TEXAS CoCoRaHS OBSERVER

Winter 2020-21

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 Winter Weather Summary

Winter, 2020-2021

John Nielsen-Gammon, Texas State Climatologist

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

The story of the winter was the mid-February cold, winter precipitation, power outages, water crises, political fallout, etc. Wow. As cold waves go, this was one of the great ones. Texas saw temperatures get colder than on any day since December 1989. A few areas exceeded that record; Tyler and Longview even managed to break their historical record for all-time lowest temperatures. Daily records were a piece of cake. Jacksonville, in East Texas, has records going back to the 1950s. They managed to tie or break their daily minimum temperature record eight days in a row.

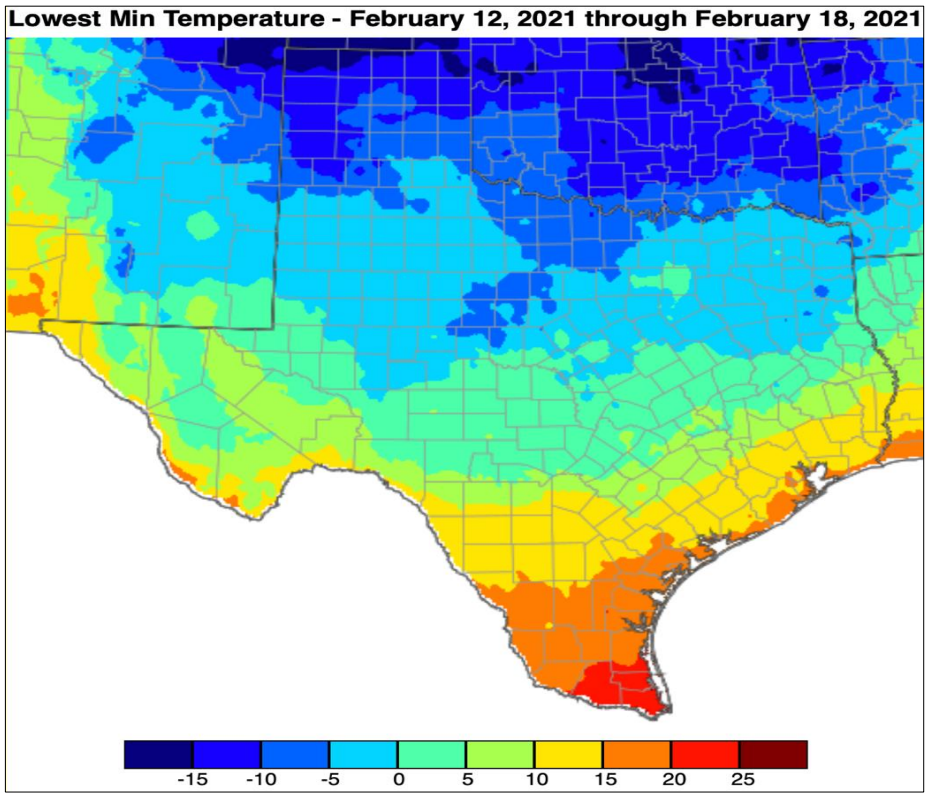

Figure 1: Lowest Min temperature for February 12 – February 18, 2021.

Continued page 2 >

"Because Every Drop Counts, As Do All Zeros"

Texas Winter Summary (continued)

I said one of the great ones. That's because there have been almost a dozen days that, when averaged across Texas, were as cold or colder. The absolute record holder was on February 12, 1899, when the state-average minimum temperature was below zero. For some bizarre reason, or probably for no reason at all, most of the coldest days in Texas history occurred in the 1890s or the 1980s.

For most Texans, one of the largest impacts of the event were the power outages and rolling blackouts. These were driven by a combination of increased demand due to the cold weather and reduced generation capacity due to the cold weather. For others, the damages to agriculture and plants were devastating. For both types of impacts, what mattered was not just how cold it got but, how warm it didn't get during the day.

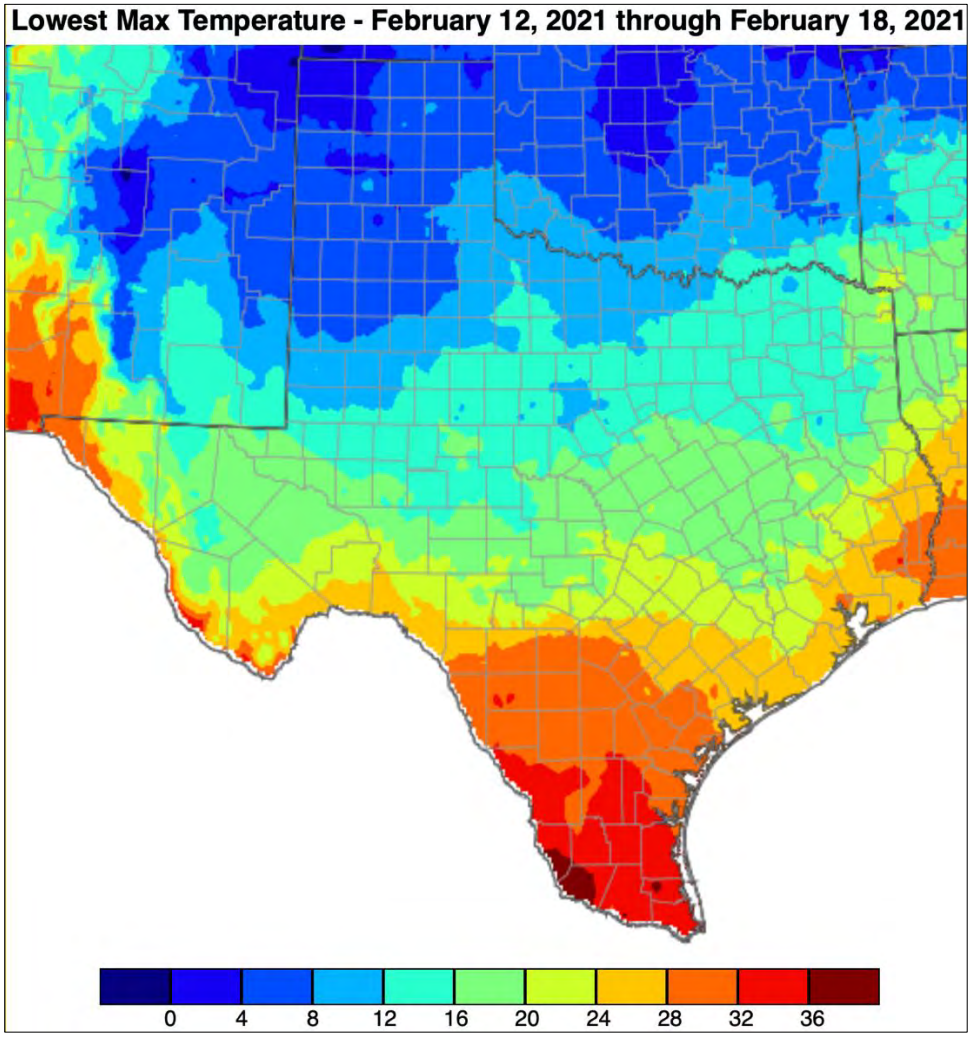

Figure 2: Lowest Max temperature for February 12 – February 18, 2021.

Most of the state had at least one day in which the temperature never got above freezing. In the northwestern tip of the Texas Panhandle, it seems that the temperature on the coldest day never even got above zero. The day-long cold meant that exposed surfaces were able to freeze easily and furnaces had to work extra hard, if they had a source of power.

Texas Winter Summary (continued)

Considering the average of the maximum and minimum temperatures in the more populous parts of the state, February 15 was something like the third coldest day ever, behind just 1899 and 1989.

But it was cold for several days before February 15, and it stayed cold for several days after that, making recovery of the power grid challenging and making the lack of heat especially difficult to deal with. Leading the record books for coldest week is a prolonged cold spell in 1983 (there's the 1980s again!). Where most people live, though, 2021 comes in second-coldest overall.

One way of looking at that is to consider the hottest (!) temperature achieved during the entire week of Feb. 12-18, 2021. Across a large swath of northern and central Texas, the temperature never made it above freezing. What might be considered warmth, if a day in the 60s can be considered warm, was limited to extreme south Texas and those parts of far west Texas where the mountains provided a bit of a barrier to the cold air.

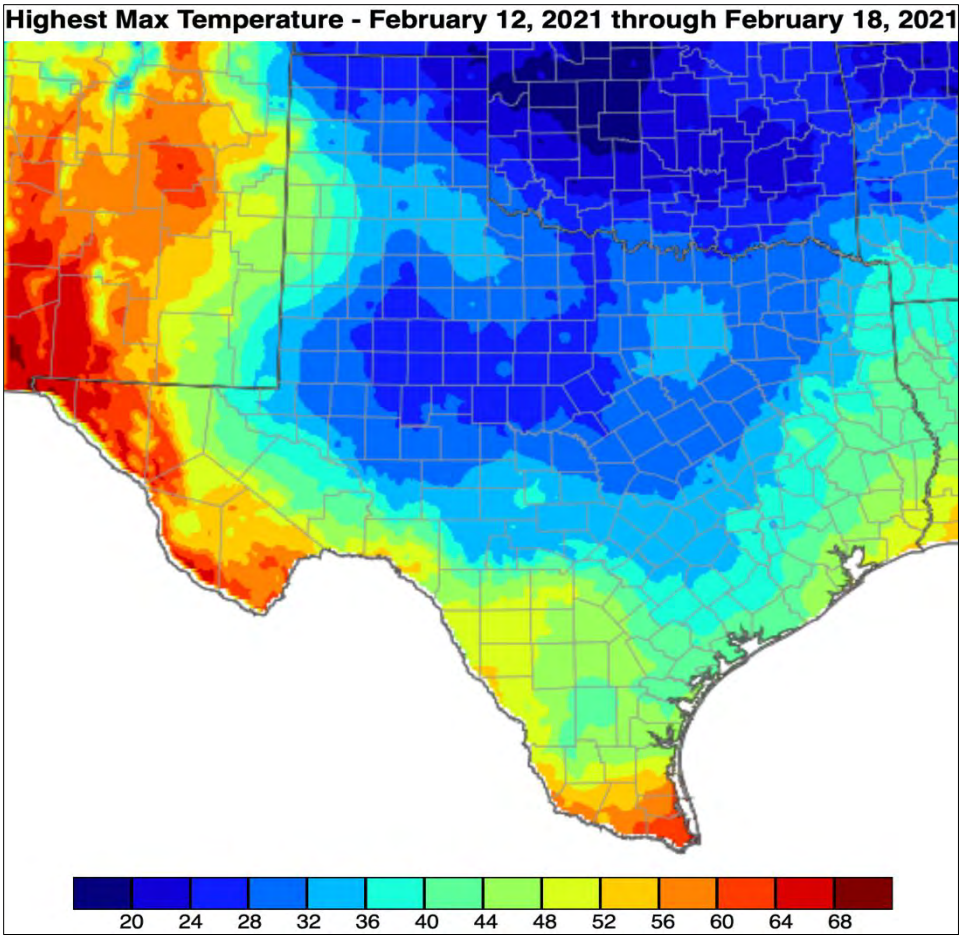

Figure 3: Highest Max temperature for February 12 – February 18, 2021.

There was a lot of interest, and confusion, in the possible role of climate change in the extreme cold temperatures. On the one hand, climate change is making temperatures warmer, but on the other hand, climate change is making the weather more extreme. So what gives?

Texas Winter Summary (continued)

Scientists have developed a three-pronged approach for assessing the extent to which the odds of particular events or types of events can be said to be affected by climate change. The first prong is the historical record: what sort of trend does the data show? The second prong is computer simulations of the climate system: what do they predict? Last, but not least, is our basic physical understanding of how the climate system works. What would we think ought to happen?

I'll take the last question first, and I'll break it down even further. The change in temperatures can have a direct effect on extremes. For example, warmer air can hold more water vapor, so warmer temperatures directly mean that a rain-producing storm is capable of producing more rain. But also, climate change can affect the wind patterns themselves and even the structure of individual storm systems. Those can be a bit harder to pin down, but they can be every bit as important.

For extreme cold in Texas, the direct temperature effect is easy to figure out. Warmer temperatures imply warmer temperatures. Furthermore, since we get our cold air from the Arctic, and the Arctic is warming faster than the rest of the globe, the coldest temperatures are warming fairly rapidly.

Against this effect, we have the possibility that a warmer Arctic might lead to a weaker jet stream that may wavier and be more prone to dipping southward and bringing cold air with it. The physical reasoning for this is much less direct than the temperature effect, and scientists are not even convinced that it all works out right. Even if there is such an effect, it would have to be strong enough to more than make up for the fact that temperatures will be warmer to start with. So, just based on physics, the most likely outcome is a reduction in the frequency of extreme cold temperatures in Texas.

Observations and models are simpler. Historical cold temperatures have been getting warmer in Texas, and all climate models predict that cold temperatures should continue to get warmer.

So, with the three-pronged test, two prongs point directly toward fewer extreme cold days and the third strongly leans in that direction. Most experts think that cold weather will continue to become less frequent, despite what you might have heard.

I suppose that's good news, for a variety of reasons. Maybe someday you'll be able to tell your grandchildren about the time Texas stayed bitterly cold for an entire week, and they'll have a very hard time believing you. Or maybe you already have grandkids and they'll say, "Yeah, we know, we were here! Can we talk about something else now?"

Amarillo Regional Summary

Historic Record Breaking Cold in the Texas and Oklahoma Panhandles

By: Angela Margrave, NWS Amarillo

A historic outbreak of arctic air resulted in record breaking cold temperatures that lasted almost two weeks for some locations in the combined Texas and Oklahoma Panhandles. The cold air moved over the northeastern combined Panhandles as early as Feb 8th, and spread southwest through Feb 12th, engulfing most of the southern plains by Feb 13th. The frigid arctic air would put a strain on area power grids, resulting in rotating blackouts for some locations (this was much worse for other portions of Texas). In addition, two storm systems interacted with the arctic air to produce several inches of snow, not only across the Panhandles but across most of the Great Plains, including almost the entire state of Texas and surrounding states. Amarillo ended up with 5.0" on Feb 14th, and 7.4" on Feb 16th. Periods of flurries and freezing fog also occurred mainly in the overnight and morning periods almost each day Feb 12th through Feb 18th.

One interesting tidbit that may have been left off, the **7 consecutive days below freezing in Amarillo tied the 7th longest such streak** for the station going back to 1892! We hit 33 degrees on Feb 11th after being only 24 on the 10th which reset the clock. If we had just stayed at 32 on the 11th, the streak would have reached 9 consecutive days below freezing and would have then tied 3rd all time - a very close call. The record is 12 consecutive days in case you are wondering.

Amarillo Climate Data:

Date	High	Low	Ave	Ave Temp Dep	HDD	CDD	Precip Liquid	New Snow	Morning Snow Depth
2021-02-09	36	16	26.0	-13.0	39	0	T	T	0
2021-02-10	24	15	19.5	-19.7	45	0	0.02	T	T
2021-02-11	33	10	21.5	-17.9	43	0	T	T	T
2021-02-12	20	10	15.0	-24.6	50	0	0.01	T	T
2021-02-13	14	8	11.0	-28.7	54	0	0.01	0.9	T
2021-02-14	8	-1	3.5	-36.4	61	0	0.13	4.1	3
2021-02-15	7	**-11**	-2.0	-42.2	67	0	T	T	3
2021-02-16	10	-1	4.5	-35.9	60	0	**0.25**	**7.4**	2
2021-02-17	19	2	10.5	-30.1	54	0	T	T	**6**
2021-02-18	21	5	13.0	-27.8	52	0	T	T	5
2021-02-19	40	8	24.0	-17.1	41	0	T	T	5

Chart 1: Climate data for Amarillo from 2/9/2021 to 2/19/2021

Amarillo Regional Summary (continued)

Snow Round 1: February 14th

Figure 1: Large snow drift in Canyon, TX (Aaron Ward)

Figure 2: Photo in Amarillo (Dawn Johnston)

Snow Round 2: February 16th

Figure 3: Snow at NWS Amarillo (Aaron Ward)

Figure 4: NWS Amarillo (Aaron Ward)

Amarillo Regional Summary (continued)

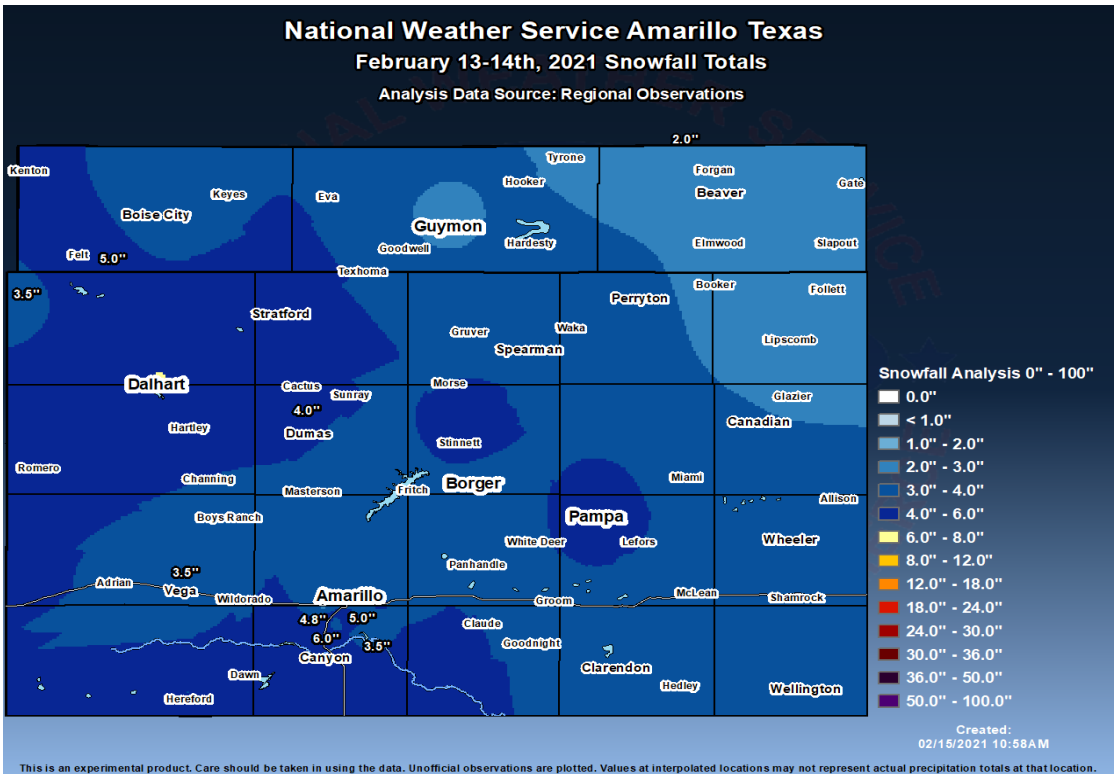

Figure 5: The map above is a representation of interpolation of snow reports received covering Sunday, February 14th, 2021 snow event. It includes snowfall from Sunday ONLY and is not a map of overall snow depth, which is a combination of snow from both Sunday and Tuesday.

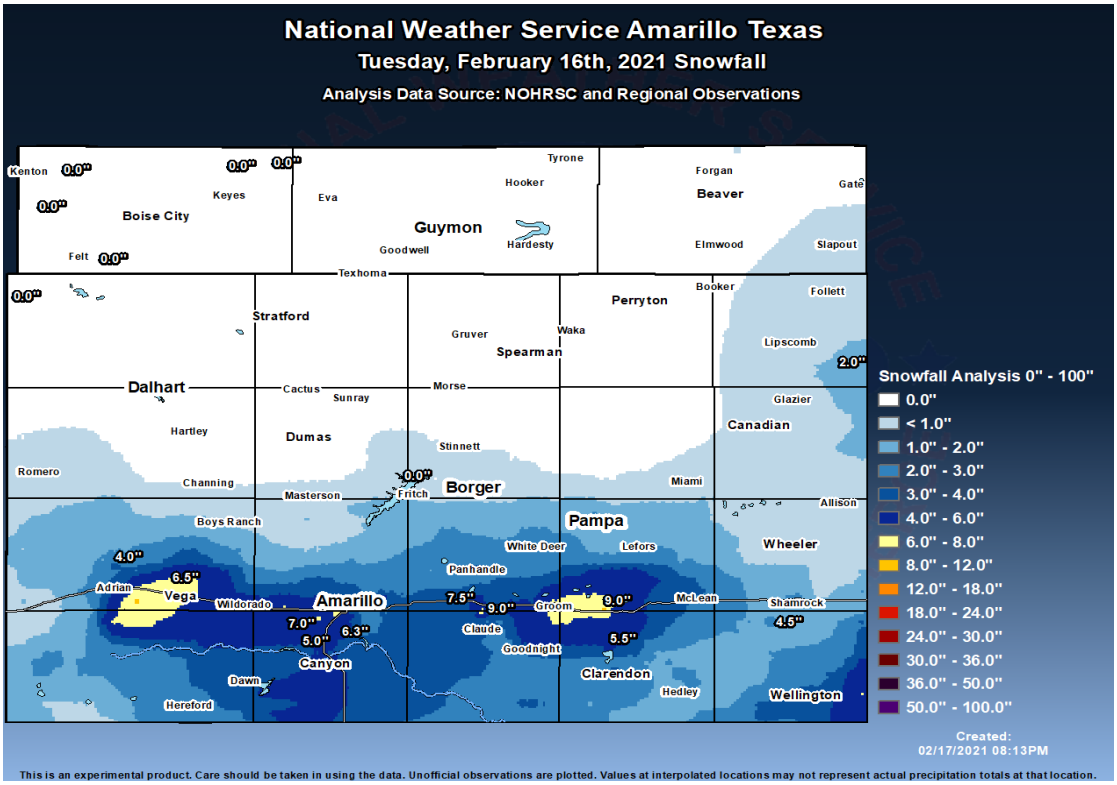

Figure 6: The map above is a representation of interpolation of snow reports received covering the Tuesday, February 16th, 2021 snow event. It includes snowfall from TUESDAY ONLY and is not a map of overall snow depth, which is a combination of snow from both Sunday and Tuesday.

Austin/San Antonio Regional Summary

A winter that lived up to its Name

By: Keith White – WFO Austin/San Antonio

The "Winter-iest" winter in several decades is now thankfully behind us after a parade of weather systems brought round after round of winter precipitation to the region. In sum, a good chunk of the region received much needed precipitation through the winter, however not every location finished the season above normal (See Figure 1).

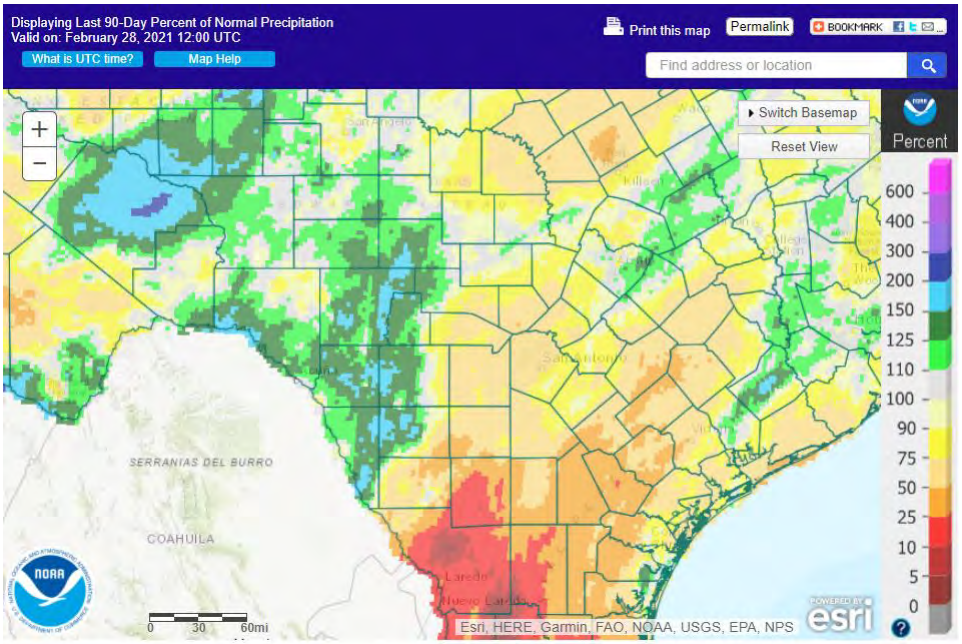

Figure 1: 90 day precipitation for Austin/San Antonio Region.

Aside from scattered showers on Dec 5th mainly over the southern half of the region and again on the 11th but this time mainly over the northern half, conditions were mostly quiet through the first half of the month. On the morning of the 19th, scattered showers and thunderstorms developed across the Hill Country and brought much needed rainfall to northern and eastern portions of our area, with the highest totals of 1" to as much as 1.8" across eastern Travis and Williamson and northern Bastrop and Lee counties. Another period of calm weather followed until the end of the month.

On Dec 30th and 31st, a potent southern-stream trough dipped into South-Central Texas, bringing an arctic air mass along for the ride and spinning up a coastal surface low. Showers and thunderstorms initially only brought additional heavy rainfall amounts on the 30th to many of the same areas that were the beneficiaries on the 19th. However, on the 31st a significant portion of our area received a half inch or more of precipitation. Across the western Hill Country and southern Edwards Plateau, a wintry mix and eventual changeover to snow occurred as temperatures dipped into the lower 30s and upper 20s. Two CoCoRaHS observers in Edwards County measured 4.5" of new snow, while snow accumulations were also reported to the east into Gillespie, Kerr, and Llano counties. Although these two big events accounted for the vast majority of the precipitation in December, much of the Rio Grande Plains and Southern Edwards Plateau finished with above normal precipitation, as did the I-35 corridor from Caldwell County northward.

Another day of scattered showers over the east half of our area Jan 6th meant another day of spotty 0.25"+ rainfall amounts although most locations saw less and some received no rain at all. However, winter weather was right on its heels. On Jan 10th, many areas across the Hill Country and along and east of the I-35 corridor from northern Bexar County northward received anywhere from a dusting to about 4" with isolated totals of as much as 6" of heavy, wet snow. The highest amounts were concentrated across far northeastern portions of the area. Little to no precipitation fell along the Rio Grande with this event, which on its own was a once every 3-10 years type of deal in this part of the country. But it was followed just over a month later by historic, once-or-twice in a century type of week in mid-February.

Austin/San Antonio Regional Summary (continued)

Another few days of off-and-on moderately wet weather returned Jan 19th-25th with generally light and scattered rainfall amounts, and otherwise quiet and seasonal conditions rounded out January. February started out benign as well and featured a historically warm day on the 4th. But beginning on Feb 11th and lasting through the 18th, the region saw four separate winter systems with widespread, devastating impacts as well as bitter cold temperatures not seen in this area since at least 1989. The first system brought freezing rain amounts ranging from a light glaze as far south as Comal and Guadalupe counties to 0.5" or more in portions of Burnet, Gillespie, Llano, and Williamson counties. Afterwards, temperatures struggled to rise above freezing for much of the next week in our northern counties and even when they did, it wasn't enough to melt off all the ice from the trees. In addition, many areas saw several periods of freezing drizzle over the next several days, making roadways slick sometimes to the point they were impassable.

Then, overnight into the early morning of Monday the 15th, a powerful system moved through with snowfall rates as high as 2"/hr. at times and winds gusting to 35 mph, with temperatures on its heels dipping into the single digits and teens Monday morning. Dozens of CoCoRaHS observers across south-central TX reported several inches of snow, with the highest amounts generally in the 5-7" range concentrated right along the I-35 corridor (Figure 2). For our long-term NWS climate sites in Austin and San Antonio, this snow event was 4th and 5th all-time, respectively, with amounts of 6.4" in Austin and 3.7" in San Antonio. Records date back to the late 1800s.

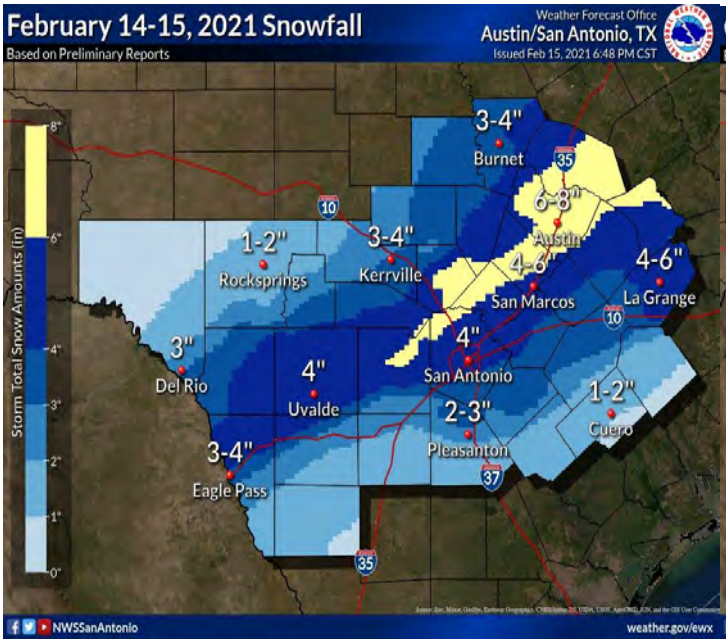

Figure 2: Snowfall on February 14th-15th.

Figure 3: Snowfall on February 18th.

A much-needed but brief reprieve from the precipitation continued through Tuesday, but Tuesday morning Feb 16th featured some of the coldest temperatures in decades across much of the east half of the areas. One NWS observation site at Taylor measured a low of -2F, tied for the twelfth coldest temperature ever recorded in our area. The Hill Country and along and east of the I-35 corridor just couldn't catch a break though, as overnight into Wednesday the 17th, yet another round of freezing rain impacted primarily the northeastern third of our area once again with widespread reports of 0.2" or more of ice accretion and several reports of near 0.5".

One final round of winter on Thursday Feb 18th packed a punch! Widespread additional snow impacted primarily western portions of the area this time through, and a mesoscale snow band set up across the Del Rio area and eastward that ultimately dumped an all-time record 11.2" of snow at Del Rio. This round also brought 2-5" to northern portions of the San Antonio Metro area up towards Canyon Lake (Figure 3). In all, it was the snowiest February in recorded history across much of our area, and Winter 2020-2021 will go down in the record books in the top three snowiest at all of our long-term observation sites.

Austin/San Antonio Regional Summary (continued)

By the time temperatures rose back above freezing in Austin at 4PM on the 18th, it had been 144 straight hours with temperatures below 33, the longest on record. The previous record was 140 hours in 1983. But just as quickly as it began, it was all over. Highs were back into the 70s by the 21st, and Austin Bergstrom was the only of the four long-term climate sites to finish in the top five coldest Februaries as a result of its shorter period of record going back only to 1942. The winter as a whole was below normal across much of the area. However, portions of the area along the Rio Grande as well as Lavaca and Fayette counties and a small swath east of I-35 managed to remain warmer than normal on the whole though this winter (Figure 4). Note that the positive anomaly centered over Dimmit County was computer analyzed in error so disregard.

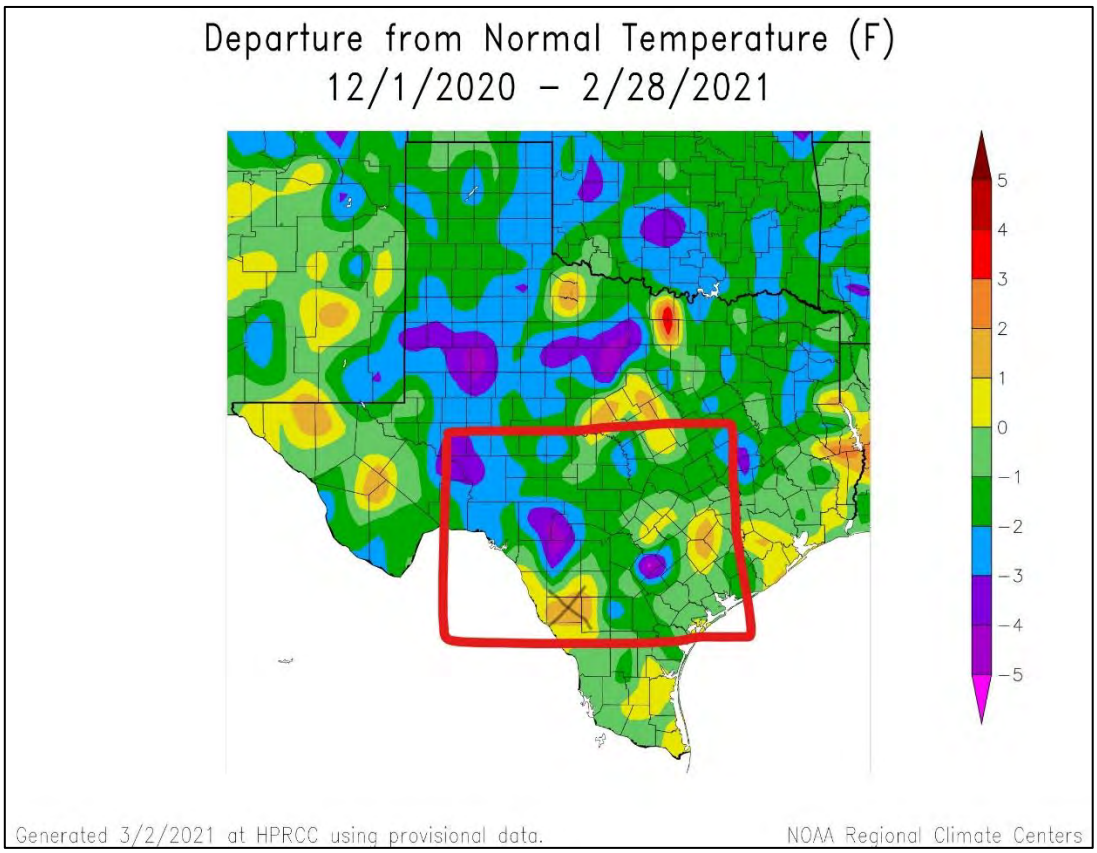

Figure 4: Winter season temperature departure from normal.

Keeping our eyes on the bright side, expectations at the beginning of the season were for higher than usual chances for warmer and drier than normal conditions on average for the winter season due to the moderate La Nina in place. Drought was anticipated to expand and/or worsen slightly through the season. However, by the end of February the US Drought monitor actually showed only 21% of the area in D2 drought compared to 77% at D2 or D3 the beginning of December as a result of our busy winter season. This was not entirely unexpected; the last measurable snow in Austin was in 2017 as well as the record 13+" snowfall in San Antonio in 1985 were both during La Nina winters.

Wichita Falls Regional Summary

Cold and Snow Stole the Show

By Charles Kuster

CIMMS/NSSL - Cooperative Institute for Mesoscale Meteorological Studies at National Severe Storms Laboratory

By far, the biggest weather story of the season was the cold-air outbreak and snowfall that affected the area during a memorable week in February. Snow fell during the 24-hour periods ending at 7am on February 15th and February 17th with all CoCoRaHS observers reporting between 3" to 8" of new snow each day. In total, CoCoRaHS observers reported between 4.5 and 14.2" of snow across the region during this time (Fig. 1). The even bigger story was the prolonged period of very cold temperatures. Wichita Falls recorded a temperature of -8° F on February 16th, which was a new record low temperature for the month of February (Fig. 2). Low temperatures were also below freezing for 13 straight days. Even high temperatures remained below freezing for 10 straight days (Fig. 2). The prolonged cold temperatures caused widespread frozen pipes and stressed the power grid, causing significant power outages.

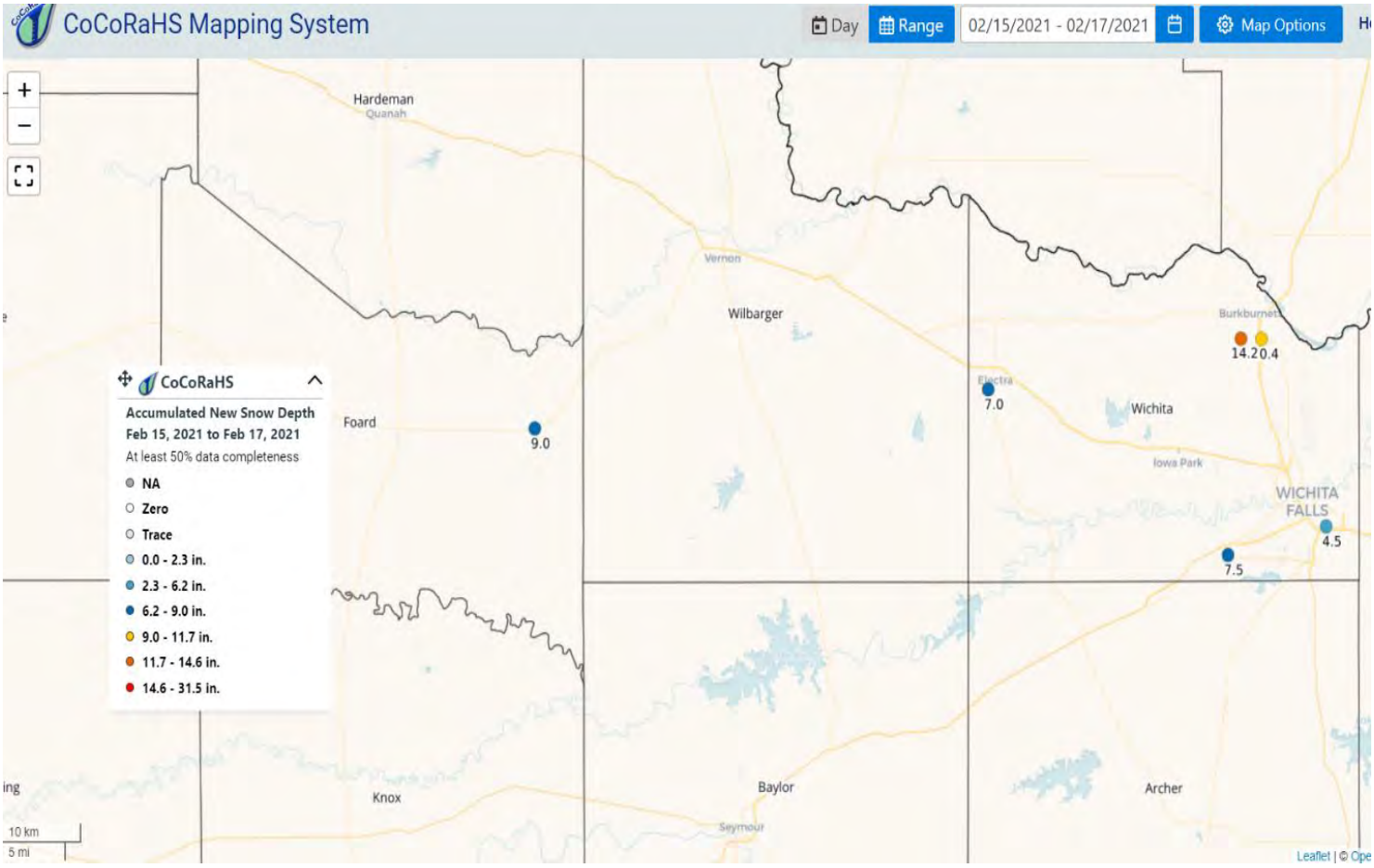

Figure 1: CoCoRaHS new snow totals between 2/15 and 2/17.

Wichita Falls Regional Summary (continued)

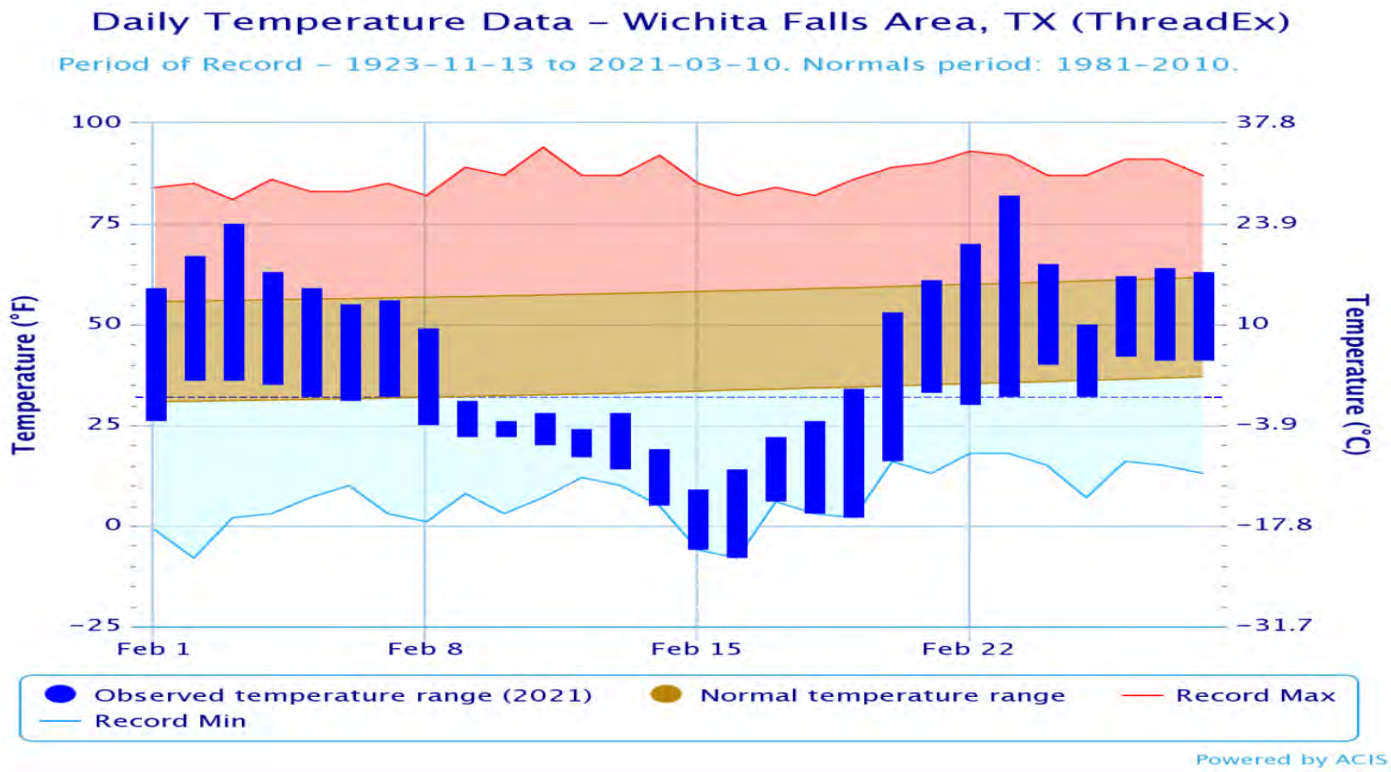

Figure 2: Temperature graph for Wichita Falls, TX for February 2021. The blue bars show the observed temperature range for each day, with the top of the bar indicating the daily high temperature and the bottom of the bar indicating the daily low temperature. The brown region shows the normal temperature range. The red line indicates the record high temperature for each day, while the blue line indicates the record low temperature for each day.

It is not surprising that February saw well below normal temperatures across the region (Fig. 3a). Overall, temperatures for the season (December–February) were slightly below normal (Fig. 3b). The remainder of the winter season may have been less memorable than February, but observers did wake up to 1–3" of new snow New Year's morning and additional light snowfall about 10 days later. This season, we experienced 75 dry days (all CoCoRaHS stations reported less than 0.05 inches) and 15 wet days (at least one CoCoRaHS station reported 0.05 inches or more). For comparison, the region experienced 75 dry days and 16 wet days last winter.

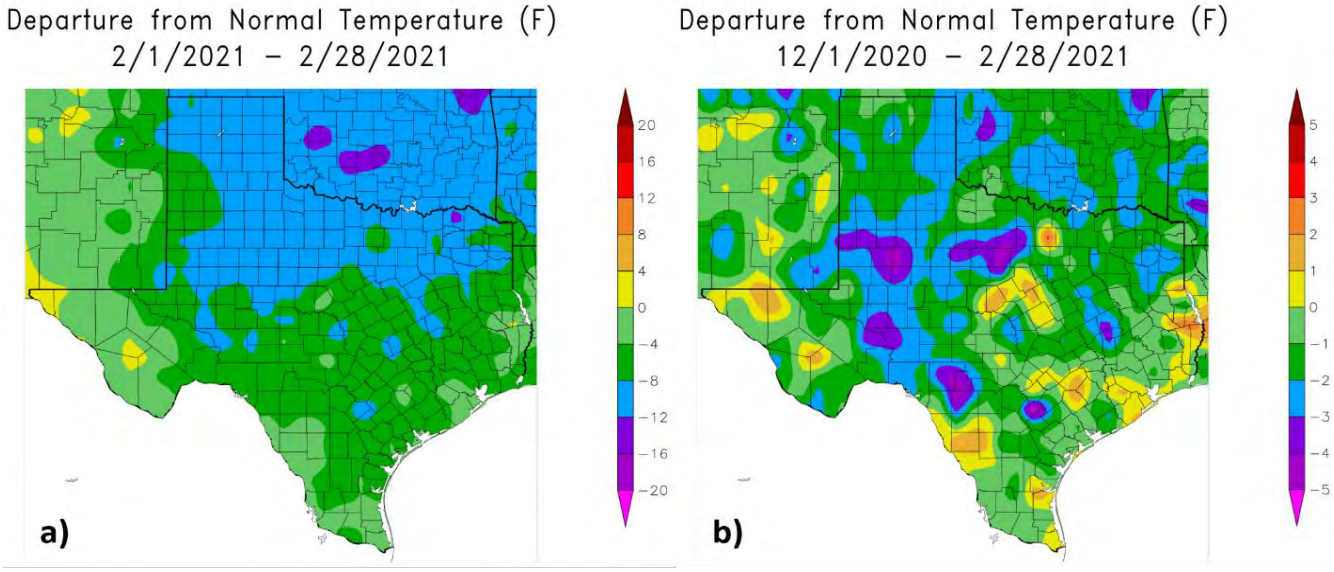

Figure 3: Departure from normal temperature for a) the month of February and b) the entire winter season. Cooler colors indicate below normal temperatures while warmer colors indicate above normal temperatures. Color bars are located at the right edge of each image.

San Angelo/Abilene Regional Summary

Winter 2020 - 2021 West Central Texas
By: Joel Dunn
Edited by Katie Dedeaux

The winter period across West Central Texas had a bit of a slow start, but would prove to be quite active. The forecast area would experience a total of 3 winter weather events, each one proving to be stronger than the last. One would break a 5 year snow drought and one another would result in historic snowfall for both San Angelo and Abilene.

December 2020

December began warm and dry, more like an extension of fall. Though overnight lows often cooled off into the 20s and 30s, the daytime highs would regularly reach the 60s and 70s. This heat wave resulted in both Abilene and San Angelo reaching over 80°F on the 10th; nearly 20°F above normal. As far as precipitation, West Central Texas had a few showers resulting in minimal rainfall amount early in the month, but the main event occurred at the end of the month.

During the last week of the month, models were hinting at a winter weather event, but there was some uncertainty as to what type of precipitation would be falling. Though snowfall was expected, it was not yet certain when the precipitation would transition to snowfall and how much would occur.

Below is an excerpt from the Area Forecast Discussion on December 29th, 2020 issued by the National Weather Service Office in San Angelo.

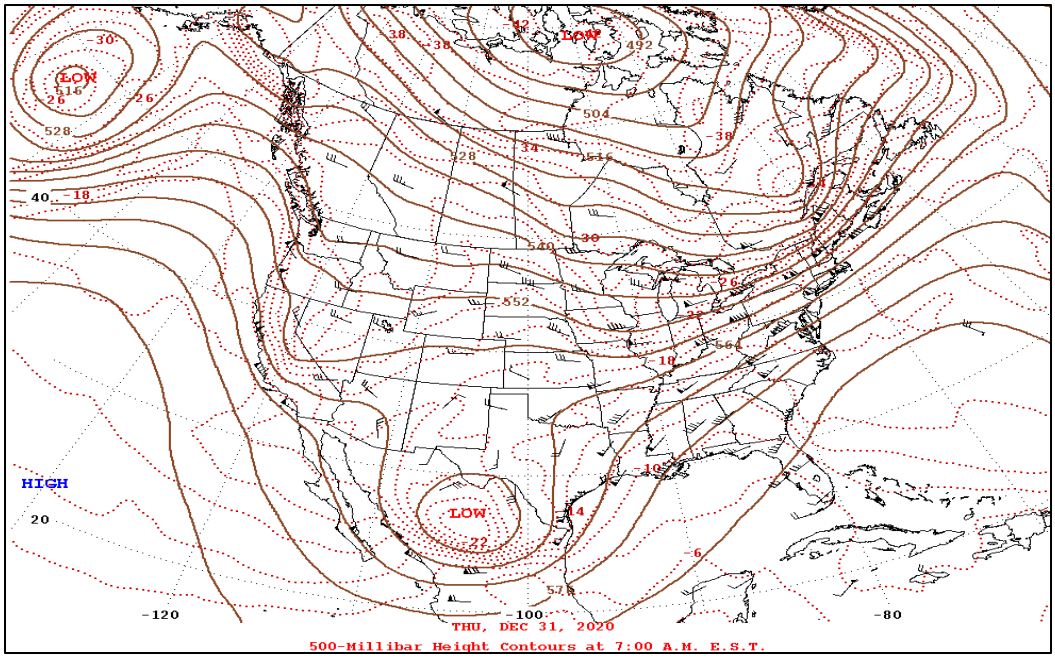

Image 1 *- 500mb Height contours showing the position of the low*

"…models do show a 1°- 4° C warm nose in the low levels at that time for much of the region, so a wintry mix looks likely for most of the area Wednesday night into the pre-dawn hours Thursday. As we go through the day Thursday, expect that warm nose to dissipate and for a gradual transition from west to east to mostly all snow. A Winter Storm Watch has been issued for the Northern Edwards Plateau, Concho Valley and southwestern Big Country. 2-6 inches of snow will be possible across that region, with potentially amounts near 9 inches in Crockett and Irion counties. As we get closer to the event, we may need to add other counties to the Watch, but right now the uncertainty regarding snow potential/amounts in those counties is too low. There's also the potential for some freezing rain resulting in light ice accumulations… however, the main impact is expected to be snow."

During the early morning hours of New Year's Eve, the precipitation began, mainly rain at first, though the weather service receive reports of sleet were received as early as 1:30 AM. The system was approaching from the southwest, which brought snow to the Ozona area early in the morning. The Concho Valley didn't transition to snowfall until around noon and the Big Country until after 6 PM. The snowfall would persist through the night, finally coming to an end early the next morning.

San Angelo/Abilene Regional Summary (continued)

City	Snowfall Amount
Abilene	2.6*
Sterling City	8-9**
San Angelo	1.7*
Ozona	5-6**
San Saba	3*

*Table 1 - Snowfall amounts reported *=official **=estimate*

Though Sterling City was the clear winner, it is worth noting, the official snowfall observation of 1.7" at WFO San Angelo broke the longest running snow drought for that area. The last time San Angelo recorded 0.5" or more was on December 27th, 2015. The record stands at 5 years and 4 days.

January 2021

The New Year wasn't a week old before the chances of snow returned to West Central Texas. At first, the models forecasted this system to be weaker than the one before it, yet that would turn out to not be the case. This system would be coming in from the northwest rather the southwest, bringing winter weather first to the Big Country. By the 8th, a Winter Storm Watch was issued for the Big Country, as heavy snow with totals between 3-6" was expected, while areas further south could expect anything from just rain, to up to 3 inches of snowfall. The very next day, the Winter Storm Warning would be expanded to most of the Concho Valley and Northwest Hill Country, and an Advisory would be issued for areas along the I-10 corridor.

***Image 1** - Map of Preliminary snowfall totals*

On the morning of January 10th, a strong upper level low was located across southern New Mexico. Areas of snowfall had developed across southern New Mexico and east into Midland, TX, while areas of rainfall had developed across the Concho Valley and Northern Edwards Plateau. By 4 AM, the rainfall had transitioned to snow across the Concho Valley and was moving north into the Big Country. By late morning, most of West Central Texas was covered in snow, from 1 inch in Junction to as high as 8" in Sweetwater. Snowfall measurements would reveal an almost perfect 10 to 1, snow to liquid ratio.

Though not nearly as noteworthy, yet still welcome, was the second system that passed through West Central Texas mid-January bringing an additional 0.50" of rainfall to the area, though no additional frozen precipitation was observed.

San Angelo/Abilene Regional Summary (continued)

February 2021

February started out quite warm with temperatures 5-10°F above normal. However, all of that was about to change. The models were becoming increasingly more consistent about a particularly cold arctic front, with snowfall, driving as far south as Brownsville, due to the Polar Vortex pushing south into the upper portions of the United States.

On February 14th, 2021 Abilene had already seen a trace of snowfall as early as 6 AM, and by noon an inch had fallen. San Angelo was not expected to see snowfall until mid to late afternoon, however, the first flakes were observed mid-morning and did not stop until late into the evening. Meanwhile, temperatures continued to plummet, and by 7PM Abilene was in the single digits and two hours later San Angelo hit 9°F. The cold temperatures resulted in a higher snow to liquid ratio and made for powdery snow that more easily blew in the wind, ultimately making it more difficult to acquire accurate snowfall measurements.

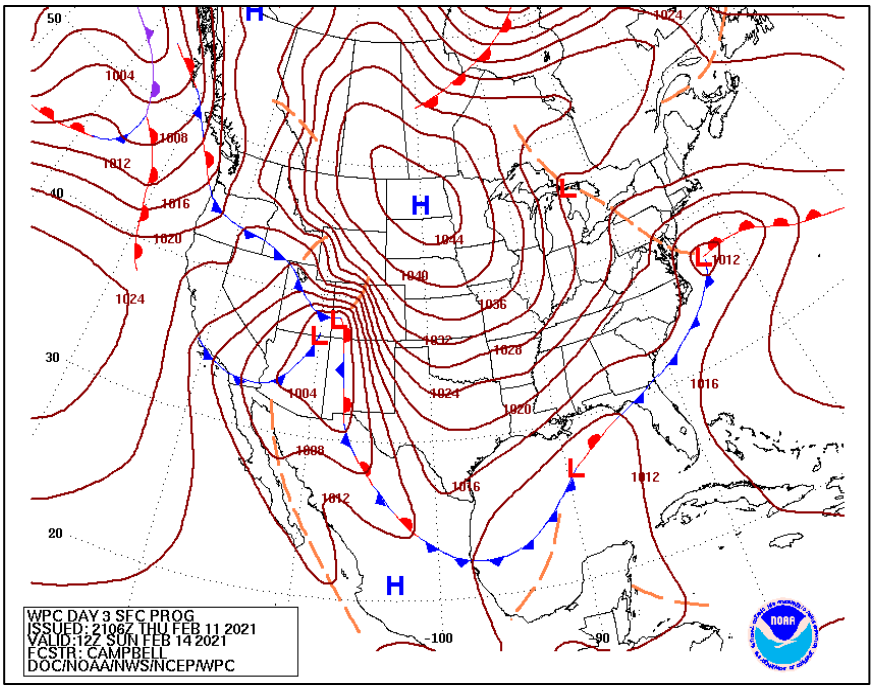

Image 3 *- Day 3 Front & Pressures issued by NOAA WPC on Thursday February 11th, 2021*

Station	Snowfall
Abilene	9.8”
San Angelo	10.1”

Table 2 *- Table of snowfall measurements from February 14th*

Abilene and San Angelo recorded historic snowfall measurements, beating all-time record snowfall for a 24-hour period. The previous all-time record for Abilene was 9.3”, which fell on April 5th, 1996. San Angelo’s previous all-time record snowfall was 10 inches, which fell on January 16th 1919, therefore breaking a record that was over 100 years old.

Station	February 15th Low	February 15th Previous Record	February 16th Low	February 16th Previous Record
Abilene	-2°F	0°F set in 1895	-4°F	-4°F Tie, 1895
San Angelo	-1°F	-1°F tied, 1985	-1°F	16°F in 1909

Table 3 *- Record Low Temperatures at Abilene & San Angelo*

Other notable records were the low temperatures at both Abilene and San Angelo. On the 16th of February, Abilene’s low temperature of -4°F tied the previous record set in 1895, and is the 7th coldest low on record. San Angelo’s low temperature on the 15th and 16th was -1°F, and tied the previous record on the 15th, set in 1985, and broke the record set on the 16th, set in 1909. The low temperatures of -1°F on the 15th and the 16th are the 3rd and 2nd coldest low temperatures on record respectively. This made for quite the historic event. This event caused statewide power outages, burst pipes across cities and water shortages lasting well into the week. Sadly, these factors would lead to numerous deaths across the state.

West Texas/SE Mexico Regional Summary

Below Normal Precipitation for West Texas and Southeast New Mexico

By: James DeBerry, NWS Midland/Odessa

December

December would have been another dry month for West Texas and Southeast New Mexico, if not for two winter weather events, both of which were almost entirely comprised of snow. This is unusual for this region, as warmer temperatures aloft and/or a lack of moisture usually yield a mix of rain, freezing rain, sleet, and snow during winter weather.

The first event occurred on December 5th, when an upper-level disturbance laid a swath of 3-6" of snow through the Davis Mountains.

The second event closed out the year on the 30th-31st, when a more potent trough produced record snowfall from the Davis Mountains up through the Stockton Plateau, central and southeast Permian Basin, and upper Colorado River Valley. Most areas received 8-12" of snow, with isolated amounts of 18-24".

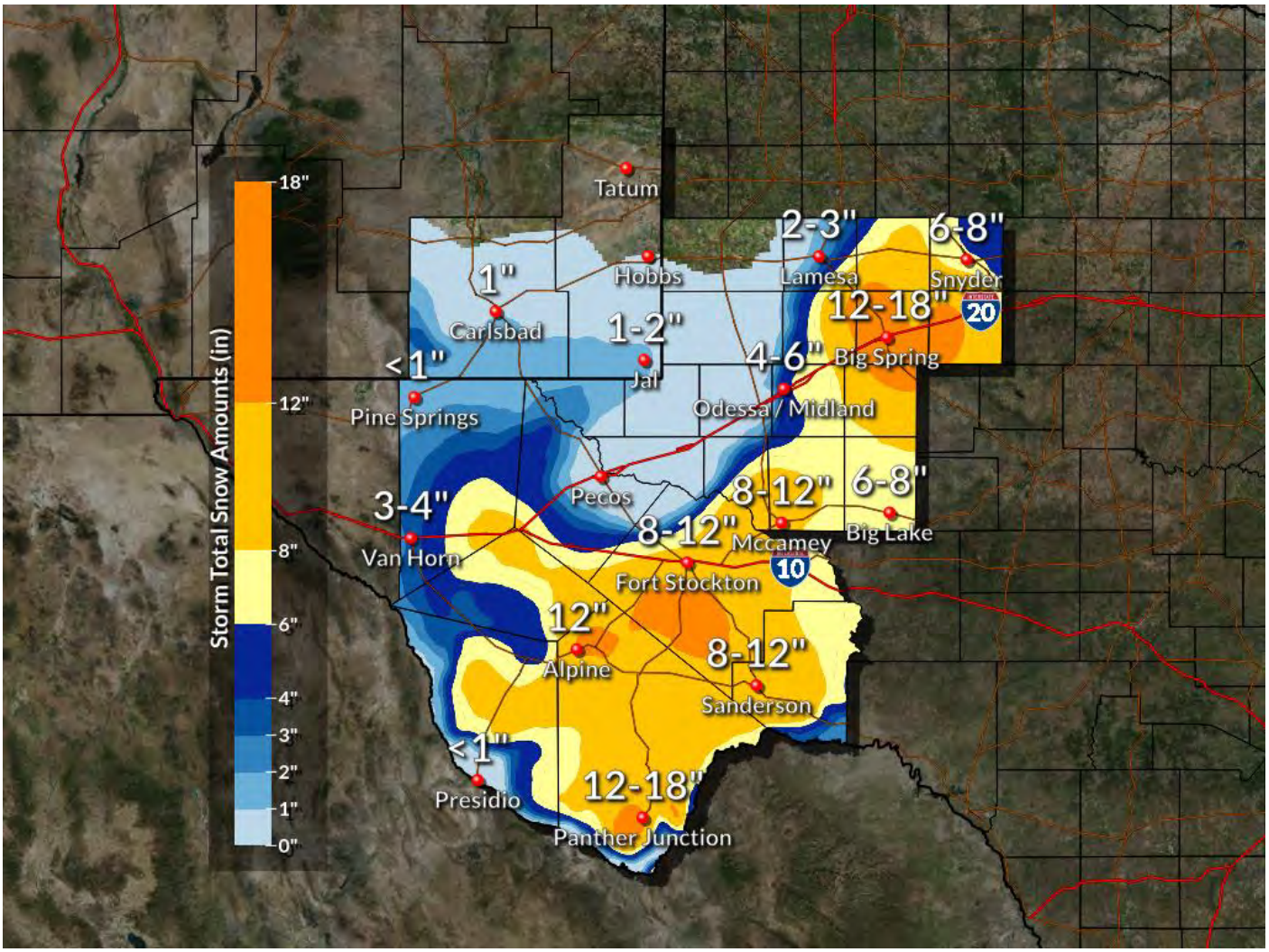

Figure 1: December 30th-31st Snowfall Totals

Monthly radar rainfall estimates ranged no precipitation in northern Eddy and Lea Counties to up to 6" in Glasscock County. The highest observed rainfall was 1.58" at Lamesa in Dawson County. The average of precipitation reported across West Texas and Southeast New Mexico was 0.38".

West Texas/SE Mexico Regional Summary (continued)

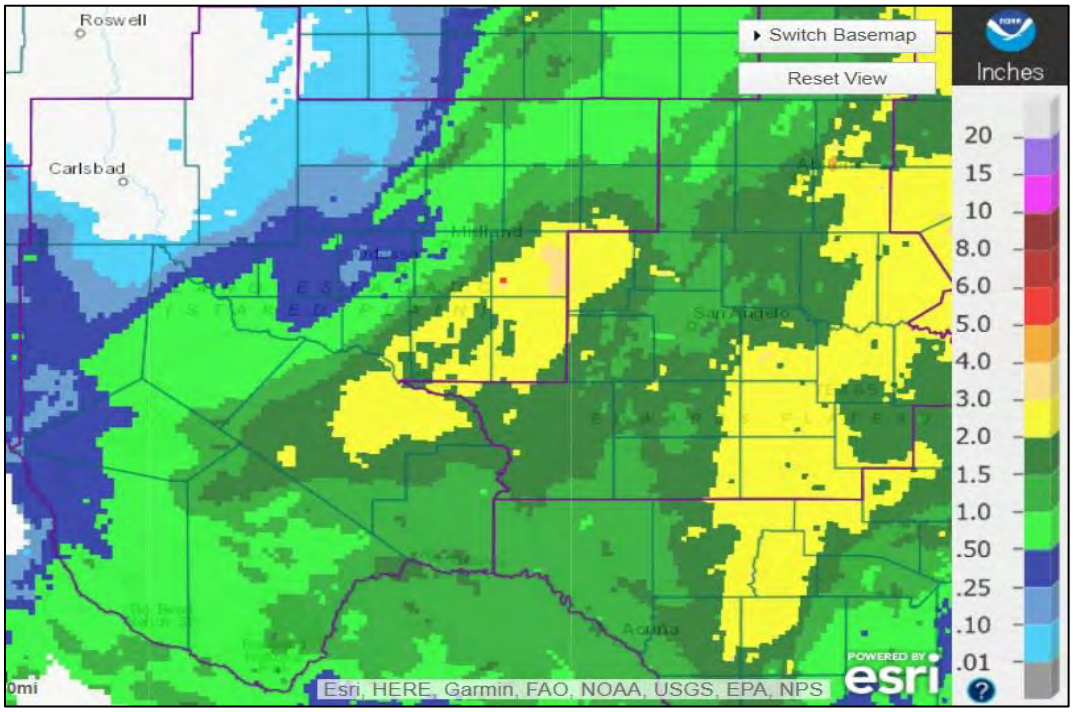

Figure 2: December Precipitation

January

Areas of West Texas and Southeast New Mexico west of the Pecos received below-normal precipitation in January, whereas most real estate east of the river was near- to above-normal.

Monthly radar rainfall estimates ranged from nothing in parts of Brewster County to up 1.5” in some areas of the Western Low Rolling Plains and the southeast Permian Basin. The highest observed rainfall was 2.33” in Carlsbad in Eddy County. The average of rainfall reported across West Texas and Southeast New Mexico was 0.53”.

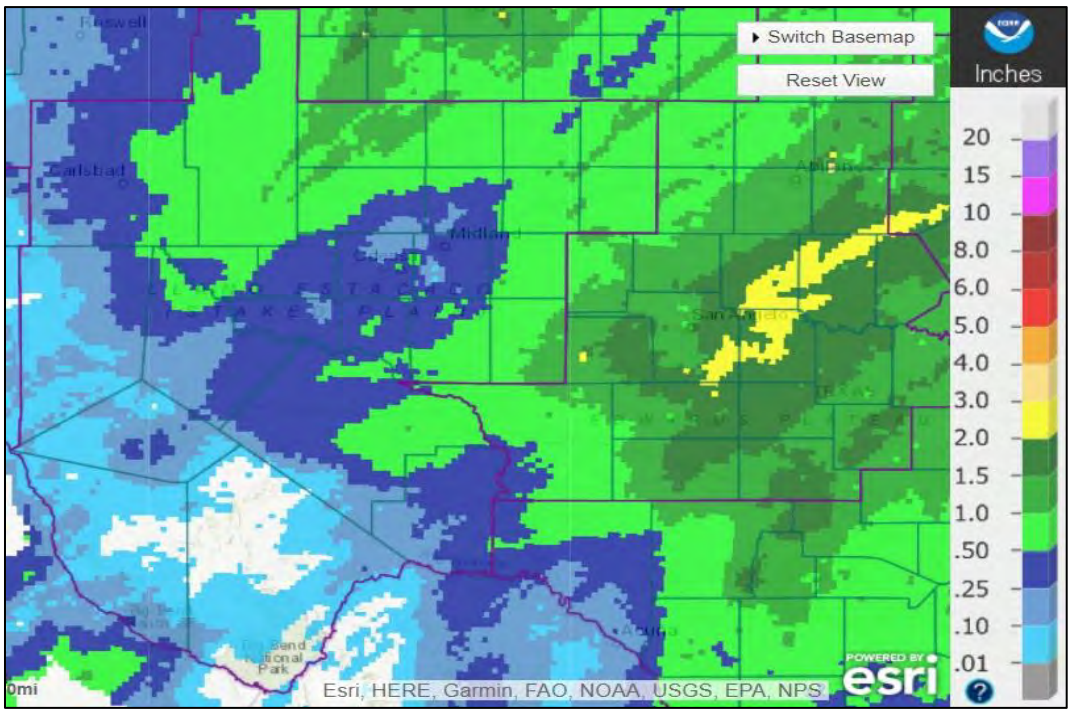

Figure 3: January Precipitation

West Texas/SE Mexico Regional Summary (continued)

February

Aside from a few locations along the West Texas Pecos River and Rio Grande, below-normal precipitation was observed across West Texas and Southeast New Mexico in February. Most of what did fall came from a snowstorm that occurred mid-month across the entire HSA.

Monthly radar rainfall estimates ranged from nothing in the Davis Mountains and parts of the southeast New Mexico plains to up to 1.5" in the Texas Pecos River Valley. However, the highest observed rainfall was 1.33" at Castolon in Brewster County. The average of rainfall reported across West Texas and Southeast New Mexico was only 0.26"

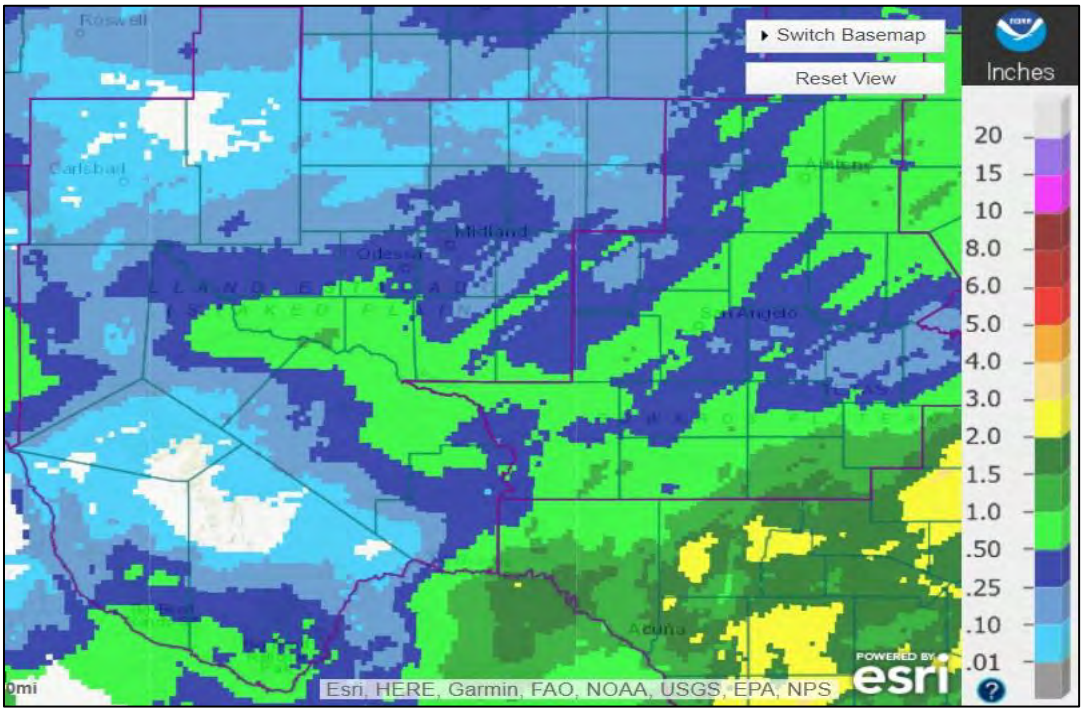

Figure 4: February Precipitation

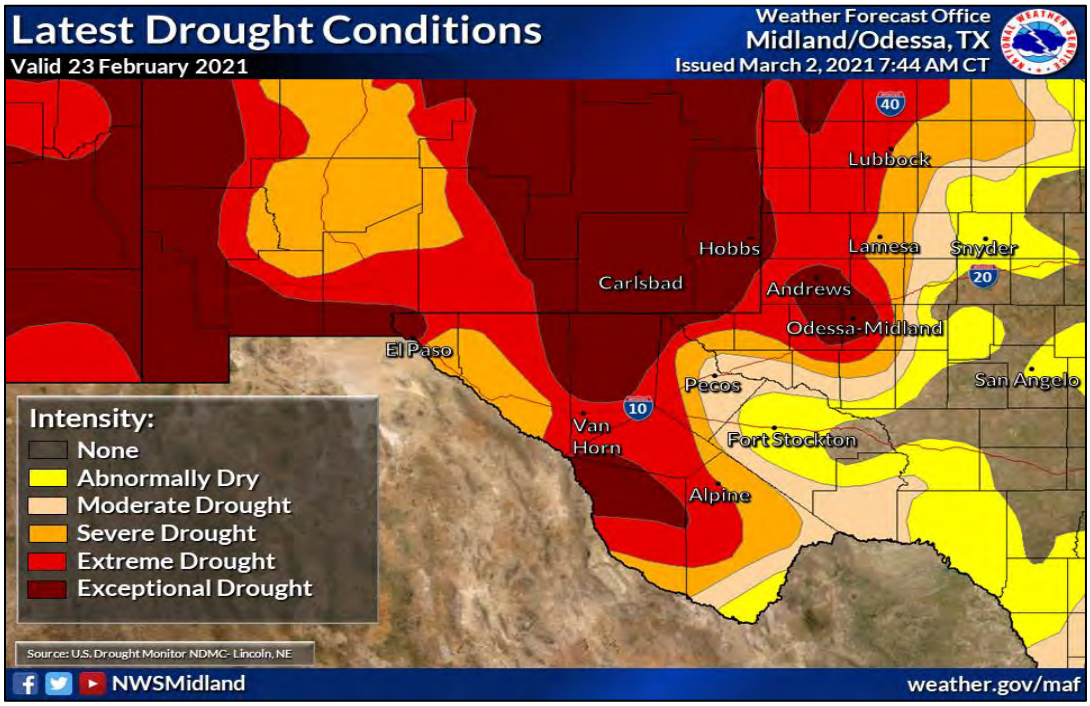

Figure 5: Drought conditions over West Texas as of March 2, 2021.

North Texas Regional Summary/Hydrology

Drier than normal winter across North Texas

By: Greg Story, NWS Retired

Greetings from North Texas! Needless to say, 2020 was a strange year in many ways, and 2021 started off where 2020 left off. In 2020 it was incredible how busy we were in the rainfall department, as we had near-record setting amounts for the first six months. Then the rain backed off, and in most months we saw below normal rainfall. Then we experienced record rainfall the very last day of 2020. I guess that is fitting. I am thankful to each and every one of you for reporting your rainfall via CoCoRaHS! With rainfall as important as it was in 2020, your reports were invaluable to the National Weather Service (and other entities) to determine locations of both flooding and drought.

Over the past several months, back in September the center part of Texas got above normal rainfall. Only the western and far southwest sections had below or much below normal precipitation. Then in October, which is usually a wet month, it was very dry state-wide. Only northwest Texas and the Sabine River basin from Toledo Bend Lake southward (and western Louisiana) saw above normal rainfall. In November the dry weather regime continued, with only parts of south central and Southeast Texas observing above normal rainfall. All other parts of Texas were below normal. This was quite a shift from earlier this year! In December it was quite wet over roughly the southeast third of the state, as was southwest Texas, while lower South Texas and the Panhandle region were dry. Overall, near normal precipitation was recorded. In January 2021 it was a dry month. There were a few locations that had near normal to a bit above normal precipitation, such as west Texas and the Concho valley. But below normal precipitation was noted at most locales. In February we experienced some pretty significant storm systems, one in particular Texans won't forget anytime soon. But in spite of that, Texas actually ended up with below normal precipitation state-wide. Only parts of the Rio Grande valley of Southwest Texas saw above normal precipitation. All other locations were near or below normal.

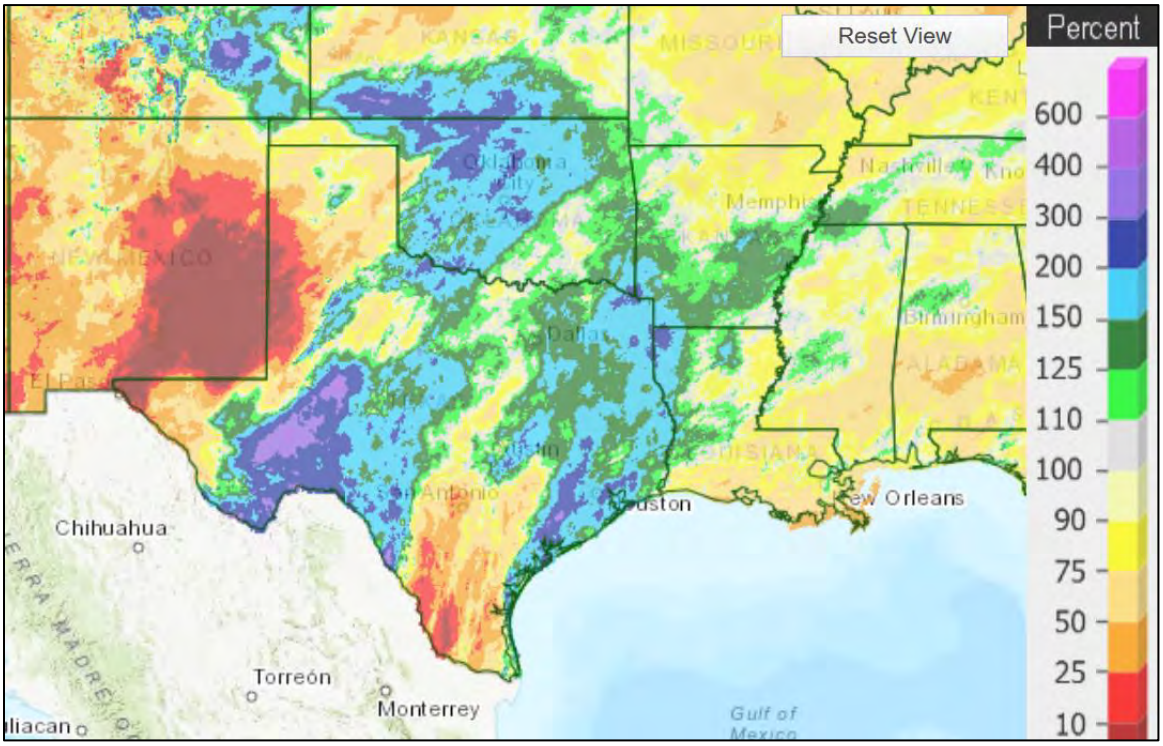

Figure 1: Percent of normal precipitation map for December 2020. The green and light yellow colors indicate near normal precipitation; the blue and purple colors indicate above normal, while the brown and red indicates below normal precipitation. December was pretty wet over Southwest Texas and over roughly the southeast third of the state. A few regions had below normal precipitation, including lower south Texas and the Panhandle region.

For December 2020 DFW airport received 3.00" of rain. The normal amount is 2.55" so they were 0.45" above normal for the month. In Waco during December 2020, they received 4.48". The normal amount of precipitation is 2.75" so they were 1.73" above normal for the month.

North Texas Regional Summary/Hydrology (continued)

There were about four significant storm systems which affected our weather in December. Here are the highlights of the weather for the month.

December 12 – 15:
A strong low pressure system passed just north of Texas. Snow fell in Oklahoma, while rain fell in Texas. The area from Mansfield to Richardson in North Texas received 1" to 1.50", and also Palestine got over 1". Behind the first low, a fast moving upper air disturbance produced rain over north Texas, but the rain was light (less than 0.25"). It produced more snow from the Texas Panhandle into Oklahoma.

December 19:
A cold front and upper air disturbance moved through Texas. Most of the rain was from central into East Texas, with maximum amounts of 2" to 2.50" from Galveston to Beaumont.

December 23:
A strong cold front passed through Texas. There was no rain in North Texas. However, showers and a few thunderstorms did occur over Southeast Texas where there were maximum totals of 1.50" to 2.34".

December 29 – 31: Perhaps the strongest storm of the month occurred the last few days of 2020. A major low pressure system moved from California into northern Mexico and eventually passed across Texas on the 31st, additionally, a strong cold front moved through Texas late on the 29th through the 30th. Initial precipitation was 1" over west Texas on the 29th. Widespread rain occurred on the 30th and 31st. The heaviest rain on the 30th was over Southeast Texas with 4" to 5.50" from Huntsville to Sealy. Also, 2.50" fell in Tyler and 3 - 4" occurred from Athens to Canton. West Texas received heavy snow. Meanwhile, widespread showers and thunderstorms fell over Central and East Texas. The heaviest precipitation on the 31st was 4" over Southeast Texas near Jasper and Woodville. In North Texas, Rowlett got nearly 3.75". DFW received 1.64", which was a record for the last day of the year. The previous record for December 31 was 1.55" in 1984. Waco also set a record rainfall amount for December 31. They received 1.96". The previous record was 1.69" set back in 1978.

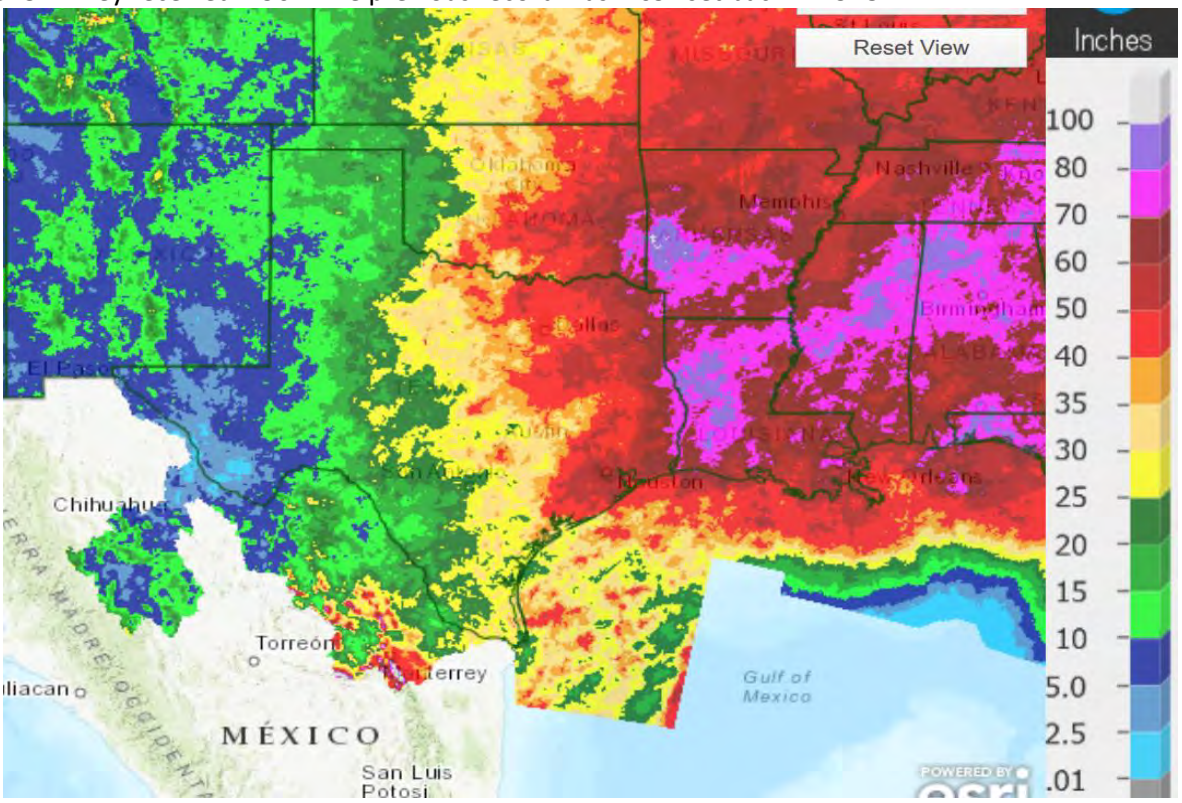

Figure 2: Total precipitation for 2020. For the year 2020 DFW airport registered 43.70". The normal annual amount for DFW is 36.14" so they were 7.56" above normal for the year. In Waco for 2020 they received 45.56". The normal amount for a year is 34.69" so they were 10.87" above normal for 2020.

North Texas Regional Summary/Hydrology (continued)

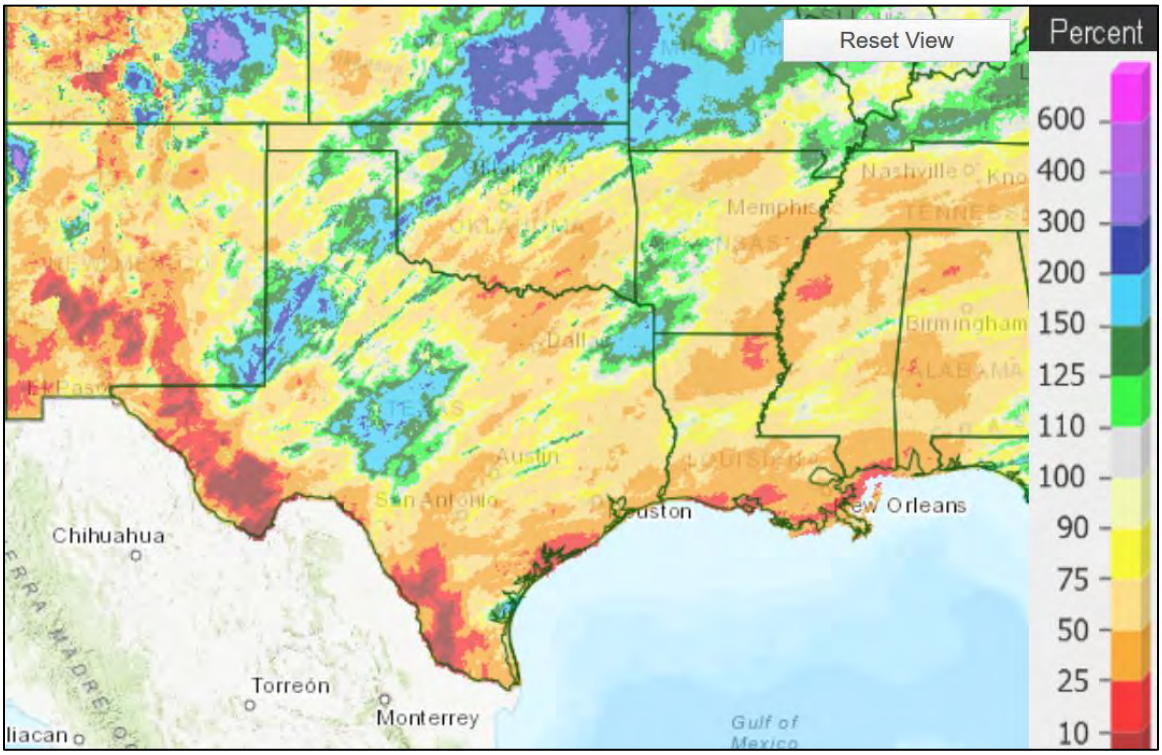

Figure 3: January 2021 percent of normal precipitation map. The red and yellow colors indicate below normal precipitation, while the blue and green indicate above normal precipitation. In January, most of the state had below normal precipitation. There were a few locations which got above normal precipitation, such as parts of West Texas and the Concho valley. But much of far southwestern, lower South Texas and parts of North Central Texas received below normal precipitation in January. But, the area near Texarkana had above normal precipitation.

At DFW Airport in January 2021 they received 0.85”. The normal amount of precipitation is 2.13” so they were -1.28” for the month. This included a Trace of snow at DFW.

At Waco in January 2021, they received 0.92”. The normal amount is 2.12” so they were 1.20” below normal for the month. This included 4.4” of snow. In a normal January Waco receives 0.3” of snow so for the month they were 4.1” of snow above normal.

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

January 1:
The major low pressure system that affected the region at the end of December moved out of north Texas into Oklahoma the morning of the 1st. The total amount of precipitation over north Fort Worth for this storm was just under 2”.

January 6:
A cold front and an upper air disturbance crossed Texas. Most of the showers and thunderstorms were over the eastern third of the state. The heaviest rain in north Texas was 3" at Milano and 3.60" at Big Sandy.

January 10:
A major low pressure system crossed Texas. There was lots of snow across the state, with some rain mixed in. They experienced showers and a few thunderstorms across extreme southeast Texas. Almost 3" fell around Corpus Christi. There were widespread snow water equivalent reports of 0.75" south of DFW, with a maximum of 1.50" around Gause and Cameron. Much of the precipitation which fell was snow, with 7 to 8" of snow from Chalk Mountain and Hamilton to Granbury.

North Texas Regional Summary/Hydrology (continued)

January 19 – 26:
A prolonged period of unsettled weather occurred with a couple significant storm systems. A deep low pressure system developed off Baja California. This low weakened and passed over Texas by the 22nd. Short wave troughs ahead of the low generated rain over Texas. Initial rain from the 19th to early on the 20th was 1" to 1.42" from Lott to Longview. From the 20th to early on the 21st rainfall amounts were under 1". From the 21st to early on the 22nd 1" - 2" fell over East Texas, with a maximum amount of a little over 2" at Toledo Bend Lake. Then, late on the 23rd through the morning of the 24th a deep low pressure system formed over California. The low opened up and moved northeastward across New Mexico to Southwest Kansas late on the 24th to the 25th. A few showers and thunderstorms over North Texas on the 24th. More widespread showers and thunderstorms formed late on the 24th into the 25th and moved from west to east across the state. Reports of 1" to 1.50" were noted from Grand Prairie through Dallas to Greenville. Lingering rain the morning of the 25th was light. Finally, late on the 26th a short wave trough and cold front brought some light rain to North Texas. Rainfall amounts of 0.50" to 1" occurred from Rice to Trinidad.

January 29 – 30:
From late on the 29th through the 30th a strong upper air disturbance moved across the Texas Panhandle into Oklahoma. Early morning showers and thunderstorms occurred over North Texas, but all the amounts were light.

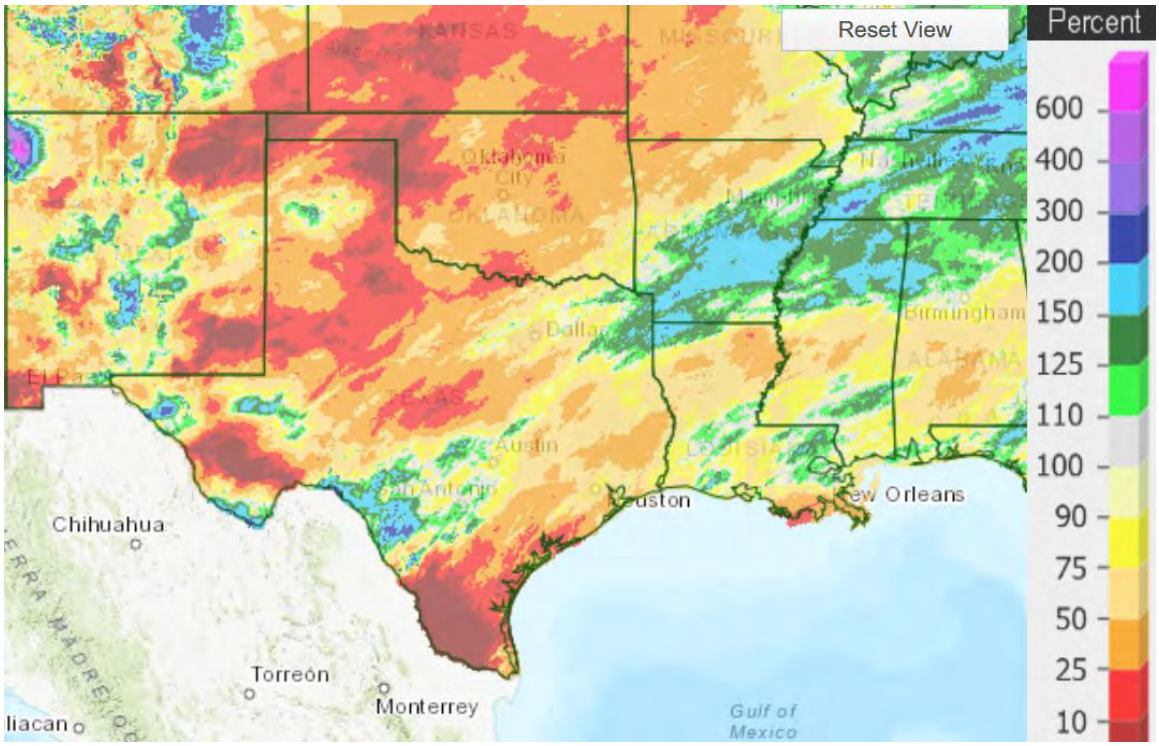

Figure 4: Percent of normal precipitation map for February 2021. The brown and red colors indicate below normal precipitation, while the green and blue colors indicate above normal precipitation. In February small parts of the Rio Grande valley of Southwestern Texas got above normal rainfall, but the vast majority of Texas received below normal precipitation. Most of Western Texas received much below normal precipitation in February, as did most of lower South Texas.

At DFW airport in February 2021 they received 2.22" of precipitation. The normal amount for February is 2.66" so they were 0.44" below normal for the month. This included 5.0" of snow. The normal snowfall amount for February is 0.9" so they were 4.1" above normal for snow.

At Waco in February 2021, they received 0.79" of precipitation. The normal amount in February is 2.63" so they were 1.84" below normal for the month. This included 4.6" of snow for the month. The normal snowfall in Waco in February is 0.4" so they were 4.2" above normal.

There were about five significant storm systems which affected our weather in February. Here are the highlights of the weather for the month.

North Texas Regional Summary/Hydrology (continued)

February 4 – 5:
A cold front moved through the region, followed by a short wave trough. There was some light rain on the 5th, mainly over Southeast Texas. Close to an inch of rain fell near Beaumont, and slightly over 0.50" was measured near New Braunfels.

February 10 - 18:
One of the most historic winter weather events in Texas history occurred during this time frame. On the 10th a strong cold front moved across Texas. Also, a short wave trough formed over the southwestern U.S. into Baja California. The Initial rainfall was light. On the 11th an upper air disturbance moved slowly east and extended from far West Texas to Western Mexico. Patchy freezing rain and freezing drizzle developed, with heavier thundershowers over East Texas late on the 10th, then over South Central and Southeast Texas on the 11th. A little over 1" fell near Jonesville and Marshall. There was 2” to 3.33" across South Central Texas during the day on the 11th. On the 12th the upper air disturbance weakened and passed across South Texas and Mexico. Meanwhile, a new storm system started digging into Southern California. Precipitation was light on the 12th. Late on the 13th the California storm moved quickly across South Texas while another, stronger storm followed across the four corners region and Arizona. Precipitation began again late on the 13th to the 14th. On the 14th and 15th, the strong upper air disturbance continued moving east. Freezing rain became snow across North Texas. Maximum snow amounts of 9.5" were measured at Gun Barrel City, 9" in Fairfield, 8.5" in Palestine, and 8" in Aledo. Total snowfall at DFW airport was 4" and 4.6" in Waco. A record snowfall of 4.0” was set at Dallas Fort Worth for February 14. This broke the old record of 3.0” set in 1951. As the upper disturbance moved east, an extremely cold high pressure system temporarily settled in. Record cold temperatures were observed. The low of -2 degrees at DFW airport the morning of the 16th was the coldest temperature in more than 70 years. On the 16th and 17th, a new trough of low pressure developed over Colorado and New Mexico. Snow and mixed precipitation moved into West Texas during the day on the 16th, with snow moving into North Texas by evening. Around 1" of new snow fell in DFW. Power outages from the cold weather were widespread across Texas. The upper disturbance moved slowly east, creating light snow over North Texas, with sleet and freezing rain from central into Northeast Texas. Snow water equivalent amounts of 0.50" to 1" occurred from Bryan/College Station to Marshall. North Texas snowfall was mostly 1 - 2". On the 18th the final part of the last upper air disturbance passed across South Texas. Snow was reported in South Texas including Austin/San Antonio and Del Rio, with lingering precipitation maximum amounts around 1" over the Texas Hill Country on the 18th.

February 25 – 28:
From the 25th to early on the 26th a short wave trough developed over New Mexico and Colorado and moved east. It weakened over Oklahoma on the 26th. Showers and thunderstorms developed on the 25th as warm, moist air was lifted over the existing cold air mass. Most of the rain was confined to north parts of Texas. Around 3" of rain fell from Frisco to McKinney to Blue Ridge. Then from the 27th through March 1 a new storm formed over the intermountain western US. As the storm moved east, a closed low formed over New Mexico late on the 28th. Initial rainfall on the 27th was light over Northern and Eastern Texas. On the 28th a cold front moved through Texas. Showers and thunderstorms occurred mainly along and ahead of the front. By evening, light rain developed as the upper low pressure system approached. Maximum rainfall was 2” to 2.50" from Lindale and Longview to Marshall.

North Texas Regional Summary/Hydrology (continued)

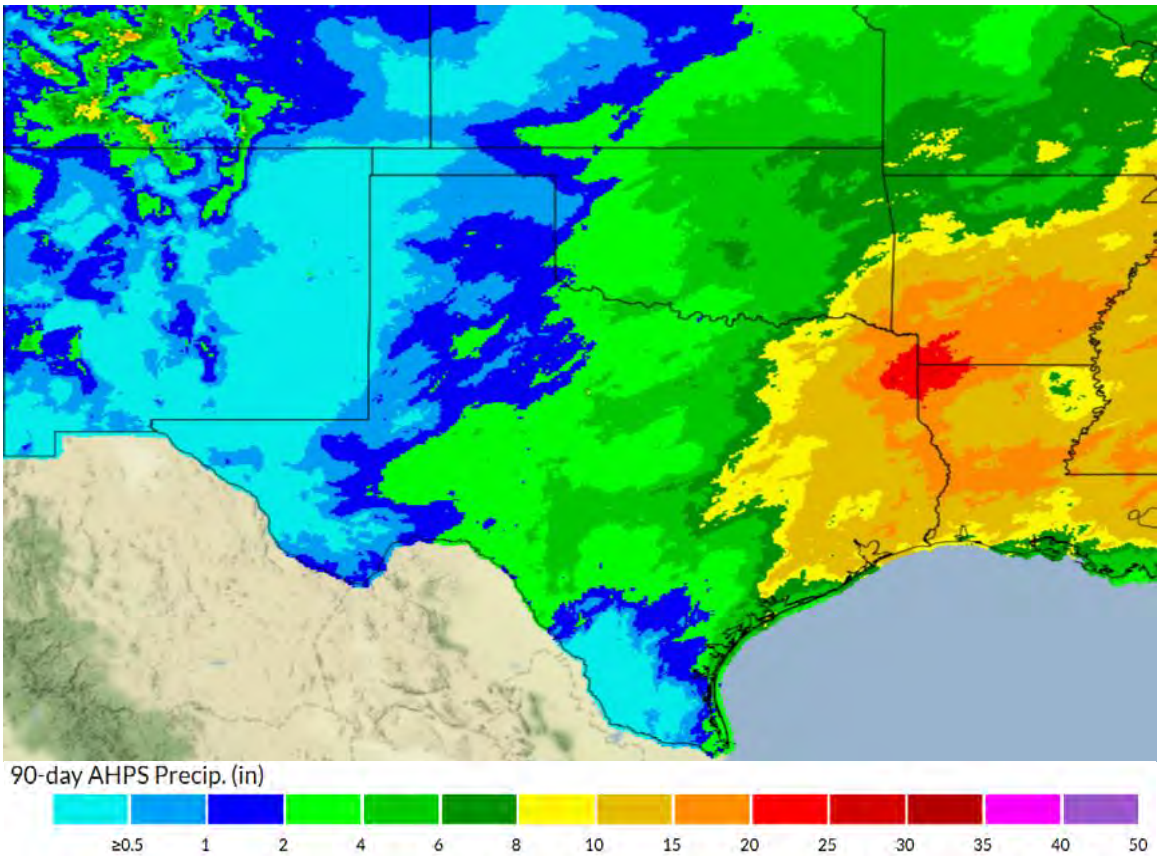

Figure 5: Winter season precipitation for 2020-21. The bright red and brown colors indicate the largest precipitation totals while the light green and blue colors show light amounts.

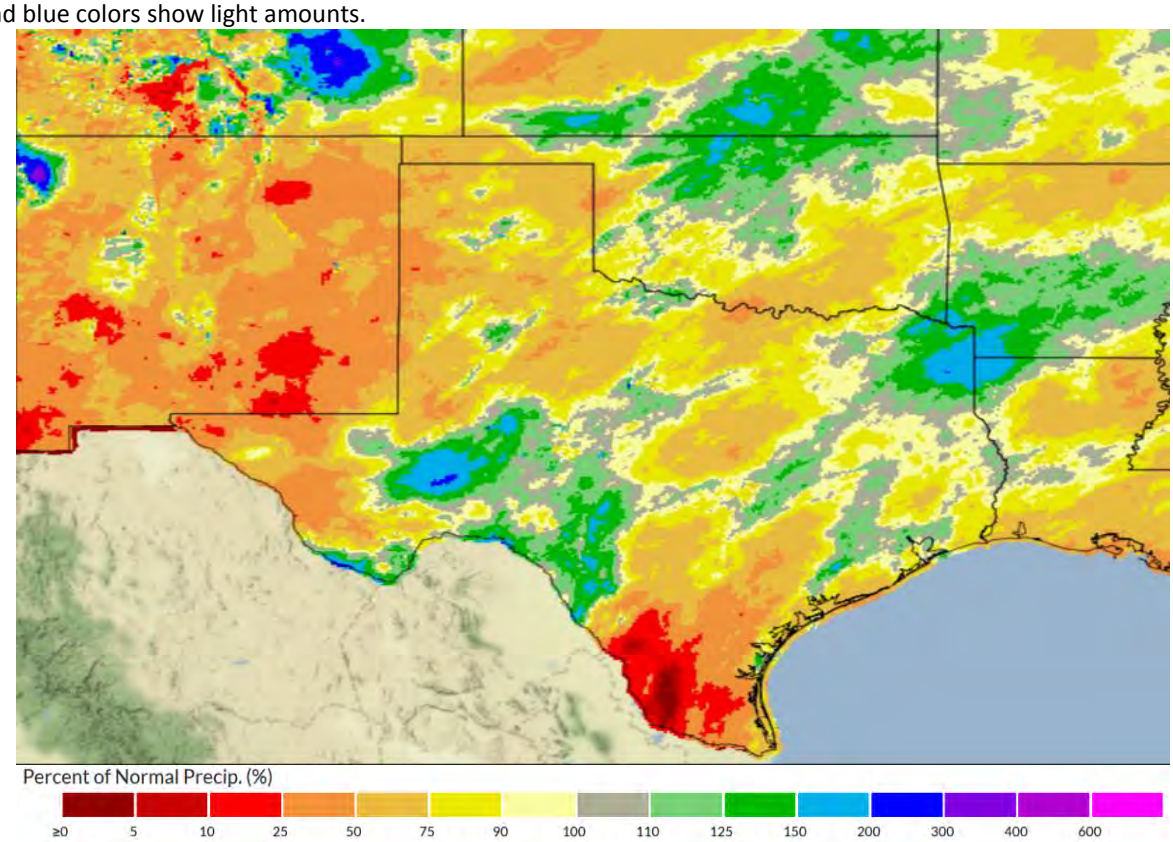

Figure 6: Percent of Normal Precipitation for winter 2020-21. The dark blue and green colors indicate above normal precipitation. The brown, yellow and red colors indicate below normal amounts. Note the prolonged dryness over far Southwest and far West Texas into Southeast New Mexico, as well as over lower South Texas. The most significant rains occurred over extreme Northeast Texas and south of Midland.

North Texas Regional Summary/Hydrology (continued)

For the winter season, DFW airport received 6.07” of precipitation. The normal amount for the December to February period is 7.34” so they were 1.27” below normal for the season. This included the 5” of snow which fell in February. The normal snowfall in a winter season is 1.4” so they were 3.6” above normal for winter.

In Waco, they received 6.19” of precipitation for the winter. The normal amount is 7.50” so they were 1.31” of precipitation below normal for the December to February period. However, Waco received a whopping 9.0” of snow for the season. The normal amount is only 0.7” so they were 8.3” above normal for snow.

Thanks to you all for your weather observations! The amount of the rainfall which fell at your station is extremely important and valuable information to the National Weather Service’s West Gulf River Forecast Center. I want to give a special shout out to those of you who made observations during the week of very cold weather that is not often seen in North Texas. Kudos also to you who reported your snowfall amounts as well. While we don’t have occasion to measure snow or ice often (it’s been four years), we all had to dust off the instructions on how to arrive at the snow water equivalent amount. And we had to remember to report that liquid equivalent as our 24-hour report. Measuring snow on the ground is a challenge, too, especially if the snow is drifting. While we may be done measuring snow or ice for this season, it may not hurt to go back and read the very well written instructions on the CoCoRaHS web site on how to do this and get up to speed like measuring rainfall. See the following link: https://media.cocorahs.org/docs/MeasuringSnow2.1.pdf Remember, even on days you are not home (vacation) or unable to report for any reason, you can make a multi-day accumulation report upon your return.

Please consider inviting your neighbors, relatives and friends to join CoCoRaHS! This month is “March Madness”, our annual membership drive where we strive to add new observers.

I realize that this has been a difficult time for many of you due to COVID-19. But your faithfulness in submitting your rainfall readings to CoCoRaHS during this winter season has not gone unnoticed. Your dedication helps the users of CoCoRaHS data out a lot. Have a great spring, and happy observing!

Greg Story

Far West Texas Regional Summary

Valentine's Day Storm Not Enough to Break Drought Conditions

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

The winter season is usually a dry period for southern New Mexico and far West Texas, with most common source of precipitation coming from Pacific low pressure systems. In Texas, El Paso and Hudspeth counties typically report 1"-2" of liquid precipitation during the winter (December-February) season with the climatological average at El Paso International Airport (KELP) being 1.64". This makes up only 18% of the average annual rainfall. The majority of precipitation in this region falls during the summer monsoon, where winter and spring are typically the drier seasons due to the scarcity of moisture sources.

Lowland snow is highly variable this far west with several years on record without any measureable snowfall. While mountain snowfall is common and a yearly occurrence, above-freezing temperatures across far west Texas usually keep precipitation type as rain during the winter months. The exception usually occurs during cold air intrusions from the east drop freezing levels to the valley floors.

The 2020-2021 winter season featured below normal precipitation in El Paso and Hudspeth counties. A persistent La Nina in the Northern Hemisphere mirrored historical patterns by keeping the U.S. Southwest drier than normal. December was particularly dry, with no monthly totals above 0.10". While portions of east Texas and the Big Bend region saw above normal precipitation, very little rain fell during what was supposed to be one of the wetter winter months. In El Paso County, 22 CoCoRaHS observers reported precipitation, mostly for the day of December 10th, when an upper low over the northern Gulf of California progressed over the region and brought light rain showers that day. The rest of the month featured very dry weather.

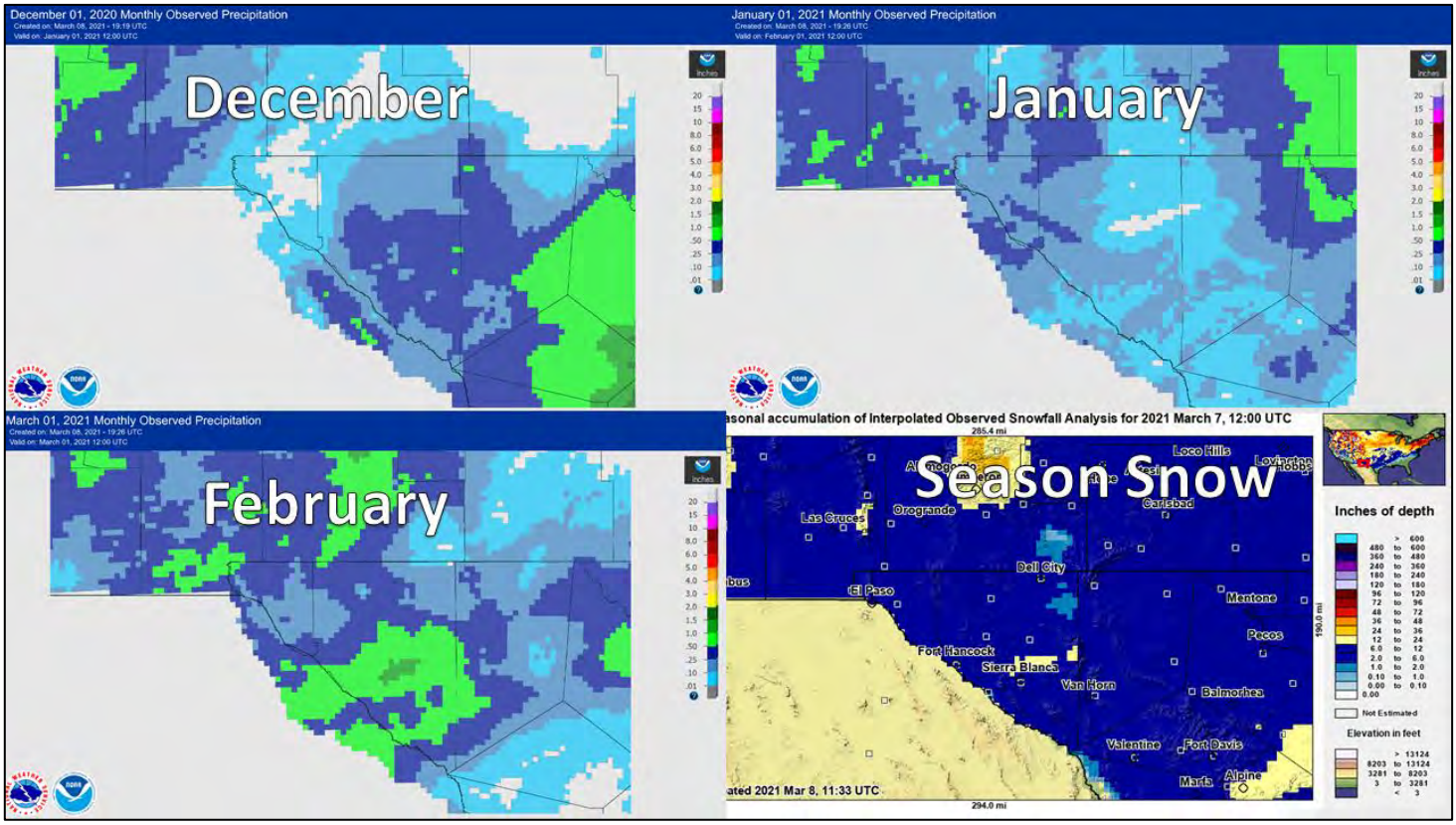

Figure 1: *Monthly Observed Precipitation for December 2020 – February 2021 and Seasonal Snowfall Totals focused on far west Texas*

Far West Texas Regional Summary (continued)

Abnormally dry conditions continued well into January with our first measureable precipitation not occurring until January 19th. A brief period of wetter weather brought several days of light precipitation reports to the region. A few areas in El Paso received 0.10”-0.20” of rainfall during the second half of the month, along with a few reports of light snowfall the morning of January 26th. Drought conditions worsened during this month, with the U.S. Drought Monitor upgrading the area to Severe Drought status.

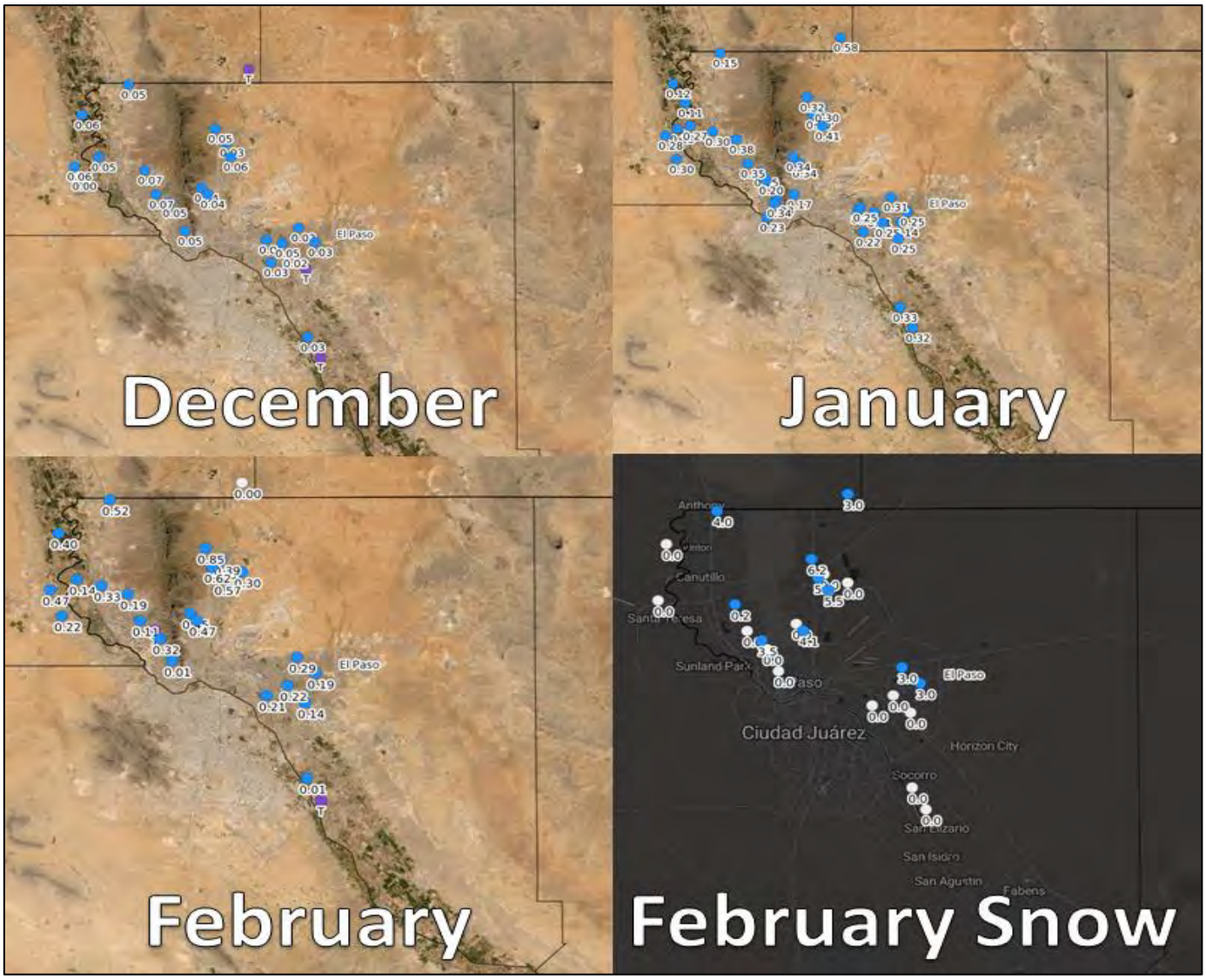

Figure 2: *CoCoRaHS Monthly Precipitation Summaries for the 2020-2021 winter season and February snowfall reports for El Paso County, Texas*

The most memorable event of this year’s winter season occurred on Valentine’s Day as a highly anticipated cold air instruction met with an approaching upper low to produce widespread snowfall and some of the coldest weather of the season. Cold air arrived the morning of Sunday, February 14th bringing 3-6” of snow accumulations to the Rio Grande valley and Hudspeth highlands. Many CoCoRaHS reports were split into two days, reporting the Sunday morning snow totals on February 14th and the afternoon accumulations on February 15th. Observers did a great job of accurately measuring snowfall and converting to liquid precipitation.

The other notable impact with this storm was freezing temperatures. Temperatures dropped below freezing early Sunday morning and remained below freezing through much of the daytime hours. Overnight lows plummeted to the lower teens, causing power outages and widespread water pipe breaks. Despite the conditions, the impacts felt in El Paso were much less severe than further east throughout Texas. Power outages were short-lived and water access remained available throughout the event.

Far West Texas Regional Summary (continued)

Figure 3: *Snow cover in and around El Paso, Texas after the 2021 Valentine's Day storm*

The winter season featured 31 active observers in El Paso County, and 4 in Hudspeth County. A total of 1,841 daily reports were submitted, along with 21 multi-day reports. No Significant Weather or Condition Monitoring reports were submitted this season. Thanks again to all our local observers who participated in the 2020-2021 winter season!

Houston/Galveston Regional Summary

Drier than average for the season and a very cold February

By: Ron Havran - CoCoRaHS Houston/Galveston Regional Coordinator

December

Temperature across Southeast Texas averaged above normal about 1°F to 2°F. There were several days with daytime highs in the upper 70°s to lower 80°s from a strong south to southwest flow ahead of storm systems. There were some nights below freezing in the region this month but partly to mostly sunny days prevailed throughout the month bringing plenty of mild conditions in between the cold fronts that had cooler temperatures and rain.

Most of the region had above normal precipitation for December from multiple storm systems with cold fronts moving through the region after very warm and moist conditions had become established. Most of the rain fell at the beginning and ending of the month. Austin and Wharton counties had the highest CoCoRaHS observer county average rainfall while Colorado and Polk counties had the driest CoCoRaHS observer county average rainfall for December.

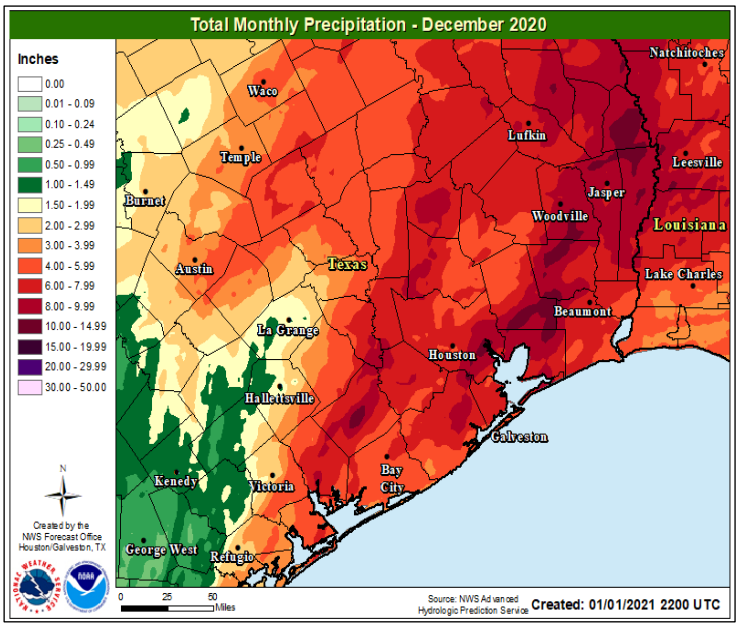

Figure 1: December 2020 Total Monthly Rainfall

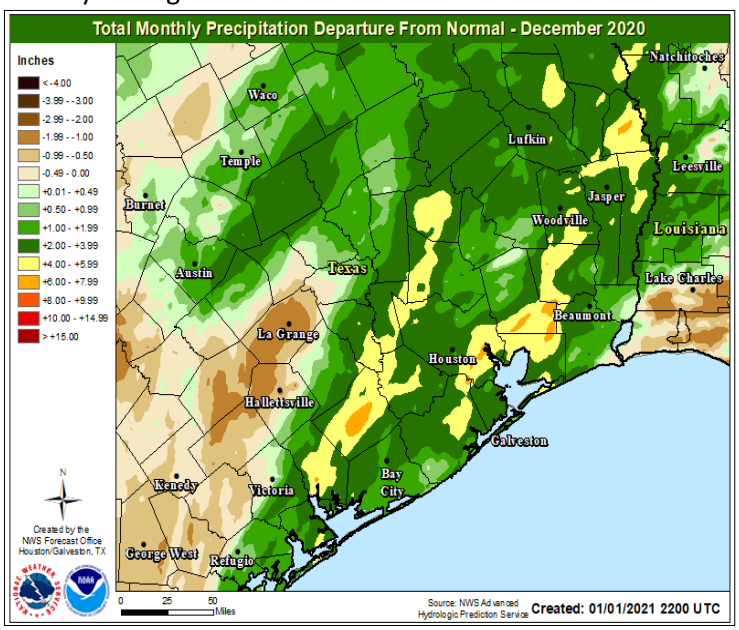

Figure 2: December 2020 Precipitation Departure from Normal

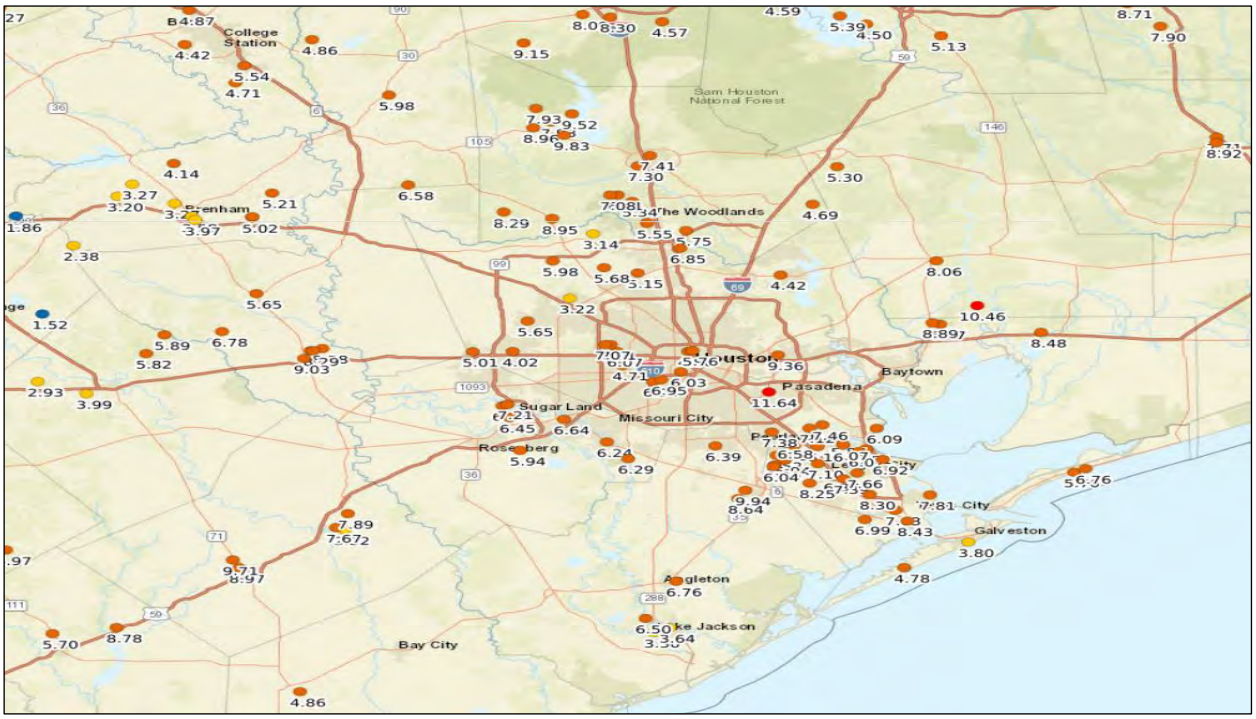

Figure 3: December 2020 Precipitation Recorded by CoCoRaHS Observers

Houston/Galveston Regional Summary (continued)

January

It was a warm and dry start to 2021 in the month of January. Temperatures were 1°F to 2°F above normal again this month just like December ended up at. The classic LaNiña conditions of warmer than normal temperatures and drier than normal precipitation was the prevailing pattern in the first month of the year.

Precipitation was in short supply across the entire region. About the only thing of note was snow across the northern parts of the region on January 10th (Figure 7). Amounts were generally 1 to 2 inches in the far northern and northwest counties. Austin and Liberty counties had the highest CoCoRaHS observer county average rainfall while Jackson and Wharton counties had the driest CoCoRaHS observer county average rainfall for December.

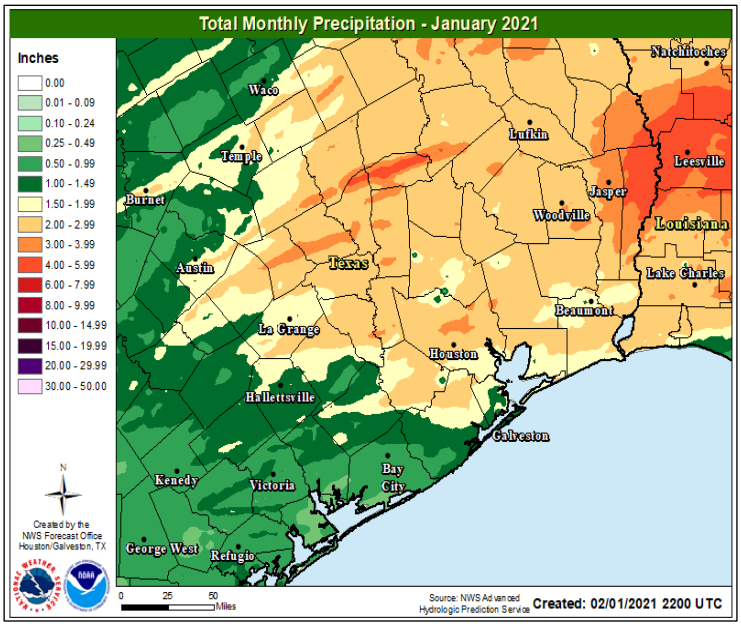

Figure 4: January 2021 Total Monthly Rainfall

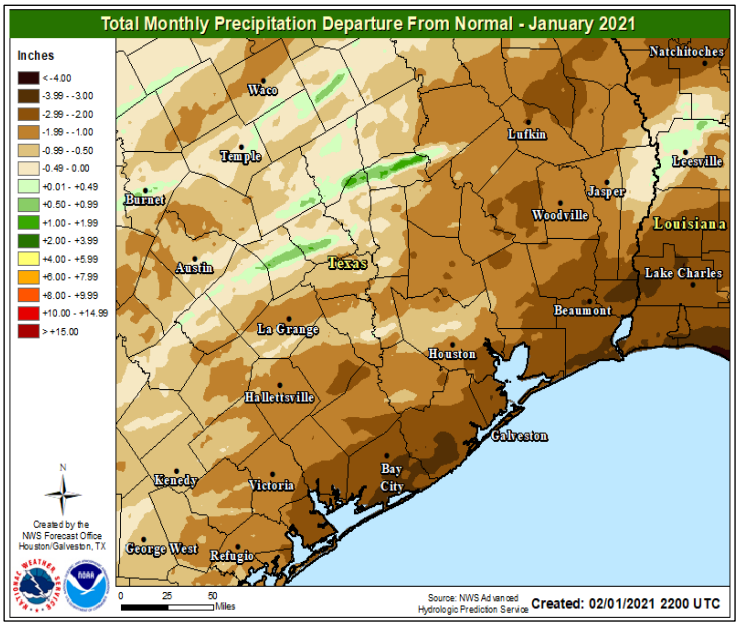

Figure 5: January 2021 Precipitation Departure from Normal

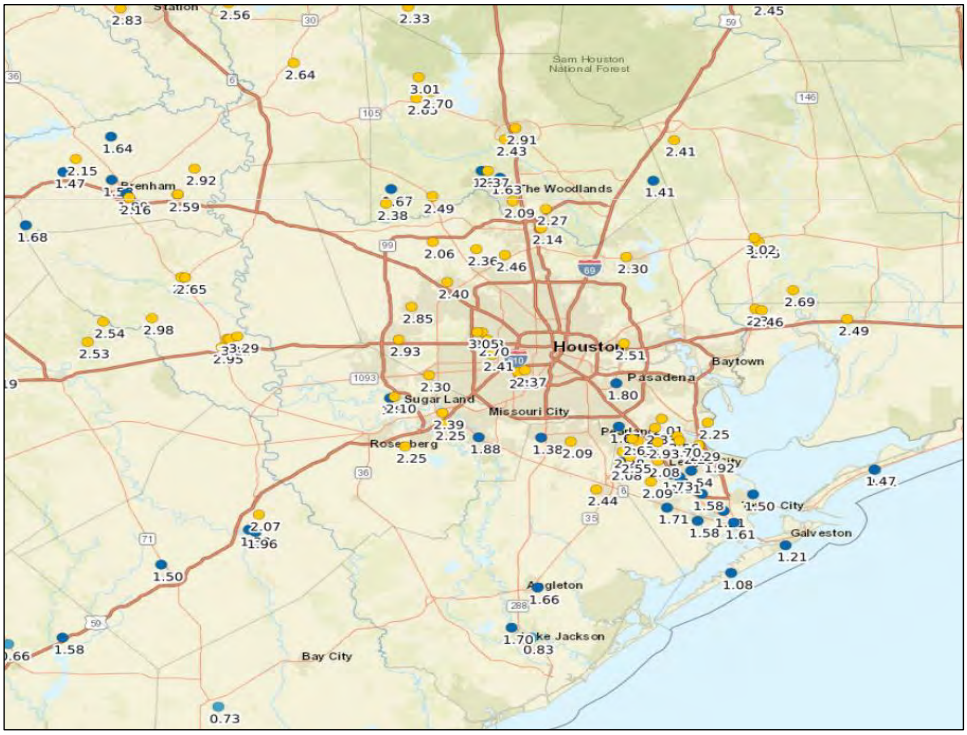

Figure 6: January 2021 Precipitation recorded by CoCoRaHS Observers

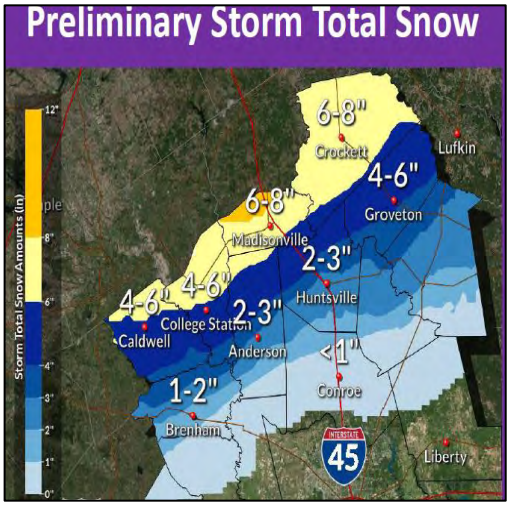

Fig. 7: January 10th snowfall totals

Houston/Galveston Regional Summary (continued)

A very cold and dry February with multiple days of frozen precipitation that broke several records and caused many types of problems throughout Southeast Texas. All of Southeast Texas was well below normal on precipitation this month. Wharton, Chambers, and Liberty counties had the highest CoCoRaHS observer precipitation totals. The counties with the lower CoCoRaHS observer precipitation this month were Jackson, Brazoria, and Galveston counties. The most significant story about precipitation this month was the snowfall that occurred across Southcentral and Southeast Texas on the evening of the 14th and early morning on the 15th. See figure 8. The northwest and northern portions of the region had the highest amounts.

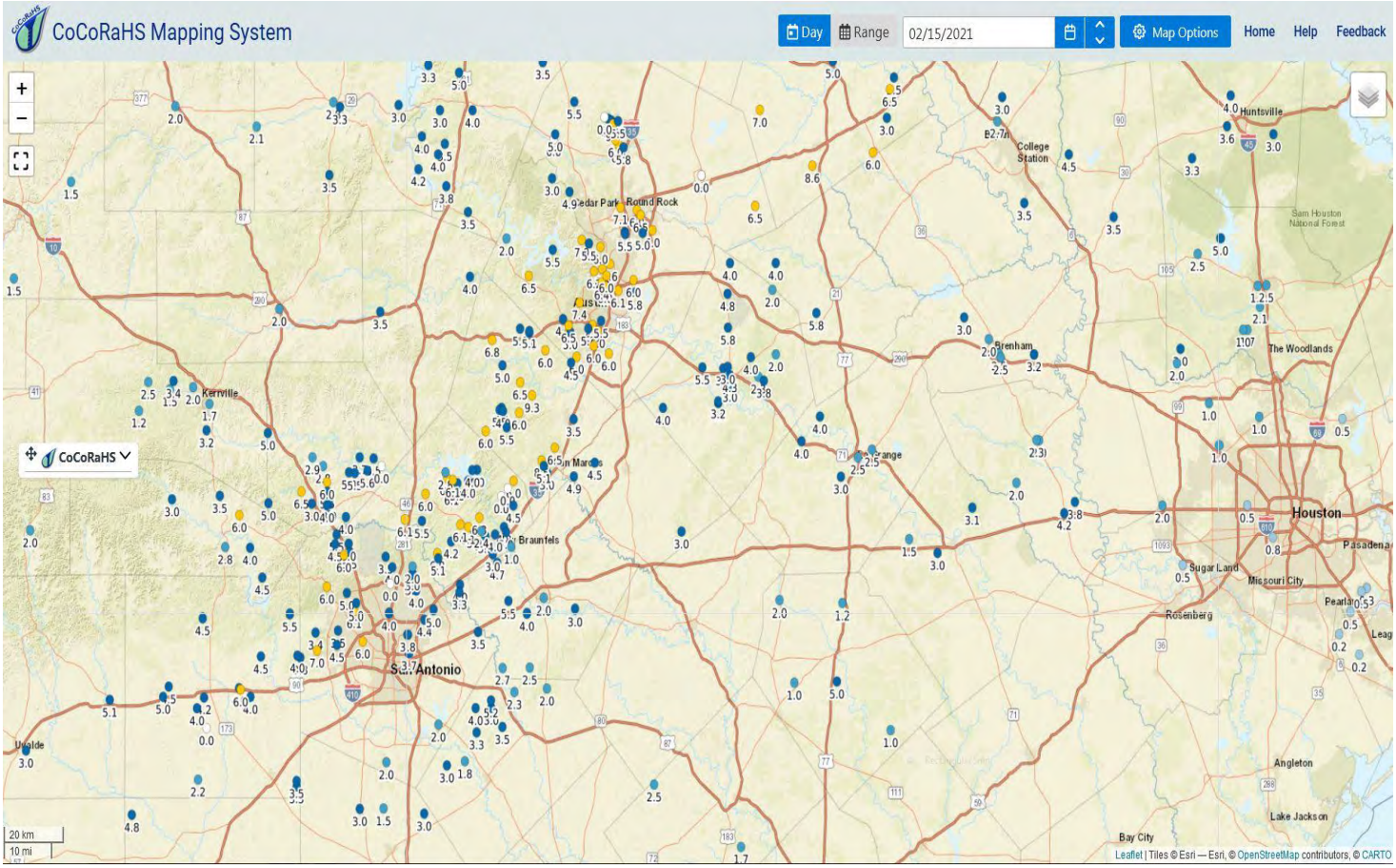

Figure 8: CoCoRaHS observer snowfall amounts for February 15th after passing quality control checks.

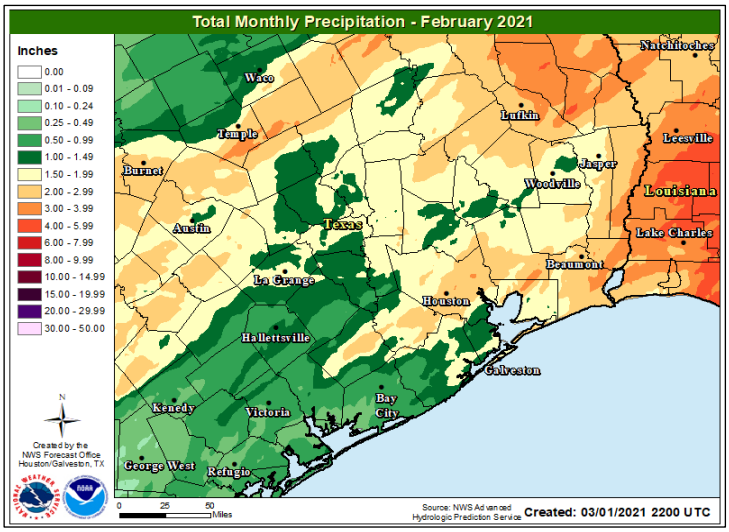

Figure 9: February 2021 Total Monthly Rainfall

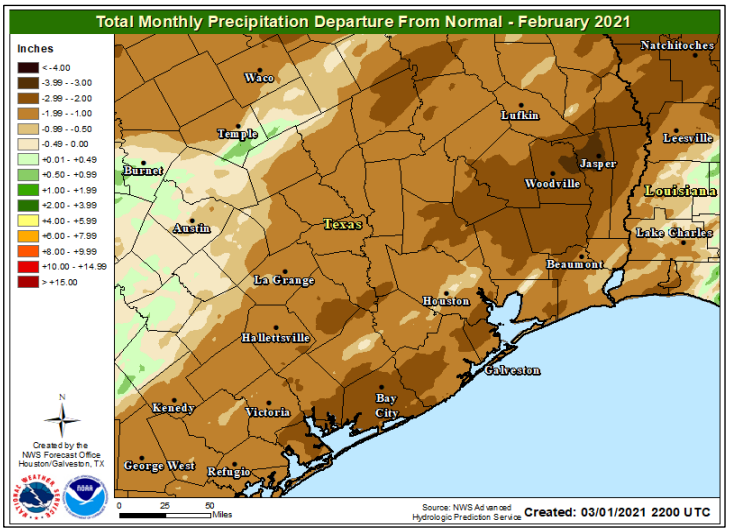

Figure 10: February 2021 Precipitation Departure from Normal

Houston/Galveston Regional Summary (continued)

Southeast Texas had the coldest weather since December 1989 when temperatures fell to the single digits in mid-February. The Arctic blast may have resulted in long-term injury to citrus trees and could adversely affect the next sugarcane harvest in both Louisiana and Texas. Here in Texas and neighboring areas, mid-month power outages caused a chain reaction of adverse impacts that included potable water shortages; frozen and broken water pipes; cattle and poultry deaths; and ornamental and greenhouse losses. According to preliminary data provided by the National Centers for Environmental Information, the contiguous U.S. experienced its 19th-coldest, 50th-driest February during the 127-year period of record from 1895. It was the nation's coldest February since 1989 and fifth coldest since the end of the Dust Bowl era, behind 1960, 1978, 1979, and 1989. Texas had its 11th coldest February on record and the 29th driest February on record since 1895. See figures 11 and 12.

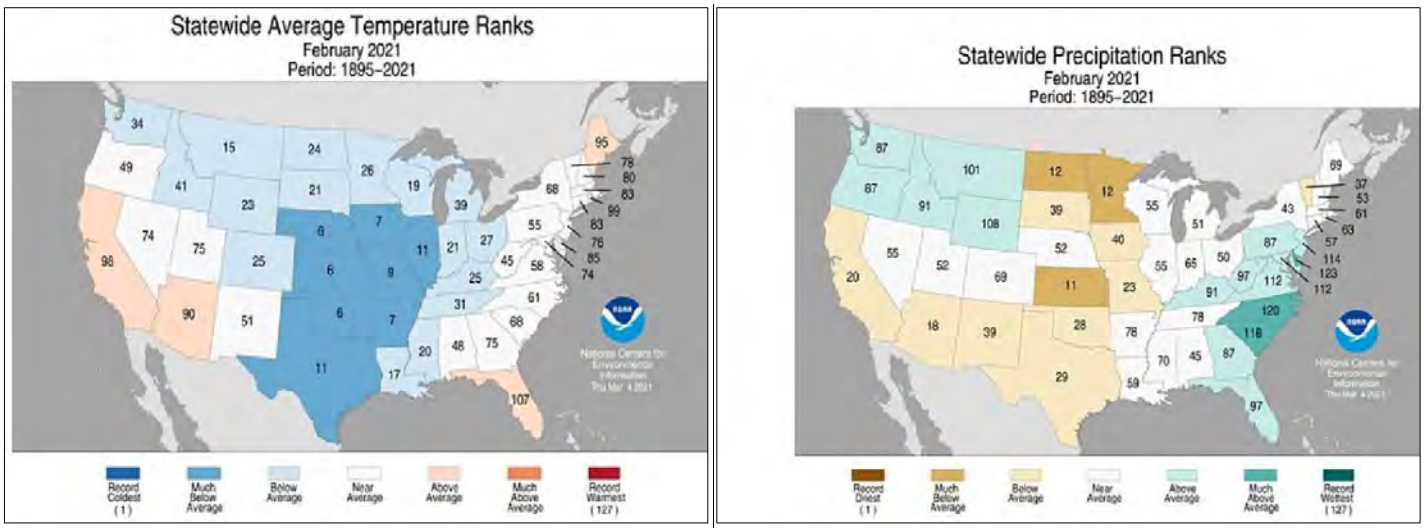

Figure 11: Statewide ranking for temperature and precipitation across the lower 48 from 1895-2021.

Winter 2020-21 CoCoRaHS Stations Houston/Galveston Region Rainfall

Actual Station Measured County Rainfall Averages in inches per month

County	December	January	February	Winter Total
	AVG.	AVG.	AVG.	Dec.- Feb
Austin	8.52	2.83	1.47	12.82
Brazoria	6.43	1.68	1.26	9.37
Chambers	7.88	2.42	2.23	12.53
Colorado	4.35	2.22	1.59	8.16
Fort Bend	6.75	2.15	1.76	10.66
Galveston	6.43	1.72	1.29	9.44
Harris	6.09	2.29	1.51	9.89
Jackson	7.24	1.12	1.06	9.42
Liberty	7.83	2.82	2.31	12.96
Montgomery	7.21	2.31	1.39	10.91
Polk	5.03	2.37	1.86	9.26
San Jacinto	5.57	1.98	2.09	9.64
Wharton	8.50	1.56	2.33	12.39
Region Totals	6.76	2.11	1.70	10.57

Highlights wettest month for a category

Highlights driest month for a category

Note: All data taken from the CoCoRaHS website in Total Precipitation Summary Report

Note: Only counties with 2 or more active observers reporting are displayed in this chart.

Chart 1: Southeast Texas CoCoRaHS Observer Rainfall Totals

Houston/Galveston Regional Summary (continued)

PUBLIC INFORMATION STATEMENT
NATIONAL WEATHER SERVICE HOUSTON/GALVESTON TX
1001 AM CST TUE FEB 16 2021

...SNOWFALL REPORTS...

LOCATION	AMOUNT	TIME/DATE	LAT/LON
...AUSTIN COUNTY...			
SEALY	4.2 IN	0700 AM 02/15	29.78N/96.16W
1 WNW SAN FELIPE	3.8 IN	0700 AM 02/15	29.80N/96.12W
8 SSW BELLVILLE	2.0 IN	0700 AM 02/15	29.85N/96.32W
1 ENE BELLVILLE	2.0 IN	0700 AM 02/15	29.95N/96.25W
BELLVILLE	2.3 IN	0600 AM 02/15	29.95N/96.25W
...BRAZOS COUNTY...			
1 E COLLEGE STATION	6.0 IN	0930 AM 02/15	30.62N/96.32W
1 WSW COLLEGE STATION	4.0 IN	1000 AM 02/15	30.62N/96.34W
1 WNW WELLBORN	3.5 IN	0700 AM 02/15	30.54N/96.33W
BRYAN	3.5 IN	0652 AM 02/15	30.67N/96.37W
1 NNE UR089	2.7 IN	0800 AM 02/15	30.72N/96.39W
2 S COLLEGE STATION	2.5 IN	0850 AM 02/15	30.59N/96.33W
...CHAMBERS COUNTY...			
1 NE ANAHUAC	0.1 IN	0738 AM 02/15	29.77N/94.66W
...COLORADO COUNTY...			
3 WSW COLUMBUS	3.0 IN	0954 PM 02/15	29.69N/96.60W
5 E WEIMAR	1.5 IN	0845 AM 02/15	29.70N/96.70W
...FORT BEND COUNTY...			
6 WNW MISSION BEND	1.0 IN	0808 AM 02/15	29.72N/95.76W
1 N PECAN GROVE	0.5 IN	0600 AM 02/15	29.65N/95.73W
2 SW MISSION BEND	0.1 IN	0428 AM 02/15	29.67N/95.69W
...GALVESTON COUNTY...			
2 ENE DICKINSON	2.0 IN	0750 AM 02/15	29.46N/95.04W
1 WNW BAYOU VISTA	1.5 IN	0800 AM 02/15	29.33N/94.95W
1 SSE JAMAICA BEACH	0.5 IN	0820 AM 02/15	29.18N/94.98W
2 NW DICKINSON	0.3 IN	0800 AM 02/15	29.47N/95.08W
3 NE GALVESTON	0.1 IN	0154 AM 02/15	29.26N/94.86W
...GRIMES COUNTY...			
10 SSW IOLA	4.5 IN	0800 AM 02/15	30.63N/96.14W
...HARRIS COUNTY...			
CYPRESS	3.0 IN	0754 AM 02/15	29.98N/95.68W
1 SE KINGWOOD	3.0 IN	0735 AM 02/15	30.05N/95.18W
TOMBALL	3.0 IN	0658 AM 02/15	30.10N/95.61W
KATY	2.0 IN	0800 AM 02/15	29.79N/95.82W
1 NW HEDWIG VILLAGE	1.2 IN	1130 AM 02/15	29.79N/95.53W
4 SE CYPRESS	1.0 IN	0700 AM 02/15	29.94N/95.63W
BELLAIRE	1.0 IN	0700 AM 02/15	29.70N/95.47W
WEST UNIVERSITY PLACE	0.8 IN	0645 AM 02/15	29.72N/95.44W
4 N MEADOWS	0.8 IN	0714 AM 02/15	29.71N/95.58W
3 E WEST UNIVERSITY PLACE	0.7 IN	0730 AM 02/15	29.72N/95.38W
1 N NASSAU BAY	0.5 IN	0700 AM 02/15	29.56N/95.09W
4 NNW NASSAU BAY	0.3 IN	0700 AM 02/15	29.59N/95.11W
2 SE LA PORTE	0.3 IN	0654 AM 02/15	29.65N/95.02W
3 NNW NASSAU BAY	0.2 IN	0816 AM 02/15	29.58N/95.11W
...HOUSTON COUNTY...			
5 NE LOVELADY	3.8 IN	0800 AM 02/15	31.18N/95.39W
2 NNE CROCKETT	3.6 IN	0930 AM 02/15	31.34N/95.44W
...MADISON COUNTY...			
5 ENE MADISONVILLE	3.0 IN	0930 AM 02/15	30.97N/95.83W
...MONTGOMERY COUNTY...			
6 ENE MONTGOMERY	5.0 IN	0700 AM 02/15	30.42N/95.61W
3 SW STAGECOACH	3.1 IN	0700 AM 02/15	30.11N/95.75W
1 E CONROE	2.5 IN	0800 AM 02/15	30.32N/95.46W
4 W STAGECOACH	2.0 IN	0800 AM 02/15	30.14N/95.78W
1 S THE WOODLANDS	2.0 IN	0539 AM 02/14	30.14N/95.49W
5 NNW THE WOODLANDS	1.7 IN	0700 AM 02/15	30.22N/95.52W
...POLK COUNTY...			
LIVINGSTON	3.0 IN	0600 AM 02/15	30.71N/94.93W
1 WSW ONALASKA	2.5 IN	0700 AM 02/15	30.81N/95.12W
5 ENE GOODRICH	1.3 IN	0800 AM 02/15	30.65N/94.87W
...TRINITY COUNTY...			
5 NW TRINITY	5.1 IN	0700 AM 02/15	31.00N/95.43W
6 ESE GROVETON	3.0 IN	0600 AM 02/15	31.03N/95.04W
...WALKER COUNTY...			
5 NNW HUNTSVILLE	4.0 IN	0600 AM 02/15	30.78N/95.58W
3 WSW HUNTSVILLE	3.6 IN	0700 AM 02/15	30.70N/95.59W
2 NW HUNTSVILLE	3.5 IN	0600 AM 02/15	30.73N/95.57W
7 ESE HUNTSVILLE	3.0 IN	0600 AM 02/15	30.67N/95.44W
...WASHINGTON COUNTY...			
1 E BRENHAM	2.5 IN	0700 AM 02/15	30.16N/96.39W
3 NNW BRENHAM	2.0 IN	0700 AM 02/15	30.20N/96.41W
1 NNE BRENHAM	1.5 IN	0830 AM 02/15	30.18N/96.39W

OBSERVATIONS ARE COLLECTED FROM A VARIETY OF SOURCES WITH VARYING EQUIPMENT AND EXPOSURES. WE THANK ALL VOLUNTEER WEATHER OBSERVERS FOR THEIR DEDICATION. NOT ALL DATA LISTED ARE CONSIDERED OFFICIAL.

Houston/Galveston Regional Summary (continued)

Low Temps on Feb. 15th at first order stations

Location	Low Temperature	Coldest Since
Austin	9 on 2/15	6 on 12/23/1989
San Antonio	9 on 2/15	6 on 12/23/1989
Victoria	14 on 2/15	9 on 12/23/1989
Galveston	20 on 2/16	14 on 12/23/1989
Houston	13 on 2/16	11 on 12/24/1989

Other Stations Lowest temperatures across SE Texas from February 15th and 16th

Location	Low Temperature
...AUSTIN COUNTY...	
CAT SPRING	6 F
INDUSTRY 3 W	7 F
8.8 NE FAYETTEVILLE	8 F
BELLVILLE 1 SW	9 F
8.3 S BELLVILLE	10 F
BELLVILLE 1 SW	10 F
SAN FELIPE	11 F
...BRAZORIA COUNTY...	
DAMON 1 NNW	14 F
WEST COLUMBIA	15 F
1 E LAKE JACKSON	15 F
ANGLETON	15 F
1 E FREEPORT	16 F
BRAZORIA NWR	16 F
2.7 NE DANBURY	16 F
MANVEL	16 F
FREEPORT	17 F
IOWA COLONY	17 F
ALVIN	20 F
LAKE JACKSON	22 F
PEARLAND	22 F
ALVIN	22 F
...CHAMBERS COUNTY...	
ANAHUAC	13 F
MONT BELVIEU	13 F
...COLORADO COUNTY...	
FAYETTEVILLE	6 F
CUMMINS CREEK NEAR FRELSBURG	7 F
7.3 SW COLUMBUS	7 F
7.9 SE FAYETTEVILLE	7 F
COLUMBUS	7 F
4.9 E WEIMAR	8 F
10.4 E COLUMBUS	8 F
7 W EAGLE LAKE	8 F
WEIMAR 7 S	8 F
6.8 S WEIMAR	9 F
ATTWATER NWR	9 F
COLORADO RIVER AT COLUMBUS	10 F
COLUMBUS	10 F
WEIMAR	10 F
6.9 SW EAGLE LAKE	12 F
EAGLE LAKE	12 F
7.1 NW EAGLE LAKE	12 F
...FORT BEND COUNTY...	
3.6 N BEASLEY	10 F
3 NW RICHMOND	10 F
KATY	11 F
3 ENE FULSHEAR	12 F
4 S KATY	12 F
ROSENBERG	13 F
MISSOURI CITY	13 F
FIRST COLONY	13 F
RICHMOND	13 F
FULSHEAR	13 F
STAFFORD	14 F
SUGAR LAND	14 F
4 WSW FIRST COLONY	15 F
3 SW THOMPSONS	15 F
4 E FULSHEAR	15 F
...GALVESTON COUNTY...	
1.6 SE WEBSTER	13 F
13 S STOWELL	14 F
FRIENDSWOOD	15 F
LEAGUE CITY	15 F
1 NE LEAGUE CITY	15 F
1 SSE TEXAS CITY	15 F
CRAB LAKE	16 F
2 W LEAGUE CITY	16 F
TEXAS CITY	17 F
SAN LEON	17 F
2 N BAYOU VISTA	18 F
GALVESTON: SCHOLES FIELD	19 F
...HARRIS COUNTY...	
2 WNW SPRING	9 F
4.9 N ALDINE	9 F
6 WSW SPRING	10 F
3 SW SPRING	10 F
SPRING	11 F
CYPRESS	11 F
KATY	11 F
TOMBALL	11 F
2 NE HOUSTON	11 F
3 NE JERSEY VILLAGE	11 F
4 NNW HOUSTON	11 F
3 NE SOUTH HOUSTON	12 F
WEBSTER	12 F
HOUSTON INTERCONTINENTAL	12 F
2 NNE SOUTH HOUSTON	12 F
5 N FRESNO	12 F
1.5 N DEER PARK	12 F
1 NNW HOUSTON	12 F
3 SSE ALDINE	12 F
3 S BUNKER HILL VILLAGE	12 F
1 SSE PINEY POINT VILLAGE	12 F
HOCKLEY	12 F
2 NE SOUTH HOUSTON	13 F
1 SE SOUTHSIDE PLACE	13 F
3 E HOUSTON	13 F
5 NE HILSHIRE VILLAGE	13 F
2 E HILSHIRE VILLAGE	13 F
KINGWOOD	13 F
4.3 SW HUMBLE	13 F
4 S ALDINE	13 F
1 SSE SOUTHSIDE PLACE	13 F
1 ENE CYPRESS	13 F
4 SSW ATASCOCITA	13 F
4 ESE HOUSTON	13 F
HOUSTON DW HOOKS	14 F
2 WSW GALENA PARK	14 F
2 W SHOREACRES	14 F
1 WSW HOUSTON	14 F
1 E HOUSTON	14 F
2 ESE HOUSTON	14 F
2 E WEST UNIVERSITY PLACE	14 F
1 SSE PASADENA	14 F
1 NNW HILSHIRE VILLAGE	14 F
4 N BAYTOWN	14 F
4 SSW PASADENA	14 F
3.3 W JACINTO CITY	14 F
CROSBY	14 F
4 NNE FRESNO	14 F
1.7 W JERSEY VILLAGE	14 F
HOUSTON HOBBY	15 F
NASSAU BAY	15 F
BAYTOWN	15 F
1 N BELLAIRE	15 F
MORGANS POINT, TX	15 F
3 W JACINTO CITY	15 F
DEER PARK	15 F
SOUTHSIDE PLACE	15 F
2 S BELLAIRE	15 F
2 WSW KINGWOOD	15 F
1 SE HUNTERS CREEK VILLAGE	15 F
EL LAGO	16 F
1 SE LA PORTE	16 F
2 WSW GALENA PARK	16 F
HUMBLE	16 F
FRIENDSWOOD	16 F
1 SSE HUNTERS CREEK VILLAGE	16 F
...JACKSON COUNTY...	
EDNA	12 F
9.3 SE INEZ	13 F
2.9 W LA WARD	14 F
LA WARD	15 F
LOLITA	15 F
FRANCITAS	16 F
VANDERBILT	20 F
...LIBERTY COUNTY...	
KENEFICK	10 F
7.5 W DAYTON	10 F
4 ENE CLEVELAND	11 F
SPLENDORA	11 F
5.8 SW DAYTON	11 F
DAYTON	12 F
5.2 S DAISETTA	14 F
4.4 E DEVERS	14 F
...MATAGORDA COUNTY...	
10.7 N PALACIOS	14 F
MIDFIELD	15 F
SARGENT 1 ENE	15 F
14.6 S SWEENY	15 F
COLORADO RIVER AT BAY CITY	16 F
2.9 W BAY CITY	16 F
BAY CITY	16 F
MARKHAM	16 F
4.8 SW BAY CITY	18 F
SARGENT	19 F
...MONTGOMERY COUNTY...	
MONTGOMERY	8 F
CONROE	9 F
7 ENE CUT AND SHOOT	9 F
WILLIS	9 F
THE WOODLANDS	10 F
2.5 SE OAK RIDGE NORTH	10 F
3.1 N TOMBALL	11 F
4 NE TODD MISSION	11 F
PORTER	16 F
...POLK COUNTY...	
0.8 N CORRIGAN	6 F
4 ENE GOODRICH	7 F
LIVINGSTON	7 F
4.2 W GOODRICH	10 F
4.3 NE LIVINGSTON	10 F
... SAN JACINTO COUNTY...	
COLDSPRING	13 F
4.6 NE NORTH CLEVELAND	16 F
...WHARTON COUNTY...	
5.6 W EAST BERNARD	10 F
SAN BERNARD RIVER EAST BERNARD	12 F
COLORADO RIVER AT WHARTON	13 F
WHARTON	13 F
COLORADO RIVER NEAR LANE CITY	14 F
6.1 W WHARTON	14 F
EL CAMPO 15 WSW	14 F
EL CAMPO 2 NW	15 F
1.7 NW EL CAMPO	15 F
1 ENE EL CAMPO	15 F

Corpus Christi Regional Summary

A quiet winter with dry conditions and light frozen precipitation

By: Juan Carlos Peña Jr., Meteorologist, National Weather Service, Corpus Christi

With La Niña conditions forecasted, and affecting South Texas this winter, warmer and drier conditions were expected. Therefore, below normal precipitation was observed during the winter months, especially across the Brush Country and Rio Grande Plains. Winter across South Texas included only one beneficial rain event, mainly across the Coastal Bend and Victoria Crossroads, a cold snap as the arctic air mass made its way to South Texas which resulted in minor frozen precipitation across the area, and several dry cold fronts. Therefore, South Texas observed all forms of precipitation, from rain to snow during this winter.

December across South Texas was fairly quiet with only minimal accumulation of precipitation, until the last day of the month when beneficial rains fell across the coastal locations. With an abundance of moisture ahead of an approaching upper-level disturbance and associated cold front, showers and thunderstorms were observed at the end of the month. The highest monthly reports were from the Coastal Bend and into the Victoria Crossroads. As seen in figure 1 below, observers across the Coastal Bend reported accumulations greater than 2.00" with as high as 5.63" across the Victoria Crossroads. Across inland locations, less than an inch was reported with only 0.12" in Laredo.

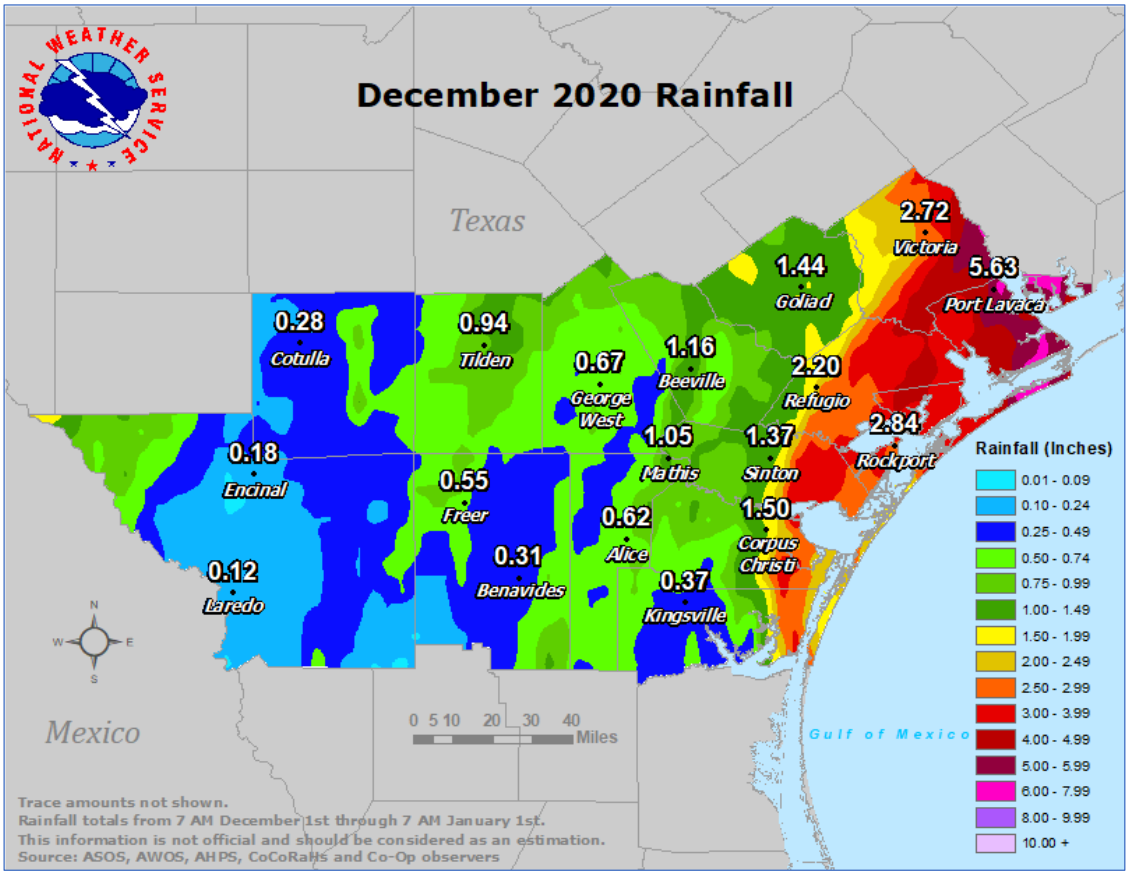

Figure 1: December preliminary precipitation totals for South Texas.

With La Niña still in place and holding firm, January was very similar to December with very little in the way of precipitation with only three rain events affecting South Texas. The first rain event occurred January 5th through the 7th as a cold front approached the region, however, precipitation was limited to the Northern Coastal Plains with observers reporting less than 0.50" of rain. The most efficient rainfall event occurred on January 10th as ample moisture was in place ahead of an approaching cold front. The bulk of the rainfall occurred across the Southern Coastal Bend where accumulations up to 2" to 3" were reported. Elsewhere, observers in the Corpus Christi and Kingsville area reported from 1" to 1.5" with the rest of the area reporting less than a 1" for the month of January. The third and final cold front swept across South Texas with minimal precipitation as only up to 0.25" of precipitation affecting South Texas. After all was said and done, rainfall amounts were 1 to 2" below normal for January except for portions of the Southern Coastal Bend.

Corpus Christi Regional Summary (continued)

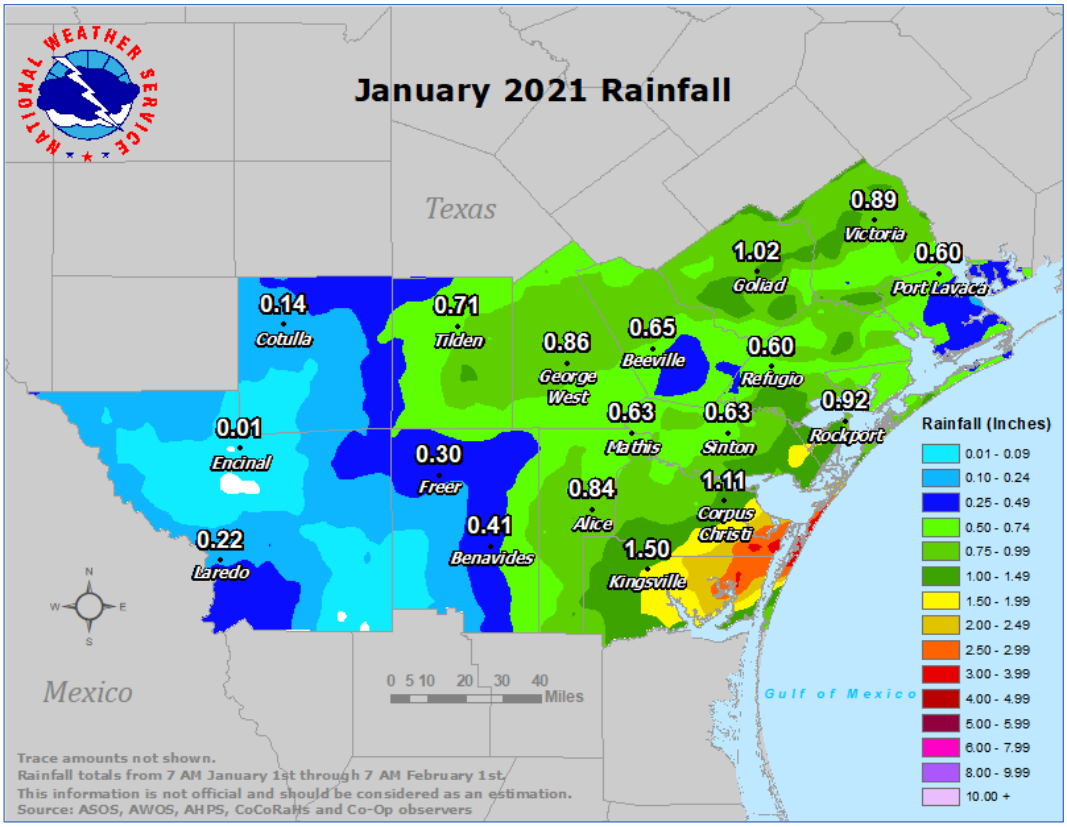

Figure 2: January preliminary precipitation totals for South Texas.

Despite a much colder month in February, precipitation accumulations were light across South Texas, even with the occurrence of the rare winter weather of freezing rain, sleet and even some snow. The highest precipitation accumulations were found across the Victoria Crossroads and the Northern Rio Grande with observers reporting close to 0.50” in Victoria, just over 1” in Goliad and between 0.50” to just over 1” across the Northern Rio Grande as seen in figure 3 below.

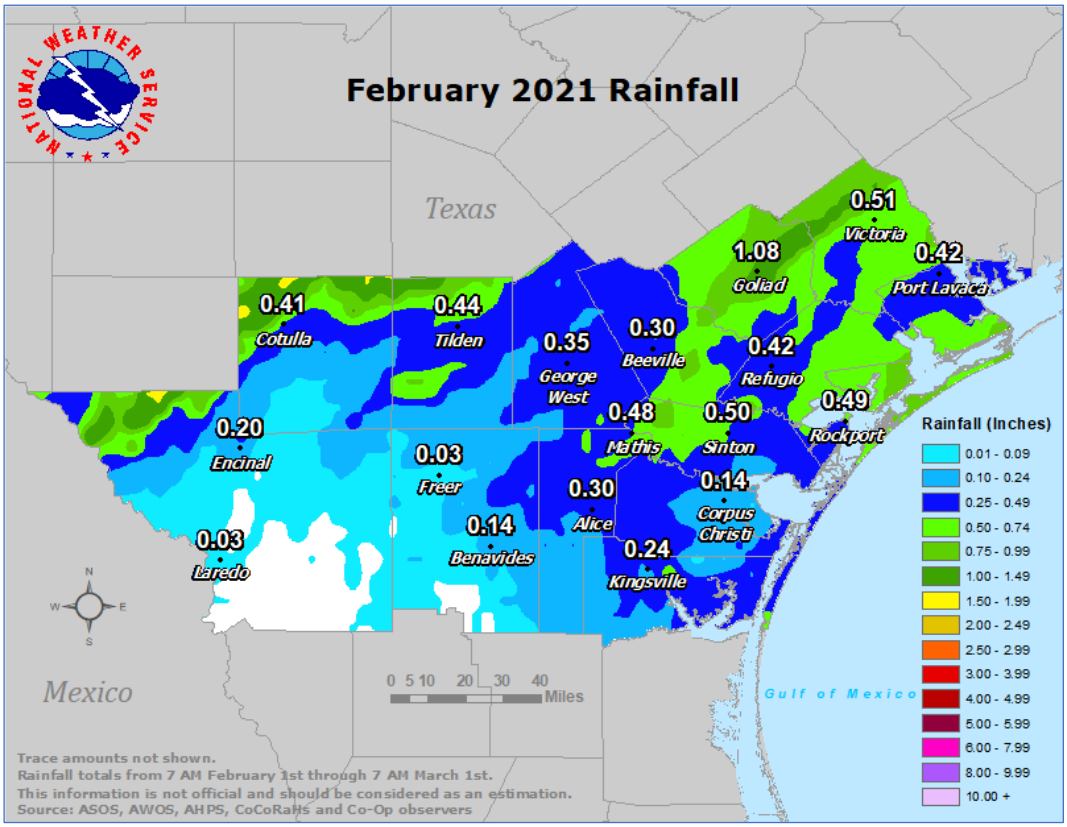

Figure 3: February preliminary precipitation totals for South Texas

Corpus Christi Regional Summary (continued)

Rain chances began increasing February 10th and 11th as a cold front approached South Texas resulting in accumulations up to 1" across the northern counties. Rain chances returned mid-month along with historic cold temperatures due to a dip of the polar jet stream resulting in the arctic air mass invading the State of Texas. During this timeframe, record lows were broken, dating all the way back to the 1890's. With cold temperatures, including below freezing temperatures, sufficient moisture and forcing was in place to produce winter weather across South Texas. As seen below in figures 4 and 5, mostly all of South Texas experienced some sort of winter weather. As seen in figure 4, observers reported between 1" to 2" of snow/sleet across the Northern Brush Country with less than a 1" elsewhere. Conversely, in areas that did not see much snow/sleet is where the bulk of the ice accumulations were found. Ice accumulations up to 0.10" to 0.25" were located across the Coastal Bend and Victoria Crossroads. In the wake of this historic winter storm, dry conditions settled in with little to no rainfall occurring across South Texas to close out the month.

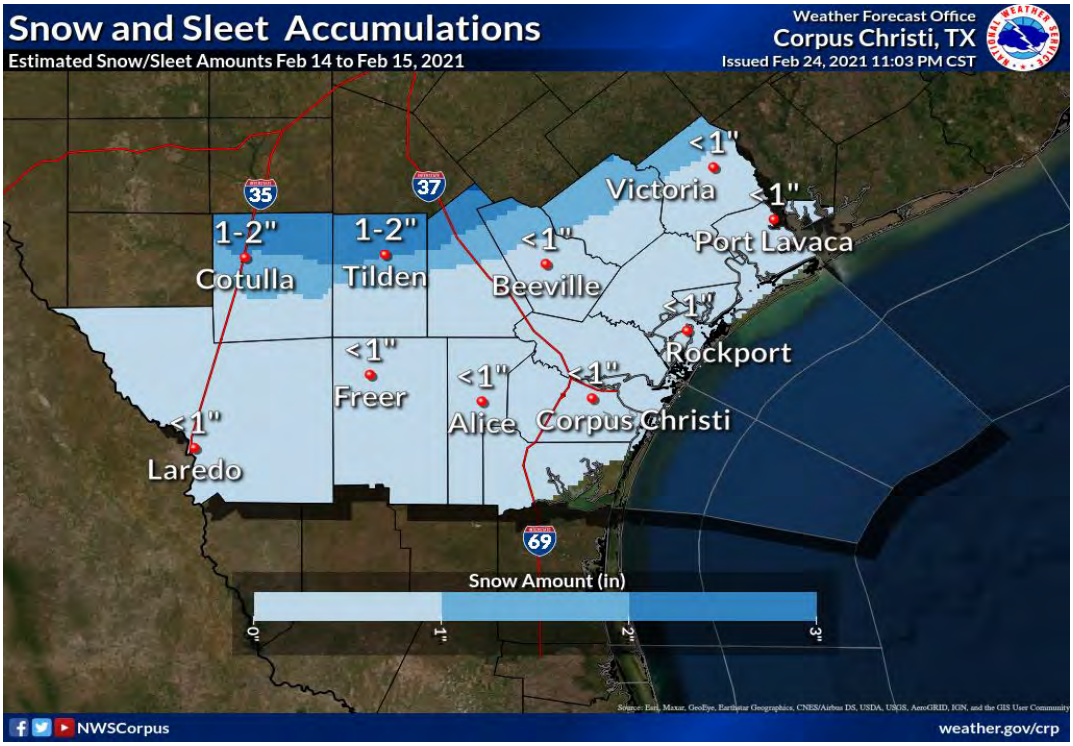

Figure 4: Estimated snow/sleet amounts from February 14th and 15th across South Texas.

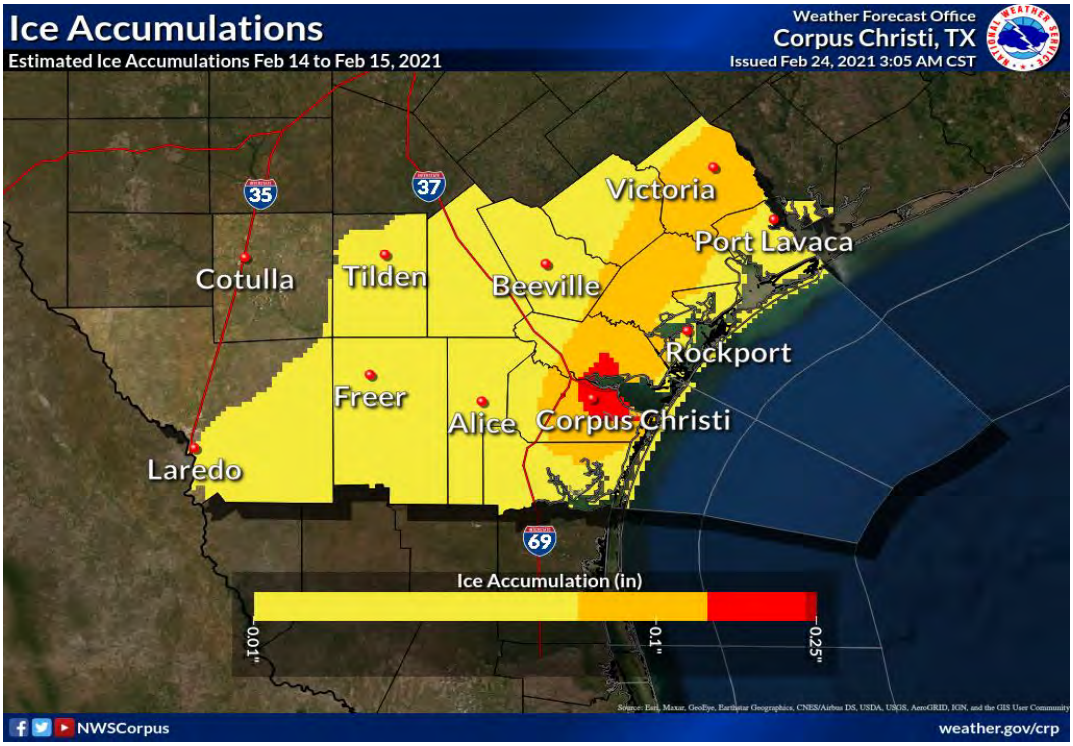

Figure 5: Estimated ice accumulations from February 14th and 15th across South Texas.

Rio Grande Valley Summary

"St. Valentine's Day Massacre" Killing Freeze Ravages Rio Grande Valley

Unprecedented Late Season Event Likely to Cause Over $1 billion in agricultural damage alone was the story of Winter 2020/2021

By: Barry Goldsmith, Warning Coordination Meteorologist, National Weather Service, Brownsville/Rio Grande Valley

Image 1: Damaged citrus in Rio Grande Valley after being hard hit by temperatures well below freezing.

In a winter that featured six minor freezes across the Lower Rio Grande Valley/Deep South Texas ranchlands in December (1st, 17th, and 25th) and January (1st, 13th, and 16th), winter 2020/2021 saved its "worst" for last, with the most intense arctic outbreak to strike the region, in terms of cold temperatures and duration, since December 22-25, 1989. Parts of the region had at least a minor freeze on the 13th through 17th, and again on the 19th and 20th.

The killing freeze occurred from late evening on Valentine's Day through around noon on February 16th. Across parts of the ranch country, including northern Zapata through northern Kenedy County, temperatures remained at or below freezing for nearly two full days. However, unlike the most recent prolonged freeze (February 2-4, 2011), ambient temperatures fell into the mid-teens to lower 20s during the morning of February 15th, and similar minimum temperatures during the morning of February 16th, with all Lower Valley and ranch locations in hard freeze (27°F or lower) for 6 to 16 hours each day, and 12 to 24 hours in total. The combination of wind and ambient temperatures made it "feel like" 0 to 10°F above during the post-daybreak hours of 7 to 9 AM on the 15th - rivaling observed values during the December 22-24, 1989 period. Another Valley-wide light freeze occurred on the 19th, with a heavy frost (along with temperatures in the upper 20s for most) ending the event early on the 20th.

The lateness of the arctic outbreak was unprecedented in the modern record, with only mid-February 1895 rivaling 2021 - a time when the Rio Grande Valley's population was less than one-tenth of what it was today. On the 15th and 16th, new record low temperatures were set everywhere. In locations with periods of record dating back to after 1895, old records were shattered by 8 to 15 degrees, including at some locations with more than 100 years of data! New records were achieved on the 17th, 19th, and 20th, with smaller departures. Record "low maximum" temperatures were crushed at even greater differences on the 15th, with populated Valley locations breaking the old records by 14 to 20 degrees!

Rio Grande Valley Summary (continued)

Records...Shattered! (Feb. 15, 2021)

Weather Forecast Office Brownsville/Rio Grande Valley, TX

Preliminary Minimum Temperatures

Location (records since)	Preliminary New Record	Prior Record (year)	Difference
Brownsville (1878)	22*	25 (1895)	-3
McAllen (1941)	22	35 (1946)	-13
La Joya/Mission (1911)	21	33 (1951)	-12
Raymondville (1913)	21	32 (1963)	-11
Rio Grande City (1897)	20	25 (1963)	-5
Falfurrias (1908)	16	26 (1963)	-10
Edinburg (2000)	22	38 (2004)	-16
Port Mansfield (1958)	21	36 (1963)	-15
McCook (1942)	20	31 (1963)	-11
San Manuel (2000)	20	37 (2010)	-17
Santa Rosa (1987)	23	36 (1997)	-13

Note: These are preliminary values and subject to change with quality control.
* Based on cooperative site measurement in place of automated sensor.

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Figure 1: Minimum temperatures preliminary records on Feb. 15th for the Rio Grande Valley

"Low Maximum" Temps, Feb. 15, 2021

Weather Forecast Office Brownsville/Rio Grande Valley, TX

Preliminary

Location (since)	Preliminary New Record	Prior Record	Difference
Brownsville (1878)	34	50 (2007)	-16
McAllen (1941)	38	51 (1966)	-13
Rio Grande City (1897)	38	54 (1966)	-16
Edinburg (2000)	34	56 (2007)	-22
La Joya/Mission (1911)	31	51 (1966)	-20
Weslaco 2E (1914)	36	50 (1933)	-14
Port Mansfield (1958)	37	50 (2007)	-13
McCook (1942)	33*	47 (1968)	-14
Falcon Dam (1963)	43	53 (1966)	-10

* Unknown if this is a calendar day observation.

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Figure 2: "Low maximum" temperatures preliminary records on Feb. 15th for the Rio Grande Valley

Rio Grande Valley Summary (continued)

Records Shattered (Feb. 16, 2021)

Weather Forecast Office
Brownsville/Rio Grande Valley, TX

Preliminary Minimum Temperatures

Location	Preliminary New Record	Prior Record	Difference
McAllen (1941)	25	33 (1980)	-8
Edinburg (2000)	20*	35	-15
Rio Grande City (1897)	19*	32 (1977)	-13
Raymondville (1913)	21*	31 (1980)	-10
Falcon Dam (1963)	19*	32 (2007)	-13
Weslaco (1915)	20*	33 (1922)	-12
La Joya/Mission (1911)	21*	31 (2010)	-10
McCook (1942)	20*	30 (1951)	-10
Santa Rosa (1988)	22*	34 (2007)	-12

*These are based on 7 AM to 7 AM reports, not on calendar day. Therefore, the listed values may have occurred between 7 and 9 AM on February 16th.
--Brownsville's 26 (not shown) was four degrees above the prior record (22 in 1895)

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Duration of Cold Temperatures

Weather Forecast Office
Brownsville/Rio Grande Valley, TX

February 12 through 17, 2021

Location	Lat	Lon	Duration ≤32, Consecutive	Duration ≤32, With Breaks	Duration ≤27, Consecutive	Duration ≤27, With Breaks
George West	28.4659	-98.2524	89	--	19(e)	34
Hebbronville/RAWS	27.3528	-98.7439	23	66(e)	17.5 (Feb 15)	33
Hebbronville/Jim Hogg Co.Airport	27.3333	-98.7333	45.5	84	17.5	32
Robstown	27.7783	-97.6903	21	38.5	12.5	22.5
Los Machos Farm	27.4702	-98.1358	36.5	49.5	15 (Feb 15)	29
Alice	27.7411	-98.0269	40(e)	--	17	--
Rancho Los Comitas/TWDB	26.7688	-98.6181	19.5	46	13.5 (Feb 16)	24
Texas AgriScience Center/Monte Alto	26.3518	-97.8973	20	37	8 (Feb 16)	15
Kleberg Airport	27.5509	-98.0309	18	34.5	9 (Feb 16)	18.5
San Manuel 1 SE (US CRN)	26.5258	-98.0633	18	39	11 (Feb 16)	21
11 N. Edinburg/S. Texas Int'l Airport	26.4417	-98.1222	19.5	43	10.5 (Feb 16)	18.5
McAllen/Miller Int'l Airport	26.1758	-98.2386	15	32	5.5 (Feb 15 AM)	10.5
Santa Ana NWR	26.0786	-98.1572	15.5	30	9.5 (Feb 16)	15
Harlingen/Rio Grande Valley (Feb 14/15 only)*	26.2271	-97.6551	19.5	--	8.5 (Feb 15)	--
Brownsville/South Padre Island (Feb 14-15 only)*	25.9061	-97.4260	16.5	--	5 (Feb 15)	--
Matamoros HADS	25.8858	-97.5186	17	27	6 (Feb 15)	6

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Figure 3 & 4: Minimum temperatures preliminary records on Feb. 16th plus duration of cold in Rio Grande Valley

Rio Grande Valley Summary (continued)

Impacts from the Event

Life in Texas ground to a crawl, or even a halt, as the electric grid became overwhelmed by the unprecedented ***late season*** cold and wintry precipitation. For the Lower Rio Grande Valley, this included an unknown number of water main/water pipe bursts, generator failures that affected water pressure, and other infrastructure damage to be determined. Leading into the killing freeze on the 15th was a period of light freezing rain and sleet, which coated trees and grass but also icing up elevated surfaces, causing more than 50 roads to be temporarily closed.

The most costly impacts were to the natural environment. The following items tell the tale (as of mid-March, 2021):

- $380 million (and counting) in agricultural damage, with $230 million to citrus. The 2022 citrus crop was in some jeopardy, as at least 50 percent of the crop had begun the spring floral blooms that typically arrive in mid-February. These were wiped out in the freeze, ensuring no fruit.
- 3.8 million fish killed in the Laguna Madre, with nearly 3.5 million in Lower Laguna Madre alone. This was the most since more than 14 million across coastal Texas in December 1989.
- More than 10 thousand rescues of "stunned" sea turtles, including at least 7 thousand along the Lower Texas coast, a record since statistics began in 1980
- Tens of thousands of damaged or destroyed semi-tropical ornamental plants, with damage likely to be in the several hundred million dollar range
- A distinct halt to tree and flower buds and blooms, with an eerie, barren winter landscape that followed for three weeks.

Meteorology of the Event

Similar to all of Texas, the event was created by a pool of arctic air that was brought into the northern Great Plains by a "piece" of the circumpolar vortex that slid south toward the Canadian/US border soon after February began. Surface high pressure, reinforced by the presence of the piece of the vortex, oozed into the northern and central Plains, then continued steadily southward, bringing subfreezing temperatures and winter precipitation into north and Central Texas around the 10th. Much below average temperatures, but still above freezing (mainly 30s and 40s), crashed into the Lower Valley late on the 11th, and locked in through Valentine's Day under a steel gray low overcast with occasional drizzle and biting north wind. A strong upper level disturbance, extending from southwest Canada through northwest Mexico, slid eastward late on the 14th and 15th, bringing the seasonally unprecedented surge of frigid air deep into Mexico.

Additional upper level impulses crossed Texas through the 19th, with the final wave exiting the state that day. Each impulse kept the much colder than average air locked in. A warm up finally arrived on the 20th, and would continue through the end of the month.

Other Notables from the Winter of 2020/2021 in the Lower Rio Grande Valley

Drought. The prevalence of "dry" vs. "wet" cold fronts, somewhat predictable given atmospheric teleconnections (primarily, a moderate La Niña) and a persistent pattern of dry, desert/mountain air with no tropical "connection", gradually worsened drought across the region, from moderate to severe conditions in December to severe to extreme conditions at the end of February. Rainfall for the three-month period was between 5 and 25 percent of average across the Jim Hogg/Starr/Zapata County ranchlands, to near 50 percent of average in eastern Cameron and Willacy County. With most fronts coming through dry prior to the Killing Freeze, sunshine and relatively mild temperatures brought repeated periods of low humidity and gusty winds.

Wildfire. Those conditions were sufficient for rapid spread and continuation of significant wildfires in the region, with two fires combining to burn 12 thousand acres, near Hebbronville (5 thousand in early February) and near Encino (Brooks County; 7 thousand in January).

Rio Grande Valley Summary (continued)

When all was said and done, temperatures ended the December-February period just a slight tick below average, primarily due to the 10 day period (February 11-20) where average temperatures overall were in the 30s to lower 40s, an average of 25 degrees below normal. That said, the very cold conditions were bookended by above average temperatures, enough to push the all-time February cold ranking into the top 18 to 25 all-time, rather than the top 5 or top 10. December and January were between 1 and 2.5°F above average, balancing out the season.

Rio Grande Valley Winter Climate Stats

Seasonal rainfall (inches) (anchor cities):
Brownsville: 2.85" (0.65" below average); 81 percent of average
Harlingen: 1.46" (2.27" below average); 39 percent of average
McAllen: 1.47" (1.88" below average); 44 percent of average

Monthly temperature (degrees F°):
Brownsville: Dec: 63.9° (1.7° above average)
Jan: 63.6° (2.5° above average)
Feb: 60.1° (4.1° below average)

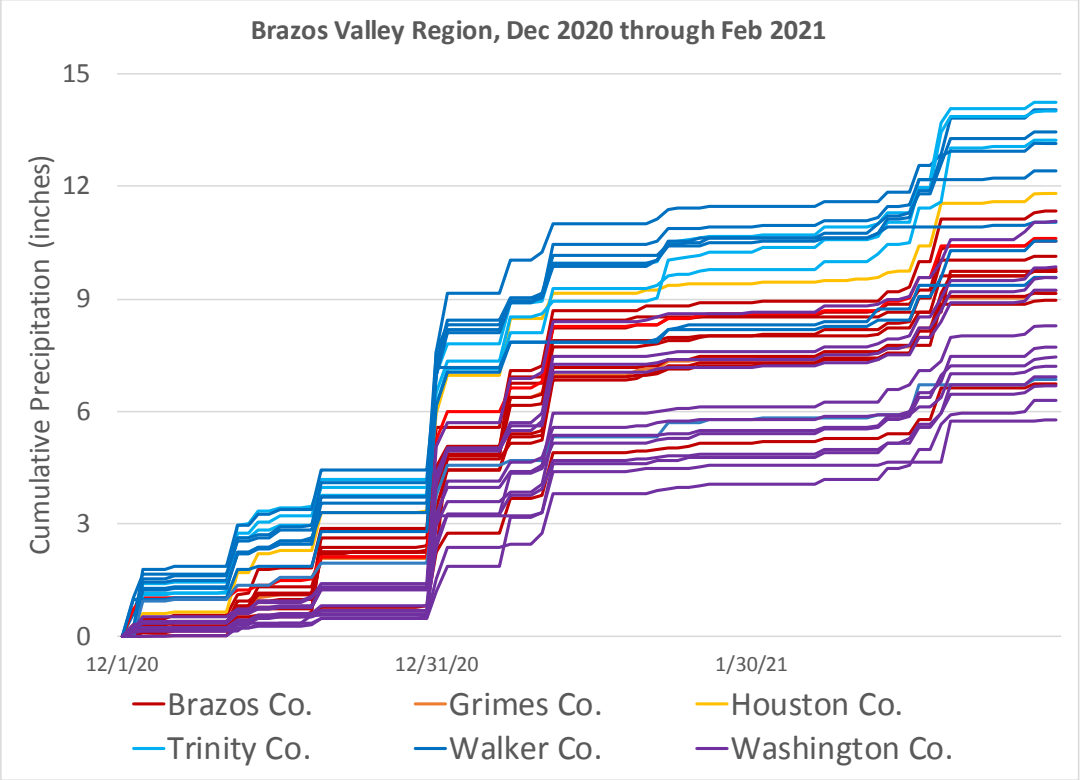
Harlingen: Dec: 62.4° (1.7° above average)
Jan: 61.7° (1.6° above average)
Feb: 59.0° (4.4° below average)

McAllen: Dec: 63.0° (1.0° above average)
Jan: 62.5° (1.7° above average)
Feb: 60.9° (3.8° below average)

Brazos Valley Regional Summary

Winter 2020-2021 Precipitation Summary
Bryan-College Station/Brazos Valley Region, Texas

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



Summary:
For a dry winter, this sure was eventful. Temperatures were generally fairly mild, but the notable exception was the extreme cold of mid-February. Also, the area received two substantial snowfalls, one in mid-January and one in mid-February. The snowiest CoCoRaHS observer was in Trinity County, with 5.1" on February 15 and 9.6" for the entire season. At College Station, the official observing station reported a season total of 7.5", just a half-inch below the all-time record set in 1972-1973. The first half of the winter was quite a bit wetter than the second half: typical totals through mid-January were 4"-10", but only 2"-3" fell the rest of the winter.

Observer Statistics:
This was a tough season for observations. With the frozen precipitation, major cold, and power outages, only five observers submitted reports for all 90 days. Another 14 submitted reports for most days, and a grand total of 29 observers took enough observations to make it possible to estimate seasonal totals.

Season Statistics:
Wettest day: 74.28", December 31, Walker County
Wettest seasonal total: 14.24", Trinity County
Driest seasonal total: 5.38", Washington County
Soggy Socks Award (longest spell of daily reports with measurable rain): Brazos County had eight consecutive days of rain from January 19 through January 26.
Dusty Soles Award (longest spell of daily reports without measurable rain): Numerous stations in the region went a total of ten days without measurable precipitation. At least the weather kept us busy!

East Texas Regional Summary

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

Overall, above normal precipitation fell over most of East Texas this winter. This resulted in most of the region becoming drought free for the start of spring 2021.

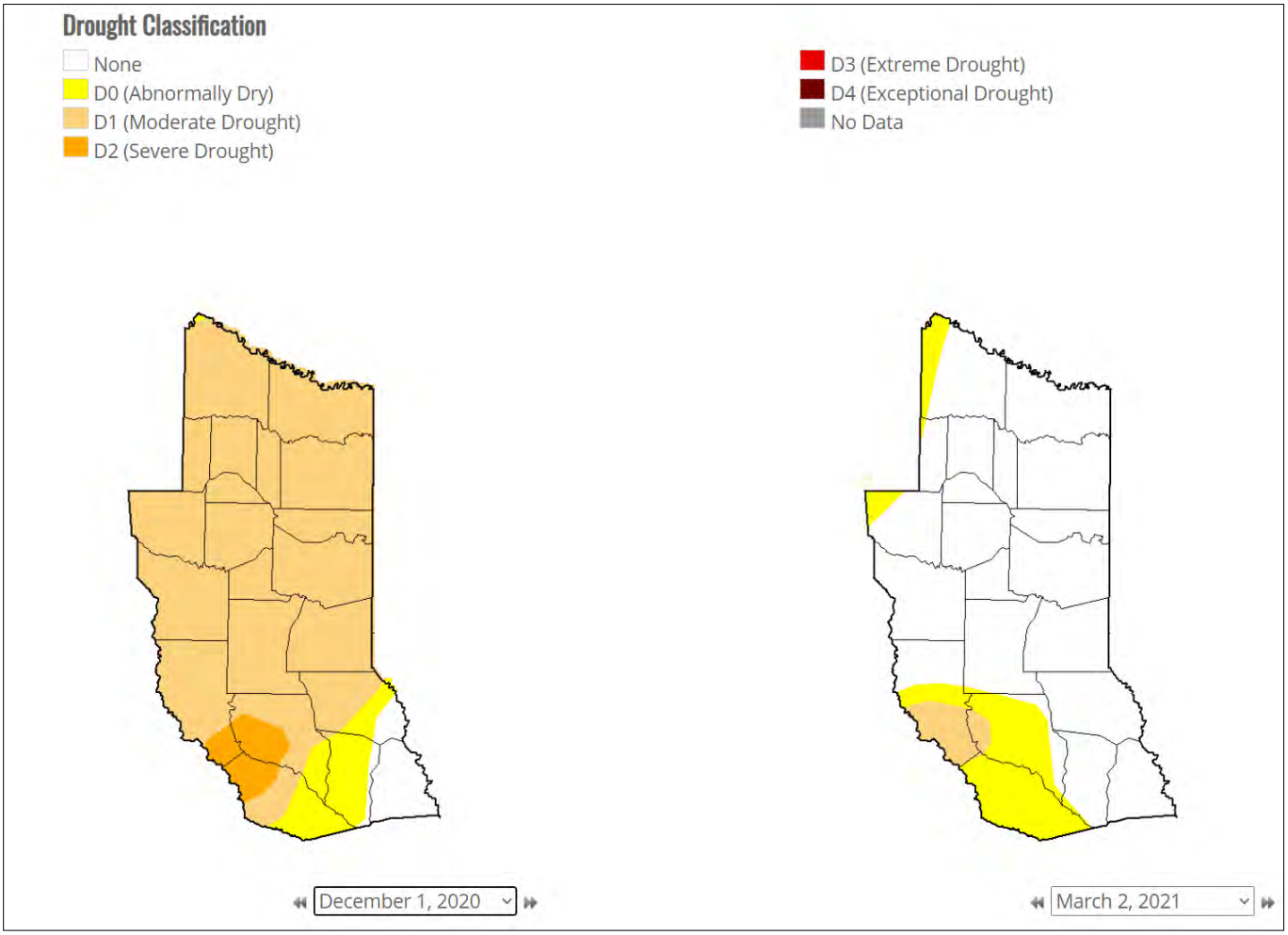


Fig.1: Drought Monitor
Image Courtesy of NDMC/USDA/NOAA

December was the wettest month of the three this winter. A fairly active weather pattern developed during the month, bringing a series of frontal boundaries and troughs through the region. Precipitation amounts of 1" to 2" was observed between the 2nd and 3rd with similar rainfall reported between the 11th and 13th of the month. However, by the end of the month, the National Weather Service in Shreveport received record rainfall at their East Texas climate sites. A cold front moved through the region on the 30th, but it slowly returned back as a warm front on New Year's Eve, bringing heavy rainfall to the region. Tyler and Longview airports recorded rainfall records of 1.94" and 2.12" respectively for the 31st, to go along with a record rainfall of 2.88" at the Texarkana airport. In general, most of the CoCoRaHS sites reported a two-day total from the 30th to 31st of 3" to 4", with some sites in Bowie and Harrison counties reporting 4" to 5".

East Texas Regional Summary (continued)

Near average rainfall continued for the month of January, with a large chunk of it occurring on the 6th when another surface low and associated cold front moved through the region. The heaviest rainfall was generally along and north of the Interstate 20 corridor, where the overwhelming majority of the sites recorded 2" to 3" of rainfall, with a couple of locations over 4" in Cass County. However, the highlight of the moth occurred on the 10th, when an upper level storm system moved into the region. With cold air already in place, precipitation changed over to snow. The heaviest snowfall was observed generally along and south of the Interstate 20 corridor, with totals ranging from 3" to 6".

Fig.2: Liberty City, TX (Gregg County) Snowfall – January 11, 2021
Photo Credit: Alisa Ross McCary

Rainfall amounts generally decreased for the month of February. However, this month proved to be quite historic across the region. Very cold, record breaking arctic air moved into region after the 10th, with many locations staying below freezing until the 19th. In addition, to the frigid temperatures, a series of upper level disturbances moved across the region on the 14th and 15th, and again on the 17th, bringing wintry weather to the region. Most of the precipitation fell as snow on the 14th and 15th, but more of a mix fell on the 17th, with a mix of freezing rain and sleet across Deep East Texas and sleet and snow north of Interstate 20. This event resulted in very hazardous travel along with utility outages, as many places lost power and water. The National Weather Service in Shreveport reported record snowfall at all of its East Texas climate sites, along with the snowiest winter on record at Tyler and Texarkana. Area CoCoRaHS totals ranged from around 2" in Deep East Texas to over 16" in extreme Northeast Texas. The region was finally able to thaw out by the end of the month, but February wouldn't leave quietly. Strong to severe thunderstorms developed during the late evening hours of the 25th and early morning hours of the 26th, with the public reporting large hail in Red River and Bowie Counties. In addition to the hail, heavy rain was recorded, with CoCoRaHS sites in Red River and Bowie counties reporting 2" to 3". (Figure 4)

East Texas Regional Summary (continued)

Fig.3: Texarkana (Bowie County) Snowfall – February 15, 2021
Photo Credit: TXK Today

Fig.4: Texarkana area (Bowie County) Hail – February 25, 2021
Photo Credit: KTAL-TV viewer Amy Lancaster Kemp

Snowfall pictures around Texas this winter season

Fig. 1: Snow covered park in Amarillo 2/14/21 (Miriam Contreras).

Fig. 2: Snowy road in Amarillo 2/14/21 by Martha Granados Dumas.

Fig. 3: Snow in Austin on Feb. 15th, 2021

Fig. 4: Cactus covered with ice on Feb. 15th, 2021 in Llano

Fig. 5: Snow and ice near Madisonville (James Robinson)

Fig, 6: Snow Covered Streets in Galveston (Stan Blazyk)

Texas Spring Weather Outlook

Will La Niña Go Away This Spring

By: Bob Rose, Meteorologist, Lower Colorado River Authority

Following one of the coldest outbreaks in Texas history, temperatures in late February and early March warmed considerably as the arctic pattern totally abated. By most measures, the atmospheric circulation across the U.S. reverted back to a pattern similar to where it was before the cold outbreak, consisting of milder than-normal and drier-than normal weather.

The biggest influence on Texas weather over the fall and winter months was from a moderate La Niña in the central and eastern tropical Pacific. The La Niña helped steer the jet stream flowing east from Asia up toward western Canada instead of allowing it to spread east towards the West Coast and eventually Texas and the southern U.S. This resulted in fewer storm systems and less rainfall for much of Texas. And except for that week of bitter cold in the middle of February, this same pattern kept the coldest air from making frequent visits to our state. Of course, occasional breaks in the La Niña pattern did allow for some brief periods of rain, snow and cold weather. As of early March, a good part of Texas was in some form of drought due to the lack of rain over the past six to eight months.

Observations in early March indicated waters in the tropical Pacific were warming and this winter's La Niña was steadily weakening. Climate Prediction Center forecasts indicate there's a good chance the La Nina will dissipate this spring, with the Pacific returning to ENSO-neutral. While on the surface this is good news, unfortunately, the latest outlooks don't call for any significant changes in the weather pattern across Texas this spring. History has shown it takes a few months for the atmospheric circulation to respond to changes in the sea surface temperatures in the Pacific. In other words, while La Niña is expected to dissipate this spring, its memory will likely live on in the atmospheric circulation into early summer. This circulation is expected to result in fewer storms reaching Texas, leading to lower than-normal rainfall and warmer than-normal temperatures. A contributing factor to this warm and dry outlook is the ongoing drought across much of the state. The lack of soil moisture associated with the drought has been shown to reinforce the drier and warmer than-normal pattern during the warm months. And depending on how the pattern sets up, summer-like temperatures could arrive early this spring and stick around going into summer. Drier than-normal rainfall in the spring, a time when it should be raining, will also cause drought conditions to grow worse.

Spring Weather Outlook (continued)

The Climate Prediction Center's April through June Outlook agrees with an early arrival to summer-like weather. It shows increased odds temperatures will average warmer than-normal and rainfall will average below normal.

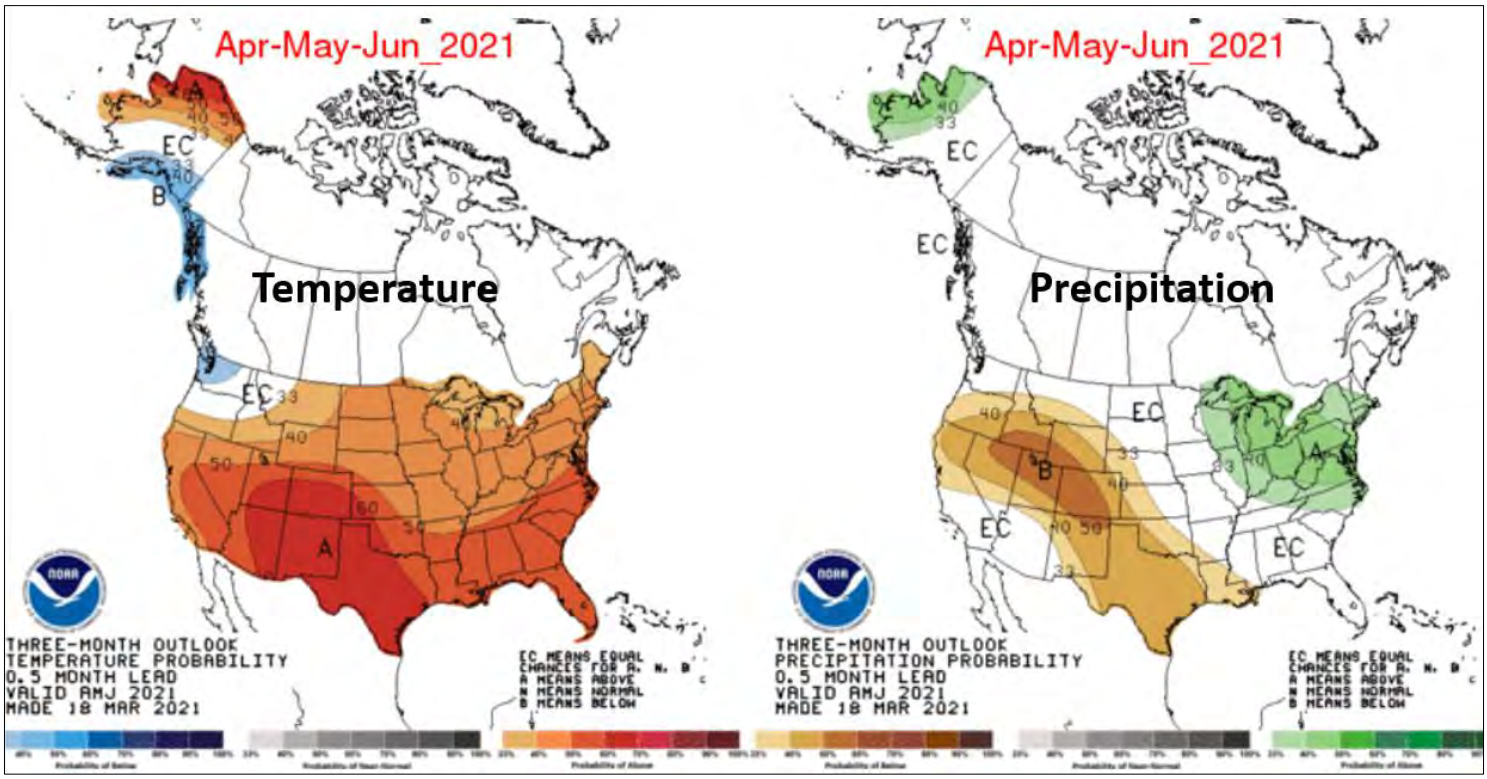


Figure1: Climate Prediction Center's April through June Outlook

Of course, these are then general conditions that can be expected through late spring. Like what we saw over the winter, there will exceptions from time to time, with periods of rain, storms and even some brief cooldowns. But be prepared for a warm and less rainy spring. Unfortunately, summer looks to be arriving early this year.

Observer Tips & Training Material

Is Your Rainfall Report for One Day, or is it for Multiple Days?

It is important not only to read your rain gauge correctly, but to report correctly as well. If you have an amount that has accumulated in the gauge over a period of two or more days (like over a weekend), you must report this using the Multi-Day Accumulation report, NOT the Daily report.

For many observers reporting precipitation for multiple days is an infrequent occurrence, and we forget that these amounts are entered differently than the daily report. The Daily Report form (the one that appears after you log in) is ONLY for an amount collected for a one-day period. If you are reporting an amount collected for a period of two or more days, then use the Multi-Day Precipitation form on the web site. This form is for reporting an accumulation of precipitation over two or more days where you did not take daily observations. In other words, for any given date, you should report precipitation using either the Daily Precipitation Report or the Multi-Day Precipitation Report form.

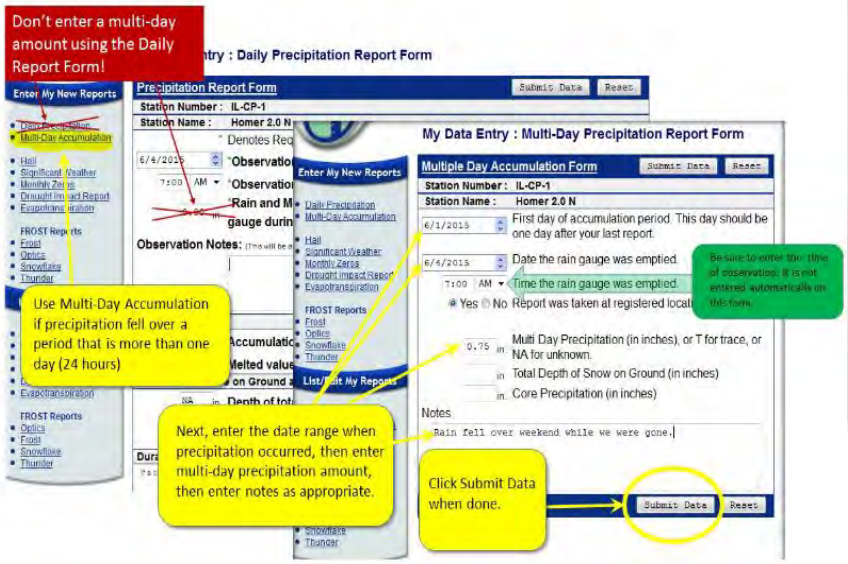
Here are two examples which will clarify how to report precipitation for multiple days.

Example 1

After your observation on May 31, you head out for a long weekend. You return late on June 3. On the morning of June 4 you check your rain gauge and find 0.75 inches of rain in the tube. How do you report this?

Log on to the CoCoRaHS web site as usual. IGNORE the Daily Report screen that pops up. Instead select Multi-Day Accumulation in the menu

On the form, enter the first day of accumulation. In this case it is 6/1, the day after your last report (May 31). You emptied the rain gauge on 6/4. Enter the time you emptied the rain gauge, then enter the amount that you measured in the field labeled "Multi Day Precipitation (in inches)". In this case, you would enter 0.75. Click on Submit Data and you are done.



Example 2

One weekend you take your daily observations but for a variety of reasons are not able to get access to the computer to enter your observations into the CoCoRaHS web site. You have the following observations:

6/1 0.01"
6/2 0.00"
6/3 0.50"
6/4 0.25"

You are able to enter your data on June 4. How do you report this?

DO NOT use the Multi-Day Precipitation form. That is only used for entering one measurement that represents an accumulation over a period of two or more days, not for multiple daily reports.

DO use the Daily Precipitation report form. When the form appears on the screen, change the date to 6/1, enter the observation, and click the Submit Data button. Then, click on Daily Precipitation under Enter My New Reports, change the date to 6/2 and enter that observation and click the Submit Data button. Repeat for the last two observations.

Observer Tips & Training Material (continued)

Understanding the Difference between Precipitation and Condensation

Question: ***Which one does CoCoRaHS measure and what is the difference?***

Answer: CoCoRaHS measures rain, hail, sleet, and snow. These are all forms of precipitation.
Precipitation is a process of a liquid or solid aqueous particles in the atmosphere such as a cloud and falling to the earth's surface as rain, hail, sleet, and snow. Only precipitation values *should* be reported on a *daily report form*.

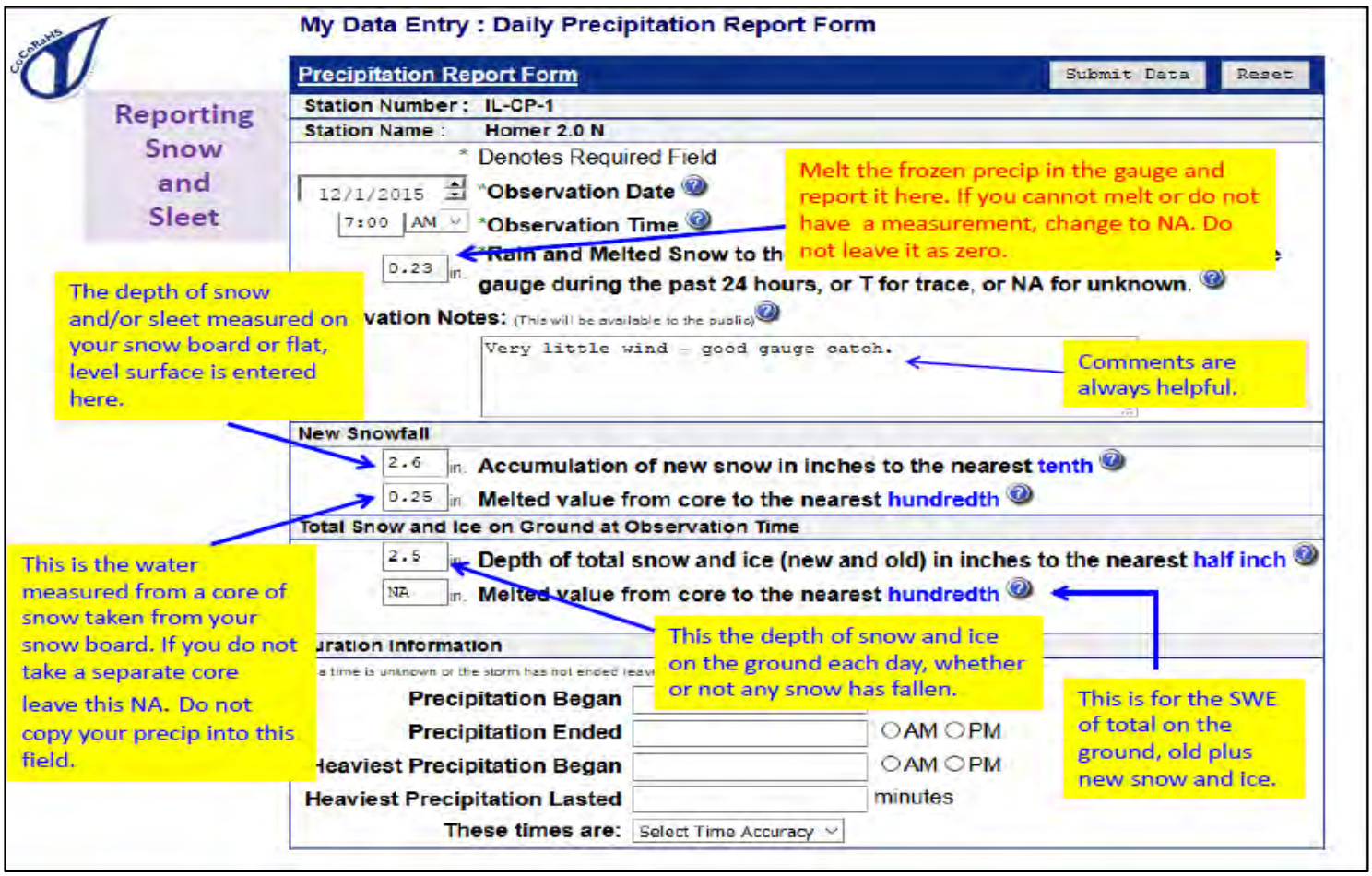
Condensation is the process of water vapor changing from a vapor phase to a liquid phase which is deposited on surfaces such as a rain gauge. Dew, fog, fog mist, and frost are the result of condensation. CoCoRaHS does not measure or report any values of condensation. CoCoRaHS observers *shouldn't* report condensation collection in the 4-inch diameter gauge as precipitation on the daily report form. *Only make a note in comments of condensation from dew and leave box at 0.00".*

The first thing every observer should do when reading their gauge and finding water in it is to ask themselves how did it get in the gauge. Did other CoCoRaHS stations in your county and surrounding counties report precipitation? Was the sky clear all night? Condensation on a vehicle windshield will make it difficult to see clearly through while rain will wash a windshield clean. These are some things an observer can do to answer the question of how did the water get in the gauge. Sometimes an observer will not completely empty the CoCoRaHS gauge of all water by slinging it dry. It only takes a very small amount of water left in the gauge to settle to the bottom of it and collect as 0.01". There have been many occasions of reports of 0.01" of rain from stations just after previous days had rainfall and the gauge was read the previous morning. Not all water was completely emptied from the gauge that morning before the current observation resulting in the left over water being reported again as 0.01" of rain on a clear 24 hour period. Hopefully these tips and understanding of condensation will help you answer the question of where the water came from. There is a huge difference between condensation and precipitation! Dew, melted frost, fog, and fog mist on your gauge may trick you into reporting a trace amount or 0.01"- 0.02" of precipitation, but you won't be fooled now, will you?

Observer Tips & Training Material (continued)

How to report snow and sleet

"Keep and save"



If freezing rain and snow is possible, Always Remember to Remove Funnel and Center Tube and Take Indoors

Observer Tips & Training Material (continued)

Instructions on how to measure snow and sleet

Total Rain and Melted Snow
Enter only the amount of rain or melted snow that fell into the rain gauge for the past 24 hours ending at 7:00 A.M. the day of entry. If warm water was added to help melt snow, be sure to subtract that amount.

If there was no precipitation, report 0.00. If some precipitation fell, but the total was less than 0.01 inches, enter T in this blank "field".

New Snow:
This is the depth of the new snow (not its water content) that fell in the last 24 hours. This is measured with a ruler and reported to the nearest one-tenth (0.1") inch. The **New Snow** is the maximum accumulation of fresh snow during the past day prior to melting or settling. Since snow melts and settles, you may have to measure during or soon after the snowfall ends since by 7:00 A.M. the depth may be reduced.

If snow fell in the past 24 hours, but you did not measure it, please do not leave it as 0.0". Instead, please enter NA ("not available").

Total Snow on Ground

This is the total amount of snow (new and old snow combined) on the ground, measured to the nearest 0.5 (1/2) inch. The **Total Snow on Ground** is reported even on days when no new snow has fallen. If there is snow on the ground but you did not measure the depth, then leave "NA" on the form ("Not Available"). If there is no snow at all on the ground, replace the "NA" on your form with 0.0

Uneven Snow: If the wind has blown and the snow is uneven, or if melting has occurred in some areas but not in others, then please take several measurements. Average your measurements into one value, and enter that value

Details about variations in snow may be added in the "Notes" section.

Melted Value From Core
If you believe your gauge has not caught all of the precipitation that has fallen (or if you're just curious), then you can take a core sample of the new snow that has fallen using your 4 inch diameter rain gauge, on your snowboard. If the amount is less than 0.01 inches, enter T in the field.

Example:
The snow begins to fall in mid-morning. At 3 P.M. the snow stops falling and you measure the depth at 4.2". The sun then comes out and the snow quickly begins to melt and settle. At 7 A.M. the next morning you measure 2.6" of snow on your snowboard. There was little wind with this snow, and your rain gauge has likely caught most of the snow that fell. You melt the contents of the gauge and find 0.41".
What do you report for each entry?

Total Rain and Melted: 0.41" (the melted snow and/or rain)
New Snow: 4.2" (the amount of snow received in the previous 24 hours, prior to melting and settling)
Total Snow on Ground (in inches) 2.5" (assuming bare ground prior to this snow)

Note: Please read the training slide shows on the CoCoRaHS home page to learn the complete process of measuring snow at www.cocorahs.org

Scheduled CoCoRaHS Webinars

Upcoming WxTalk Webinars:

Webinar #76 - Thursday, May 6, 2021 -1PM EDT

Mount Washington Observatory, 'Home of the World's Worst Weather'
Brian Fitzgerald
Director of Science and Education
Mt. Washington Observatory
North Conway, NH

Back on April 12, 1934, weather observers at the fledging nonprofit Mount Washington Observatory recorded a world-record wind gust of 231 MPH, which still stands as the fastest wind speed directly observed by humans on the surface of the Earth. Since then, MWO has amassed one of North America's longest-running climate records with 24/7/365 human-verified measurements in one of the harshest environments on the planet. Join MWO's Director of Science & Education, Brian Fitzgerald, and he shares about the climate of Mount Washington, how this historic mountaintop weather station operates, and current research and product testing projects happening on the "Rockpile."

CoCoRaHS WxTalk Webinar Series

Texas CoCoRaHS Observer

The official newsletter of Texas CoCoRaHS

Newsletter Editor: **Ron Havran,** Regional Coordinator - Houston/Galveston Region
Assistant State Coordinator cocorahs.hou.galv@gmail.com

Texas CoCoRaHS: **Bill Runyon,** Texas State Coordinator
texas@cocorahs.org

Texas CoCoRaHS @Texas CoCoRaHS