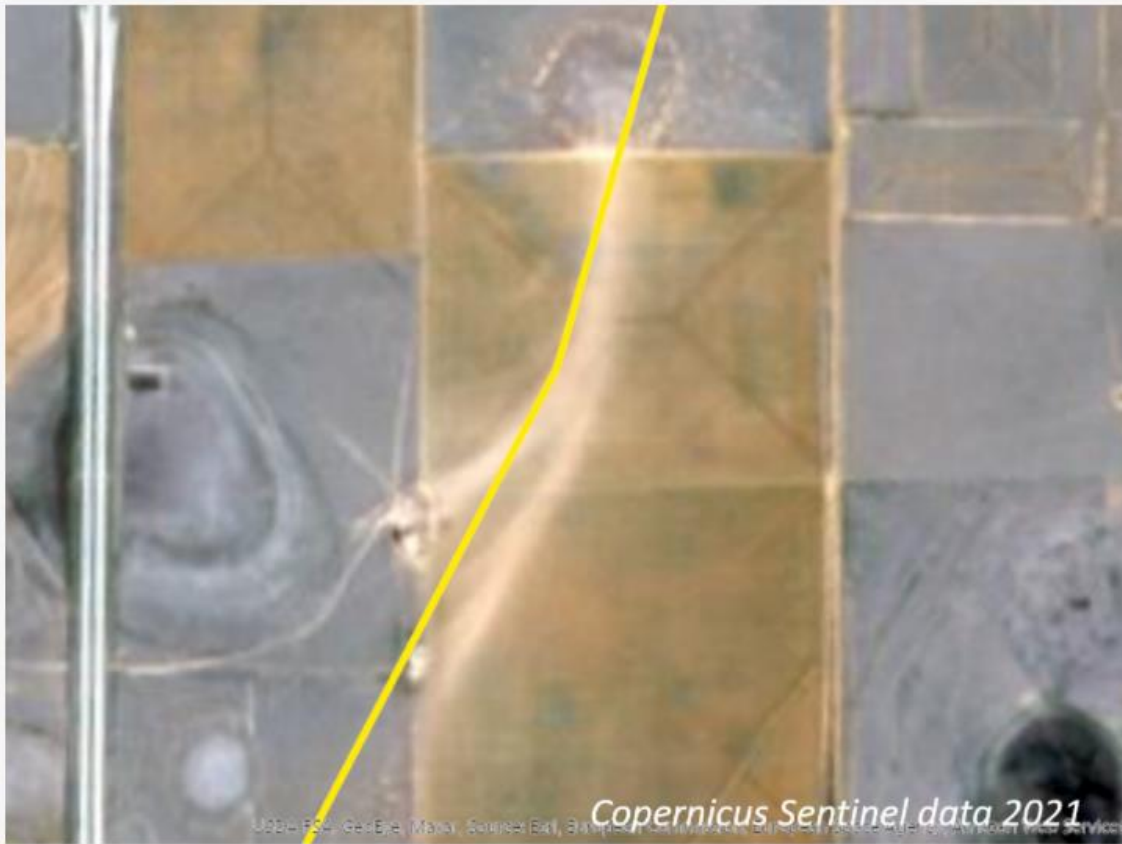


Photo 3: Scoured ground with tornado survey tracks overlaid.



March 13, 2021 Panhandle Tornadoes (continued)

Additional pictures of the Happy Texas tornado and damage associated with it follows below:



North of Happy
(Jay McCoy)



Damage to a home north of Happy
(Amarillo OEM)



Damage to a home north of Happy
(Amarillo OEM)



Damage to a home north of Happy
(Amarillo OEM)

Please see an additional picture from the March 13th, 2021 storms on the following page 42 by storm chaser Ian Shelton.

Spring Storm Season Pictures

By: Ian Shelton, Storm Chaser – Houston Texas



Image 1: Large wedge tornado that was documented near Happy, Texas in the Texas Panhandle on March 13th 2021.

Spring Storm Season Pictures (continued)



Image 2: Large cone shaped tornado on 5/17/2021 near Forsan, Texas west of Sterling City, Texas.



Image 3: Waterspout developed on an outflow boundary moving offshore from decaying thunderstorm near Galveston on 5/31/2021.



Image 4: Beautiful mothership structure on a supercell thunderstorm near Roswell, New Mexico in Late May 2021.

Texas Summer Weather Outlook 2021

Will Storms Continue to Bring Heavy Rain

By: Bob Rose, Meteorologist, Lower Colorado River Authority

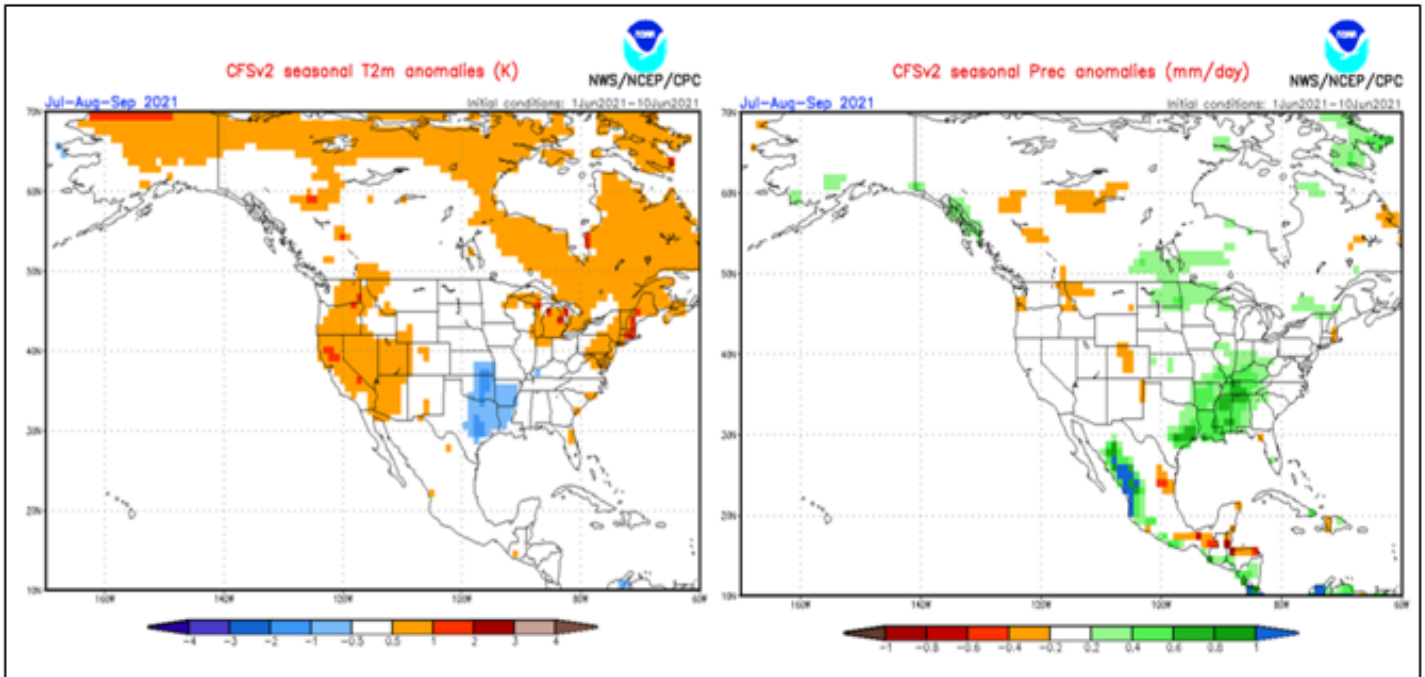
Summertime in Texas and the living is easy! Sunny days, gentle breezes and limited rainfall make summer a great time to take it easy in the backyard hammock or to make a refreshing visit to the lake or beach. Of course, I neglected to mention those pesky mosquitos and the sizzling triple-digit temperatures. Putting those minor details aside, this summer is shaping up to be a little easier than most as temperatures are forecast to be less hot, while rainfall is predicted to be close to normal. Now before you think I've been out in the sun for too long, I do want to explain the weather pattern leading up to this summer has been unique. The month of May featured wave upon wave of soaking rains across most of Texas. In fact, May 2021 turned out to be 5th wettest May on record for Texas, dating back to 1895. The wet ground and green vegetation leading into summer is expected to keep the brutally hot temperatures more out to the west and north of Texas.

In most summers, the dreaded ridge of high pressure in the upper atmosphere, or heat dome, generally sets up over or near Texas in mid-June and persists across the state through July and August. It's this ridge of high pressure that keeps most storms away and creates the familiar and repetitive pattern of sunny and very hot weather. The summertime ridge likes to get its start over areas where the ground is dry. The dry ground heats up under the summer sun, warming the atmosphere above it. The warming temperatures reinforce its development, keeping the weather dry as the ridge grows stronger and stagnates. Going into summer this year, the driest landscape is located over the Desert Southwest and the southern Rockies, while the Texas landscape is relatively wet and green. As a result, forecasts call for the heat dome to set up across the western U.S. and not directly over Texas as we typically see in most summers.

With the heat ridge spending less time directly over Texas, temperatures are forecast to be less extreme than we see in most years. In addition, without the ridge directly overhead, it will open up more opportunities for rain from time to time.

The outlook for July-August and September calls for temperatures across Texas to generally average near normal. In fact, readings across the eastern half of Texas could even average slightly below normal. Rainfall is predicted to average near normal, with East and Southeast Texas expected to see slightly above normal rain.

Summer Weather Outlook (continued)



*Climate Forecast System Version 2
Temperature Forecast
Forecast for July-August-September*

*Climate Forecast System Version 2
Precipitation Forecast
Forecast for July-August-September*

Keep in mind even near average temperatures still won't be a walk in the park. We all know it gets hot during the summer in Texas. It's just this summer, we shouldn't see as many of those "really hot days". And near normal rainfall should limit the development of widespread drought.

Hurricane forecasters are predicting another very active Atlantic hurricane season and there is some potential this summer's pattern could be interrupted or changed by a potential tropical cyclone moving into Texas from the Gulf of Mexico or the eastern tropical Pacific.

So, get ready for another hot Texas summer. Hopefully, this one will be a little less extreme than those we have seen in recent years. Nevertheless, the days will be long, and the temperatures still quite hot! Be sure to take the all the necessary precautions to keep you and your family cool and safe from the hot Texas sun.

Observer Tips & Training Material

The Importance of Observation Time

We ask observers to measure their precipitation in the morning, typically 7:00 a.m. There are a number of reasons for this, but the primary one is so that CoCoRaHS observations are consistent with other precipitation observations made in the U.S. Starting in the early 1960s the (then) U.S. Weather Bureau requested that U.S. Cooperative Observers start taking their measurements in the morning as that would minimize the amount of evaporation from rain gauges and result in more accurate precipitation measurements. Prior to this both temperature and precipitation measurements were taken in the late afternoon, typically 5-7 p.m... The current instructions for U.S. Cooperative Observers states the following:

"Observations at precipitation stations should be taken at 7 a.m. local time, although you may usually choose any time between 6 a.m. and 8 a.m... Be sure, however, to take observations at the same time every day throughout the year if at all possible. Continue observing at the same time whether standard or daylight saving time is in effect. Convert from 7 a.m. standard time to 7 a.m. daylight saving time when the latter takes effect."

CoCoRaHS follows this same guideline. Many National Weather Service precipitation products are based on these observations. In Texas the West Gulf River Forecast Center will take 7:00 a.m. observations and enter CoCoRaHS data into computer models that give forecasters the very latest picture of the current state of hydrology in the Texas regions. A map showing 24-hour precipitation amounts, such as this one from the Advanced Hydrologic Prediction Service (AHPS), uses a combination observed precipitation from Coop, CoCoRaHS, first-order stations (any meteorological station that is staffed in whole or in part by National Weather Service, FAA, or civil service personnel), and radar to map the precipitation.

Some argue that a calendar day (midnight-to midnight) total is more representative of daily precipitation. That may be true, but precipitation measurement is still by and large a manual process performed by humans, many of whom don't want to or can't wait until midnight to make an observation. The 7:00 a.m. time also closely aligns with 12:00 UTC, one of the standard synoptic hours for weather measurement. These synoptic hours (in Universal Coordinated Time, or UTC), based on international agreement through the World Meteorological Organization (WMO), are hours which meteorological observations are made simultaneously throughout the world at three or six-hourly intervals. The primary synoptic hours are every six hours, commencing at 00:00 UTC. 12:00 UTC also marks the end of the "hydrologic day", a standard used by hydrologic modelers and the River Forecast Centers.

Observer Tips & Training Material (continued)

The CoCoRaHS Precipitation Map

The CoCoRaHS precipitation map displays all reports of precipitation with observation times within 2.5 hours of 7:00 a.m., i.e. 4:30 a.m. to 9:30 a.m. local time. Any observations made outside of this window will not appear on the daily map, but remain in the database for users. This data is still needed and valuable for time periods longer than a day, such as weekly, monthly and longer precipitation summaries. Our map represents 24-hour precipitation amounts, in line with the synoptic time, the end of the hydrologic day, and represents most of the CoCoRaHS observations made that day. For example, on Friday, June 5, out of nearly 13,000 CoCoRaHS observations only 340, about 2.5 percent, were made outside of the 4:30 a.m. - 9:30 a.m. window.

The important thing is to be consistent. Don't switch observation times from day to day (for example, from 7:00 a.m. on one day to 11:00 a.m. the next to 8:00 a.m. on the next). If on one day you take your observation time earlier or later than usual, that's OK - be sure to enter that time in the Observation Time Field.

Here is one more thing to remember. It's not about when you enter your data (the map itself updates all the time to reflect late entries), rather it's the time you actually look at your gauge - and what is entered on the form - that is important. Time of observation is the time you make your measurement, not the time you submit your observation to CoCoRaHS. If you make your observation at 7:00 a.m. but aren't able to enter it until 11:00 a.m., it is still a 7:00 a.m. observation. But remember in order for your data to be used in computer model forecasting, you must get your report in before forecasters run computer models that morning. This is especially important when it has rained the last 24 hours. So it is always a good idea to report promptly after your observation at 7:00 a.m.

If you have been taking your observation at one time, say 6:00 a.m., and you want to change it to 8:00 a.m., contact your state coordinator or headquarters to make that change. You can't change your default observation time using the My Account menu. If you have any questions about observation time, please let us know!

Scheduled CoCoRaHS Webinars

Upcoming WxTalk Webinars:

Webinar #77 - July 22, 2021 - 1PM EDT

The National Weather Service's Observing Programs

Tom Cuff, Director
NOAA/NWS Office of Observations
Silver Spring, MD



Scheduled CoCoRaHS Webinars (continued)

Webinar #78 - Thursday, September 9, 2021 -1PM EDT

"Derechos: Nature's Wall of Wind"

Walker S. Ashley
Northern Illinois University
Geographic and Atmospheric Sciences
DeKalb, IL



Biography

Thunderstorm generated windstorms occur over broad spatial and temporal scales; however, the more widespread and longer-lived of these windstorms are known as "derechos". This talk will define derechos and their different types, reveal the interesting origin and history of the term derecho, provide a climatological overview of these extreme events, and illustrate the impacts these windstorms can have on communities by examining a few noteworthy events. We will also examine the unique visual and radar characteristics of thunderstorm systems that produce derechos. We will conclude with a discussion of how climate change may affect derechos and their parent thunderstorm systems in the 21st century.



Texas CoCoRaHS Observer

The official newsletter of Texas CoCoRaHS

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Texas CoCoRaHS



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