

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 Weather Summary Winter, 2022-2023

John Nielsen-Gammon, Texas State Climatologist



Precipitation distribution for Texas, December 2022 through February 2023, using Oregon State PRISM analyses, generated from SC-ACIS.

Continued page 2 \rightarrow

"Because Every Drop Counts, As Do All Zeros"

Texas Weather Summary (continued)

The climatological precipitation in Texas has a distinct annual cycle. Wintertime tends to be dry, especially in West Texas. The difference in precipitation between western and eastern parts of the state is typically a factor of twenty or more. Precipitation typically increases during the springtime, with May and June being the wettest months on average across the state. The relative gains in precipitation are larger toward the west; there's almost no seasonality to precipitation along the Louisiana border. By July, far West Texas is having its typically wettest month, while most of the rest of the state away from the Gulf Coast is experiencing what on average is the driest month of the year. Then tropical disturbances kick up and eventually the jet stream starts getting involved too, so that there's a second peak of precipitation on average in September and October. Then things cool off, literally and figuratively, and the big difference between western Texas and eastern Texas re-emerges.

This year, the difference between western and eastern Texas was much more than even a typical winter produces. Lots of cities, including Del Rio (0.21", normal 1.9") and Brownsville (0.80", normal 3.4"), experienced one of their five driest winters on record. Meanwhile, near Louisiana, many rainfall totals exceeded 20", with the highest CoCoRaHS total I could find being 24.95", more than 100 times wetter than Del Rio!

I guess you could say that Central Texas was intermediate in precipitation as it is intermediate in geography. If you were lucky or unlucky enough to have received between 2.10" and 2.50", you can proudly boast that you received ten times as much precipitation as parts of southwestern Texas and a tenth of the rain in parts of East Texas.

Winter was also warm, as befits a La Niña year. Just as eastern Texas had higher precipitation totals, they also had larger precipitation departures from normal, as much as 5 °F. Plants seem to think spring is here; I saw my first bluebonnets of the season on February 27 between Bastrop and Austin and by now they're blooming in my yard in College Station.

This spring I'm teaching climatology to our undergraduate meteorology majors. A major part of the course is a term project where students have to do research on some aspect of the climate and come up with something new. This semester, one of the student groups is examining the weather conditions that lead to good or bad bluebonnet seasons. I think, based on what's poking out of the ground already, - that this is going to be one of the good bluebonnet seasons.

What's poking out of the ground in your neck of the woods? Submit a CMOR to report on the first sighting of key wildflowers. You'll be able to track what happens year after year, and maybe you'll be able to make your own wildflower season predictions after a while. Good luck!

Austin/San Antonio Regional Summary

The Last Gasp of a "Triple Dip" La Niña By Keith White and Christopher Morris– WFO Austin/San Antonio

As is the case with every winter, highly variable weather impacted south-central Texas this year. Despite a significant cold snap arriving just before Christmas and the worst pure ice storm in decades impacting portions of the region in late January into early February, the winter averaged out warmer than normal due largely to the impacts of La Niña. In fact, in Del Rio it was their 2nd warmest and 4th driest winter on record, and at Austin Camp Mabry it tied for the 9th warmest DJF period dating back to the late 1800s. Most areas saw continued below normal precipitation, though there were a few exceptions along and east of I-35 (Figure 1).



Figure 1: Percent of normal precipitation for the 90 days ending March 1, 2023, at 6am.

December started on a cool note as surface high pressure over the region kept temperatures below normal across south Central Texas on the first. Much warmer conditions occurred over the next 2 weeks as southerly winds in the low-levels of the atmosphere prevailed. The heaviest rainfall event this winter developed during the evening hours on December 10th ahead of a cold front and upper-level weather system. Very moist air in place as a surface trough stalled nearby led to several rounds of thunderstorms from northeast Bexar County into northern Lee County. CoCoRaHS, automated gauge reports and radar data showed the heaviest totals were in northeast Bexar County near St. Hedwig, where an automated gauge reported 8.39" of rainfall and a CoCoRaHS observer reported 8.02". A broad area of 4-6" totals extended into southern Guadalupe County, with some pockets of 2-4" reported over northern Caldwell and Bastrop counties. This event is clearly seen on the seasonal percent of normal precipitation map (Figure 1) as one of the only areas that experienced wetter than normal conditions this winter. Runoff from these storms resulted in minor flooding on Cibolo Creek at Sutherland Springs.

On the 12th through the 15th, a large upper low moved from the southwestern U.S. into the Central Plains, with an unstable pattern bringing daily rain chances to our region. The central and eastern 2/3 of the area benefited from cloudy skies and long periods of patchy light rain and drizzle, but rainfall totals were mainly less than 0.10" through the period. Mostly cloudy and mild days followed through the 17th with no rainfall. On the 18th, a shallow trough took shape over the southwestern U.S. and tracked east across Texas through the 19th. By the morning of the 19th, more beneficial rains arrived over the eastern 2/3 of the area. Areas from Hwy 281 and I-35/I-37 averaged 0.25-0.5" while the Austin metropolitan area and areas along Hwy 77 received 0.5-2". These rains offered some rare improvement to the long-standing drought impacting much of our vast region. No significant rainfall occurred in the final one-third of December, however the strongest cold front in nearly two years arrived on the 22nd of the month. Setting aside February 2021 for a moment, this front brough the coldest temperatures in decades for much of our region. These temperatures for the 22nd through the 24th would normally have been capable of setting records; however, two events in history - in 1989 and 1983 - occurred at the same time of year, preventing any record lows or record low maximum temperatures from being broken.

Austin/San Antonio Regional Summary (continued)

A slow warming trend and dry weather finished out the month and year, and the month of January began on a warm and dry note. This trend largely continued well into the middle of the month. Record high temperatures were set at Austin and Del Rio on the 2nd and 17th. Light precipitation amounts did occur on the 2nd and 3rd for areas mainly east of I-35 and north of I-10. Portions of the Coastal Plains did see locally heavy rainfall on the 7th as very moist conditions and an approaching cold front resulted in several rounds of storms. Most of the rain fell over Karnes, DeWitt and Lavaca counties, with radar estimated widespread amounts of 0.5-1.5" and a few pockets of 3-5".

The next round of light rain occurred on the 18th which primarily brought rainfall of 0.25-0.5" to Bastrop and Fayette Counties before a fast moving upper low would sweep across the southern high Plains the 23rd-24th of January. This helped to bring showers to the area during the early morning hours of the 24th as a warm front slowly spread across the Coastal Plains. Convection developed along and just north of this front during the mid-morning hours before exiting to southeastern Texas as the upper low lifted into the Central Plains. Rainfall totals ranged from a trace to 0.5" across the Southern Edwards Plateau, Rio Grande Plains, and western Hill Country. The eastern Hill Country and I-35 corridor saw amounts of 0.5-1.5" while the Coastal Plains saw amounts of 1-3+".

Weak southwesterly flow aloft and return flow off the Gulf brought light rainfall to the area on the 28th, primarily east of the I-35 corridor. A Canadian cold front surged through the area late on the 29th that brought renewed showers to a greater portion of the region. This frontal inversion would remain in place and become the focus for repeated rounds of showers through the end of the month. Periods of freezing drizzle and freezing rain began the night of the 30th for portions of the Hill Country and Austin metropolitan area. Ice accumulations by the end of the 31st were mainly 0.10" or less, but this was enough to lead to many roadway accidents, and the most significant pure ice storm in decades was just beginning. Just after midnight February 1st, a band of heavier precipitation arrived as the final upper-level trough moved into our area. Most of the heavy precipitation exited around or just after sunrise, but not before leaving widespread ice accumulations up to and exceeding 0.5" across much of the Hill Country and Austin Metro area, weighing frown trees and power lines and leading to widespread power outages. If not for the heavy rain dragging warmer temperatures down from above the inversion, it could have been even worse. Freezing drizzle continued to add to the totals during the daytime, and one last round of patchy freezing rain came through overnight into the 2nd before temperatures rose back above freezing across all of south-central Texas. Our office completed a review of this event in Story Map format <u>here.</u> An analysis of total ice accumulations can be found in Figure 2. A few ice accumulation measurements in the comments of CoCoRaHS observations helped immensely in filling in data gaps for this map.



Figure 2: Total Ice Accumulation from Jan 31-Feb 2, 2023. Ice accumulation was estimated based on available reports from the public and spotters as well as measurements from ASOS stations.

Austin/San Antonio Regional Summary (continued)

In total, precipitation amounts through this period (the 29th-2nd) were mostly less than 0.25" for the Rio Grande Plains, increasing towards the northeast with widespread 1-1.5" amounts along the I-35 corridor and a few spots in excess of 2". While the cold rains over the southern half of the area were beneficial for drought relief, the freezing rains north did more harm than good. The combination of high density of people and of trees, especially Oaks, in the areas hardest hit by ice led to widespread tree damage affecting power transmission. Hundreds of thousands of people were without power in the Austin area, some for nearly a week.

After nearly three days below freezing in portions of the Hill Country and Austin metro area, a warming trend brought highs back into the 70s by the 5th. A slow-moving Pacific front moved through on the 7th, and some widespread rains of 0.25-1" impacted much of the region except of the Rio Grande Plains and portions of the Coastal Plains. Locally higher totals of 2-3" associated with a small thunderstorm in Fayette County were reported by CoCoRaHS observers. Following this event, several periods of dry, breezy conditions impacted primarily western portions of the area off and on the rest of the month. These periods increased evaporation of what little precipitation fell in many areas, leading to elevated to critical fire weather conditions. Red Flag Warnings were needed on the 14th, 16th, and 22nd for mainly western portions of the region. In between, temperatures were a bit of a roller coaster with the last freeze of the season in Austin the morning of the 18th but highs in the 90s on the 22nd, for example.



Figure 3: Change in drought classification in the U.S. Drought Monitor between December 6, 2022, and February 28, 2023.

An interesting event happened on the morning of the 22nd in rural Val Verde County. A line of weak convection not even strong enough to produce lightning managed to push out a 71 mph wind gust 10 miles southwest of Comstock at 5am! Otherwise, the end of February was relatively quiet. Very little rain fell in the back half of the month, with a few spots receiving up to a quarter inch in northeastern portions of the region stretching from Llano to Lee counties. The month ended with well above normal temperatures the 26th-28th, enough to bring monthly average temperatures for February back above normal for most locations.

Austin/San Antonio Regional Summary (continued)

Over the course of the winter, drought conditions worsened over many western to central portions of the region, although there were some improvements for some areas east of I-35 (Figure 3). At the time of this writing, Extreme (D3) drought or worse has expanded to cover nearly 31% of our region with at least some level of drought conditions over about 85% (Figure 4). Many of the drought impacts are dominated by longer term issues like low streamflow's, reservoirs, and aquifers and dry deep-layer soil moistures. The good news is, we're transitioning into our primary wet season now and La Niña is coming to an end with a return to ENSO (El Niño/Southern Oscillation) Neutral conditions through this spring, but unfortunately warmer than normal temperatures are likely to continue on average through the end of May.



Figure 4: U.S. Drought Monitor valid 6am February 28, 2023.

West Texas Summary

Very Little Hydrological Events this Winter Season

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

December

2022 ended in a hydrological whimper, with very little precipitation noted during the month of December. An impressive Arctic blast arrived around Christmas and, had it not been a dry front, would have produced prodigious amounts of snowfall. Otherwise, no hydrological events were noted.

Monthly radar rainfall estimates ranged from nothing over many locations in the higher terrain out west to up to 2" in Dawson County. The highest observed rainfall was a paltry 0.61" at Colorado City in Mitchell County. The average of precipitation reported across West Texas and Southeast New Mexico was only 0.20".



Figure 1: December 2022 Precipitation for West Texas.

January

2023 got off to a dry start, as most of the HSA is still in one degree of drought or another. A minor snow event occurred on the 24th, and a minor freezing rain event at the end of the month. Otherwise, no significant hydrological activity was noted.

West Texas Summary (continued)

Monthly radar rainfall estimates ranged from nothing over the Marfa Plateau to up 1.50" in eastern Eddy County. The highest observed rainfall was 1.37" south of Odessa in Ector County. The average of rainfall reported across West Texas and Southeast New Mexico was 0.24".



Figure 2: January 2023 Precipitation for West Texas.

February

February was another relatively dry month. March's typical synoptic pattern came early, with a few widespread wind events as powerful upper-level troughs moved through the region. Unfortunately, these were frequent enough that after a trough moved through, no appreciable moisture return was able to occur before the next trough arrived. Thus, critical fire weather was more dominant than precipitation. No notable hydrological events occurred. On a more optimistic note, La Nina conditions are expected to transition to ENSO-neutral over the next month or so, improving the precipitation situation.

Monthly radar rainfall estimates ranged from nothing over west central Reeves County to up to 2" in eastern Regan County. However, the highest observed rainfall was 1.60" at Persimmon Gap in Brewster County. The average of rainfall reported across West Texas and Southeast New Mexico was 0.43"

West Texas Summary (continued)



Figure 3: February 2023 Precipitation for West Texas.



Figure 4: Latest Drought Conditions at close of winter season across West Texas.

North Texas Regional Summary

Variable Precipitation across Northern Texas this Season

By: Greg Story, CoCoRaHS North Texas Regional Coordinator

Greetings CoCoRaHS observers from the North Texas Regional Coordinator! It's time to wrap a bow around the winter season and to go back and see what the weather has been doing, particularly in North Texas, over the past several months. That is the goal of this newsletter article. After we had the wettest August of record, the fall season returned to a dry weather regime until the middle of October and into November. Then, this winter season turned back to being dry, followed by some significant precipitation in February. The variability of the rainfall over North Texas reminds me how important your rainfall reports are. Why? They help in determining the areas of drought as well as floods. Your reports continue to be invaluable to the National Weather Service and other entities (such as the Texas State Climatologist and the National Drought Mitigation Center). I am thankful to every one of you for reporting your rainfall via CoCoRaHS!

Reviewing the past several months, in August the month started out very dry, but a weather pattern change occurred, and parts of Texas turned from drought to flash floods quickly. Much above normal rainfall was noted from the DFW metroplex to Shreveport LA, and over parts of Deep South and Southwest Texas. In September the weather pattern shifted once again, and after some rain early in the month it turned dry once again. Most of Texas had below normal precipitation, with much below normal rainfall over the western parts of North Texas into the Texas panhandle. The dry weather pattern persisted into October for Central and East Texas. However, West Texas started seeing some precipitation. Below normal rainfall occurred over the remainder of Texas, especially around San Antonio. In November the weather pattern turned more favorable for precipitation. Most of the state had near to above normal precipitation. In December much of southern, central, and western parts of Texas saw below normal precipitation. However, above normal rainfall was noted over Southeast Texas, and over a small area north of San Angelo. Much of North Texas saw near to below normal precipitation. In January, extreme East Texas and all of Southeast Texas saw above normal rainfall. Elsewhere in Texas the precipitation was near to below normal. In February much of North Texas saw above normal rainfall. Elsewhere in Texas was below normal. There was a small area around the Texas Big Bend region which saw above normal rainfall as well.



Figure 1: Total Precipitation for 2022 shows it was quite wet over East Texas into Louisiana, and over a few spots over North Texas. But over the rest of Texas the precipitation amounts were low.

Percent **Reset View** 600 400 300 200 150 125 110 100 rleans 90 -Chihuahua 75 -50 25 Torreón Monterrey 10 liacano

North Texas Regional Summary (continued)

Figure 2: Percent of Normal Precipitation for 2022. This map better illustrates the above normal precipitation over East Texas and over parts of Deep South Texas, while also showing long term dryness over Central Texas near and around San Antonio.

DFW Airport for 2022 observed 36.63". The normal amount for the year is 37.01" so close to normal at -0.38" for the year. Waco for 2022 got 20.76". The normal amount for the year is 36.40" so -15.64" for the year, which was much below normal.



Figure 3: December 2022 Percent of Normal Precipitation map. The dark green, blue, and purple colors indicate above normal precipitation; the beige, dark yellow and light green colors indicate near normal, while the orange, red and dark red colors indicate below normal precipitation. In December much of southern, central, and western parts of Texas saw below normal precipitation. However, above normal rainfall was noted over Southeast Texas, and over a small area north of San Angelo and near San Antonio. Much of North Texas saw near to below normal precipitation.

DFW Airport in December 2022 received 2.38" of precipitation. This included a Trace of snow. The normal amount of precipitation in December is 2.84" so DFW was -0.46" below normal for the month. Waco in December 2022 picked up 0.55" of rainfall. The normal amount of precipitation in December is 2.87" so Waco was -2.32" below normal for the month.

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 or to look at a particular day to see what happened. Which days did you report your heaviest precipitation amounts? You can read about them here and compare what you observed against the maximum amounts.

December highlights with seven storm systems and weather associated with them for the month.

December 2 - 3:

A dry strong cold front moved through North Texas on the 2nd. In Deep South Texas on the 3rd 3.37" fell north of Mission.

December 7 - 9:

A frontal boundary sagged southward into North Texas early on the 7th. Also, a couple short wave troughs moved across the region. As this occurred, widespread light rain developed. Prior to sunrise on the 7th the rainfall amounts were generally less than 0.25", but Sulphur Springs did get 0.60". During the day on the 7th most of the rainfall amounts were light once again, except for the western parts of North Texas. The area west southwest of Burkburnett received 1.45" while the region north northwest of Seymour measured 1.32". The initial rainfall moved out of Texas the morning of the 8th, but new showers developed during the afternoon. While most rainfall amounts were on the light side once again, isolated spots received more. The two heaviest amounts were 1.37" west northwest of Celeste and 1.30" east of Granbury.

December 10 - 11:

A new short-wave trough came across Texas on the 10th, then moved east of the state on the 11th. In combination with a stationary front over North Texas, widespread rainfall developed, with even a few thunderstorms. The heaviest rainfall amounts on the 10th over North Texas were at Arthur City where 2.33" fell, northeast of Sachse with 2.31", and north northeast of Mansfield where 2.05" fell. The rain was much heavier over South Texas, especially around San Antonio where 8.02" fell west northwest of Adkins and 7.42" was recorded at St. Hedwig. The rain moved out of Southeast Texas the morning of the 11th. Residual rainfall in North Texas was less than 0.40", but over Southeast Texas 1.50" fell west of Houston and 1.30" at Palacios.

December 12 - 14:

A strong low pressure system developed over the western US on the 12th, and this storm system moved northeastward through the 13th. As a strong upper-level disturbance passed across the southern plains, a dryline and strong cold front moved across Texas on the 13th, resulting in showers and strong thunderstorms. Before sunrise on the 13th the showers and thunderstorms were most numerous over the western parts of North Texas. Maximum rainfall was reported just northwest of Fort Worth with 1.05" and east of Crowell with 0.94". The thunderstorms were severe during the day on the 13th, with at least 15 tornadoes reported including in the DFW metroplex. As the frontal system advanced, the rainfall was confined to Southeast Texas by midnight. The heaviest rainfall noted in North Texas was north northeast of Gordonville with 1.91" and west northwest of Benbrook where 1.44" was measured. The maximum rainfall in Texas was 3.28" northeast of Town Bluff. Some residual rainfall redeveloped on the 14th behind the advancing cold front over the eastern half of Texas. The maximum rainfall amounts occurred over Southeast Texas were 1.78" fell north of Beaumont and 1.13" fell northeast of Wallisville.

December 18 - 19:

A short-wave trough passed through Texas on the 18th and 19th, resulting in widespread (but mostly light) rainfall over primarily the southeast half of Texas. The heaviest rainfall was measured over Central Texas late on the 18th into the early morning of the 19th. Observers recorded 1.70" east northeast of Manchaca and 1.52" north northeast of Pipe Creek. While the rainfall amounts remained light over North Texas on the 19th, the rainfall intensities increased over Southeast Texas. The largest rainfall amounts were 3.96" east southeast of Colmesneil, 3.80" east of Trinity, and 3.52" east southeast of Rockdale.

December 22:

A strong Arctic cold front moved through Texas on the 22nd. Many locations had temperatures drop 40 degrees within just a few hours. Precipitation was very limited with the frontal passage, but snow flurries did occur behind the front over North Texas.

December 29:

A short wave trough passed through the central and southern plain states on the 29th. This produced some rain and thunderstorms across especially east central and southeast portions of the state. Rainfall amounts prior to sunrise on the 29th over Southeast Texas were light and were under a third of an inch. But the rain became heavier and more widespread during the day over East Texas before moving east of the state around midnight. The heaviest rain in the North Texas area was east of Cameron with 2.96". But further south the maximum rainfall was 5.87" just south southeast of Bacliff and 5.34" east of Milam.



Figure 4: January 2023 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, red and dark red colors indicate below normal precipitation. In January, extreme East Texas and all Southeast Texas saw above normal rainfall. Elsewhere the precipitation was near to below normal.

DFW Airport in January 2023 received 1.38". The normal amount of precipitation in January is 2.53" so DFW was -1.15" below normal for the month. This included 1.30" of snow and sleet. The normal January snowfall amount is 0.10". Waco in January 2023 picked up 1.43". The normal amount of precipitation is 2.59" so Waco was -1.16" below normal for the month. This included 0.10" of sleet and snow, which is slightly above normal.

January highlights with seven storm systems and weather associated with them for the month.

January 2 - 3:

A strong upper atmospheric low pressure system formed over Arizona early on the 2nd and moved northeastward toward the central plains. This caused a dryline and cold front to advance eastward across Texas, which created showers and thunderstorms. The maximum rainfall over North Texas on the 2nd was west of Gause with 0.97" and northeast of Paris with 0.93". But further south they received 3.20" at Jonesville and 2.59" at San Augustine. The rain moved east of Texas on the 3rd. The heaviest residual rainfall was 0.60" south southwest of Jasper and 0.54" northeast of Town Bluff.

January 7 - 8:

A cold front swept across Texas on the 7th into the morning of the 8th. No rain occurred over North Texas with its passage, but showers and thunderstorms did develop over the southern and eastern parts of the state. The peak rainfall amounts were 3.76" at Frelsburg and 3.54" north northeast of Victoria. Some lingering rainfall continued over Southeast Texas the morning of the 8th before moving out of the state. The maximum rainfall reports were 0.60" at Houston and 0.58" at Victoria.

January 18:

An upper atmospheric low pressure system formed over the four corners region late on the 17th and moved eastward. A few showers formed early on the 18th as a result, but initial rainfall reports were all under 0.20". Showers and thunderstorms formed during the day on the 18th primarily over East Texas with 1.59" falling southeast of Marshall and 1.32" at Longview.

January 21:

A short-wave trough passed across Texas and produced some rain, primarily across Southeast Texas. While the rain was less than 0.10" across North Texas, 2.28" fell northwest of Orangefield and 1.64" north of Orange.

January 24:

A deep upper atmospheric low pressure system formed over Arizona and New Mexico early on the 24th, which moved east northeastward through the day. Widespread rainfall developed ahead of the low. Rain spread from west to east, and prior to sunrise on the 24th the rainfall over North Texas was less than 0.40". The maximum rainfall in the state was 1.03" south of Seguin. The rainfall picked up after sunrise with severe thunderstorms and a few tornadoes along and near the upper Texas Gulf coast. Very heavy rainfall occurred over Southeast Texas, while the rain changed to snow over the Texas panhandle and along and near the Red River. In North Texas the heaviest rainfall was south southeast of Kerens with 1.89" and the area south of Sanger with 1.75". Near Houston 6.55" fell east southeast of Hockley and 5.89" northwest of Jersey Village.

January 28 – 29:

A couple upper air disturbances moved across Texas on the 28th and 29th. In addition, a strong cold front moved through Texas on the 29th. Initial rainfall on the 28th was mainly confined to east Texas, as north Texas rainfall amounts were light. Marshall had 4.36" and 4.20" fell in Jonesville. The rainfall continued into the 29th and were accompanied by thunderstorms over southeast Texas. Heavy rain occurred near Houston with 5.37" north of Spring and 4.53" southeast of The Woodlands.

January 30 – February 1:

A series of upper air disturbances moved across Texas. With cold air in place, the precipitation which fell in response to the disturbances was in the form of freezing rain, sleet, and a little snow. It began on the morning of the 30th. Most precipitation amounts were less than 0.65" over North Texas, but over East Texas 1.10" was observed in Longview and 1.01" was observed west southwest of Harleton. Another round of wintry precipitation occurred on the 31st. The heaviest mixed precipitation tended to be over central portions of the state. In North Texas on the 31st the area northeast of Sachse measured 0.73" and the Dallas Executive Airport received 0.72". But further south 1.33" fell north of Thorndale and 1.10" fell east northeast of Manchaca. Sleet did cover the ground over many spots in North Texas. On the 31st a daily maximum snowfall record was set at DFW airport. A record snowfall (which mostly fell as sleet, but that is an official snow amount) of 1.3" breaking the old record of 1.2" set in 1985.



Figure 5: February 2023 Percent of normal precipitation map for February 2023. The dark green, blue, and purple colors indicate above normal precipitation; the beige, light yellow and light green colors indicate near normal, while the orange, red and dark red colors indicate below normal precipitation. In February much of North Texas saw above normal precipitation, while much of South Texas was below normal.

DFW in February 2023 measured 3.97". This included a Trace of snow. The normal amount of precipitation in February is 2.76" so this is +1.21" above normal for the month. Waco for February 2023 picked up 3.29". The normal amount of precipitation is 2.68" so this is +0.61" for the month.

Six significant storm systems affected our weather in February. Here are the highlights of the weather for the month.

February 1 - 2:

The last of the series of upper air disturbances produced widespread mixed precipitation over Texas, mostly freezing rain. On the 1st the precipitation was mostly in the 0.30" to 0.50" range in the DFW area, but a few spots picked up to 0.75". The heaviest precipitation was over East Texas where 1.75" fell north northwest of Zavalla and 1.60" was measured east of Alto. On the 2nd the heaviest mixed precipitation began to move into East Texas and Louisiana. Lingering precipitation amounts in the DFW area were in the 0.25 to 0.50" range. West of Lavon received 0.74" while in downtown Dallas picked up 0.67". Over East Texas the heaviest precipitation was 1.85" south southeast of Kerens and 1.61" at San Augustine.

February 7 - 8:

A rather vigorous short-wave trough approached Texas from the west on the 7th and passed across the state on the 8th. Rain developed ahead of this storm on the 7th. Prior to sunrise on the 7th all the rainfall amounts were light, with the heaviest reading being 0.38" west southwest of Goldthwaite. The rain became more widespread during the day on the 7th, with thunderstorms also noted with locally heavy rainfall. In the DFW metroplex the maximum rainfall reading was east northeast of Lincoln Park with 3.24". But further east 4.08" fell north of Cumby and 4.00" northwest of Greenville. On the 8th the rain and thunderstorms continued but moved out of the state prior to midnight. The heaviest rainfall was in Benbrook with 2.90", while over Southeast Texas 1.95" fell north northwest of Edna.

February 13 - 14:

A deep low pressure system moved east off the Pacific Ocean into extreme southern California on the 13th. As this low moved rapidly northeastward, rain began to develop over Texas later in the day. The rain was widespread the morning of the 14th, but quickly moved out of the state late in the day. Rainfall amounts prior to sunrise on the 14th were all under 1", with the heaviest amounts being 0.97" north northeast of Gordonville and 0.93" east northeast of Lincoln Park. Rainfall amounts during the day on the 14th were all less than 0.75", with 0.72" northwest of Waxahachie being the highest total.

February 15 - 16:

A new low pressure system moved down the west coast to replace the first one late on the 14th, then this low deepened as it advanced east and northeastward on the 15th. This low produced showers and thunderstorms over extreme North Texas late in the afternoon on the 15th. Most of the showers and thunderstorms remained over Oklahoma. By late on the 15th into the 16th additional showers developed along a cold front over east and Southeast Texas. Rainfall amounts were light and were under a half inch. The rainfall moved out of Southeast Texas during the afternoon of the 16th, with additional rainfall amounts of 0.50" or less.

February 22:

A short-wave trough and a cold front moved across Texas. Initial rainfall began late on the 21st over West Texas, then spread eastward overnight on the 22nd and through the day. The maximum rainfall amounts prior to sunrise on the 22nd were 0.67" north northeast of Stephenville and 0.63" east southeast of Bowie. Residual rainfall over the eastern half of Texas during the day on the 22nd was heaviest at Centerville with 0.60" and Longview with 0.50".

February 26 – 27:

A vigorous upper air disturbance moved from New Mexico into the central plain states. This pushed the dryline eastward and a cold front southward, resulting in showers and thunderstorms. While a fast moving line of storms moved across North Texas, the severe weather was confined mostly to Oklahoma and the Texas panhandle. Wind measurements of 114 mph were recorded in Memphis TX and 9 tornadoes and numerous high wind reports in Oklahoma. Rainfall-wise the reports on the 26th weren't too heavy due to the speed of the storms. East of Crowell received 0.41" and northwest of Springtown measured 0.37". Residual rainfall readings on the 27th were very light and were less than 0.10".



Figure 6: The winter season precipitation for 2022-23. The brown, orange and bright red colors indicate the largest precipitation totals, while the light green and blue colors show the lightest amounts.



Figure 7: Percent of Normal Precipitation for winter 2022-23. The purple, blue and dark green colors indicate above normal precipitation. The brown, orange and red colors indicate below normal amounts. As you can see, it was a drier than normal winter over southern and western Texas. There was some prolonged dryness over the lower Texas Hill Country and parts of the panhandle and far southwest parts of Texas. But also of note was the spots over north central and eastern parts of the state, and over much of the southeastern parts of the state that received above normal amounts.

DFW airport for the winter season received 7.74". This included 1.3" of snow and sleet (which is the normal amount). The normal amount of precipitation in winter is 8.13" so this is -0.39" for the season, which is just slightly below normal.

Waco for the winter season recorded 5.27". This included 0.1" of snow (which was slightly below normal). The normal amount of precipitation over the winter season is 8.14" so Waco was -2.87" below normal.





I want to give a special shout out to those who are new to CoCoRaHS, including those that joined during "March Madness". Welcome! You may wonder if anyone looks at your weather reports when you enter them. Rest assured; someone is! Every day CoCoRaHS data is carefully examined and incorporated by the National Weather Service at the West Gulf River Forecast Center for use in their flood forecasting models.

Thanks again for your dedication in making all your weather observations! And we appreciate it if you report zero rainfall daily on the dry days. Why? Because if you go a month or longer without measurable rainfall (as many did in summer 2022), that tells us a lot, too! And don't forget that on days you are not home or unable to report your 24-hour rainfall observation for any reason, you can make a multi-day accumulation report upon your return. This is important information as well. And that includes zero rainfall. This helps us to make changes to the drought monitor.

Everyone, please consider inviting your neighbors, relatives, and friends to join CoCoRaHS! The more rainfall observers we have, the better our chances are of determining the highest rainfall totals during rainfall events, and the location of drought when it isn't raining. If we can help you with your observations or reporting in any way, please let us know! Either I or your county coordinator are here to help you.

Have a great spring season and enjoy the changeable weather we are blessed with in Texas!

Greg Story

Southeast Texas Regional Summary

Soaking Storms to Very Dry Portions with Mild Temperatures

By: Ron Havran - SE Texas CoCoRaHS Regional Coordinator, HCFCD

December 2022

A very warm December across all of SE Texas with temperatures 1.7° - 2.5°F above normal. Temperatures would have been even more above normal if it wouldn't have been for an extremely cold artic outbreak the third week of the month. See page 23 for information on lowest temps. Rainfall was above normal across the northern parts of SE Texas while parts of some southern counties were below normal. (See figure 1 and page 20) Observers in the Golden Triangle Section had a county average of 7.18" while the Houston/Galveston Section had a county average of 3.99". The driest counties averaging less than 2.00" were Fort Bend, Wharton, Matagorda, Jackson, and Brazoria counties. Tyler and Jasper counties had the highest rain totals.



Figure 1: Total Precipitation and Departure from Normal for SE Texas December 2022.

January 2023

Very warm temperatures continued through January running 4.0° - 6.0°F above normal. See page 21. Rainfall was above normal in most counties except Matagorda and Wharton Counties. There was an area from Colorado County to the border with Louisiana that was much above normal. A strong upper level low combined with a stalled frontal boundary on the 24th and brought severe storms with tornadoes and very heavy rains along this swath from Colorado County to the border with Louisiana. See figure 2 showing the much above normal rainfall in mentioned counties. Also, from this system Southeast Harris County near Pasadena and Deer Park experienced an EF3 rated tornado on the afternoon of the 24th between 2:00pm to 3:00pm. A complete story of this supercell storm and the EF3 tornado it produced is covered on pages 23-26.



Figure 2: Total Precipitation and Departure from Normal for SE Texas January 2023.

February 2023

Rainfall across Southeast Texas in February was much below normal in all counties. CoCoRaHS observers had very little to measure. Orange County had the highest total with a very low 2.56". The Houston/Galveston Section average CoCoRaHS observer county rainfall was only 1.09" while the Golden Triangle average CoCoRaHS observer county rainfall was 2.19". (See Chart 1 and Chart 2) Temperatures were above average once again ranging from 2.5° - 4.0°F above the norm.

Figure 4 shows the Winter Total Precipitation across Southeast Texas. Thanks to all CoCoRaHS observers for reporting.



Figure 3: Total Precipitation and Departure from Normal for SE Texas February 2023.



Figure 4: Southeast Texas Winter Rainfall from December 2, 2022, to March 1, 2023.

County	December	January	February	Winter Total
1.12	AVG.	AVG.	AVG.	Dec Feb.
Austin	3.85	6.82	0.97	11.64
Brazoria	2.97	3.73	0.52	7.22
Chambers	5.02	6.67	0.72	12.41
Colorado	3.84	5.79	0.99	10.62
Fort Bend	1.69	4.06	1.04	6.79
Galveston	4.72	4.67	0.76	10.15
Harris	3.35	6.65	1.08	11.08
Jackson	2.49	4.26	1.95	8.70
Liberty	3.88	6.94	1.29	12.11
Matagorda	2.05	2.03	0.38	4.46
Montgomery	5.75	8.45	1.44	15.64
Polk	7.57	7.09	1.70	16.36
San Jacinto	6.71	5.22	1.53	13.46
Wharton	2.03	3.02	0.93	5.98
Region Totals	3.99	5.39	1.09	10.47

Color indicates highest avg. rainfall total for a county in a month Color indicates lowest avg. rainfall total for a county in a month

Note: Counties without a significant # of observers reporting are not listed on the chart.

Chart 1: CoCoRaHS Observers Average Precipitation by County for Houston/Galveston Section

County	December	January	February	Winter Total
1	AVG.	AVG.	AVG.	Dec Feb.
Hardin	6.20	7.01	1.87	15.08
Jasper	7.96	8.27	2.41	18.64
Jefferson	5.93	6.07	2.21	14.21
Newton	NA	NA	NA	NA
Orange	6.44	6.51	2.56	15.51
Tyler	9.35	8.37	1.89	19.61
Region Totals	7.18	7.25	2.19	16.61

Chart 2: CoCoRaHS Observers Average Precipitation by County for Golden Triangle Section

Houston/G	alveston Tem	peratrure	& Rainfall (Data for 2023 \	Winter Se	ason	
		De	ecember Cl	imate			
Site Location (record start)	Hi	Lo	Mean	Departure	Rain	Normal	Departure
Bush Airport (1888)	66.7	47.4	57.1	1.7	3.88	4.03	-0.15
Hobby Airport (1930)	68.5	50.2	59.3	2.4	2.71	4.34	-1.63
Galveston (1871)	66.8	53.8	60.3	1.8	3.01	4.23	-1.22
Sugar Land (2000)	68.7	48.4	58.6	2.0	1.77	3.76	-1.99
and the tax management	1	J	anuary Clin	nate		1 stores a	1
Site Location (record start)	Hi	Lo	Mean	Departure	Rain	Normal	Departure
Bush Airport (1888)	67.6	48.1	57.9	4.1	5.68	2.86	2.82
Hobby Airport (1930)	69.7	51.7	60.7	5.7	3.98	4.09	-0.11
Galveston (1871)	68.1	55.5	61.8	5.8	2.67	4.30	-1.63
Sugar Land (2000)	70.2	48.7	59.5	4.7	3.04	3.63	-0.59
	_	F	ebruary Cli	mate			
Site Location (record start)	Hi	Lo	Mean	Departure	Rain	Normal	Departure
Bush Airport (1888)	70.5	50.4	60.5	2.8	1.49	2.97	-1.48
Hobby Airport (1930)	71.9	53.8	62.8	4.0	0.71	2.85	-2.14
Galveston (1871)	68.1	55.7	61.9	2.6	1.08	2.14	-1.06
Sugar Land (2000)	72.0	50.9	61.5	2.7	0.98	2.83	1:65

Table 1: Temperature and Precipitation data from official observation sites for the Houston/Galveston Section.

		De	cember Cl	imate			-
Site Location	Hi	Lo	Mean	Departure	Rain	Normal	Departure
Port Arthur Airport	67.7	48.0	57.9	2.3	5.71	4.98	0.73
Beaumont Research Center	65.4	48.3	56.8	2.6	5.12	5.04	0.08
Orange 9N	63.4	45.5	54.4	2.2	7.60	5.26	2,34
Site Location	L 11	J	anuary Clin	Departure	Pain	Normal	Departure
Port Arthur Airport	60.1	10.0	50.5	5 g	1 08	5 32	-0.34
Beaumont Research Center	67.5	48.7	58.1	6.0	4.85	4.77	0.08
Orange 9N	66.5	47.9	57.2	6.7	6.07	5.65	0.42
		F	ebruary Cli	mate			
Site Location	Hi	Lo	Mean	Departure	Rain	Normal	Departure
Port Arthur Airport	71.0	52.0	61.5	4.0	1.40	3.09	-1.69
Beaumont Research Center	70.8	52.7	61.7	5.8	2.12	3.62	-1.50
Orange 9N	66.7	49.0	57.9	3.9	2.91	4.18	-1.27

 Table 2: Temperature and Precipitation data from official observation sites for the Golden Triangle Section.

On the morning of December 23rd 2022, the Houston/Galveston Section and the Golden Triangle Section had the coldest temperatures recorded of the winter season. Below is a listing of stations low temperatures for morning of 12/23/2022. Wind chills ranged from 9°F to -8°F. This cold spell lasted from December 21st through December 27th and was the most significant winter weather of the season.

Public Information Statement National Weather Service Hous 347 FM CST Fri Dec 23 2022	ston/Galve	ston TX		Missouri City 3.6 N Beasley (UPR) Katy	14 F 14 F 15 F	0816 AM 12/23 0650 AM 12/23 0730 AM 12/23	29.56N/95.52W 29.55N/95.91W 29.71N/95.75W	7 S Normangee North Zulch Lake Madisonville	12 F 13 F 13 F	0740 AM 12/23 0739 AM 12/23 0730 AM 12/23	30.92N/96.11W 30.87N/96.01W 30.96N/95.91W
PRELIMINARY LOW TEMPERATUR	E REPORTS			Richmond Rosenberg Rolahaan	15 F 16 F	0730 AM 12/23 0735 AM 12/23	29.69N/95.74W 29.59N/95.81W	Matagorda County			
Location	Temp	Time/Date	Lat/Lon	Weston Lakes Katu	16 F	0820 AM 12/23 0805 AM 12/23	29.67N/95.94W 29.72N/95.82W	4.8 SW Bay City (UPR) 5.4 W Sweeny (UPR)	15 F 15 F	0753 AM 12/23 0721 AM 12/23	28.92N/96.00W 29.03N/95.79W
Texas				Sugar Land 3 SW Thompsons	16 F 17 F	0754 AM 12/23 0805 AM 12/23	29.54N/95.67W 29.45N/95.66W	Markham Sargent	18 F 18 F	0759 AM 12/23 0800 AM 12/23	28.97N/96.06W 28.81N/95.67W
Austin County 8.3 S Bellville (UPR)	13 F	0755 AM 12/23	29.83N/96.28W	Stafford	17 F	0817 AM 12/23	29.63N/95.54W	Bay City Palagian	18 F	0755 AM 12/23	28.97N/95.87W
Bellville 1 SW	14 F	0700 AM 12/23	29.94N/96.27W	Galveston County				Colorado River at Bay City	19 F	0825 AM 12/23	28.97N/96.01W
Cat Spring	14 F	0745 AM 12/23	29.89N/96.38W	1.6 SE Webster (UFR)	14 F	0741 AM 12/23	29.52N/95.10W				
D.O NL rayetteville	14 E	0755 M 12/23	29.90N/90.55W	Friendswood	16 F	0740 AM 12/23	29.51N/95.21W	Montgomery County			
7.3 NE Eagle Lake	15 F	0700 AM 12/23	29.66N/96.24W	2 W League City	16 F	0825 M 12/23	29.50M/95.10W	4 NE Todd Mission	11 F	0730 AM 12/23	30.31N/95.77W
Eagle Lake 7 NE	15 F	0740 AM 12/23	29.66N/96.24W	1 SSE Texas City	16 F	0750 AM 12/23	29.39N/94.95W	3.1 N Tomball (UPR)	11 F	0739 AM 12/23	30.14N/95.63W
San Felipe	16 F	0813 AM 12/23	29.80N/96.12W	2 WSW Kemah	17 F	0745 AM 12/23	29.52N/95.05W	Conves	10 F	0/25 AM 12/28	30.3/M/93.24W
				2 WSW Santa Fe	17 F	0735 AM 12/23	29.36N/95.13W	Montgomerv	14 F	0815 AM 12/23	30.30N/95.63W
Brazoria County				League City	17 F	0729 AM 12/23	29.51N/95.05W	Willis	14 F	0727 AM 12/23	30.39N/95.56W
Raty	16 F	1152 NM 12/23	29.42N/95.45W	La Marque	17 F	0800 AM 12/23	29.36N/95.00W	Houston	15 F	0804 AM 12/23	30.17N/95.44W
Lake Jackson	16 F	0804 PM 12/23	29.04N/95.45W	Santa Fe	17 F	0745 AM 12/23	29.35N/95.08W	Magnolia	15 F	0805 AM 12/23	30.21N/95.80W
2.8 E Sweeny (UPR)	16 F	0744 AM 12/23	29.04N/95.65W	Crystal Beach	18 F	0830 AM 12/23	29.46N/94.61W	Hockley	15 F	0830 AM 12/23	30.11N/95.80W
Damon 1 NNW	17 F	0745 AM 12/23	29.30N/95.74W	Crab Lake	18 F	0833 AM 12/23	29.47N/94.62W	Santa Maria	15 F	0745 MM 12/23	20.100/90.030
Alvin	17 F	0735 AM 12/23	29.42N/95.28W	Levee	18 F	0743 AM 12/23	29.42N/94.89W	The Woodlands	15 F	0745 AM 12/23	30.18N/95.54W
Manvel	17 F	0815 AM 12/23	29.52N/95.38W	San Leon	21 F	0850 AM 12/23	29.50N/94.95W	Spring	15 F	0756 AM 12/23	30.12N/95.36W
1 E Lake Jackson	17 F	0745 AM 12/23	29.04N/95.43W	Galveston	21 F	1152 AM 12/23	29.2/M/94.8/W	Pinehurst	15 F	0736 AM 12/23	30.20N/95.6BW
2.3 3 Hillcrest (UFR)	17 5	0758 AM 12/28	29.36N/95.22W	Grimes County							
Angleton	18 F	0740 AM 12/23	29.19N/95.29W	Navasota	12 F	0740 AM 12/23	30.39N/96.09W	Polk County			
Pearland	18 F	0737 AM 12/23	29.55N/95.42W					0.8 N Corrigan (UFR)	11 F	0630 AM 12/23	31.01N/94.83W
Iowa Colony	18 F	0805 AM 12/23	29.44N/95.45W	Harris County				4 LNE GOODRICH	12 1	0730 AM 12/28	30.64N/94.8/W
BRAZORIA	18 F	0745 AM 12/23	28.93N/95.54W	Cypress	11 F	0803 AM 12/23	29.91N/95.73W	LIVINGSOON	10 1	0043 AM 12/28	30.00M/ 53.04W
San Bernard Nwr	18 F	0729 AM 12/23	28.86N/95.57W	2 WNW Spring	12 F	0745 AM 12/23	30.07N/95.42W	San Jacinto County			
Clute	19 F 10 F	0806 AM 12/23	28.94N/95.35W	4 SSW Atascocita	12 F	0805 AM 12/23	29 93N/95 20W	Coldsprings	13 F	0802 AM 12/23	30.52N/95.09W
1 E Freenort	19 F	0805 MM 12/23	28 95N/95 24W	2 NE Houston	13 F	0744 AM 12/23	29.79N/95.36W				
1 0 11000010		0000 121 12,20	201000, 001010	2 NNW Waller	14 F	0750 AM 12/23	30.09N/95.93W	Trinity County		0040 334 40.400	
Brazos County				Kingwood	14 F	0752 AM 12/23	30.05N/95.15W	2.5 S Irinity (OPR)	10 F	0749 AM 12/23	90.91N/99.99M
UP429 (UPR)	11 F	0639 AM 12/23	30.55N/96.30W	Hunters Creek Village	14 F	0745 AM 12/23	29.77N/95.49W	Walker County			
Texas A&m Kyle Field	12 F	0720 AM 12/23	30.61N/96.34W	4 LaL nouston	14 F	0040 AM 12/23	29.74N/95.33W	4.3 N New Waverly (UPR)	9 F	0649 AM 12/23	30.60N/95.48W
UR089 (UPR)	12 F	0710 AM 12/23	30.71N/96.40W	4 9 N Aldine (HPR)	14 F	0748 AM 12/23	29 9RN/95 29W	2.8 NW Huntsville	13 F	0706 AM 12/23	30.74N/95.59W
Z SSL College Station	13 E 12 F	0795 MM 12/23	30.33N/90.30W	Morgans Point	15 F	0840 AM 12/23	29.68N/95.01W	Huntsville	13 F	0706 AM 12/23	30.74N/95.64W
1 ENE College Station	13 F	0735 AM 12/23	30.60N/96.33W	Bee Cave	15 F	0757 AM 12/23	30.06N/95.54W	5.5 W Cakhurst (UFR)	14 F	0724 AM 12/23	30.74N/95.40W
Bryan	13 F	0735 AM 12/23	30.66N/96.36W	SPRING	15 F	0739 AM 12/23	30.04N/95.44W	H-ller Country			
3 E UP429	13 F	0735 AM 12/23	30.55N/96.25W	4 N Baytom	15 F	0825 AM 12/23	29.82N/94.96W	8 9 N Hernstead (HPR)	11 F	0716 NM 12/22	30 220/96 070
Coulter Fld AP	14 F	0735 AM 12/23	30.72N/96.33W	Bouston	15 F	0755 AM 12/23	30.12N/95.54W	Prairie View (SCAN)	15 F	0800 AM 12/23	30.08N/95.98W
Easterwood Field Airport	14 F	1153 AM 12/23	30.58N/96.37W	Spring	15 F	0725 AM 12/23	30.06N/95.54W				
Burleson County				Humble	15 F	0759 AM 12/23	30.00N/95.17W	Washington County			
3.4 NE Caldwell (UFR)	10 F	0742 AM 12/23	30.55N/96.65W	Houston Intal	15 F	1153 AM 12/23	30.00N/95.37W	Brenham	13 F	0742 AM 12/23	30.28N/96.46W
1.9 NE Caldwell (WEATHERSTEM	13 F	0740 AM 12/23	30.55N/96.68W	Tomball	15 F	0729 AM 12/23	30.10N/95.61W	4 NNE Burton	13 F	0810 AM 12/23	30.24N/96.58W
Frenstat	13 F	0735 AM 12/23	30.40N/96.64W	Seriaire Canaba	16 F	0759 AM 12/23	29.70M/95.47W	Sanda	14 1	0000 MA 12/28	30.328/30.208
Caldwell	13 F	0735 AM 12/23	30.52N/96.70W	CIOSDY	10 1	0020 AM 12/28	23.328/33.028	Wharton County			
Somerville	14 F	0755 AM 12/23	30.40N/96.55W	Houston County				1 ENE El Campo	16 F	0735 AM 12/23	29.21N/96.25W
College Station	14 1	U/45 MA 12/23	30.338/90.438	Crockett	10 F	0735 AM 12/23	31.30N/95.40W	Boling	16 F	0724 AM 12/23	29.27N/95.95W
Chambers County				3.7 NE Kennard	10 F	0602 AM 12/23	31.39N/95.14W	Wharton	16 F	0805 AM 12/23	29.30N/96.04W
Mont Belvieu	15 F	0805 AM 12/23	29.86N/94.87W	Ratcliff	10 F	0702 AM 12/23	31.39N/95.14W	San Bernard River at East Be	16 F	0755 AM 12/23	29.53N/96.06W
Baytown	17 F	0746 AM 12/23	29.80N/94.91W	2 1 NW Lovelady (NDD)	10 F	0630 AM 12/28	31.3/M/93.40W	Colorado River near Lane Cit	17 8	0740 MM 12/23	29.190/90.0/0
Anahuac	17 F	0812 AM 12/23	29.67N/94.44W	Jackson County		0020 101 12/20	31.108/ 50.108	Maxitime Stations	1, 1	0140 AM 12/20	25.518/ 50.108
Colorado County				Edna	15 F	0805 AM 12/22	28,971/96,650	18 S Bay City	18 F	0818 AM 12/22	28.71N/95.91W
4.5 E Fayetteville (UPR)	10 F	0639 AM 12/23	29.92N/96.60W	9.3 SE Ines (UPR)	15 F	0749 AM 12/23	28.79N/96.67W	Matagorda 1 S	18 F	0725 AM 12/23	28.68N/95.97W
7 W Eagle Lake	12 F	0744 AM 12/23	29.57N/96.45W	2.9 W La Ward (UPR)	15 F	0712 AM 12/23	28.84N/96.51W	Morgans Point, TX	18 F	0800 AM 12/23	29.68N/94.98W
7 2 SW Columbus (THDB)	14 F	0725 M 12/28	29.91N/90.00W	Ganado	17 F	0809 AM 12/23	29.04N/96.51W	Bacliff	19 F	0845 AM 12/23	29.51N/94.98%
Attwater Nwr	15 F	0735 AM 12/23	29.67N/96.27W	La Ward	18 F	0747 AM 12/23	28.84N/96.46W	Eagle Point, TX	19 F	0900 AM 12/23	29.48N/94.92W
Colorado River at Columbus	15 F	0740 AM 12/23	29.71N/96.54W	Liberty County				1 33W Surfside Beach	19 F 10 F	0800 AM 12/23	20.94N/95.29W
Weimar	15 F	0735 AM 12/23	29.71N/96.71W	7.5 W Davton (UPR)	11 F	0719 AM 12/23	30.05N/95.02W	1 NNE Port Lawara	19 F	0848 MM 12/23	28 64N/96 61W
7.9 SE Fayetteville	15 F	0800 AM 12/23	29.83N/96.58W	2.4 S Cleveland	13 F	0802 AM 12/23	30.31N/95.09W	8 NE Galveston	20 F	0818 AM 12/22	29.31N/94.79W
LOLUMBUS	15 F 15 F	0/35 AM 12/23	29.00N/96.52W	1 NNW Liberty	14 F	0804 AM 12/23	30.061/94.800	11 SW Jamaica Beach	20 F	0918 AM 12/23	29.08N/95.12W
6.6 NE Eagle Lake	16 F	0520 AM 12/23	29.66N/96.25W	Splendora	15 F	0750 AM 12/23	30.27N/95.13W	13 ESE Magnolia Beach	20 F	0854 AM 12/23	28.42N/96.33W
12.4 SW Eagle Lake (TWDB)	16 F	0755 AM 12/23	29.44N/96.44W	Liberty Municipal Airport	16 F	0.22 Mi 12/23	30.1110/94.93W	Port OConnor, TX	20 F	0754 AM 12/23	28.45N/96.39W
2				another manualper withold		COLO IN INI ANI AG	55.500y 24.70W	Matagorda Bay	20 1	0628 AM 12/23	20.59N/95.98W
Fort Bend County				Madison County				Galveston Fishing Pier	21 F	0928 AM 12/22	29.25N/94.85W
3.7 W Rosenberg (UFR)	13 F	0622 AM 12/23	⊿⊴.50N/95.86Ŵ	Madisonville	10 F	0800 AM 12/23	30.95N/95.92W	Surfside Beach	22 F	0807 AM 12/23	28.93N/95.29W

Below are the low temperatures for the Golden Triangle Section for December 23, 2022.

December 23, 2022 Low Temperatures

STATE	LOCATION	STATION TYPE	LOW	LA	LELAND BOWMAN LOCK	COOP	21
LA	ALEXANDRIA	COOP	15	LA	MOSS BLUFF 2 NNW	COOP	14
LA	ALEXANDRIA ESLER FIELD	ASOS	14	LA	NEW IBERIA AIRPORT - ACADIANA REGIONAL	ASOS	20
LA	ALEXANDRIA INTL AP	ASOS	15	LA	OAKDALE	AWOS	16
LA	AMERADA PASS	NOS	26	14	OBERLIN FIRE TOWER	COOP	14
LA	BERWICK	NOS	23		OBELOUSAS	414105	47
LA	BOYCE 3 WNW	COOP	10	LA	OPELOUSAS	AWUS	1/
LA	CAMERON	NOS	18	LA	PATTERSON	AWOS	23
LA	CARLYSS	AWOS	18	LA	SALT POINT	ASO5	23
LA	CHENAULT	AWOS	18	LA	VERNON	RAWS	13
LA	DE RIDDER	AWOS	13	TX	JASPER	AWOS	12
LA	DE QUINCY	AWOS	15	TX	KIRBYVILLE	RAWS	14
LA	EVANGELINE/GARDNER	RAWS	14	TX	LUMBERTON	COOP	15
LA	FORT POLK	ASOS	12	TX	MCFADDEN	RAWS	17
LA	FRANKLIN 3 NW	COOP	21	ΤХ	ORANGE 9 N	COOP	16
LA	GRAND COTEAU	COOP	17	TX	PORT ARTHUR SETX REGIONAL AR	4505	17
LA	JENNINGS	COOP	16			A505	
LA	LAFAYETTE 13 SE	ASOS	20	TX	SABINE PASS	NOS	18
LA	LAFAYETTE REGIONAL AP	ASOS	20	ТΧ	SAM RAYBURN DAM	COOP	16
LA	LAKE ARTHUR 7 SW	COOP	18	TX	SOUTHERN ROUGH	RAWS	14
LA	LAKE CHARLES REGIONAL AP	ASOS	16	TX	TOWN BLUFF DAM	COOP	12
LA	LEESVILLE	COOP	12	TX	WOODVILLE TEXAS	RAWS	12

Summary of January 24th 2023 Southeast Harris County Tornado

SOUTHEAST HARRIS COUNTY TORNADO

A large supercell thunderstorm which formed near southern Victoria County around mid-morning on the 24th moved east-northeast across portions of Jackson, Wharton, Fort Bend, and northern Brazoria Counties before moving into extreme southern Harris County near Beltway 8 and Pearland Pkwy. This thunderstorm would produce a significant tornado across a portion of southeast Harris County between 2:00 p.m. and 3:00 p.m. Forward storm motions associated with the tornado were on the order of 40- 60mph across portions of southeast Harris County and video obtained from the City of Deer Park indicated a tornado heavily shrouded in heavy rainfall with very little if any visibility of a condensation funnel or lofted debris. Unlike tornadoes in the Great Plains, many of the tornadoes along the US Gulf coast are hidden within heavy rainfall and very difficult to observe.

TORANDO DAMAGE SURVEY

Damage surveys to determine the intensity and rating of the tornado were completed on January 25th with two teams from the National Weather Service. An aerial survey was conducted with the National Weather Service and the Harris County Sherriff's Office to determine the full track extent and survey areas difficult to reach on the ground.

Initial minor wind damage was noted on the east side of El Franco Lee Park north of Dobie High School. EFO damage was noted on the east side of Hall Rd between Kingspoint Rd and the Beltway 8 eastbound feeder where three power poles were snapped and tree limbs downed. The tornado then crossed Beltway 8 at the Blackhawk Blvd intersection and proceeded east-northeast into an open field and then impacted the Southeast Houston Wastewater Treatment Plant and a subdivision west of Beamer Dr. EF1 damage was noted in this area with a properly bolted detached garage lifted and destroyed at the end of Newton St. The tornado also broadened in this area with damage noted over a three to four block width. The tornado then impacted the Beamer Place Apartments with mid-range EF2 damage to all the second floor units along Kirkshire Dr. Several units had the roof completely removed and a few locations experienced properly attached roof rafters lofted and exterior second floor brick walls collapse. Wind damage was confined to the second floor roof and a few exterior walls. The tornado crossed Beamer Rd impacting Beverly Hills Intermediate School (mainly tree damage) and then into the Sagemont Park subdivision along the west side of Sabo 7 Rd. where a few homes lost portions or most of their roof structures. There was a broad swath of EF0/1 damage across this area. The tornado continued east-northeast crossing I-45 between Kurland Dr. and Gulf Pointe Dr. damaging an apartment complex on the east side of the Interstate (The Parker at Ellington). Several or entire portions of the roof was removed and lofted into a wooded area to the east. Rating in this area was high end EF1.

The tornado then weakened and crossed through several industrial areas and a couple of subdivisions bounded by Fuqua St. to the north and Kurland Dr. to the south. Much of this area experienced sporadic EFO damage with mainly wooden fences and tree limbs downed. The tornado then crossed HWY 3 at the intersection of Fuqua/Genoa Red Bluff. At the southeast corner of this intersection significant damage occurred to a well-constructed metal warehouse where properly anchored large metal beams were twisted and torn from the foundation with a high end EF2 rating. The tornado continued along Genoa Red Bluff Rd. and then turned northeast crossing the road between Strawberry Rd and Burke Rd and impacted the Pasadena Animal Shelter.

A section of the roof was torn off the building along with nearby roof damage in a subdivision on the east side of Burke Rd across the street from the Pasadena Animal Shelter. Damage in this area was rated EF1. The tornado continued northeast crossing Beltway 8 near Fairmont Pkwy and Vista Rd.

After crossing Beltway 8 the tornado entered the Bliss Meadows subdivision with a broad swath of tree, fence, and roof damage. One structure on S Meadow Dr. suffered extensive damage when the roof lifted and at least one exterior brick wall failed. This isolated point was rated EF2 within a broader swath of EF0/1 damage. The tornado crossed Spencer HWY west of Space Center Blvd with damage to a Post Office and several businesses as well as several homes north of Spencer HWY. Some of the more significant damage was noted along Bramely Dr. east of Randolph Rd. where a church (Mouth of God Ministries) had significant roof and some exterior brick wall failure along with several surrounding houses. A travel trailer in the driveway of a nearby house was flipped on its side.

The tornado continued northeast through highly residential areas between Center St. and Red Bluff Rd. and crossed Pasadena Blvd just west of Center St. and then Center St. between McDermott St. and E P St. A broad swath of EF0/1 damage was observed across this area with isolated pockets of low to mid-range EF2 damage. After crossing Center St. the tornado impacted St. Hyacinth Catholic Church with portions of the roof removed and partial collapse of exterior brick walls and then through several residential areas with extensive tree damage and loss of portions of roofs and a few exterior brick walls near Luella Ave. and East X St. The tornado impacted several industrial areas along Independence Pkwy north of SH 225 and south of Miller Cut Off Rd where several freight containers were blown over with damage in the EF1 range. Just south of the San Jacinto Battleground State Park, multiple high tension electrical transmission towers were either completely destroyed or heavy damaged with an EF3 rating with winds near 140mph. This is the maximum rating along the entire track of the tornado.

The tornado crossed the lower San Jacinto River and moved into the northwest portions of Baytown producing damage to trees, power lines, homes, and an apartment complex near and to the east of the Baytown Nature Center A mobile home and single family homes along Weaver St. near Bayway were destroyed. The tornado weakened after crossing Spur 330. Several power poles were knocked down on the east bound feeder road of I-10 between Main St. and Sjolander near the end of the tornado track. There was little to no indication that the tornado continued to the northeast beyond I-10 from either the ground or air surveys.

Product	Start Time	End Time	Area Covered			
Tornado Watch	10:50 a.m.	6:00 p.m.	All Harris County			
Tornado Warning	1:45 p.m.	2:00 p.m.	Eastern Fort Bend + Northern Brazoria Counties			
Tornado Warning 2:10 p.m. 2:3		2:30 p.m.	Northern Brazoria + Southeast Har Counties			
Tornado Emergency	2:24 p.m.	3:00 p.m.	Southeast Harris, Southwest Liberty, northwest Chambers Counties			

Table 1: Showing first ever tornado emergency for Harris County was issued at 2:24 p.m.

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Southeast Texas Regional Summary (continued)



The tornado tracked through highly populated areas of southern and southeastern Harris County impacting numerous structures in the cities of Houston, Pasadena, Deer Park, and Baytown. Damage assessments as of February 7, from the cities impacted indicate approximately 1,635 single family homes were damaged, 855 multi family units, and 15 mobile homes.

Figure 1: Maps of tornado path with damage and preliminary storm information

HISTORY OF HARRIS COUNTY TORNADOES

While tornadoes are frequent in Harris County, most are on the lower end of the EF scale, EF0, EF1 and result in minor damage, however while rare, significant tornadoes have occurred in the county over the last 70 years. Since 1950, a total of 247 reported tornadoes have resulted in 13 deaths, 325 injuries, and 520 million dollars in property damage across Harris County. Interestingly, of the 13 fatalities, 5 were associated with EF/F2 or higher tornadoes. The table below details the number of Harris County tornadoes and their EF/F rating.

Rating	Number
EF/F0	129
EF/F1	74
EF/F2	34
EF/F3	9
EF/F4	1
EF/F5	0
Total	247

Table 2: Number of Harris County Tornadoes by EF/F Scale Rating

Of the 247 tornadoes in Harris County since 1950, 203 or 82% were rated EF/F0 or 1. There has never been an EF/F5 tornado and only one EF/F4 tornado which impacted the east side of Harris County from near Channelview to Crosby during a significant multi-tornado outbreak on November 21, 1992. This tornado was on the ground for 20 miles and was 1.0 mile in width resulting in 15 injuries. The following table below summarizes the 10 EF/F3 or 4 tornadoes that have impacted Harris County in context with the January 24, 2023, tornado.

Date	Rating	Length (mi)	Width (mi)	Injuries	Deaths	Location
2-11-1950	3	12.0	0.6	12	1	La Porte/Baytown
9-11-1961	3	1.0	0.1	22	0	Channelview
9-8-1969	3	0.8	0.1	0	0	Pasadena
10-28-1974	3	3.3	0.1	7	1	Baytown
12-13-1977	3	19.7	.25	35	1	NE Houston/Crosby
2-5-1986	3	5.0	0.1	0	2	Klein
11-21-1992	3	4.0	.25	0	0	Huffman
11-21-1992	4	20.0	1.0	15	0	Channelview/Crosby
3-30-2002	3	0.7	0.1	0	0	La Porte
1-24-2023	3	23.7	.66	5	0	South Houston/Baytown

Table 3: Summary of the 10 EF/F3 tornadoes to impact Harris County since 1950.

The January 24, 2023, tornado is the longest recorded in Harris County since 1950 and the second widest. Interestingly, 60% of the recorded EF/F3 tornadoes or higher have occurred in our cool season months (October-February). The September 11, 1961, Channelview tornado was in association with the landfall of a hurricane (Carla) which tend to produce a majority of our summer tornadoes. Our greatest threat for strong tornadoes along the upper Texas coast tends to occur in the winter months and not during the more "traditional" spring severe weather months although tornadoes can occur year round in Harris County.

*All data and information taken from the National Weather Service and Harris County Flood Control District

Abilene/San Angelo Regional Summary

Roller Coaster Temperatures & Spotty Precipitation By Joel Dunn, Observation Program Lead, NWS Abilene/San Angelo

December

For the third year in a row La Nina has dominated West Central Texas. This resulted in a roller coaster of temperatures. To better understand the dramatic shift of temperatures from day to day, a chart was created. In the chart below the value of the daytime high temperature on the 1st of the month was subtracted from the daytime high temperature on the 2nd, the 2nd was subtracted from the 3rd, and so on. Each spike in the chart shows the quick swing in afternoon high temperatures. A positive spike means temperatures increased (warmed) dramatically the next day. Conversely, a negative spike means the temperatures decreased (cooled) dramatically the next day. Spikes near the center line mean the daytime highs did not shift substantially.



Figure 1 -December day to day high temperature difference

For the sake of completeness, included below is the day-to-day low temperature difference. There were generally fewer dramatic swings in overnight temperatures. Yet, there were still notable days that experienced the passage of a frontal boundary, which drove the temperature down quickly within a 24-hour period.



Figure 2 – December day to day low temperature difference

Abilene/San Angelo Regional Summary (continued)

As far as precipitation, it was nearly as fickle as the temperatures. Despite four rounds of precipitation, only portions of the Concho Valley, Heartland and southern Big Country ended the month above normal. The below image is a visual depiction of the Percent of Normal, and the mentioned area can clearly be seen representing 110%-400% of normal.



Figure 3 - December Percent of Normal

January

Though January experienced a couple rounds of precipitation, the month still finished drier than normal. In fact, the month overall was warmer than normal as well. This was due to the first half of the month being warm and windy, and the second half of the month not able to catch up despite two rounds of winter precipitation. See the table below for a breakdown in precipitation, average temperatures, and their respective departures from normal.

City	January Rainfall	Departure from Normal
Abilene	0.73"	-0.37"
San Angelo	0.55"	-0.37"
Junction	0.25"	-0.64"

Table 1 - January Rainfall & Departure from Normal

City	January Average Temperature	Departure from Normal
Abilene	50.9°	4.6°
San Angelo	50.1°	2.7°
Junction	51.2°	3.4°

Table 2 - January Temperature & Departure from Normal

As mentioned above, January was also warmer than normal, yet received two rounds of winter weather. The first on January 24th, and the second on the 30th, and 31st. The first round of winter weather only affected the Big Country, areas mainly along and north of Interstate 20, while areas to the south just received rainfall and cold temperatures. The areas that were cold enough to receive frozen precipitation saw rain first, then sleet, and finally snow flurries, though reports from official observers only amounted to a Trace.

Abilene/San Angelo Regional Summary (continued)

The second round, on the 30th and 31st, impacted the entire West Central Texas area, and led to the issuance of a Winter Storm Watch. The event was mainly freezing rain, though traces of sleet were reported by the Abilene volunteer observer. These winter weather events were the primary source of precipitation for the month.



Figure 4 - January Percent of Normal

Areas of green and blue received at or above normal precipitation for the month, mainly Crockett County, and portions of Coleman and Brown counties, elsewhere received below normal precipitation.

February

February began cold and wet as the winter weather event at the end of January extended into the beginning of the month. La Nina continued its influence on the area, though fluctuations in temperature were not quite as notable as December. Overall, February was not as dry as January, mainly for areas north of Interstate 10. The table below shows the precipitation received and departure from normal, the image below that shows the percent of normal precipitation for the month.

City	February Rainfall	Departure from Normal
Abilene	1.36"	0.07"
San Angelo	0.91"	-0.29"
Junction	0.16"	-0.96"

 Table 3 - February Temperature & Departure from Normal

The table above shows the precipitation varied considerably across the West Central Texas Area.

Abilene/San Angelo Regional Summary (continued)



Figure 5 - February Percent of Normal

As the end of the month approached temperatures began steadily increasing. These were the first indications that spring was around the corner, and spring would bring some much-anticipated changes, especially regarding the El Nino/La Nina oscillation. According to the Climate Prediction Center, "The most recent [model data] favors ENSO-neutral to continue through the spring, with El Niño forming during summer 2023 and persisting through the fall." After nearly 3 years under La Nina conditions, this will be a welcome change.

Wichita Falls Regional Summary

Warm Winter in the Wichita Falls Region

By: Charles Kuster

National Severe Storms Laboratory

Generally, our winter was quite warm but only slightly dry this year. The season started off with a wetter period with seven wet days (at least one CoCoRaHS station reported 0.05" or more) occurring within the first 13 days of December. The faucet then turned off and we saw very little precipitation for more than a month. The maximum cumulative precipitation in our region between December 14, 2022, and January 17, 2023, was only 0.02" (Figure 1). We give a big thanks to all who reported so many 0.00" reports during that time period! February brought more rain and there were eight wet days across our region during the month. In total, the entire winter saw 72 dry days (all CoCoRaHS stations reported less than 0.05") and 18 wet days. For comparison, last winter we experienced 80 dry days and 10 wet days.



Figure 1. Total rainfall reported by CoCoRaHS observers between December 14, 2022, and January 17, 2023.

Wichita Falls Summary (continued)

Overall, many areas saw very close to normal precipitation, though Archer County was generally 1.5–3.0" below normal (Fig. 2a). These near normal conditions resulted in very little changes to the drought conditions, with most of our region still being in some level of drought category according to the U.S. Drought Monitor (<u>https://droughtmonitor.unl.edu/</u>). Despite the near normal precipitation, we did experience a relatively warm winter. Most locations saw temperatures 2–3 degrees Fahrenheit above normal (Fig. 2b).



Figure 2. Departure from normal a) precipitation and b) temperature for the beginning of December 2022 through the end of February 2023. 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).

El Paso/Far West Texas Regional Summary

Another near Normal Winter Keeps Drought at Bay

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

Traditionally a dry time of year for far West Texas, the 2022-23 winter season brought several rounds of light precipitation to the area, ultimately resulting in a normal winter season for the region. Pacific storm systems moving across the Southern Rockies were the primary contributor to rain and snow chances, arriving every 10 days on average which stayed consistent throughout the season.

December began the season on a dry note, with a few days of measurable rainfall only resulting in **0.25-0.50**" monthly totals. December behaved like we would expect during a La Niña event, with average temperatures a bit above normal and precipitation a bit below normal. These warm conditions resulted in no snowfall for Texas, as snows focused on the high elevations of New Mexico. The most notable rain event occurred December 28-30 as a strong Pacific storm brought windy conditions and scattered rain showers to El Paso and Hudspeth Counties.



Figure 1: Cotton candy-colored lenticular clouds at sunset over the Franklin Mountains on December 27th. Photo Credit: Ray Chiarello

Colder air finally arrived in January, often Pacific-sourced with cold fronts moving in from the west. Still, snow chances evaded the area and continued to focus over higher terrain. January's monthly rain totals again ranged from **0.30**-**0.65**", the majority of which arrived January 2-3 with observers in central El Paso reporting **0.50**". Precipitation totals the following four weeks were under **0.25**".

El Paso/Far West Texas Regional Summary (continued)



Figure 2: December 2022 - February 2023 CoCoRaHS precipitation totals for El Paso County, Texas

February featured a significant transition into spring, with a chilly start and a windy finish. The month began with a strong cold front from the east bringing below normal temperatures and even some light snow across parts of Hudspeth County. This was not captured in CoCoRaHS observations. The bulk of precipitation in February occurred on the 19th, with widespread rain totals of **0.30-0.50**". Significant wind events occurred on the 22nd and 26th with local mountain sites recording winds over 100 mph.

Season precipitation totals of **1.00-2.00**" were fairly near normal for this time of year. AHPS analysis shows this is only 60-80% of climate normals, but a departure of less than 0.50" due to the dry nature of El Paso's winters. El Paso International (KELP) recorded a season total of **0.98**" and NWS El Paso (NWSEP) recorded **1.05**", slightly below the climate average of **1.42**". No precipitation records were broken. No changes were made to drought outlook, as El Paso and Hudspeth County remain in no drought status according to the U.S. Drought Monitor. This is welcome news as the region enters their wind and fire weather season.



Figure 3: AHPS Observed Precipitation and Percent of Normal for Dec-Feb in far west Texas

The winter season featured 35 active observers in El Paso County, and 2 in Hudspeth County. A total of 1,756 daily reports were submitted, along with 58 multiple-day reports. Only 365 daily reports had measurable precipitation, which means 79% of total reports were 0.00". No Significant Weather or Condition Monitoring reports were submitted this season. Thanks again to all our local observers who participated in the 2022-23 winter season!

Winter 2022-2023

Corpus Christi Regional Summary La Niña is Drying Out

By: Juan Carlos Peña Jr., Meteorologist, Corpus Christie NWS

With the El Niño and the Southern Oscillation finally switching to neutral from La Niña, there is some hope that for a more normal precipitation pattern for the months ahead, because looking back at the last few months, it has been dry! Despite several cold fronts and our first freeze just before Christmas, rain was hard to come by for the month of December. Other than the Victoria Crossroads, all observers reported accumulations of less than 1.00" for month (fig. 1). Observers across the Victoria Crossroads reported accumulation between 1.00" - 2.00", across the Coastal Bend observations ranged from 0.20" - 0.90" and finally observers from the Coastal Plains to the Brush Country reported less than 0.25" for the month. The greatest accumulations form the Coastal Bend were limited to the barrier islands, where streamer showers would occur. Looking at the percent of normal rainfall for December, all areas received below normal rainfall as all locations were below 100% (fig. 2).



Figure 1: December 2022 Estimated Rainfall Totals



Figure 2: December 2022 Estimated Percent of Normal Rainfall

Corpus Christi Regional Summary (continued)

January was another dry month for South Texas except for the Victoria Crossroads once again. Victoria County was not only the only county that received normal rainfall for the month, but they doubled their normal rainfall, with the country checking in at over 200 percent of normal rainfall (fig. 3). All other counties across South Texas were once again below normal with most locations seeing less the 25 percent of normal rainfall, which means they got less than ¼ of their average totals. So, what does all that relate to in actual observations for month (fig.4)? Accumulations between 2.00'' - 6.00'' across the Victoria Crossroads, 0.50'' - 1.00'' across the Coastal Bend and generally less than 0.50'' for the Brush Country and Rio Grande Plains.



Figure 3: January 2023 Estimated Percent of Normal Rainfall



Figure 4: January 2023 Estimated Rainfall Totals

Corpus Christi Regional Summary (continued)

Not to sound like a broken record, but February was yet another dry month. Not only was February a dry month, but it was the driest month covered in this article. Despite the Victoria Crossroads being the big winner again with observations for the month between 0.50'' - 1.00'', they were still only 48 percent of their normal rainfall (fig. 5). All other areas of South Texas checked in at under 25 percent of normal rainfall, with the Brush Country under 10%! What does that translate to in rainfall accumulation, between 0.10'' - 0.30'' across the Coastal Bend and between 0.01'' - 0.10'' from the Coastal Plains through the Brush Country and into the Rio Grande Plains (fig. 6)?



Figure 5: February 2023 Estimated Percent of Normal Rainfall



Figure 6: February 2023 Estimated Rainfall Totals

Amarillo & Lubbock Regional CoCoRaHS Winter Precipitation



Amarillo Regional winter total CoCoRaHS precipitation from December 2, 2022 – March 1, 2023



Lubbock Regional winter total CoCoRaHS precipitation from December 2, 2022 – March 1, 2023

East Texas Regional Summary

Active Weather at Times during Winter 2023

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

Weather conditions started out relatively quiet during the first week of winter 2022-2023. However, the month became full of various weather events. On the 6th of the month, record warmth settled over portions of the region for a few days. This was followed by a frontal boundary that stalled near the Interstate 30 corridor on the 8th, before finally pushing through the remainder of the region on the 11th. This boundary brought widespread rainfall amounts of 1" to 2" to CoCoRaHS sites in NE Texas and Deep East Texas. By the 13th, another cold front brought additional widespread rainfall of 1" to 3" inches along with severe weather, as a tornado touched down in Panola and Harrison Counties near the communities of DeBerry and Elysian Fields. Another round of 1" to 3" rainfall fell across the region on the 19th and 20th, before a major arctic airmass invaded the region from the 22nd through the 25th. A few CoCoRaHS sites along and north of Interstate 20 reported snow flurries with this airmass on the 22nd, but the major takeaway with this event was the extremely cold air. Low temperatures ranged from single digits to teens during this period across the entire region. Dry weather remained across the region for several days afterwards before another cold front brought widespread 2" to 4" of rainfall by the 29th and 30th of the month.



Fig.1: Large Wedge Tornado near DeBerry, TX (Panola County) on December 13th, 2023. <u>Photo Credit: Ryan Cartee</u>

A somewhat active weather pattern remained over the East Texas CoCoRaHS sites during the month of January, as a series of frontal boundaries move across the region. Things got started during the morning of the 3rd, as the first of these boundaries resulted in public hail reports of quarter to ping pong size between the cities of Nacogdoches and Carthage. Little to no rainfall was observed for quite some time afterwards, although a few CoCoRaHS sites in Deep East Texas reported rainfall on the 7th and 8th near 1". The next significant rainfall didn't occur until the 18th and 24th of the month respectively. There was another brief dry period afterwards, but widespread rainfall settled over the region during the last 4 days of the month, along with a cold airmass on the 30th and 31st. This resulted in freezing rain and sleet in areas along and west of a line from Tyler to Clarksville, TX. Overall, rainfall amounts during the month of January were near or above the National Weather Service climatic January averages of 3.50" to 4.00".



Fig.2: Icy Fence in Tyler, TX- Feb.1st, 2023 Image Courtesy of Doc Deason

The cold weather at the end of January continued into the first couple of days in February, with more freezing rain observed in areas along and north of the Interstate 20 corridor. This turned out to be the highlight for the month, as the remainder of the month could be summarized by near normal precipitation and above normal temperatures. Overall, the winter of 2022-2023 brought normal to above normal precipitation across East Texas. This resulted in drought free conditions by the start of the 2023 meteorological spring.



Fig.3: Drought Monitor Image Courtesy of NDMC/USDA/NOAA

Rio Grande Valley Regional Summary

Drought Worsens Due to Lack of Rain; Pre-Christmas Cold Wave Punctuates Otherwise Top-Ten Warm and Dry Season

By Barry Goldsmith Warning Coordination Meteorologist NWS Brownsville/Rio Grande Valley



Picture 1&2: Left: Damaged leafy-green vegetables following the December 23-25, 2022, freeze and hard freeze across the Lower Rio Grande Valley. Right: Frozen fountain in Brownsville, near the Brownsville and Matamoros Bridge, on December 23, 2022

Month-by-Month Summary

December was a temperature roller-coaster, with record warmth for the first thirteen days of the month as day/night combined temperatures averaged in the mid-70s. The heat was a fool's errand, as the month's first cool-down arrived by mid-month with combined temperatures slipping back into the mid-50s to lower 60s from the 14th through the 22nd, leading up to the coup-degras, a fast-moving dry arctic front which arrived just before Christmas, making the Valley matched more closely with advertising campaigns showing people in sweaters, winter jackets, gloves, and hats. The pre-Christmas chill, which was the coldest actual and apparent temperatures since 1989, saw actual temperatures in the 20s and 30s for most areas from just after midnight on the 23rd through the mid-morning Christmas Day.

A hard freeze (temperatures below 28°F for 2 hours or more) greeted people, pets, and plants on December 23, and daytime temperatures struggled to get above freezing in most areas, with locations near the coast holding below freezing due to thicker cloud cover. Wet-bulb temperatures fell into the lower 20s for the first half of December 23rd, causing concern for citrus fruit should the situation last for more than a day. Slight warming of air temperatures into the lower 30s allowed wet-bulb temperatures to rise into the upper 20s during the afternoon and evening. The clouds which kept daytime temperatures from rising also insulated the ground as December 23 turned into Christmas Eve Day. While temperatures held at or just below freezing overnight, they did not fall below 28°F across the Valley's "fruit belt" – sparing significant loss of fruit and the trees that grow it. Wet-bulb temperatures generally held in the mid and upper 20s from late on the 23rd into early on the 24th, which was sufficiently "warm" enough to keep fruit membranes from icing. The same could not be said for herbs and some vegetables, as crops such as cilantro were largely wiped out due to their lower threshold for cold-weather survival.

The full story of the pre-Christmas 2022 Cold Outbreak in the Lower Rio Grande Valley can be found here.



Figure 1. Observed actual minimum temperatures on December 23rd, 2022, for the Lower Rio Grande Valley and Deep South Texas Brush Country/Rio Grande Plains/Coastal Plains.



Figure 2. Same as Figure 1, except for apparent, or "feels like" (wind chill index) temperatures.

The record warm start, followed by the top-20 percent coldest finish, brought the overall December temperatures to right around the 1991-2020 averages. The warm-trending autumn and early winter nudged the annual average temperatures back into the top quartile all-time. While 2022 broke a five-year streak of top ten warmest finished, ending on the warm side of the ledger was still remarkable. Brownsville (since 1878) rallied to a 12th warmest finish; Harlingen (since 1912) ended up 25th warmest, McAllen (since 1942) finished 27th warmest, and Rio Grande City (1897 – missing 1907 to 1927) finished 25th warmest.

The dry pattern, whether in the initial record heat or the close-out cold, produced very little rainfall, and moderate drought conditions slowly expanded across the Deep South Texas ranchlands north of the populated Lower Rio Grande Valley. "Just-in-time" rains, combined with the colder temperatures at the end of the month, slowed the drought degradation across the populated Rio Grande Valley. One notable and surprising event occurred during the late afternoon and evening of December 3rd, when a weak warm front combined with just enough atmospheric moisture, instability (due to heating), and a weak upper-

level disturbance to drop between 2 and 3.5" of rainfall around the McAllen/metro region (Figure 3). The bulk of the rainfall, which produced local nuisance flooding, missed the annual McAllen Holiday Parade route – an event drew more than 200,000 attendees. Notable CoCoRaHS reports included 3.37" 9.6 miles north of Mission, 2.82" 4.4 miles north of McAllen, and 2.66" 3.5 miles north of McAllen. McAllen/Miller Airport, close to the end of the parade route, only received 0.19"!



Figure 3. Band of torrential thunderstorm rains that fell during the late afternoon and early evening across the McAllen/metro region (AHPS estimates).

January was less eventful than December regarding sharp temperature changes. For Winter Texans visiting from northern climes such as the Dakotas, upper Mississippi Valley, and the Canadian Prairies, January was heavenly. Filled with mainly sunny, mild to warm days, mild to warm evenings, and pleasantly cool mornings, the weather was ideal for outdoor outings which draw so many here each year. A mid-month (January 13th/14th) cold front dropped morning temperatures into the 30s (14th) with another minor front doing the same around the 25th to 27th. The first significant "nasty 'norther" arrived late on the 30th, with biting chill and drizzle/light rain closing the month. Rainfall was paltry across the region, with the sole exception along the Cameron and Willacy County coast, where an estimated and measured 0.25 to 0.75" fell. Peak rainfall included 0.63" 12.6 miles east of Brownsville, and 0.61" 1.8 miles northwest of Laguna Vista. Percentage of rainfall ranged from 0 to 5 percent across Starr, Jim Hogg, and Zapata, to 5 to 25 percent across most of the populated Lower Rio Grande Valley, with 50 percent in the areas mentioned above.

The warm temperatures ranked among the top ten warmest Januaries, including Brownsville (8th warmest), Harlingen (warmest on record), McAllen (5th warmest), and Rio Grande City (7th warmest).

February opened with a three-day continuation of the nasty chill that ended January; on the 1st, temperatures barely budged from 40°F all day and evening; combined with stiff north winds, it felt closer to 30°F during this time especially along and east of U.S.77/IH-69E in Cameron, Willacy, and Kenedy County. Between the 4th and 18th, the weather was a temperature roller-coaster that leaned cool (for the period). Beginning on the 19th, and continuing through month's end, much above average temperatures and humidity dominated the region as a broad subtropical high pressure ridge aloft stretched from the Bahamas to the Lower Texas coast and northeast Mexico. The persistent heat for those final 10 days turned a notably below-average month into an above average month, with temperatures up to 2°F above average for most.

As had been the story for winter, rainfall was few and far between, with very light amounts during the "nasty 'norther" on the 1st and 2nd, and a thin strip of rain from Weslaco through the Willacy/Hidalgo line on the 8th and a small area of rain along the Rio Grande near Brownsville on the 10th. Most areas were virtually rain-free through the month. The warmth and prolonged lack of notable rain continued to worsen drought levels as the sun angle rose and evaporation rates steadily increased. By the start of March, Level 2 to 3 drought dominated the ranchlands, and moderate (Level 1) the remainder of the Lower Valley.

For Winter Overall, the main story was the low rainfall combined with enough warm periods, despite short-lived cold outbreaks, to verify the season's forecast as "warm and dry" for the Lower Rio Grande Valley/Deep South Texas Brush Country and Coastal Plains with precision.



Figure 4. NOAA Climate Prediction Center Winter (December 2022-February 2023) forecast (top) vs. observed (bottom) temperature and precipitation. Black circle represents the south Texas/Lower Rio Grande Valley region.

Drought gradually, then more rapidly, worsened across the region; even the Lower Valley, which had been receiving "just in time" rainfall, failed to receive necessary rains as February closed. Though February saw full green-up of trees and florals, the rangeland/unirrigated grass and brush continued to turn yellow and brown – albeit much slower than across the ranchlands from Zapata through Kenedy County (Figure 5 and 6).



Figure 5. US Drought Monitor, Brownsville/Rio Grande Valley NWS service area, on December 6, 2022. At this point, the Brooks/Kenedy County ranchlands were a rainfall "hole" and had reached moderate (D1) drought status.

For the season, rainfall totals ranked among the top ten percent driest. Brownsville (2nd driest, at 0.80"), Harlingen (2nd driest, at 0.63"), McAllen (8th driest at 0.95"), and Rio Grande City (12th driest at 0.78") and, combined with the overall warmth, were the catalysts for the worsening drought. Temperature ranks were similar, with Brownsville at 7th warmest winter (65.8°F), Harlingen* at 4th warmest (66.9°F), McAllen at 3rd warmest (66.6°F), and Rio Grande City* at 4th warmest (64.1°F).



Figure 1. U.S. Drought Monitor, NWS Brownsville/Rio Grande Valley service area, February 28, 2023. Severe (D2) to Extreme (D3) Drought covered the ranchlands, with Moderate (D1) drought having reached the populated Rio Grande Valley.



Figure 7. Percentage of average rainfall for mid December 2022 through mid-March 2023. Note the near-zero amounts across the western third of the region (Starr, Jim Hogg, Zapata), with 10 to 25 percent in most other locations.

For Falcon International Reservoir, the benefits of heavy rainfall in mid to late August was all dried up by the end of February, with the only hope potentially to come from a significant release of water from still nearly full reservoirs along the Rio Grande, Rio Conchos, and Rio San Juan watersheds in Mexico. The Texas share of water in Falcon International Reservoir remained below 30 year low benchmarks to begin the year; the total share had dropped from 18.4 percent in January to 16.4 in mid-March – a result of accelerating evaporation rates due to record heat from February 20th through March 12th.

The combination of worsening drought, record/near record low water levels in Falcon International Reservoir, and top ten warmth implies urgency for wildfire prevention activities and water conservation across the Lower Rio Grande Valley and the ranch country to the north, as spring moves forward. Perhaps there will be some notable rain relief at some point after mid-April and especially May, but uncertainty remains very high.

Brazos Valley Regional Summary

Winter 2022-2023 Precipitation Summary Bryan-College Station/Brazos Valley Region, Texas

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



Despite the roller-coaster ride that had been 2022, the winter season from December 2022 through February 2023 turned out to be surprisingly normal. Rainfall was fairly regular, with precipitation ranging from about an inch below normal in parts of Washington County to around five inches above normal in parts of Walker County. The main shock to the system was the extreme cold around the Christmas holidays. In an apparent attempt to apologize for the third year in a row with an extreme cold air outbreak, two-thirds of the days in January and February were warmer than normal. In College Station, fifteen days were at least 80 °F, one fewer than in 2021-2022 and fourth largest over the past hundred years.

<u>Observer Statistics:</u> The region had 53 active observers this spring. Of those, 17 recorded precipitation observations for all 90 days (impressive over the holidays!) and another 20 had fewer than ten days missing. In all, 48 observers reported usable precipitation spanning the entire season.

- Wettest day: 5.19", December 11, Grimes County
- Wettest season: 15.87", Walker County
- Driest season: 7.59", Washington County
- Dusty Soles Award: 21 days without 0.01", January 4-24, Walker County
- Soggy Socks Award: 10 days with measurable rain, January 27-February 5, Houston County

Texas Spring Weather Outlook 2023

Bob Rose, Lower Colorado River Authority

Spring is typically the wettest and stormiest season of the year across Texas. The clash between cool and warm air, occasional storm systems, and abundant Gulf moisture often combine to produce periods of moderate to heavy rain and strong storms. Spring also brings a return of warmer temperatures and sometimes even an early taste of summer. But in 2022, La Niña overwhelmed the typical spring pattern and helped produce one of the warmest and driest spring seasons in Texas history. This year, La Nina is finally on its way out, and fingers crossed, we won't see a repeat of what happened last year.

One of the biggest influences on Texas weather since fall of 2021 has been from a weak to moderate La Niña—a cooling of the waters in the central and eastern tropical Pacific. Over the past year and a half, La Niña's influence has helped steer most Pacific storm systems up into western Canada, instead of allowing them to track east towards California and Mexico, and eventually Texas. This has resulted in fewer storm systems and well below normal rain for all but East and Northeast Texas. La Niña even played a hand in the development of last year's brutally hot and dry summer. As of the close of winter, nearly two-thirds of Texas was in some form of drought, with some areas in exceptional drought.

But a change in the weather pattern appears to be on the horizon. Observations in early March indicated waters in the tropical Pacific have recently warmed and the long running La Niña has finally come to an end. Climate Prediction Center forecasters are confidently predicting a neutral Pacific, where neither La Niña nor El Niño will be in place throughout spring and on into summer. With La Niña gone, the dry influence we've seen for the last several months should diminish, allowing the storm track to slowly take on a more normal configuration. In other words, we should see the return to a more typical springtime weather pattern.

NOAA's seasonal forecast model, the "Climate Forecast System, or CFSv2" agrees with a neutral Pacific being in place this spring. The model's outlook for April-May-June calls for near-normal rainfall across most all the state, along with a hint for above-normal rainfall across South Texas. While the rain may not be sufficient to end the drought, just having near-normal rain during what is typically the wettest time of the year should be beneficial and lead to drought improvement.

The model's temperature outlook calls for temperatures to average above normal throughout spring. However, it is thought with more frequent periods of rain and increased soil moisture, temperatures this spring shouldn't be nearly as hot as they were last year.

Texas Spring Weather Outlook 2023 (continued)



Keep in mind, this is an outlook for general conditions that can be expected throughout spring. There will likely be some dry stretches, big storms and even some brief cooldowns from time to time. But overall, a return to more typical springtime conditions can be expected. Do note the odds are increasing for the development of El Niño sometime this summer or fall.

Observer Tips & Training Material

There are many links to training material on the CoCoRaHS website for a CoCoRaHS Observer to refresh their knowledge of the correct processes to maintain their gauge, observe, and report precipitation data. We recommend that all observers review training at **least once a year to stay sharp** on observering and reporting correctly. Slide shows are a great way to stay sharp and ready to be a valuable CoCoRaHS Observer.



PDF

Texas CoCoRaHS Observer

Winter 2022-2023

Observer Tips & Training Material (continued)

The Importance of Significant Weather Reports

Significant Weather Reports (SWR's) submitted by CoCoRaHS observers are a huge help to the National Weather Service. All SWRs are automatically routed to the local NWS office, and forecasters use these reports to monitor the progress of storms. Questions we get from time to time are "What is significant weather?" and "How often should I submit a Significant Weather report?" First, Significant Weather Reports are supplementary reports and DO NOT replace your Daily Report nor should it be submitted in lieu of a Daily Report. The SWR is great for updating rainfall after your regular observation time. You should not be updating your daily report once it is submitted, except to make a correction or add additional information.

What is "significant weather"? In general, it is heavy rain (falling at a rate of 1.50" an hour or more), high winds, icing from freezing rain, and flooding. However, you are not limited to this list - use your best judgment. How often should you report? You should report as often as needed to convey what is happening. Comments included with your Significant Weather report are very useful.



Maintaining your Official Standard of Measure 4 inch diameter Rain Gauge

Is your rain gauge inner-cylinder starting to look a little grungy these days? It's that spring time of year! For most of us dirt will eventually build up on the bottom of your CoCoRaHS rain gauge inner-cylinder. In humid climates, algae growth can also be a bother. Usually maintenance of the CoCoRaHS 4 inch diameter gauge should be done about 3-4 times a year to insure that your gauge is properly set-up, clean, and ready to measure the worst storms that you will ever see. Some other important things to make sure are good include the following. A quick inspection of your mounting post to make sure it hasn't moved in the soil from heavy rains last year. Any movement of post can cause the gauge to not be level and give false reading of rainfall that are either too high or too low. Use a level to check the mounting post and the top of the CoCoRaHS gauge for a correct level reading. A quick inspection of the mounting plate attached to post is important to see if it is securely mounted into the post. Also inspect the mounting plate for any cracks in the plastic.



If you want to keep your gauge clean and looking like new, put some warm water with a little gentle liquid hand soap in the tube and let it soak for a few minutes. Then twist a thin soft towel and spin it into the cylinder until it reaches the bottom. This will wipe out most of the dirt. Also available online is a soft brush cleaner for the inner funnel which works very well at cleaning dirt, mold, and algae growth from inside the tube. Make sure to use the brush with gentle liquid hand soap to avoid any scratching of the surface of the inner tube.

Sometimes birds can be a big problem in some areas. One of the best things to keep birds off your CoCoRaHS gauge is to use **holographic reflective scare tape**. This reflective ribbon will flash dramatically in daytime light and sunlight. Birds will keep away from the flashing tape and will not land on your gauge.



Observer Tips & Training Material (continued)

The Importance of Observation Time

We ask observers to measure their precipitation in the morning, typically 7:00 a.m. There are several 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 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 the 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 take 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**.

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 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 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 by computer models you must get report in before forecasters run models.

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 & Information

Webinar #85 - Thursday, May 11, 2023

Turbulence - Don't let it throw you

Stan Trier UCAR Boulder, Colorado





Questions, Comments, and Suggestions about this newsletter are welcomed at the above email addresses.