TEXAS CoCoRaHS OBSERVER

Winter 2017

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

Welcome to the Texas CoCoRaHS Observer newsletter.

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

If you have questions, comments or suggestions, feel free to contact us via the emails listed on the back page.

A CoCoRaHS observer from West Texas has been featured on a PBS type show called "Crowd and Cloud" which debuts April 6th on the public TV World Channel. See page 11 for more information about this show and the observer

Inside this issue:

Warm & Wet Across South Central Texas

By: Brett Williams and Larry Hopper
NWS Austin/San Antonio

Winter 2016-2017 was exceptionally warm, with most locations across South Central Texas experiencing a top 5 warmest winter on record. Austin experienced their warmest winter on record since 1898 while San Antonio and Del Rio both registered their third warmest winter on record. Furthermore, both Austin and San Antonio experienced 19 days with maximum temperatures above 80 degrees,
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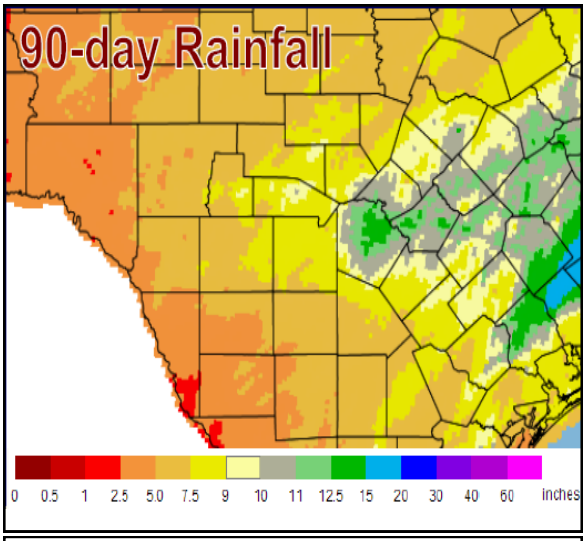


***Figure 1*: December-February rainfall totals across South Central Texas**

Texas Winter Climate Summary

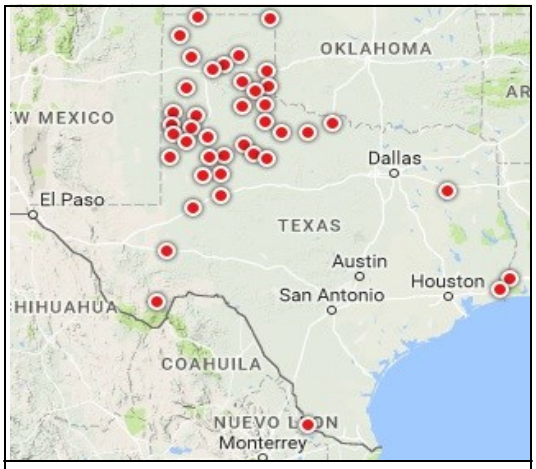
By John Nielsen-Gammon,
Texas A&M University/
Texas State Climatologist

The big weather story for the winter of 2016-2017 was the unusual warmth.

The average temperature across Texas was 52.97 °F, according to data from the National Centers for Environmental Information. This easily breaks the previous record of 52.53 °F, set way back in 1906-1907. Only one other winter even came within a degree: 1999-2000.

This marks the sixth consecutive month with above-normal temperatures. Indeed, the average for fall and winter shattered the previous record by more than a degree.

In a winter of unusual warmth February takes (or bakes?) the cake. The average temperature CONTINUED ON PAGE 3————>



Locations of stations breaking their all-time February highest recorded temperatures. *Map by the National Centers for Environmental Information.*

CONTINUED FROM PAGE 1——>which set a record at Austin and placed second at San Antonio. On the opposite end of the spectrum, all three official climate sites of Austin, San Antonio and Del Rio only had 5 days this winter in which the temperature dropped to or below freezing. However, the low temperatures in the teens and lower 20s across South Central Texas on the morning of January 7th were the coldest that most of the region has seen since February 2011! In terms of precipitation, winter 2016-2017 was generally wetter than normal, especially for the San Antonio metro area (Fig. 1). San Antonio's 12.55 inches of rain registered as its 3rd wettest winter on record, while Del Rio and Austin registered their 17th and 26th wettest winters on record, respectively.

December began with a rainy period from December 2nd through December 5th as a warm front became stationary south of the area, causing widespread rain showers. The main event occurred on Saturday, December 3rd when over 1 inch of rain fell across a large portion of South Central Texas, with the San Antonio metro area receiving over 4 inches of rain (Fig. 2). Despite a strong arctic cold front that moved through on the evening of December 17th and kept temperatures 15-20 degrees below normal through December 19th, temperatures for the month of December were slightly above normal at all locations across South Central Texas.

January began warm and finished even warmer, but another arctic cold front plunged temperatures to the teens and low 20s on the 6th, 7th and 8th. Another unsettled and rainy period impacted the region during mid-January, with the most significant weather occurring on the evening of Sunday, January 15th when severe thunderstorms impacted portions of the Edwards Plateau, Hill Country, and Rio Grande Plains before transitioning to a heavy rain event across the San Antonio and Austin metro areas.

February was exceedingly warm throughout, with a pronounced lack of arctic cold fronts impacting the region. San Antonio registered its warmest February on record, finishing the month 8.5 °F above normal and setting 4 new record highs. Austin also registered its warmest February on record, finishing 9.5 °F above normal and setting 3 new record highs. It was only the 5th warmest February on record in Del Rio, finishing the month 6 °F above normal. There were two impactful weather events across South Central Texas in February. On Valentine's Day, a passing cold front produced widespread showers and thunderstorms across the region, dropping over 1 inch of rain across a large swath of South Central Texas. Portions of the Hill Country, including Real, Bandera, Kerr, Gillespie, Blanco, Burnet and Llano Counties, received up to 4 inches of rain.

The most impactful weather event of the winter season occurred on the night of Sunday, February 19th and into the early morning hours of Monday, February 20th as -an upper level disturbance and a surface cold front teamed up to create a squall line that produced a total of 9 tornadoes across the region as well as numerous damaging wind events (Fig. 3). These tornadoes ranged from EF-0 to EF-2, including an EF-2 tornado that impacted the Ridgeview neighborhood in north-central San Antonio and the city of Alamo Heights. These 9 tornadoes were the most from a single weather event in February across South Central Texas since February 25th, 1971. Additionally, 1-3 inches of rain fell across most of the region, namely east of US Highway 83. Portions of Bexar, Lavaca, Dewitt, Fayette and Lee Counties received over 3 inches of rain from this event.

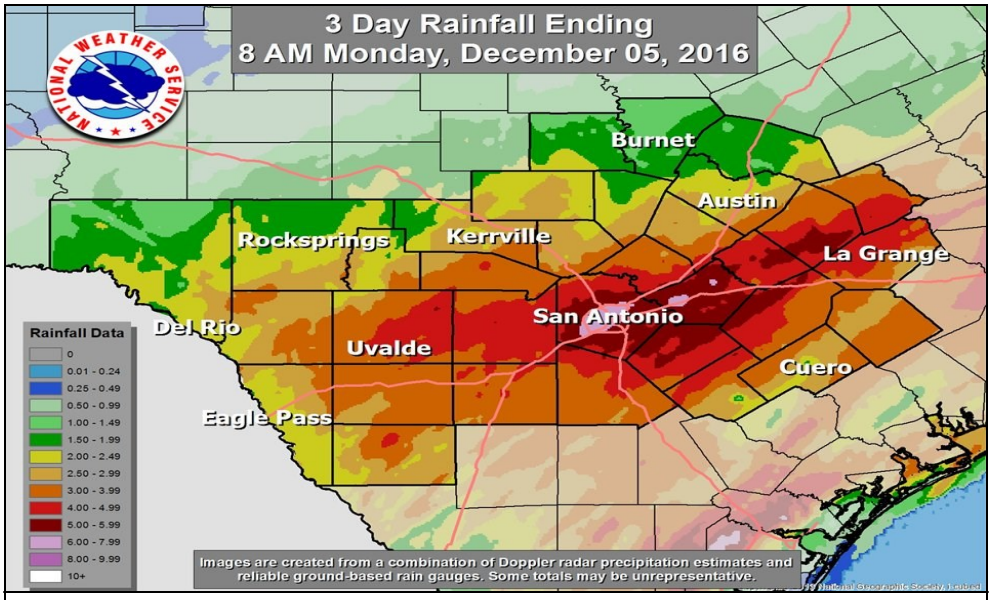
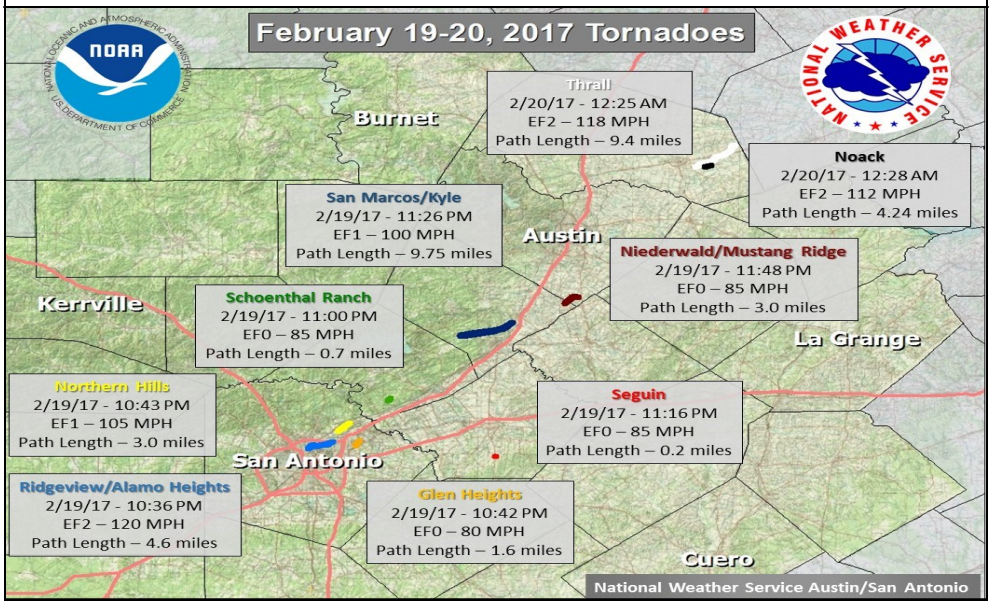


Figure 2 (Above): 3 day rainfall totals (in inches) across South Central Texas ending on December 5, 2016.

Figure 3 (below): Map of all 9 tornadoes with pertinent tornado information from the February 19-20 QLCS event



Texas Winter Climate Summary

CONTINUED FROM PAGE 1—>across Texas in February was 8 °F above the 1981-2010 average. Perhaps even more stunningly, the average February temperature was 1 ° F above the 1981-2010 average for *March*. The warmest corner of the state, compared to normal conditions, was southeast Texas.

While a majority of the state experienced record-breaking average temperatures in February and throughout the winter, some locations also broke all-time records for warmest ever day during February. These broken records were concentrated in the northwestern portion of Texas, where the average temperatures for February were only top-ten warm.

Meanwhile, other parts of Texas were busy experiencing unusually warm nighttime temperatures. It's a mouthful to say, but many stations broke their all-time February highest recorded minimum temperature.

At the beginning of winter, drought conditions were present in much of eastern Texas as well as a few other corners of the state. About 14% of the state was officially in at least moderate drought, according to the US Drought Monitor. (Figure 3)

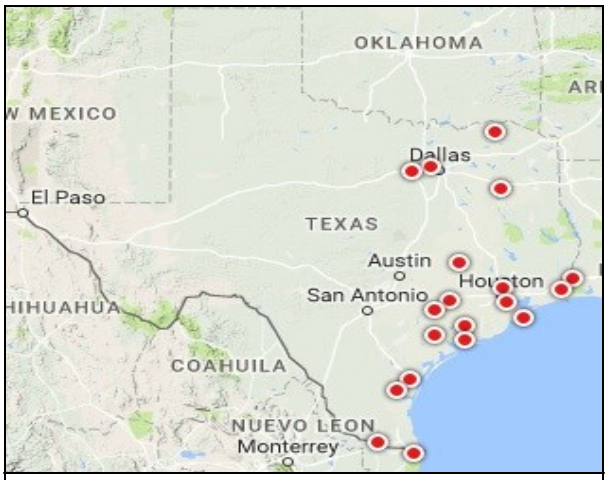
Thanks to what was the rainiest winter since 2009-2010 statewide, drought conditions retreated across most of the state. By the end of February, less than 4% of the state was in moderate or worse drought.

The improvement would have been even greater, if not for the unusually high temperatures. High temperatures tend to increase evaporation rates, drying out the soils faster between rains. Besides, the warm temperatures have caused an early arrival of spring, with trees budding and wildflowers blooming much earlier than normal. As the leaves and plants grow, they draw water from the ground through their root systems and release it into the atmosphere, further drying out the soil.

Back in 2012, the north-central United States experienced an unusually warm March and May. Research has shown that these warm temperatures depleted soil moisture, so when the area underwent a spell of dry weather, drought conditions developed rapidly.

It's a bit too early to be talking about widespread drought conditions in Texas. There is plenty of time for more rain to replenish the moisture in the soil, effectively hitting the reset button and making the rapid wintertime evaporation only a distant memory. However, until that happens, much of Texas will be vulnerable to rapid drought development.

Another danger this time of year is wildfire. There already has been a major early March wildfire outbreak in the Texas Panhandle and western Oklahoma and Kansas. Ideal conditions for wildfire include plenty of rainfall over the past one or two years (check), a stretch of dry conditions during winter or early spring (check), and a developing storm system that brings hot, dry air down from the highlands of New Mexico and northern Old Mexico and drags that air across Texas with unusual speed. Observations of rainfall and lack of rainfall over the next couple of months will be key to figuring out which areas are most vulnerable to wildfire when the right (or wrong) weather conditions come along.



Locations of stations breaking their all-time February highest daily minimum temperature. *Map by the National Centers for Environmental Information.*

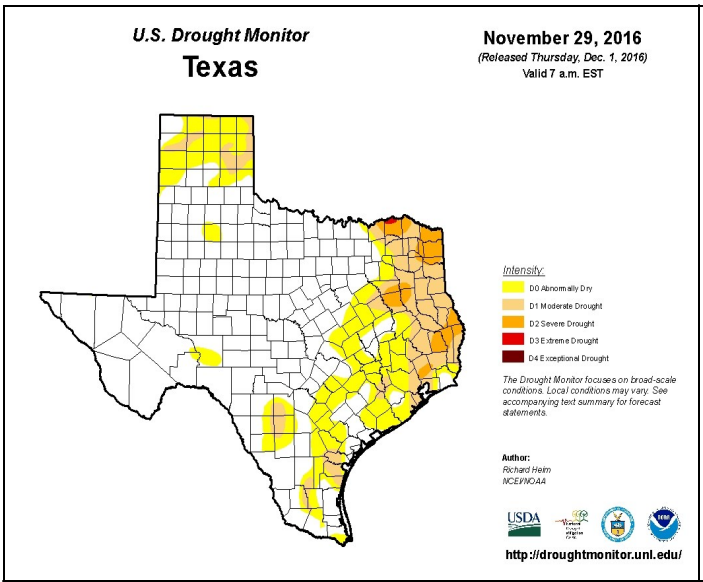


Figure 3: Areas of state classified into a drought category at end of November. *Map provided by the National Drought Mitigation Center, University of Nebraska at Lincoln.*

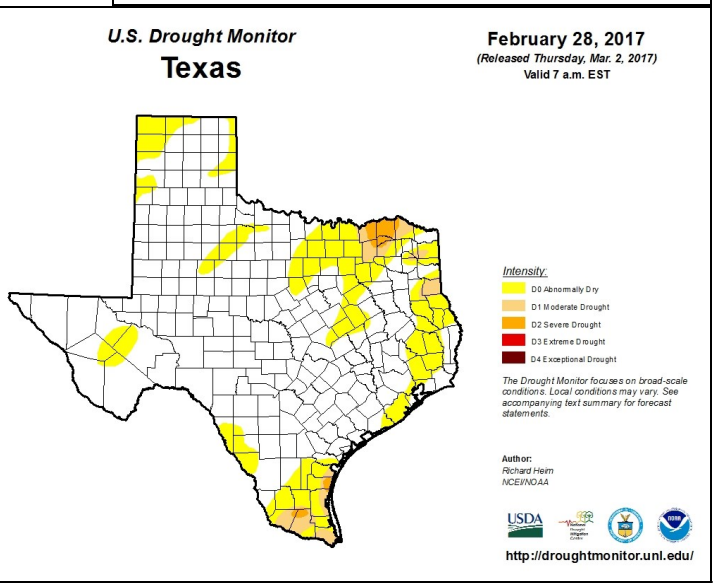


Figure 4: Areas of state classified into a drought category at the end of February. *Map provided by the National Drought Mitigation Center, University of Nebraska at Lincoln.*

Permian Basin region warm and quiet.

By Jim DeBerry
National Weather Service, Midland-Odessa

West Texas and Southeast New Mexico saw a warm winter, with few frozen precipitation events.

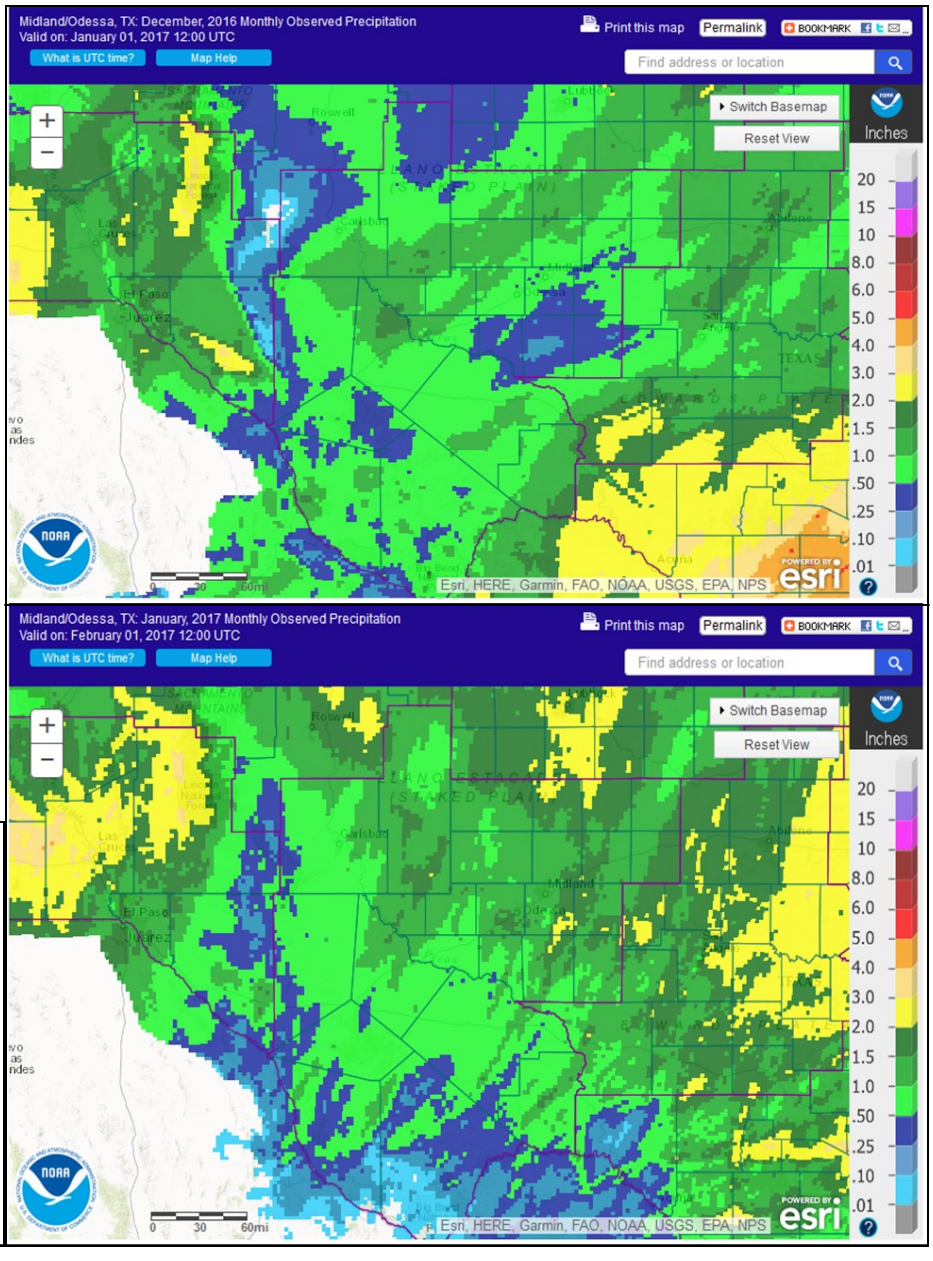
December was rather uneventful, hydrologically, with near-normal rainfall for the region. Monthly radar rainfall estimates ranged from under 0.25" in northwest Eddy County to 1.5-2" in the Trans Pecos region of West Texas. Highest observed rainfall was in the 1.5-2" range, as well. Average reported rainfall was around 0.75". No flooding events were reported.

One notable meteorological event occurred on December 17th, however. Strong westerly winds preceded an upper level storm system, with downslope warming resulting in afternoon temperatures in the record-breaking 80s for much of the area. Just to the north, these winds held an Arctic cold front at bay most of the day. At around 3 PM CST, the front plowed through Midland, Texas, plunging temperatures from 80F to 45F in 15 minutes. By midnight the mercury read 18F, setting a new diurnal (daily) temperature spread record of 62 degrees! January was uneventful as well, with below-normal rainfall in the south, and above-normal in the north. Monthly radar rainfall estimates ranged from under 0.25" along parts of the Rio Grande to up to 2-3" in the Permian Basin.

Highest observed rainfall was in the 2-3" range, as well. Average reported rainfall was around 1". The Rio Grande saw some rises, but mostly from rainfall on the Mexico side of the river.

No flooding occurred in February, which was scant on rainfall. Highest observed rainfall was in the 1.5-2.5" range, and average reported rainfall was under 0.50".

Despite this, West Texas and Southeast New Mexico are completely out of drought. A small section of the Texas Trans Pecos was abnormally dry. Reservoir levels across the region averaged 67.0% of conservation capacity as of March 1st:



Top: Radar estimated rainfall totals for December 2016.

Right: Radar estimated rainfall totals for January 2017. In both months, most areas received between 0.50 to 1.50 inches with the heaviest rains falling east and southeast of the Permian Basin region.

Brazos Valley Region Winter Precipitation Summary

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

While temperatures throughout the region were unusually warm, precipitation was not all that unusual. Rainfall totals across the region ranged from near normal to above normal.

There were 42 active CoCoRaHS observers during the period. Of those, 8 submitted observations on all 90 days (congratulations!), 5 missed only a day, and 10 missed two to ten days. Many of those made up for the gaps with multi-day precipitation totals (thank you!). Of the remaining 19, it seems that 11 submitted reports on most or all rainy days, so their seasonal rainfall totals are probably reliable. This makes a total of 34 active CoCoRaHS observers with apparently reliable data. Most were concentrated in just three counties.

As the graph of total rainfall shows, most of the rain fell in early December, mid-January, and mid-February, with drier spells in between. Walker County managed to be wettest overall. Among the highlights from the observations:

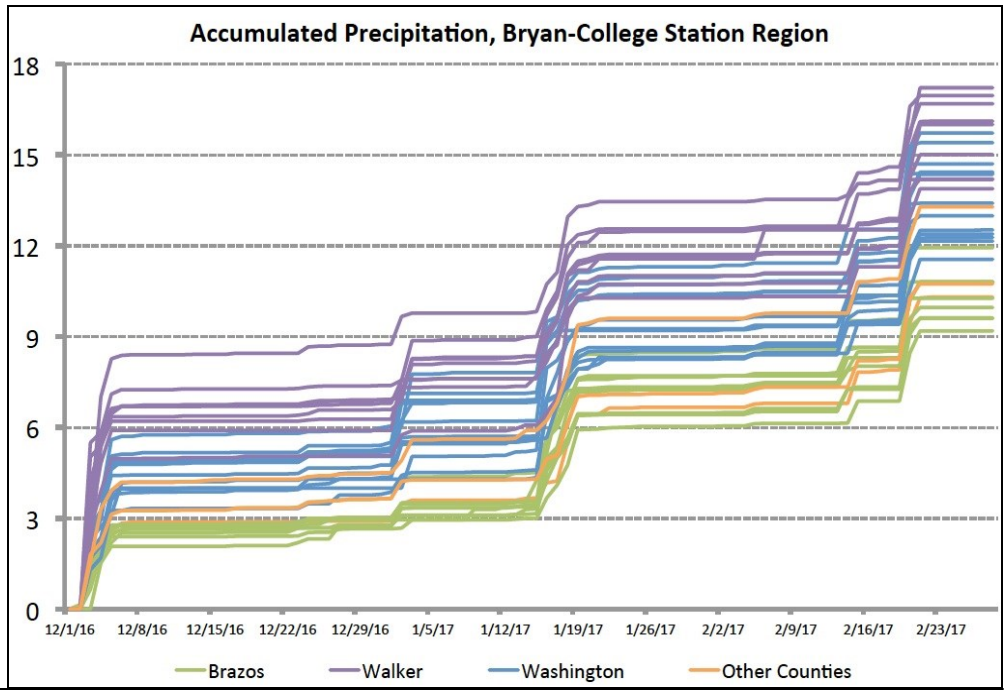
Wettest day: 5.50", December 3 (Walker County)

Wettest seasonal total: 17.22" (Walker County)

Longest spell of days with measurable rain: 13 (Brazos County)

Longest spell of days without measurable rain: 27 (Walker County)

The combination of wet weather and warm temperatures have given wildflowers an early start to the season. Bluebonnets were blooming in College Station by the first week of March, almost two weeks ahead of schedule.



Tornadoes hit Ark-La-Tex Region

National Weather Service
WFO Shreveport, Louisiana

A very strong storm system brought severe weather and a tornado outbreak to the Four State Region during the afternoon and evening of January 21, 2017. Several reports of large hail, some up to two inches in diameter, were received from Northwest Louisiana and Southern Arkansas. Several reports, pictures, and videos of tornadoes were also received by the NWS office in Shreveport. Survey teams from the NWS confirmed a total 12 tornadoes occurred.

Damage to homes from EF-2 tornado northeast of Smithland, Texas on January 21st, 2017

Photos: National Weather Service

January Ice Storm glazes Texas Panhandle

By Angie Margrave
National Weather Service-Amarillo

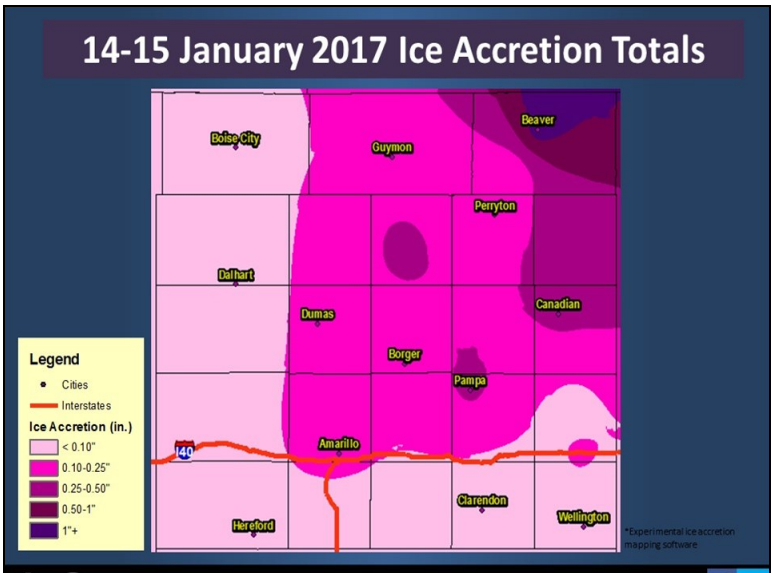
A strong closed upper low pressure system worked its way eastward, from the southern coast of California towards the Boot Heel of New Mexico, bringing with it a punch of winter weather for the 13th through the 16th of January. Dry air held off precipitation from making it to the ground most of the day Friday. The low pressure system moved just south of the Panhandles Saturday and Sunday. This put the region in a favorable position for precipitation. As moisture and instability increased Saturday and Sunday, thunderstorms developed across much of the central and eastern Panhandles. Much of the precipitation fell as freezing rain especially from Amarillo north and eastward. In Amarillo the rain froze mostly on elevated surfaces, like trees, while areas to the northeast of Amarillo saw more glazing on the roads.

On Sunday the 15th, the air temperature warmed to near freezing so water had a hard time freezing on contact, especially in Amarillo. While Amarillo only saw slight accumulations on trees other areas to the north east saw enough ice accumulation on elevated surfaces to start wreaking havoc on tree limbs and power lines.

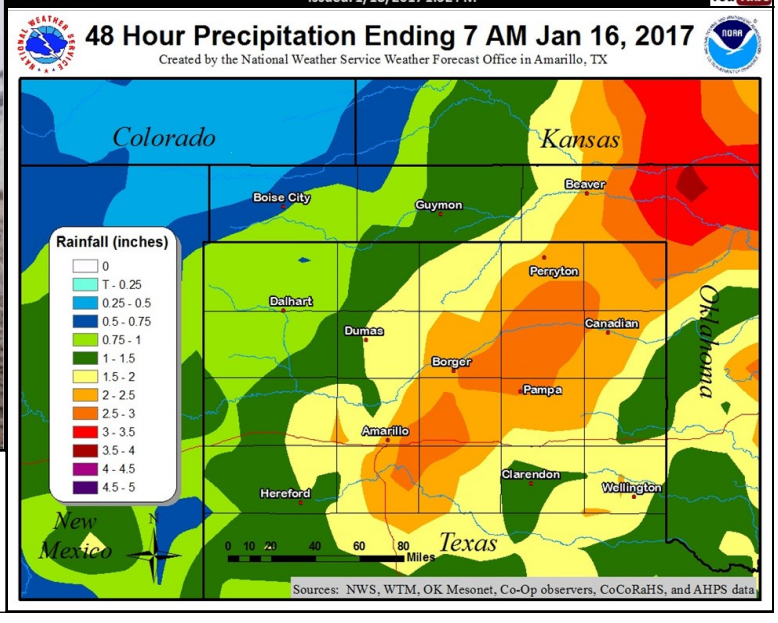
Areas to the west and northwest of Amarillo saw more sleet and snow than freezing rain. Early estimates show damages may exceed $50 million in the Texas and Oklahoma Oklahoma Panhandles combined. Amarillo did see power outages across the city, including the NWS office. Power outages in the northeast Texas and Oklahoma Panhandles lasted anywhere from several days to weeks.

As the low moved away from the Panhandles, areas west and north of Amarillo saw snow developing early on Sunday on the backside of the system.

Areas to the east and northeast of Amarillo didn't see snow develop until late Sunday evening into Monday morning the 16th. By late Monday morning the system had moved well east of the area and took the remainder of the moisture with it thus ending the precipitation event.



Ice hanging on powerlines in Northeast Texas Panhandle – Image by Emergency Management



All quiet on the Northwestern front

By Charles Kuster
CIMMS/NSSL

The Wichita Falls area experienced a relatively quiet winter with no severe weather reports, no winter storms, and no major drought development. Dry days (i.e., no CoCoRaHS stations reporting over 0.05") outnumbered wet days by almost eight to one (79 vs. 11 respectively), but we still ended up with near average precipitation for the winter season thanks to four notable rainfall events. The first such event occurred on December 2–3, 2016 when most CoCoRaHS stations reported between 0.9" and 1.5" of rain over the two-day period. The area then saw 41 straight days with no CoCoRaHS stations reporting rainfall over 0.05" before another two-day rainfall event occurred on January 14–15, 2017. Many locations saw 1–2" during this January event. February 2017 ended up being the region's wettest month as two widespread rainfall events occurred on February 13–14 and February 19. Many locations in Archer and southeast Wichita County saw over 3" of rain in February, while locations farther west typically saw 1-2" of rain (Fig. 1).

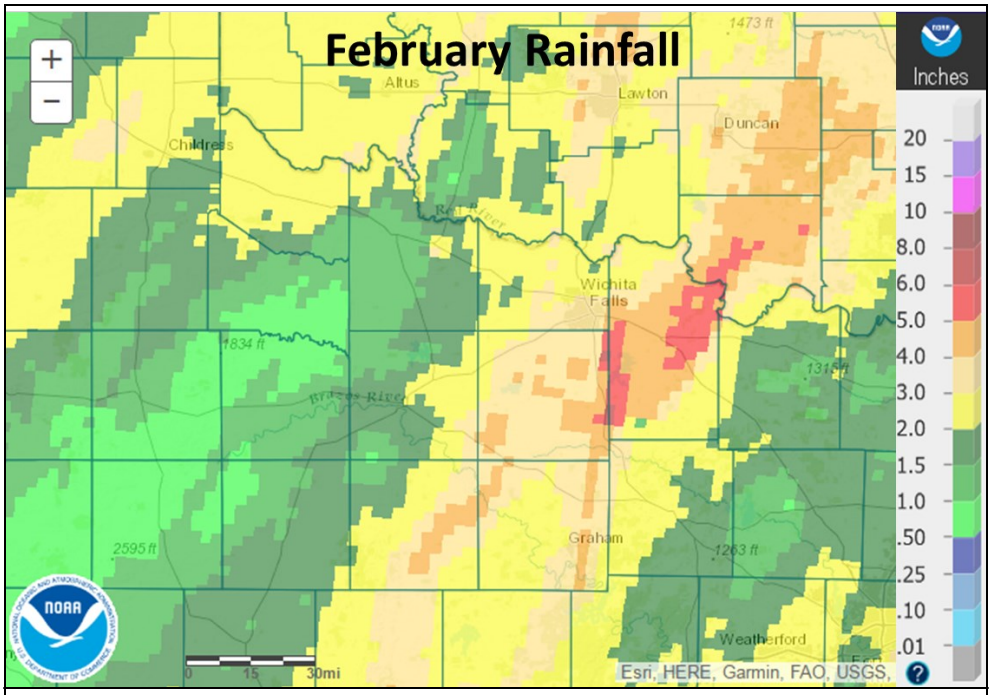


Figure 1 (above). Total rainfall during the month of February 2017.

The biggest weather story of the winter in our area was above normal—and at times record breaking—temperatures (Fig. 2). The most notable event occurred on February 11, 2017 when the high temperature reached 94 degrees F in Wichita Falls. This temperature set a new record high for the month of February in Wichita Falls, breaking the previous record of 93 degrees F that was set in 1996.

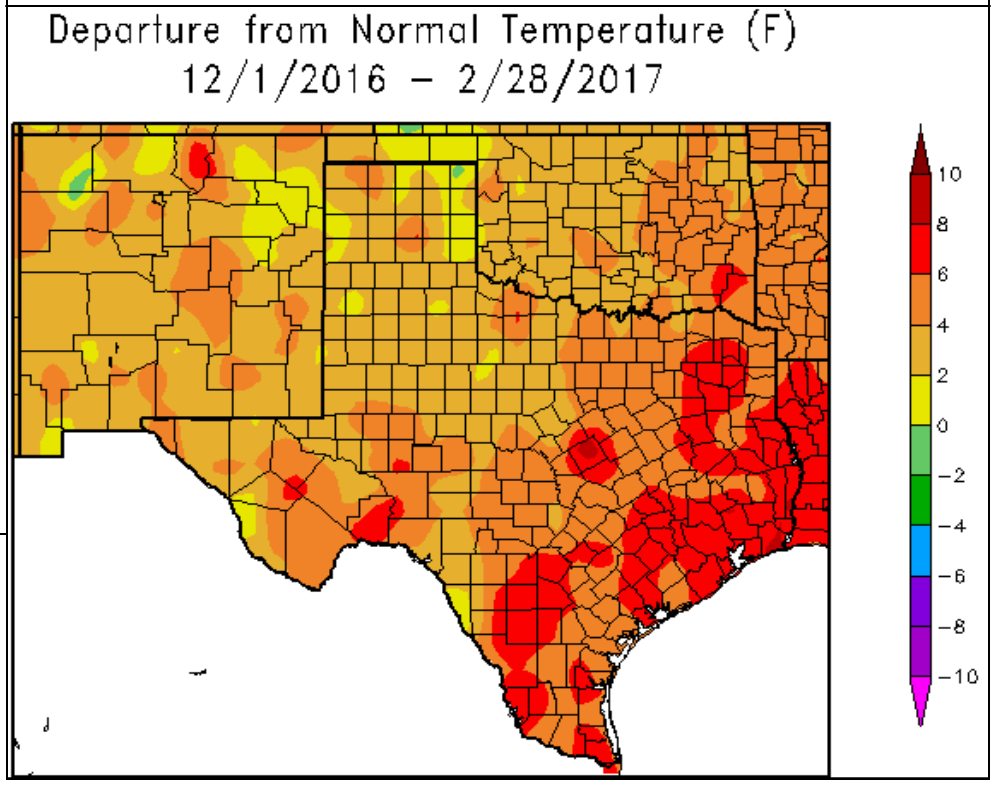


Figure 2 (right): Departure from normal temperatures for December 2016 through February 2017. Warm colors indicate above normal temperatures.

Houston-Galveston Winter Climate Summary

December 2016

The first month of the winter season had rainfall average above normal in the northern and northwestern parts of the region. Coastal areas had rainfall much above normal with totals in the 10" to 14" range with most occurring early in the month. The vast majority of the region saw rainfall near normal to slightly below normal. Galveston had a record rainfall of 7.68" of rain on December 3rd. Temperatures averaged above normal too much above normal region wide. The only below freezing weather occurred on the 18th and 19th after a very strong cold front moved through the region on the evening of the 17th with a very sharp drop in temperature of 40 degrees in about 3 hours. This was the only cold spell of the month with 80 degree days returning back to the region very quickly. Galveston set a monthly high temperature record on December 13th with 81 degrees several days before the cold spell.

January 2017

The two big stories of the month of January were the warm average temperatures, the very cold outbreak early in the month, and the heavy rainfall in the central parts of the region mid-month. A very strong cold front moved through the region on the 5th bringing low temperature reading ranging from 18-25 degrees on the mornings of the 6th – 8th. As quick of a change as the cold air-mass brought to the region it warmed back into the 70's on the 9th and temperatures never dropped below the upper 30s for the rest of the month over most of the region. On the morning of the 18th a band of training heavy thunderstorms along a slow moving cold front dumped between 4-7 inches in a line from northern Wharton County across central Fort Bend County and into south central Harris County. SE Harris County received almost no rainfall from this area of storms and only about 1.50" fell on the northwest side of this line. There were about 21 days in the month with daytime highs above 70 degrees and three of those days were above 80 degrees.

February 2017

The month of February ended up about 10 degrees warmer than normal region wide. It was the warmest month of February on record at all the first order climate sites in the Houston area. The month saw 21 record high maximum temperature records occur. There was also 1 record high minimum temperature record. Daytime highs topped out at 86 to 89 degrees on the 7th and the 8th. Along with warm temperatures rainfall was rather sparse over most of the region. The only parts of the region to have above normal rainfall were the northwest and western parts of the region. The vast part of the region had below normal rainfall. With the combination of warm temperatures and low rainfall amounts over the eastern and southern areas D-0 drought conditions developed in those areas. The southwest counties in the region had a small tornado outbreak on the morning of the 14th with 8 confirmed tornadoes in the following counties: Fort Bend (5), Wharton (1), Matagorda (1), and Brazoria (1).

Winter 2016-2017 CoCoRaHS Houston/Galveston Region Rainfall

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

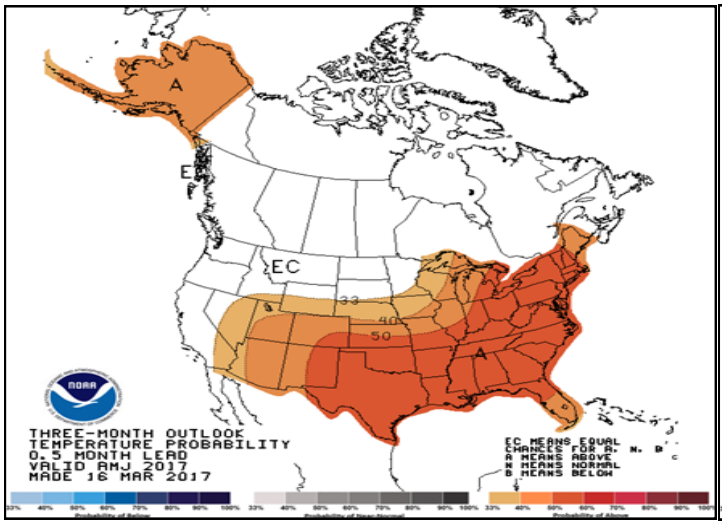
County	December			January			Ferbruary		Winter Total
	AVG.	MAX.		AVG.	MAX.		AVG.	MAX.	3-Month Rain Total
Austin	5.49	6.01		5.64	6.71		3.67	4.45	14.80
Brazoria	6.51	7.32		1.94	3.93		3.61	4.44	12.06
Chambers	N/A	5.49		N/A	4.68		N/A	1.54	N/A
Colorado	4.42	4.84		4.71	7.22		4.35	4.52	13.48
Fort Bend	3.37	4.88		7.79	9.06		2.79	3.15	13.95
Galveston	10.69	17.70		2.89	4.58		3.10	5.63	16.68
Harris	4.73	8.39		6.73	12.13		2.59	3.42	14.05
Jackson	N/A	3.53		N/A	3.41		N/A	3.85	N/A
Liberty	3.14	3.74		6.44	6.82		2.03	2.67	11.61
Matagorda	N/A	4.85		N/A	1.55		N/A	2.10	N/A
Montgomery	5.21	5.98		5.77	6.42		2.93	3.85	13.91
Polk	5.22	6.16		5.02	6.13		2.65	3.53	12.89
San Jacinto	5.76	5.86		5.44	5.76		2.97	3.89	14.17
Waller	N/A	5.89		N/A	7.64		N/A	3.49	N/A
Wharton	4.48	4.91		5.21	8.73		3.39	3.79	13.08
Region Totals	5.37	17.70		5.23	12.13		2.97	5.63	13.57

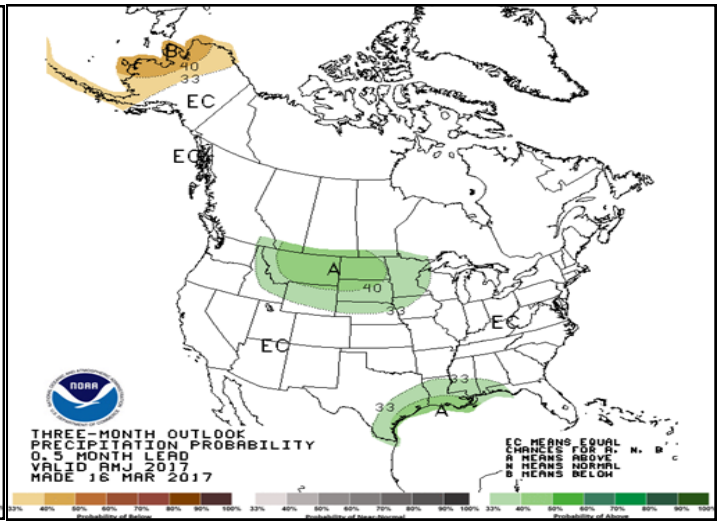
Spring 2017 Outlook

The April-May-June (AMJ) 2017 Temperature Outlook favors above-normal temperatures for much of the U.S. for the contiguous U.S., above-normal seasonal mean temperatures are most likely for an area stretching eastward from the southwest to much of the central and eastern U.S. with the greatest odds indicated for the south-central plains and eastern U.S. above-normal temperatures are also favored for much of Alaska\

The AMJ 2017 Precipitation Outlook indicates enhanced probabilities of above-median precipitation for areas of the northern Rockies, northern plains and western areas of the Gulf coast. In Alaska, below-median seasonal precipitation amounts are favored for western Alaska.`

Oceanic and atmospheric observations across Equatorial Pacific as a whole indicate that ENSO-neutral conditions are now in place. Dynamic computer models process these various weather pattern trends such as upper level winds, sea surface temperatures and many other atmospheric and oceanic phenomenon in making a forecast. As for as Texas is concerned temperatures will be much above normal over most of the state while rainfall will be normal except for coastal areas which will be above normal. Storm systems bringing severe weather may be a little more active this spring across Texas than the last 6 years.





CoCoRaHS *WxTalk* Webinar Series

Listen and ask the experts a question at:

www.cocorahs.org

Thursday, May 11, 2017 - 12:00PM CDT

The American Meteorological Society -- Who are we, what do we do?

Keith Seitter, Director
American Meteorological Society
Boston, MA

Thursday, July 13, 2017 - 12:00PM CDT

Mesoscale convective systems: Bringing both beneficial rains and hazardous weather to the central and eastern US

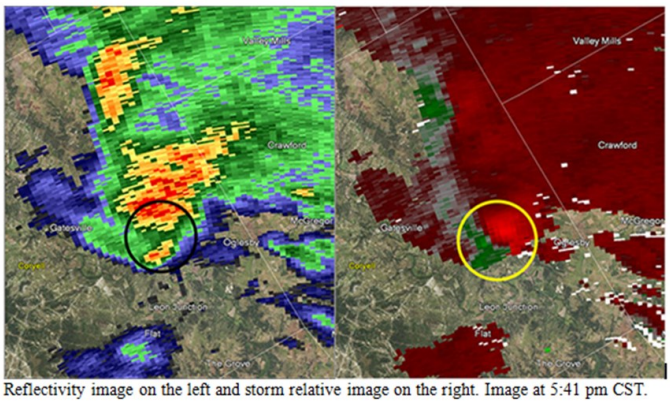
Russ Schumacher
Dept of Atmospheric Science
Colorado State Univ.
Fort Collins, CO

Texas 2017 Tornado Season Starts Early

The 2017 Texas tornado season started early this year with two wintertime outbreaks. The first outbreak occurred in the month of January with tornadoes in North Texas and parts of North Central Texas on the days of January 15-16, 2017. The second outbreak occurred in the month February southwest of Houston on the morning February 14, 2017.

The January outbreak began on January 15th with a total 6 tornadoes in the following counties: Coryell, Bosque, Hill, Johnson, Tarrant, Dallas, and Limestone. This is the first occurrence of January tornadoes in Bosque, Coryell, Hill, Johnson, Limestone, and Tarrant counties since 1950. The last time there were January tornadoes within North and North Central Texas was in 2010 on January 20th. The six tornadoes were the most since January 1996 in North Texas when 9 tornadoes occurred. Following are radar images and storm information.

Coryell City, Coryell
Mosheim, Bosque County



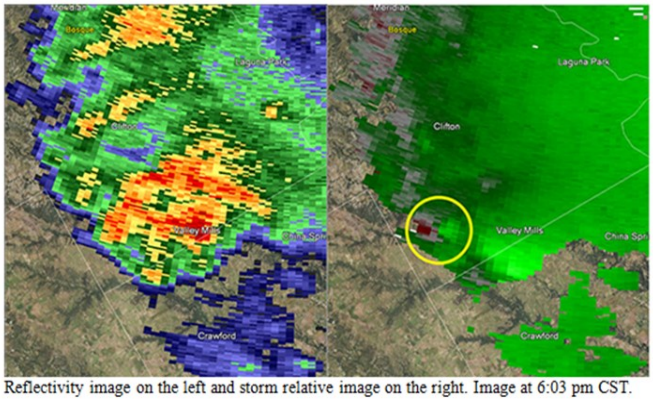
Reflectivity image on the left and storm relative image on the right. Image at 5:41 pm CST.

Confirmed tornado: EF-2 (115-120 mph)

Radar images from the Central Texas NWS radar at 5:41 pm CST. The radar is located beyond the bottom of the images.

This tornado damaged a few houses in the Coryell City area along CR 273 and CR 262. The heaviest damage was near CR 273, where two houses lost most of their roofs. Several barns, storage sheds, and farm machinery was damaged as well. The debris field extended to the north and northwest, where several power poles were broken. The tornado continued over ranch land in Coryell County before dissipating near Mosheim in Bosque County.

Clifton, Bosque County



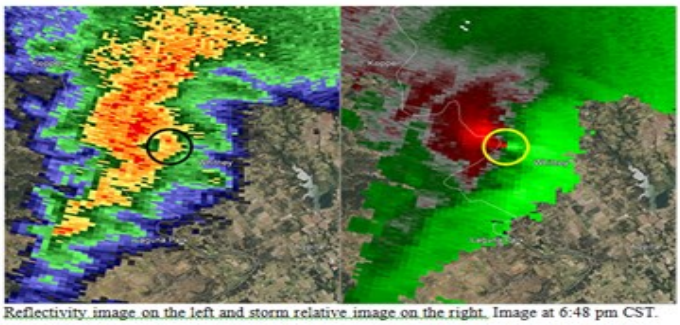
Reflectivity image on the left and storm relative image on the right. Image at 6:03 pm CST.

Confirmed tornado: EF-1 (90-95 mph)

Radar images from the NWS radar in Fort worth at 6:03 pm CST. The radar is located at the top of the image. In the reflectivity image the surface circulation was not well defined but in the SRM image the two opposing wind flows were evident.

The tornado began on the south side of Clifton, just off of 23rd Street, where several trees were uprooted and several homes suffered roof damage. This tornado produced a narrow path of damage to the north side of town, either roof damage from the tornado or from tree or other debris hitting the houses.

Lake Whitney, Bosque/Hill County

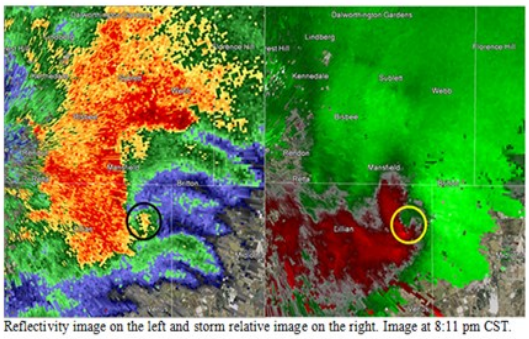

Reflectivity image on the left and storm relative image on the right. Image at 6:48 pm CST.

Confirmed tornado: EF-1 (90-95 mph)

Radar images from the NWS radar in Fort Worth at 6:48 pm CST. The radar is located at the top of the image. In the reflectivity image the tornado is on the leading edge of the parent thunderstorm. The SRM image clearly indicated rotation.

The tornado started on the far eastern side of Bosque County, near Laguna Park. The tornado then crossed over Lake Whitney before damaging several homes on the east side of the lake in far western Hill County. The heaviest damage was concentrated in Hill County, along both sides of FM 1713 near CR 1236. Numerous homes were damaged by the tornado, as were a church and a marina. Most homes in this area suffered roof and shingle damage, with at least 10 homes suffering major damage.

Mansfield, Johnson/Tarrant County



Reflectivity image on the left and storm relative image on the right. Image at 8:11 pm CST.

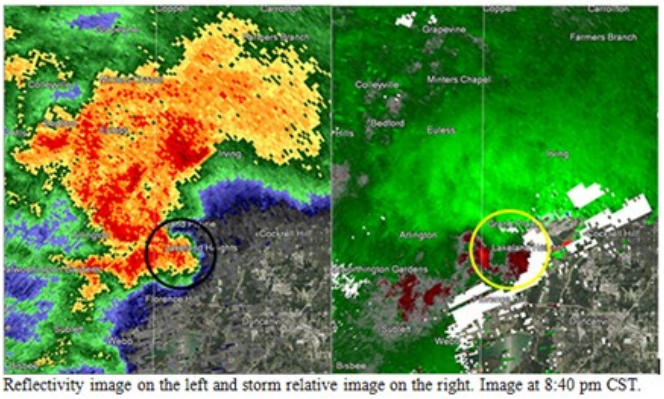
Confirmed tornado: EF-0 (70-75 mph)

Radar images from the NWS radar in Fort Worth at 8:11 pm CST (Johnson County) and at 8:20 pm CST (Tarrant County). The radar is located near the left edge of the images.

A weak tornado occurred in the far northeastern corner of Johnson County, beginning just west of Lone Star Road and Main Street in far southern Mansfield. The tornado damaged metal buildings on the south side of Lone Star Road as well as one house. The storm then moved northeast across Highway 287, damaging one barn just over the county line off of Mitchell Road.

Texas 2017 Tornado Season Starts Early — continued

Grand Prairie, Tarrant/Dallas County



Reflectivity image on the left and storm relative image on the right. Image at 8:40 pm CST.

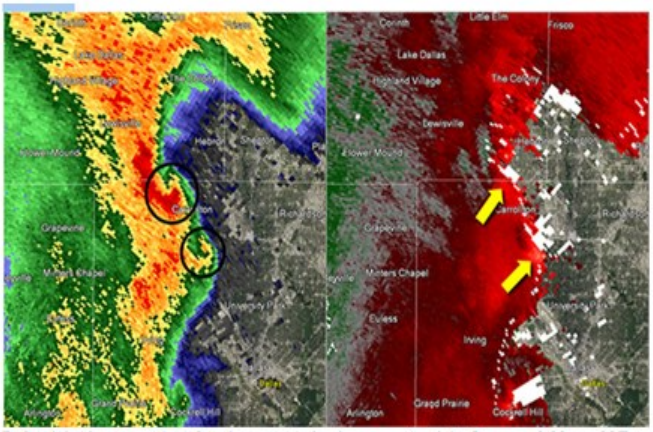
Confirmed tornado: EF-0 (80-85 mph)

Radar images from the NWS radar in Fort Worth at 8:40 pm CST. The radar is located beyond the bottom left corner of the images.

Weather equipment at Grand Prairie Municipal Airport (Tarrant County) measured a wind gust of 63 mph. Based on wind damage surveyed at the airport, the peak winds were estimated at 80 mph.

Storm spotters and airport observers reported a tornado near the airport. Damage to homes east of the airport (in Dallas County) was indicative of EF-0 tornado damage, estimated at 65 to 85 mph.

North Dallas, Dallas County



Reflectivity image on the left and storm relative image on the right. Image at 9:20 pm CST.

Confirmed tornado? No

Another example of why we have storm spotters. The reflectivity image indicated a "hook" shape, which can indicate a tornado. However, the SRM image did not indicate rotation.

At 9:20 pm CST, the two "hooks" were on the leading edge of straight line winds associated with the line of thunderstorms. Damage occurred along 635 in north Dallas.

CoCoRaHS Observers featured on "The Crowd & The Cloud" public TV World Channel

One of CoCoRaHS very own observers is featured on the public TV World Channel program "The Crowd & The Cloud". This program is about citizens who participate in many various fields of science worldwide to benefit society, the natural world, and life on the earth as a whole. The Skyler Flake family living on a cattle ranch in West Texas is featured in a 4:40 segment on the show about how they take CoCoRaHS precipitation measurements everyday as part of their daily routine while taking care of managing ranch operations. Below is a link to the segment which will run on the public TV World Channel on April 6th, 2017 at 8:00pm Central time.

https://www.youtube.com/watch?v=iDecXgH5nl4

"Cowboy CoCoRaHS": Giving & Getting Data, with Skyler Flake and family

"Cowboy CoCoRaHS": Giving & Getting Data, with Skyler Flake ...
The Crowd & The Cloud

9:00 p.m. Eastern
Apr 6, TVG

The Crowd & The Cloud: Even Big Data Starts Small
20,000 volunteers across the U.S. measure precipitation: when extreme weather hits, emergency managers turn their data into life-saving alerts. Armchair mappers worldwide update information used by first responders after the Nepal earthquake. A new project, EyesOnALZ, enlists the crowd to speed up research on Alzheimer's disease. DIY enthusiasts from Public Lab map the BP oil spill with kites, balloons and cameras and continue to watchdog pollution. The crowd, using mobile tech and the cloud contribute to science that saves lives.

Rio Grande Valley Winter Climate Summary

By National Weather Service
WFO Brownsville/Rio Grande Valley

The "heat beat" just didn't stop with the calendar in the traditional winter season. Following a record July to October hot period where "La Canícula" (the "dog days" high pressure ridge in northern Mexico) held on with clenched teeth, which led to a full calendar year (2016) of high temperature records – December through February just kept the records coming (above). Nearly all of the populated Rio Grande Valley ranked #1 or #2 for winter overall.

Unlike the forecast impacts (generally wetter and cooler) that failed to materialize in a big way from El Niño prior to the winter of 2015/16, when there was only a 4 percent probability for below average rainfall and a 24 percent probability for above average temperature – and the opposite occurred – the high confidence for a warmer and drier than average winter of 2016/17 was spot on, with the 50+ percent probability of above average temperatures easily verifying with the records. Also previewed was the possibility of an early to midseason freeze, largely based on the combination of a weak La Niña with a period where surface high pressure systems with arctic origins could blast all the way into Mexico. That period, mainly from late December through early January, produced three notable 'northers – two in December and the third between January 7 and 9, 2017, which bottomed out temperatures and brought the first Valley-wide freeze in nearly six years. Unlike some winters, when 'northers can hang on for three to six days, each of the four "big" fronts impacts were fleeting, with above average temperatures surging forth after just three days of below to much below average temperatures. For example, following the pre-Christmas chill of December 18-20, there were eight straight days (December 22-29) with temperatures more than 10°F above average! An identical situation occurred after the freezes of January 7 and 8; from the 10th through 17th, temperatures also were more than 10°F above average.

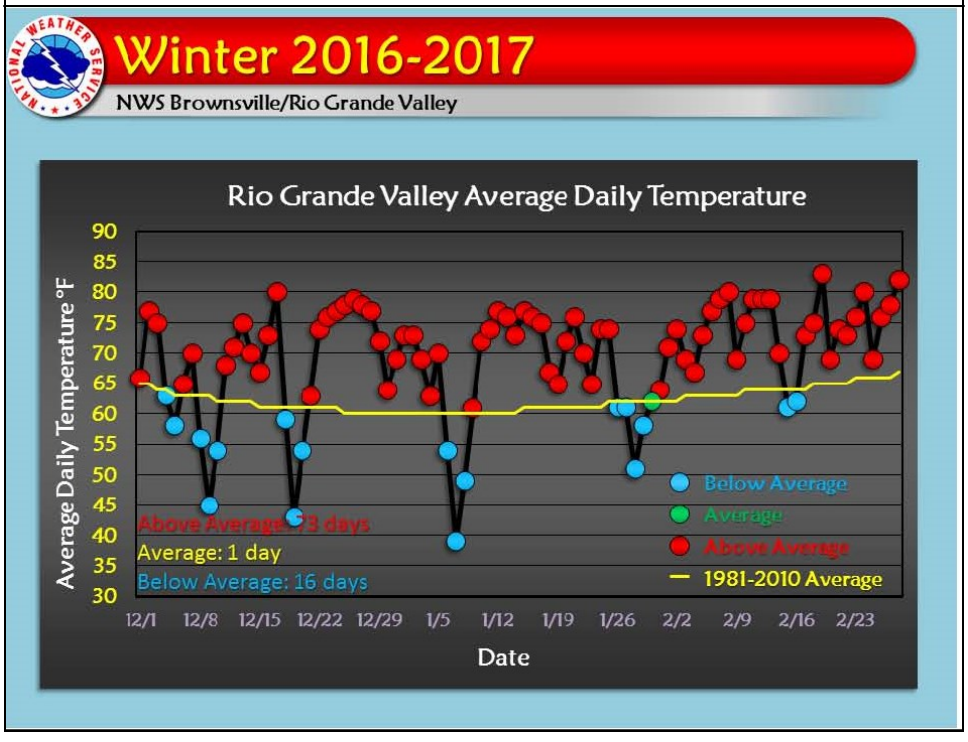
A final 'norther, just before the end of January, finished off winter (weather) for the Rio Grande Valley. February was truly unprecedented, as temperatures ranged from 9 to 11° above the 1981-2010 means and set records at nearly every location. February's tables are shown, but some additional statistics of interest include: For Brownsville, Harlingen, and McAllen, the new monthly records equivalent to Secretariat "pulling away" from the rest of the field in his quest for the 1973 Triple Crown: Brownsville's 2.9°F difference between #1 and #2 (1962) was more than 2 degrees more than the difference between #2 and #10! (1.7°F) McAllen's 3.9°F difference between #1 and #2 was equal to the 3.9 degree spread #2 and #10. Harlingen's 2.1°F difference between #1 and #2 was 0.5 degrees more than the difference between #2 and #10 (1.6°F). The monthly averages were most similar to those in April, which explained why trees and flowers looked like April by the last week of the month. Did you know that:

Record to Near Record Winter Heat!

December 2016 to February 2017

Location	2017 Value (Rank)	Current or Prior Record (Year)
McAllen/Miller (since 1961)	70.2 (1)	66.5 (1970/71) Diff: +3.7
Harlingen (since 1912)	68.3 (1)	67.9 (1949/50) Diff: +0.4
Falcon Dam (since 1962)	66.2 (1)	64.3 (1999/2000) Diff: +1.9
Port Mansfield (since 1958)	65.7 (1)	65.3 (1999/2000) Diff: +0.4
Brownsville (since 1878)	68.9 (2)	69.7 (1889/90) Diff: -0.8
McAllen/Coop (since 1942)	67.5(2)	68.6 (1949/50) Diff: -1.1
Rio Grande City (since 1897)	65.0 (4)	67.4 (1949/50) Diff: -2.4
Mission/La Joya (since 1922*)	65.0 (9)	67.3 (1949/50) Diff: -2.3

Above: **Winter temperatures for the Rio Grande Valley.**
Below: **Average daily temperatures. Note the number of above average days was more than four times that of below average days, which accounted for 81% percent of the days**



CONTINUED FROM PAGE 12—McAllen/Miller's February 2017 average would have ranked #4…in March? Brownsville's average would have ranked #8… in March? Harlingen's average would have ranked #10…in March?

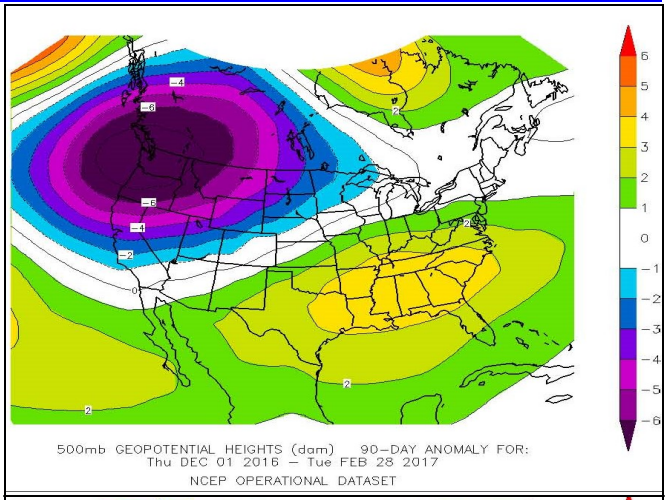
Was Your Air Conditioning Humming This Winter? Warm temperatures are one thing, but add humidity (and warm overnights) and the need for dehumidifying homes through air conditioning becomes routine. One measure of winter heating and cooling needs is the calculation of Heating Degree and Cooling Degree Days (HDD and CDD) based on an average of 65° F. Not surprisingly, CDD tracked nearly identically with the temperature rankings: Brownsville's 563 ranked just behind 1889/1890's 587 · Harlingen's 524 edged out 1949/50's 513 for #1 · McAllen/Miller's 664 obliterated 1970/71's 469 – a nearly 200 point increase on a prior record!!

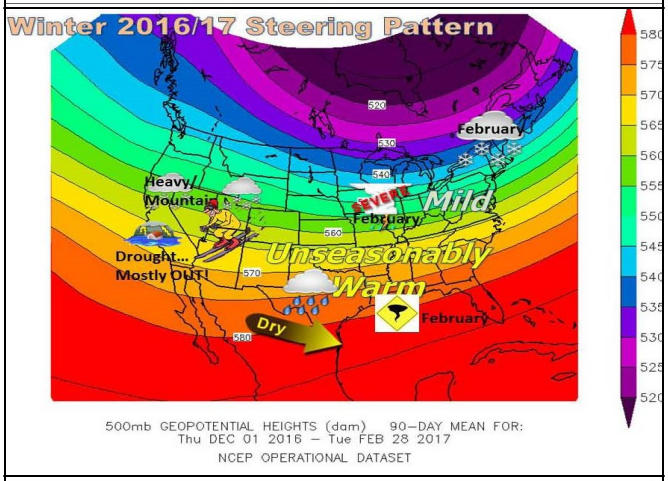
Finally, "reaching the beach" in February wasn't just for Winter Texans. For the last three weekends of the month, warm and humid conditions helped bump the surf temperature at the sea/land interface to the mid 70s, quite comfortable and unusual for so early in the season. Local crowds enhanced the weekend population to look more like April and May than the tail end of winter; even the typical "cool breeze" was lacking, as was the opportunity for sea fog with Gulf temperatures beyond shore in the mid-70s as well.

Pattern Matters Through La Canícula was replaced by more zonal atmospheric flow as fall turned to winter, the level of the 500 millibar surface (a general indicator of atmospheric heat or cold) was above average for all but the Pacific Northwest and parts of California in the Lower 48. This zonal flow, with the northern edge of the subtropical ridge never too far away from the Lower Rio Grande Valley, was a key reason for the impressive and persistent warmth from December 2016 through February 2017. The warmth was impressive, not just for Deep South Texas but the Deep SOUTH of the United States, where departure from normal temperatures were also 6 to 8°F – more than two standard deviations above average and most certainly in record territory. Nearly every location east of the Mississippi River had temperatures 4°F or more above the 1981-2010 average; only the northern Rockies and Pacific Northwest fell 4 to 8°F below average.

February alone saw many areas from Texas through the Upper Midwest and Ohio Valley with searing February temperatures up to 12°F above average; most locations south of the Ohio River experienced an early spring with accelerated blooms by10 to 20 days or more ahead of schedule.

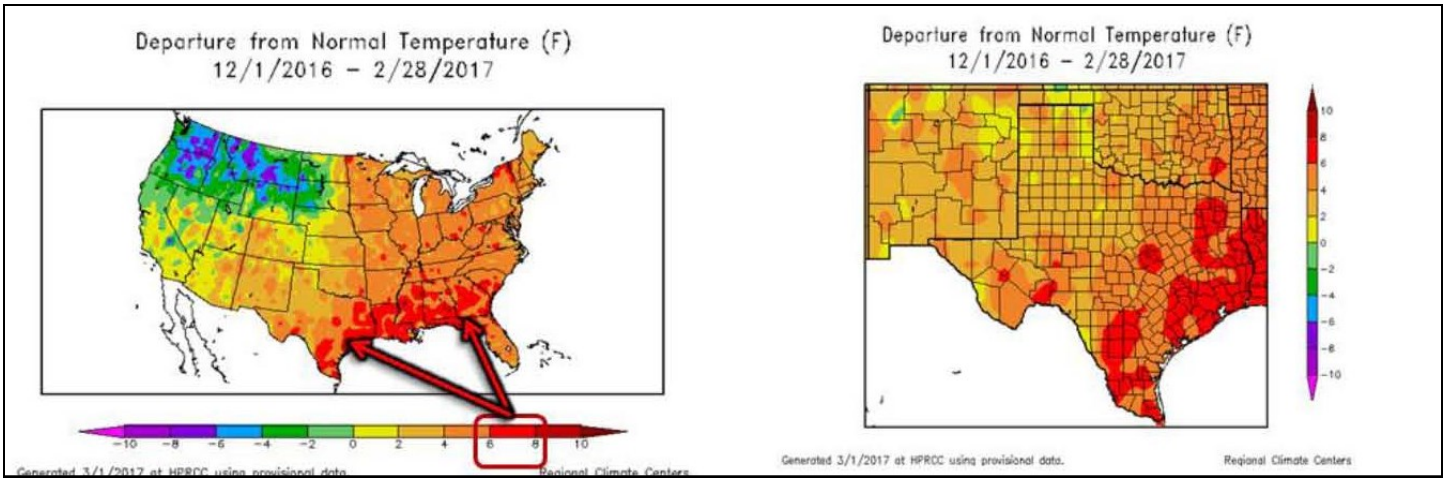
Rainfall was a mixed bag the nation and Texas mirrored that as well. While much of Texas received adequate rainfall to limit rebirth of drought conditions. the Rio Grande Valley often "waved" to rainy/stormy systems that helped out Houston, Austin and San Antonio but left the tip of Texas wanting (figure 6). Overall, rainfall was 25 to 75 percent of average for the Valley and nearby7 ranchlands from December 2016 through February 2017.





February Temperature Records Shattered!

Location	2017 Value (Rank)	Current or Prior Record (Year)
McAllen/Miller (since 1961)	75.3 (1)	71.4 (1962, 1999) Diff: +3.9
Harlingen (since 1912)	73.2 (1)	71.1 (1962) Diff: +2.1
Falcon Dam (since 1962)	71.8 (1)	70.7 (2000) Diff: +1.1
Port Mansfield (since 1958)	70.7 (1)	69.4 (2008) Diff: +1.3
Brownsville (since 1878)	73.3 (1)	70.4 (1962) Diff: +2.9
McAllen/Coop (since 1942)	73.1 (1)	72.0 (1978) Diff: +1.1
Rio Grande City (since 1897)	70.8 (3)	71.7 (1932) Diff: -0.9
Mission/La Joya (since 1922*)	70.5 (4)	71.3 (1962) Diff: -0.8



NWS Corpus Christi Regional Rainfall Summary

	December		January		February		
County	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Winter Total**
Aransas	1.62	1.73	0.43	0.49	2.28	2.53	4.34
Bee	2.98	3.00	1.47	1.81	1.08	1.08	5.53
Calhoun	3.84	5.31	0.46	1.13	3.25	3.66	7.55
Duval	3.61	4.35	0.11	0.21	0.45	0.80	4.17
Goliad	3.54	4.16	2.74	4.50	3.17	4.10	9.45
Jim Wells	3.97	4.47	0.39	0.57	0.92	1.07	5.28
Kleberg	2.92	3.14	0.22	0.34	0.97	1.11	4.11
LaSalle	3.25	3.98	0.45	1.25	1.61	2.18	5.31
Live Oak	3.74	4.71	1.33	2.35	1.47	1.91	6.54
McMullen	3.67	4.18	0.52	0.84	1.66	1.77	5.85
Nueces	1.60	4.26	0.23	0.31	1.53	2.26	3.36
Refugio	4.19	4.39	0.43	0.62	3.38	4.69	8.00
San Patricio	1.23	2.08	0.11	0.22	1.93	1.93	3.27
Victoria	3.38	4.82	3.29	4.81	3.74	4.72	10.41
Webb	2.00	3.04	0.05	0.31	1.32	2.86	3.37

NWS Brownsville Regional Rainfall Summary

	December		January		February		
County	**Avg**	**Max**	**Avg**	**Max**	**Avg**	**Max**	**Total**
Brooks	3.69	4.45	0.11	0.22	0.50	1.00	4.30
Cameron	1.29	6.56	0.54	2.12	1.31	2.37	3.14
Hidalgo	0.96	2.21	0.34	0.46	0.87	1.54	2.17
Jim Hogg	NR	NR	NR	NR	NR	NR	NR
Starr	1.21	1.44	0.57	0.38	0.25	0.30	2.03
Willacy	0.99	0.99	1.67	1.67	1.45	1.45	4.11

Texas CoCoRaHS Observer

The official newsletter of Texas CoCoRaHS

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