TEXAS CoCoRaHS OBSERVER

Summer 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.

Expanded coverage of Hurricane Harvey throughout this newsletter

Inside this issue:

Hurricane Harvey sets new rain records

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

Was there weather this summer in Texas before Hurricane Harvey? It's hard to remember anymore.

Harvey didn't set the record for greatest total rainfall production in Texas by a single storm. It ranks third on that list, behind storms in late December 1991 and late October 2015. It also didn't set the record for greatest single-day rainfall total. That record is still held by Alvin, Texas, with 42" during Tropical Storm Claudette in 1979. Otherwise, it seems that Harvey is king.

Among CoCoRaHS observers, the highest storm total observation was 49.31", which is a partial estimate because the rain gauge overflowed when about a foot and a half of water fell during one 24-hour period. This total exceeds the single-storm contiguous United States record for a single tropical storm of 48", which of course was also recorded in Texas (from Tropical Storm Amelia in 1978). A few other gauges in southeast Texas recorded higher values. Those gauge totals are still being validated, but it does seem that a CoCoRaHS observation will not be the new record. Too bad we didn't have a volunteer in the right (or wrong) place!

`For flood purposes, what matters is not rainfall at a single location but

CONTINUED ON PAGE 2————>

Downtown Houston just flooded all around." writes Christian Tycksen (@ctycksen) on Instagram (KHOU.COM)

Houston's Southwest Freeway (Interstate 69) at McGowen St. underwater due to Hurricane Harvey's heavy rainfall.

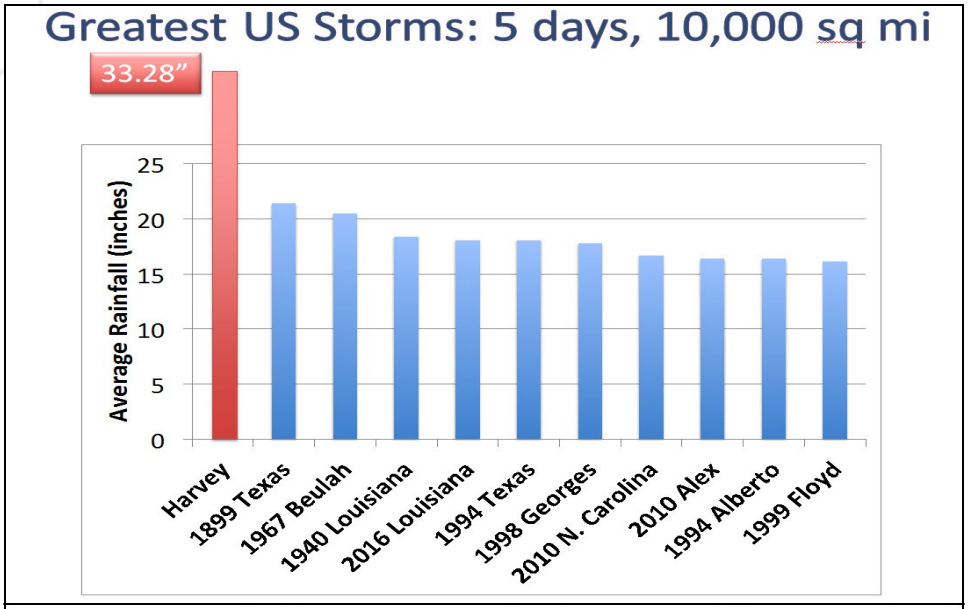
Hurricane Harvey sets new rain records

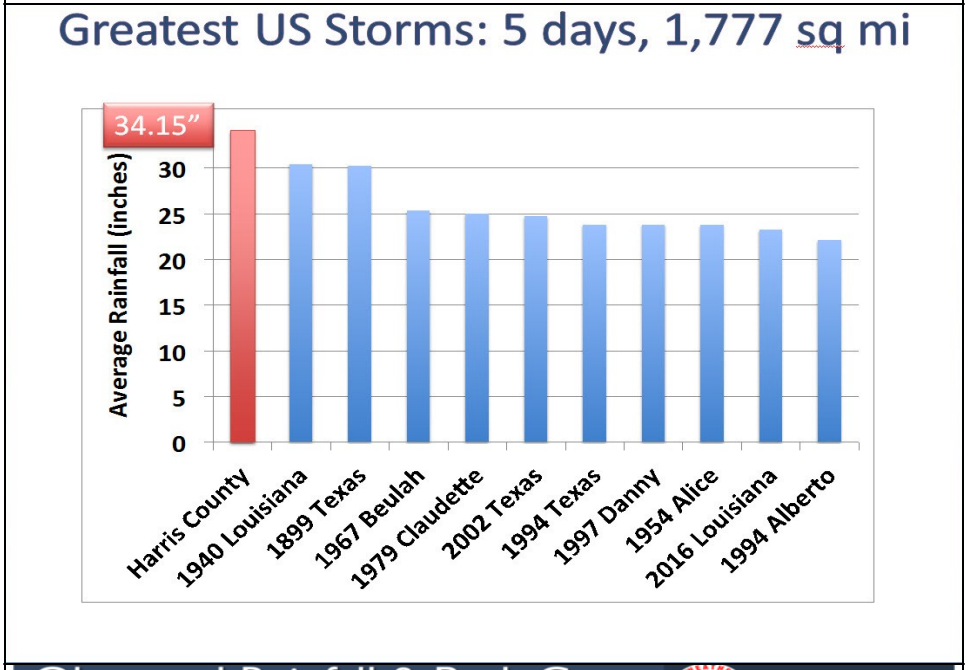
FROM PAGE 1—>rainfall over a given area during a given period of time. At this early stage in the analysis, it appears that Harvey broke all known United States records for rainfall accumulation over a broad area for three or more days. In many cases, the records were not merely broken, they were crumpled, shattered, dropped on the floor, swept into a pile, scooped up, and tossed into the trash can.

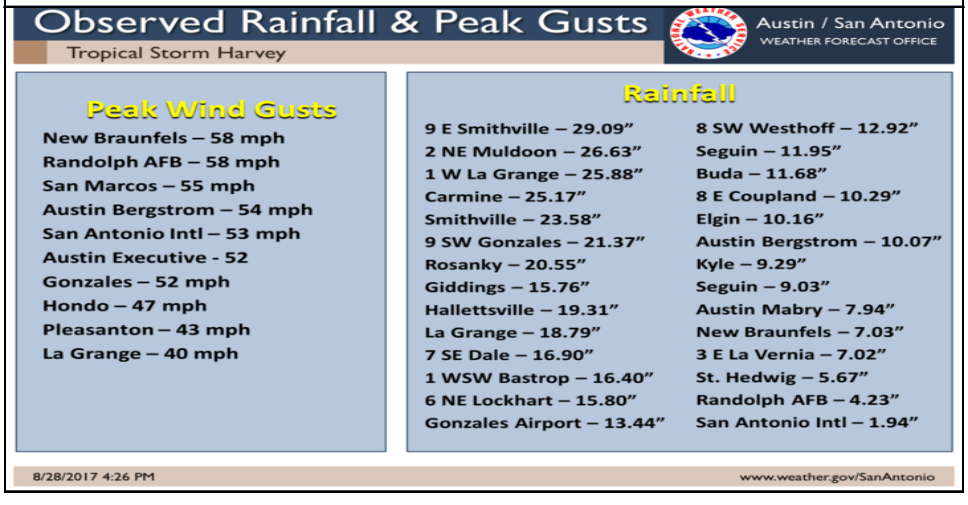
The first figure (at right) shows the United States record average rainfall accumulation over 10,000 square miles over a 5-day period. Previously, the 20" mark had barely been broken twice. Harvey produced well over 30", exceeding the previous record by over 50%. As you can see, records go back quite a long ways, though eight of the eleven events listed occurred during the past 25 years.

The second figure compares the rainfall accumulation in Harvey over Harris County, Texas (home of Houston and some surrounding suburbs; size 1,777 square miles) with the greatest rainfall totals over similarly-sized areas ever observed in the United States. The message here is that if you took the wettest storm ever recorded in United States history over an area the size of Harris County, and moved and rearranged it so that the absolute wettest part of the storm was perfectly targeted onto Harris County, it still wouldn't have produced as much rain there as Harvey produced.

Outside my office I now have a stack of five CoCoRaHS rain gauges, because that's apparently what you need now if you want to measure a Texas rainstorm.







First major hurricane since 1970 strikes Coastal Bend

By National Weather Service
WFO Corpus Christi

Hurricane Harvey is the first Major Hurricane to strike South Texas since Celia in 1970...and first Hurricane to strike the Texas Coast since Ike in 2008...

Over the past several years, meteorologists in South Texas (and other areas) have stated "it's not a matter of if but when" a major hurricane would strike the Middle Texas Coast. The last hurricane to do so was Celia back on August 3rd, 1970. Well, the "when" happened on August 25th 2017, when Harvey made landfall along the Middle Texas Coast. Harvey exploded rapidly from a tropical depression to a major hurricane in less than 36 hours. After impacting the Yucatan Peninsula earlier in the month as a tropical storm, Harvey moved into the warm waters of the Gulf of Mexico late on Tuesday August 22nd. Below is a summary of Harvey's lifecycle.

The birth of Harvey occurred on Sunday August 13th, 2017 as a tropical wave emerged off the west coast of Africa, eventually merging with a broad area of low pressure near the Cabo Verde Islands. At first, it was thought the wave and the low pressure area would have a more west-northwest track, threatening the Lesser Antilles. However, this low stayed more on a westward course as it moved over the open Atlantic Ocean toward the Eastern Caribbean Sea. For a few days on its westward track, "Harvey" remained disorganized, and there was some uncertainty whether the low would become a tropical cyclone. However, by Thursday August 17th, the National Hurricane Center began issuing advisories and forecasts on Tropical Cyclone Nine Thursday morning, and Tropical Storm Harvey Thursday afternoon. Tropical Storm Warnings were issued that afternoon for Martinique, St. Lucia, Barbados, and St. Vincent and the Grenadines. Tropical Storm Harvey impacted the Windward Islands on Friday, August 18th, entering the Eastern Caribbean Sea as a minimal tropical storm, and eventually weakening to a tropical wave late Saturday evening. Although there was some potential for the remnants of Harvey to reorganize into a tropical cyclone, a tropical cyclone failed to form as the remnants of Harvey moved into the Yucatan Peninsula on Tuesday morning, August 22nd.

With very warm waters in the Bay of Campeche and the Western Gulf of Mexico, the National Hurricane Center (NHC) was fairly confident that the remnants of Harvey would reform into a tropical cyclone. At 10 AM CDT Wednesday August 23rd, Tropical Depression Harvey reformed. Initially, NHC believed Harvey would become either a strong tropical storm or a Category 1 hurricane before making landfall somewhere between Brownsville (early Friday morning) and Houston (early Saturday morning), with the most likely location near the Rockport area late Friday night . However, with wind shear in the Western Gulf of Mexico weakening, Tropical Storm Harvey was intensifying quickly. By Wednesday evening, Harvey was forecast to make landfall as a hurricane somewhere over the Texas Coast.

On Thursday August 24th, Harvey's impact on the Middle and Upper Texas Coast seemed almost certain and potentially devastating. Not only was Harvey forecast to become a hurricane by Thursday evening, but it was expected to strengthen and make landfall as a major hurricane (Category 3 or higher) on Friday (see forecast). Worse yet, once the storm moved inland, it was forecast to eventually stall and meander over South or Southeast Texas for days. Thus, Major hurricane Harvey was not only forecast to produce devastating winds, but extremely heavy and excessive rainfall, producing devastating and historic flooding over areas especially east of the center of circulation (still most likely just north of Copano Bay).

Harvey underwent rapid intensification and quickly became a Category 3 hurricane on Friday at 2 PM (120 mph sustained winds) and then a Category 4 hurricane (130 mph sustained winds) early Friday evening. As Harvey slowly approached the coast, the National Weather Service in Corpus Christi issued a rare Extreme Wind Warning. Extreme wind

CONTINUED PAGE 4———->

Hurricane Harvey caused significant damage to many structures in Rockport, as well as much of the Texas Coastal Bend.

Hurricane Harvey—Corpus Christi Region

FROM PAGE 3——>warnings are issued for landfalling major hurricanes with winds of 115 mph or higher. Harvey was forecast to have winds in the eyewall between 115 and 130 mph! Three extreme wind warnings were ultimately issued for Harvey. The eye of Major Hurricane Harvey first made landfall on San Jose Island and then near the Rockport and Fulton, Texas area at around 10 PM CDT.

Many observing stations in South Texas with equipment measuring wind speeds were disabled before they could record the highest wind speeds. Thus, some of the observed wind speeds tallied over South Texas may be underestimated, especially over areas near the coast and close to the eyewall of Harvey. Still, a peak wind gust of 132 mph was reported 2 miles ENE of Port Aransas (the highest observed wind gusts as of this writing). Copano Village reported a peak wind gust of 125 mph.

Although the eye of Harvey made landfall around 30 miles northeast of the city of Corpus Christi, strong and damaging wind gusts were experienced away from the center of circulation at the Corpus Christi International Airport and in the city as well as other locations. The Corpus Christi International Airport had a 63 mph gust before it went offline. The Victoria RAWS station had a peak gust of 83 mph. Much higher wind gusts did occur in the city of Corpus Christi, as the Doppler radar showed velocities of 70 mph or more, just a few hundred feet off the surface.

Rockport and Fulton were hardest by the storm as they took a direct hit from Harvey's eyewall. Many structures, residences, and business in and near the Rockport and Fulton area were damaged or destroyed, as roofs were blown off and walls collapsed. Electricity and water services were lost. The city's infrastructure was crippled. Significant structural damage also occurred in numerous other coastal town including Port Lavaca, Copano Village, Aransas Pass, Port Aransas and Ingleside. Tens of thousands of South Texas residents and businesses lost power for days, with the hardest hit areas likely losing power for several weeks. Although there was a significant number of trees, fences and power poles down or damaged in the Corpus Christi Metropolitan area, structural damage was much more isolated.

The storm surge from Harvey brought dramatically increased water and tide levels over the Texas Coast. The highest maximum storm tides were observed at the Aransas Wildlife Refuge, where the storm surge levels were more than 12 feet above ground level. Storm surge in Port Lavaca was also more than 10 feet and at least 6 feet in Port Aransas. Elsewhere across South Texas, storm tide levels were from near 3 to 6 feet above ground level at Seadrift, Port O'Connor, Holiday Beach, Copano Bay, Port Aransas, and Bob Hall Pier. Besides wind and storm surge, hurricanes and tropical storms are notorious for producing torrential rainfall and flash flooding. Unfortunately, Harvey was unique. Instead of moving inland and farther away from the coast, Harvey stalled over South and Southeast Texas for days, producing catastrophic devastating and deadly flash and river flooding. Southeast Texas beared the brunt of the heavy rainfall, with some areas receiving more than 40 inches of rain in less than 48 hours! Cedar Bayou in Houston received a storm total of 51.88 inches of rainfall which is a new North American record. However, South Texas residents were not spared from this impact from Harvey, as heavy rainfall and flash flooding were observed over the eastern portions of the area. Several flash flood warnings were issued during CONTINUED PAGE 5 ——->

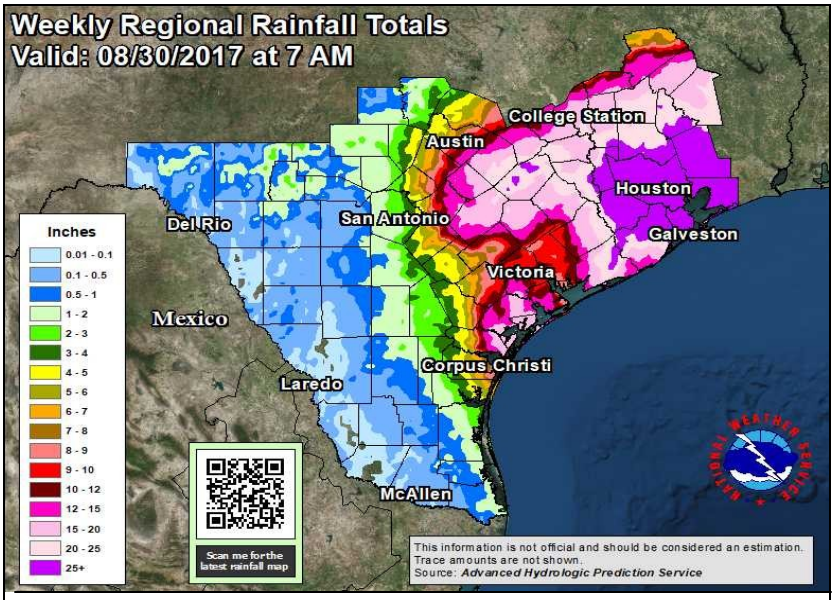
Damage from Hurricane Harvey from Aransas Pass and Rockport

Hurricane Harvey—Corpus Christi Region

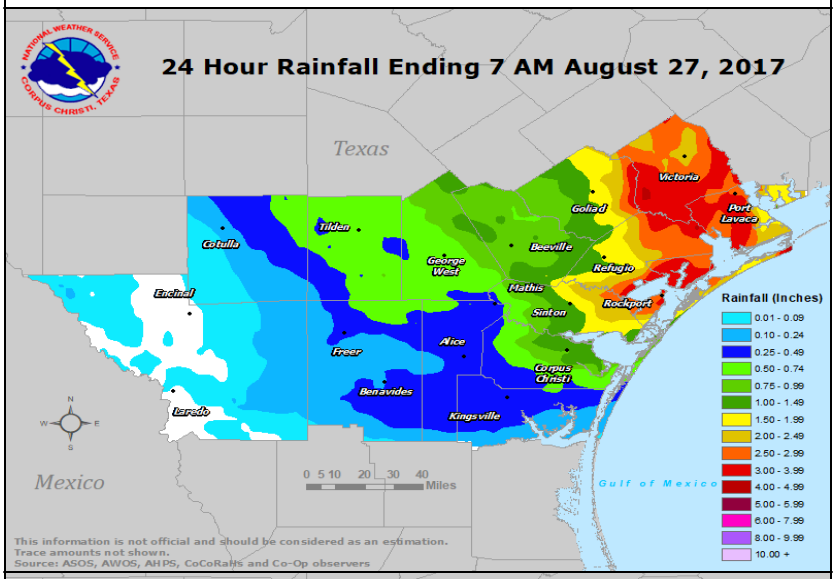
FROM PAGE 4—>during the evening and overnight hours of August 25th and 26th, as torrential tropical rains impacted the coastal counties of the Coastal Bend, as well as the Victoria Crossroads region. 24-hour rainfall amounts ending at 7 AM Saturday August 26th indicated that widespread 10 to 15 inch rainfall amounts (with isolated +15 inch amounts) had fallen over portions of San Patricio, Refugio, and Aransas Counties. Most of the eastern half of South Texas received 3 or more inches of rainfall, with much lower amounts farther west. As Harvey drifted farther north, the heavier rainfall shifted with it, with 24 hour rainfall amounts ending on Sunday August 27th of 3 or more inches over much of Victoria County and portions of Calhoun and Aransas Counties. The heavy rainfall shifted northeast into Southeast Texas on Monday. By then, 15 to 25 inch storm total (72-hour) rainfall amounts were observed over much of Aransas and Refugio Counties, as well as portions of San Patricio and Victoria Counties. Rainfall totals for Harvey decreased dramatically farther south and west, with portions of Webb County receiving no rainfall at all!

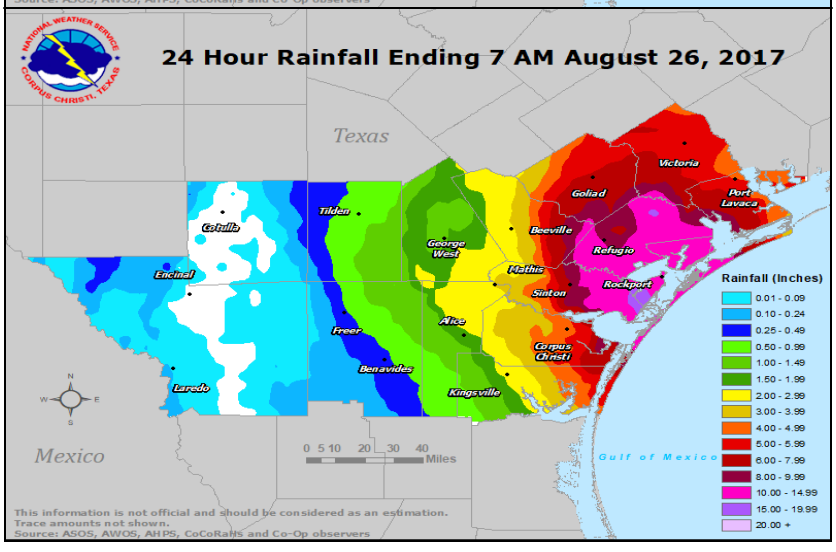
All of this excessive precipitation resulted in major river flooding over the Guadalupe River and the Garcitas and Coleto Creeks. Near major flooding was observed on the Copano Creek near Refugio, with moderate flooding on the Mission River (See the Hydrology Section for the pertinent hydrographs). Other rivers and creeks over the eastern half of South Texas saw rises, but most did not exceed flood stage. As of this writing, the Guadalupe River at Victoria is expected to crest around 31.4 feet, while Bloomington is expected to crest around 30 feet. If these verify, these will be the second highest crests at these two gauges since records have been kept, with the record stage at Victoria occurring on October 20th 1998 (34.04 feet), and 34.00 feet at Bloomington on October 21st 1998.

After causing deadly and damaging winds and floods to South Texas, and catastrophic, historical, devastating, and life-threatening flooding over Southeast Texas, Harvey finally made its final landfall near Cameron, Louisiana during the overnight hours on Wednesday August 30th. More heavy rainfall and flooding occurred over the Northern Gulf States on its final landfall. South Texas residents who experienced Harvey will long remember the storm and, unfortunately many other residents will take a long time to recover from this historic and unusual tropical system.



Rainfall maps from Hurricane Harvey.





Hurricane Harvey highlights Central Texas' Summer

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

South Central Texas had a variety of weather this summer, from a miserably hot and dry July yielding drought conditions followed by the impact of a major hurricane at the end of August. Although summer 2017 was the 11th wettest on record in Austin, San Antonio and Del Rio were a bit drier than normal, registering their 58th and 50th driest summers on record. All official climate sites experienced above normal temperatures this summer, with Austin registering its eighth warmest summer on record, whereas San Antonio and Del Rio registered their 17th and 27th warmest summers, respectively. This is currently the warmest year on record through August at both Austin Camp Mabry (average temperature of 74.6°F) and Austin Bergstrom (73.5°F) and the fifth warmest at San Antonio (74.0°F).

The first week of June featured multiple rounds of showers and thunderstorms that brought wetting rains to the region. A few of these thunderstorms produced severe weather, with strong wind gusts and a few reports of severe hail. High pressure built in over South Central Texas after this, causing temperatures to increase and rainfall to decrease. However, another low pressure system brought a few more days of rain across portions of the region during the last week of June. Temperatures were slightly above normal and precipitation was slightly below normal for most locations in June. Persistent high pressure continued in July, causing exceptionally warm temperatures and very little precipitation. Austin and San Antonio registered their third and sixth warmest July on record, respectively. Temperatures climbed to 107°F in Austin and 105°F in San Antonio on July 29-30th, the hottest temperatures for both locations since August 2013. Hot temperatures combined with drier than normal conditions also caused widespread short-term drought conditions across the region. Figure 1 shows that most of South Central Texas experienced abnormally dry (D0) or moderate drought (D1) conditions, with portions of Comal and Bastrop Counties entering a severe short-term drought (D2).

August was characterized by near normal temperatures and much above normal precipitation for most of the region excluding the Rio Grande Plains. August 2017 was the 13th wettest on record at San Antonio and the wettest on record at both Austin Camp Mabry (10.44 inches) and Austin Bergstrom (12.99 inches). In the late evening hours of August 6th and into the morning hours of August 7th, a mesoscale convective system moved from north to south across the region bringing anywhere from 2 to 6 inches of rain across the eastern Hill Country and I-35 corridor, with a bullseye of 7 inches falling in Burnet County (Fig. 2) .

San Antonio International received 3.31 inches of rain from this system, with portions of northwest San Antonio receiving as much as 5 inches of rain in a very short period of time. This caused flash flooding across the city, leading to a couple of swift water rescues. A few weeks of calm weather in mid-August followed before Hurricane Harvey made landfall near Rockport, Texas as a category 4 hurricane on the evening of Friday, August 25th.

Harvey was the first hurricane to strike Texas since Ike in 2008 and first major hurricane to strike Texas since

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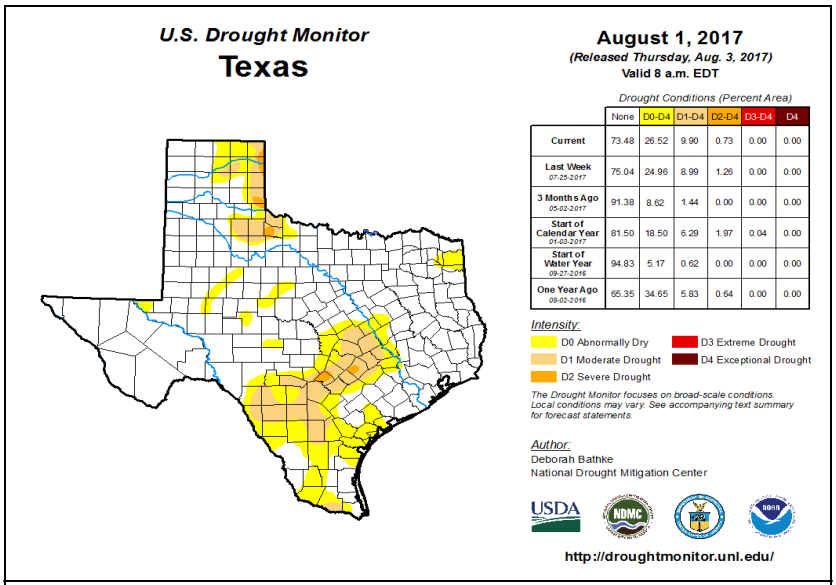
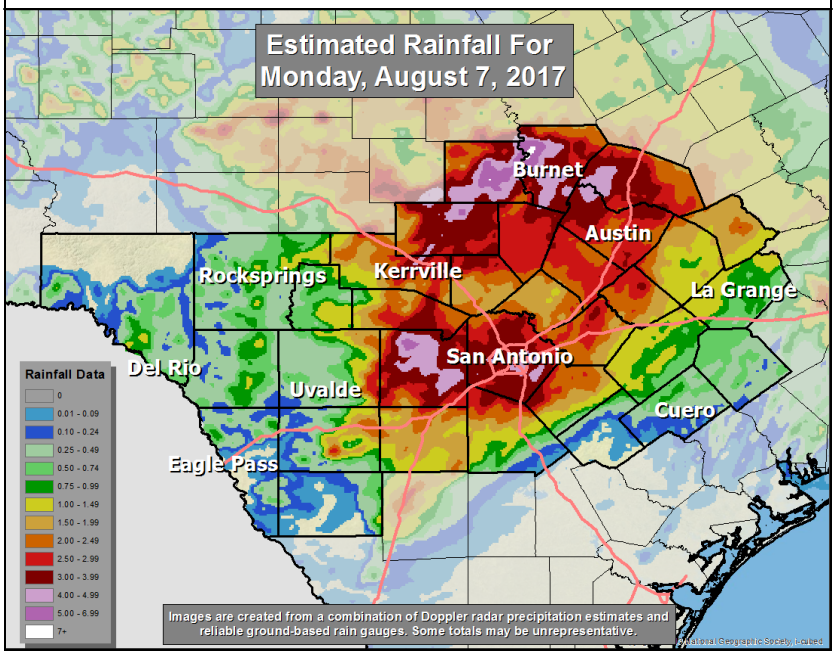


Above: Figure 1 **Below: Figure 2**

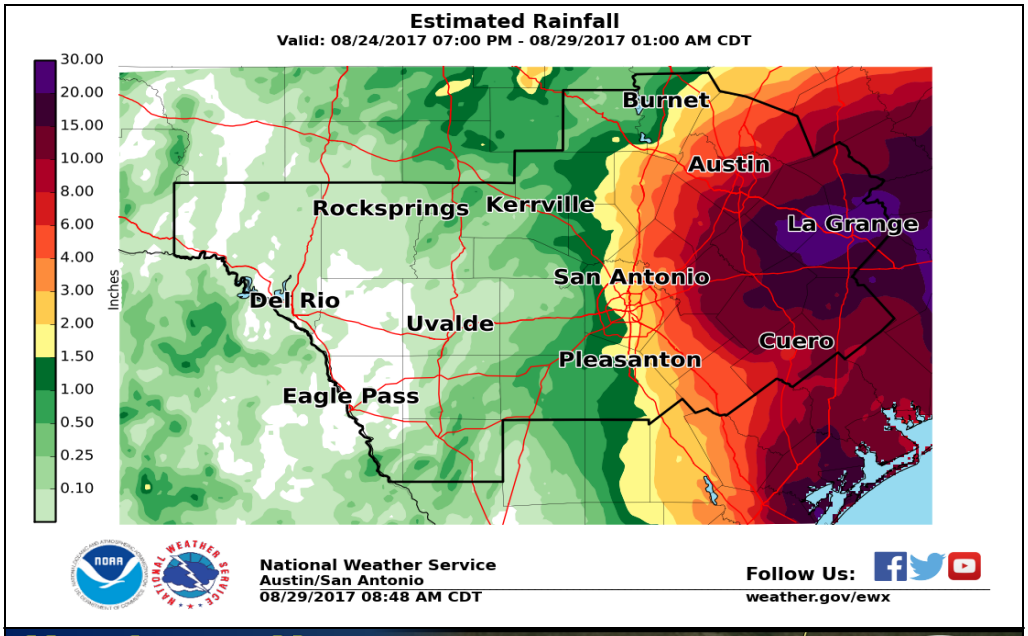


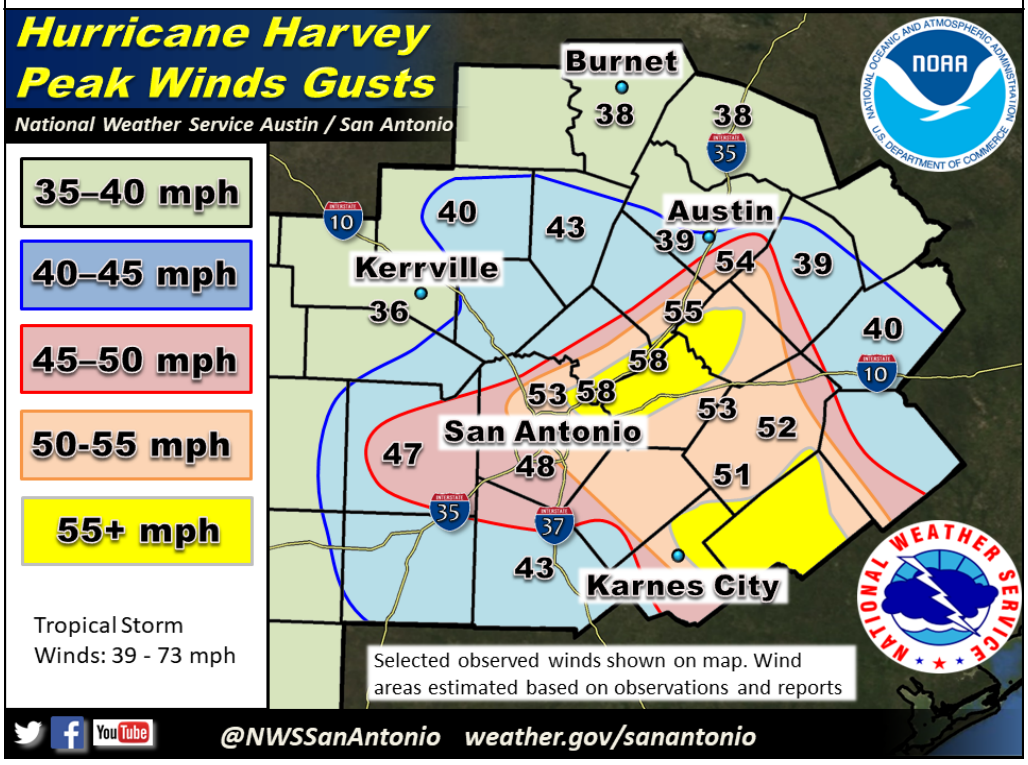
Hurricane Harvey highlights Central Texas' Summer

FROM PAGE 6——->>

Bret in 1999. Harvey's circulation gradually weakened and slowed as it moved north before stalling just north of Cuero in DeWitt County as a tropical storm on Saturday evening into Sunday morning. Harvey then slowly moved to the southeast and back over the Gulf of Mexico on Monday and Tuesday before making another landfall on Wednesday morning near Cameron, Louisiana. This slow-moving tropical cyclone brought catastrophic heavy rainfall and flooding to much of southeast Texas and southwest Louisiana, including a few reports in Jefferson County of 63.14 inches and 64.58 inches near Groves and Nederland.

Although South Central Texas did not have as much rainfall as southeast Texas, Hurricane Harvey still caused significant impacts to the region as moderate to heavy rain fell continuously east of Interstate 35 from Friday night through Monday evening. This caused massive amounts of rainfall (Fig. 3), with portions of Bastrop, Fayette, Lee, Lavaca and Gonzales counties getting over 20 inches of rain including a 29.19 inch report observed 10 miles northwest of La Grange in Fayette County. Major flooding occurred in portions of La Grange where the Colorado River crested at 54.18 feet, its third highest crest on record and the highest since 1913. The Guadalupe River at Cuero also experienced its second highest crest on record at 44.36 feet, causing major flooding in lower-lying areas near Cuero. The I-35 corridor including the cities of Austin and San Antonio avoided catastrophic flooding as they remained on the western edge of a tight rainfall gradient on Harvey's western side as drier air was entrained in from southwestern Texas and northern Mexico. San Antonio International only received 1.94 inches of rain from Harvey, whereas Austin Camp Mabry and Austin Bergstrom received 7.94 inches and 10.07 inches of rain, respectively. The rain fell over a long enough period of time to avoid any major flooding issues, with only Onion Creek at US 183 cresting in minor flood. Finally, low-end hurricane-force wind gusts likely occurred in DeWitt County, but this could not be confirmed due to a lack of observations. Wind gusts of 58 mph were recorded at New Braunfels Regional Airport and at Randolph Air Force Base in northeastern Bexar County (Fig. 4), with 53-55 mph wind gusts at San Marcos, Austin Bergstrom International Airport, and San Antonio International Airport .



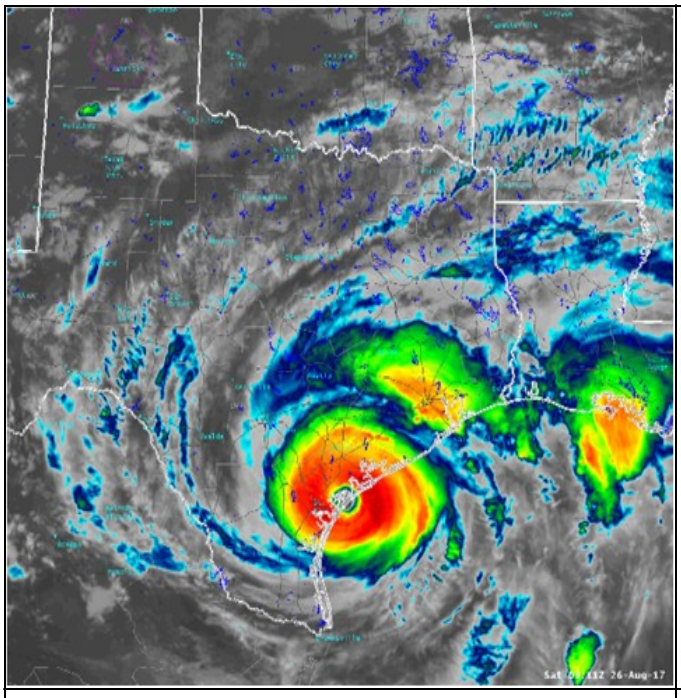


Hurricane Harvey—Houston/Galveston region impacts

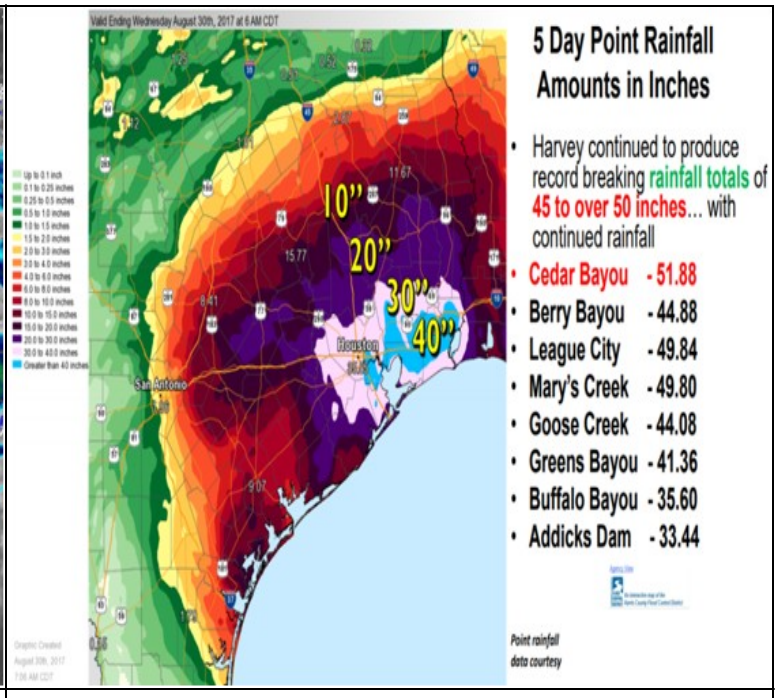
By Ron Havran
CoCoRaHS Houston/Galveston Regional Coordinator
Note: Data and information collected from local NOAA/National Weather Service offices

Hurricane Harvey is the first hurricane to hit the Texas coast since 2008 when Hurricane Ike came through the Houston area and the first major (category 3 or better) hurricane to hit Texas since Bret in 1999.

Hurricane Harvey started as a tropical wave off the African coast on Sunday, August 13th and tracked westward across the Atlantic and on August 17th become a tropical storm which moved into the Caribbean Sea where Harvey become disorganized. Harvey was then downgraded to a tropical wave which entered the Gulf of Mexico on the 22nd. On the morning of the 23rd, Harvey was upgraded again to tropical depression as the Bay of Campeche and the Western Gulf of Mexico had very warm waters. Over the next 48 hours Harvey would undergo a period of rapid intensification from a tropical depression to a category 4 hurricane. Harvey made landfall along the Texas coast near Port Aransas around 10:00 p.m. on August 25th as a cat 4 and brought devastating impacts. As Harvey moved inland, its forward motion slowed to near 5mph after landfall and then meandered just north of Victoria, TX by the 26th. Rain bands on the eastern side of the circulation of Harvey moved into southeast Texas on the morning of the 25th and continued through much of the night and into the 26th. A strong rainband developed over Fort Bend and Brazoria Counties during the evening hours of the 26th and spread into Harris County and slowed while training from south to north. This resulted in a rapid development of flash flooding between 10:00 p.m. and 1:00 a.m. as tremendous rainfall rates occurred across much of Harris County. The morning of the 27th saw additional rain bands continued to develop and produced additional excessive rainfall amounts. As the center of Harvey slowly moved east-southeast and back offshore heavy rainfall continued to spread through much of the 29th and the 30th exacerbating the ongoing widespread and devastating flooding. All of this rainfall caused catastrophic drainage issues and made rivers rise greatly. Only around 10 percent of the river forecast points in southeast Texas remained below flood stage due to the event, and approximately 46 percent of the river forecast points reached new record levels. Harvey maintained tropical storm intensity the entire time while inland over the Texas coastal bend and southeast Texas. After moving offshore, Harvey made a third landfall just west of Cameron, Louisiana on the morning of the 30th and brought more heavy rainfall to the Northern Gulf States.

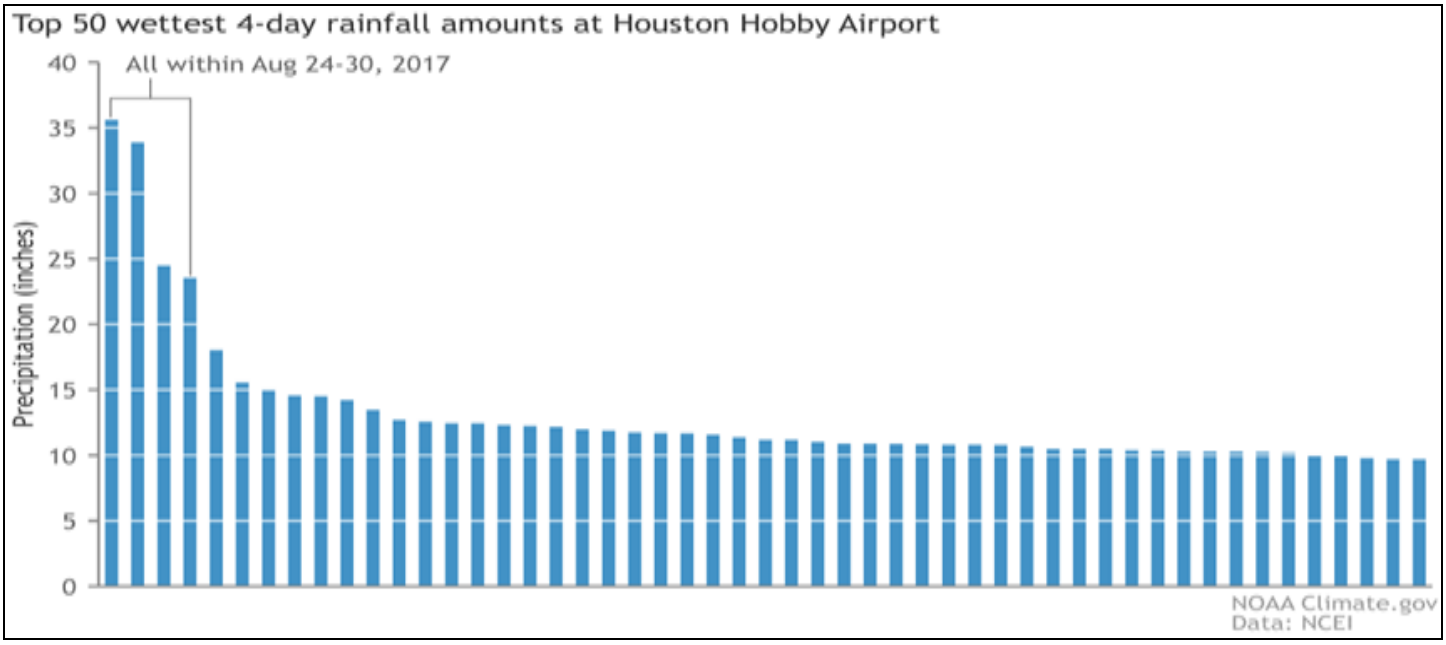


GOES 16 IR Satellite as Category 4 Hurricane Harvey Makes Landfall



5 Day Rainfall Total Based on Rivers & Bayous Courtesy of the West Gulf River Forecast Center

Hurricane Harvey—Houston/Galveston Region Impacts



WIND REPORTS - AIRPORTS

A. LOWEST SEA LEVEL PRESSURE/MAXIMUM SUSTAINED WINDS AND PEAK GUSTS

NOTE: ANEMOMETER HEIGHT IS 10 METERS AND WIND AVERAGING IS 2 MINUTES

AIRPORT LOCATION	PRES-mb	SUSTAINED	GUST
K11R-BRENHAM REGIONAL AIRPORT	1005.1	N@25mph	NE@37mph
KARM-WHARTON REGIONAL AIRPORT	1004.7	NE@24mph	NE@37mph
KBYY-BAY CITY MUNICIPAL AIRPORT	999.0	N@ 36mph	N@ 46mph
KCLL-COLLEGE STATION/EASTERWOOD FIELD	1006.4	NE@30mph	NE@43mph
KCXO-CONROE/MONTGOMERY CTY AIRPORT	1005.8	N@23mph	SE@35mph
KDKR- CROCKETT/HOUSTON COUNTY AIRPORT	1008.5	N@17mph	NE@25mph
KDWH - HOUSTON/D.W. HOOKS AIRPORT	1003.7	E@24mph	E@36mph
KEFD - HOUSTON/ELLINGTON FIELD	1003.3	N@31mph	N@41mph
KGLS - GALVESTON SCHOLES FIELD	1000.7	N@45mph	N@56mph
KHOU - HOUSTON HOBBY AIRPORT	1002.4	N@33mph	N@48mph
KIAH - HOUSTON/BUSH INT AIRPORT	1003.4	N@35mph	N@47mph
KLBX - ANGLETON/BRAZORIA CTY AIRPORT	1000.3	N@33mph	S@47mph
KLVJ - PEARLAND/CLOVER FIELD	1002.7	SE@33mph	SE@50mph
KPSX - PALACIOS MUNICIPAL AIRPORT	1000.0	SE@49mph	SE@70mph
KSGR - SUGARLAND REGIONAL AIRPORT	1001.7	NE@44mph	NE@58mph
KUTS - HUNTSVILLE MUNICIPAL AIRPORT	1006.8	N@20mph	NE@33mph
KAXH - HOUSTON SW AIRPORT	1002.0	E@30mph	E@43mph
KELA - EAGLE LAKE AIRPORT	1001.7	E@29mph	E@41mph
KTME - HOUSTON EXECUTIVE AIRPORT	1002.7	E@33mph	E@46mph
K6R3 - CLEVELAND MUNICIPAL AIRPORT	1004.1	N@20mph	SE@54mph

Hurricane Harvey —Houston/Galveston Region Impacts

Rivers

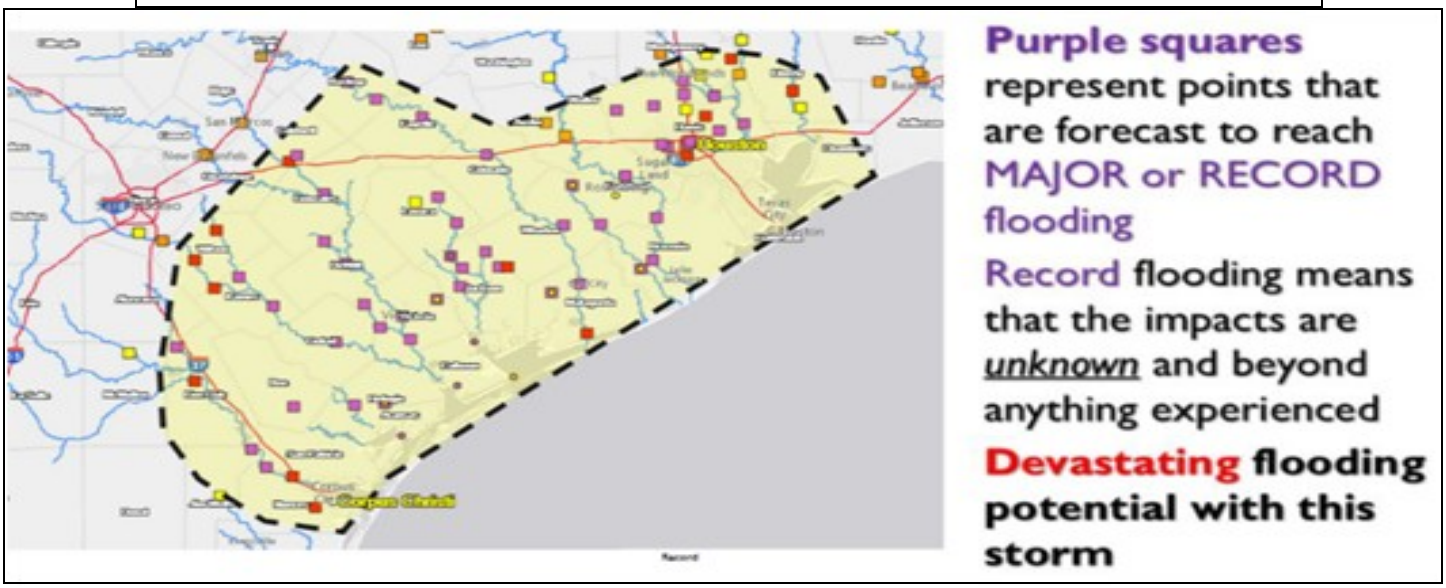
There are 67 River Forecast Points in Southeast Texas. Of these, 60 points (approximately 90%) reached flood stage. Approximately 69%, 46 out of the 67 points, reached major flood stage, and approximately 46%, 31 points out of the 67, set records.

Location	Preliminary Crest	Date
Menard Creek at Rye	35.97 ft	8/29
Trinity River at Liberty	32.74 ft	9/1
Trinity River at Moss Bluff	18.65 ft	9/1
Lake Creek at Sendera Ranch Road near the Woodlands	150.96 ft	8/28
West Fork San Jacinto River at Conroe	126.97 ft	8/29
San Jacinto River at Porter	94.87 ft	8/29
San Jacinto River at Humble	69.1+ ft	8/29
East Fork San Jacinto River at Cleveland	27.17 ft	8/28
East Fork San Jacinto River at New Caney	80.05+ ft	8/29
Peach Creek at Splendora	25.57 ft	8/28
Spring Creek at Tomball	166.35 ft	8/28
Willow Creek at Tomball	133.68 ft	8/28
Cypress Creek at Grant Road	128.04+ ft	8/28*
Cypress Creek at Westfield	97.1 ft	8/28
Greens Bayou at Ley Road	39.51+ ft	8/28
Bear Creek at Barker	119.56 ft	8/28
Buffalo Bayou at West Belt Drive	71.18+ ft	8/30*
Buffalo Bayou at Piney Point Village	63.89+ ft	8/27
Clear Creek at Mykawa Road	46.9 ft	8/29
Clear Creek at Friendswood/FM528	24.08 ft	8/29
Davidson Creek near Lyons	19.47 ft	8/28
Brazos River at San Felipe	129 ft	8/29
Brazos River at Richmond	55.19 ft	9/1
Brazos River at West Columbia	30.82 ft	9/3
San Bernard River at East Bernard	31.98+ ft	8/29
San Bernard River at Boling	43.66 ft	8/31*
San Bernard River at Sweeny	30.16 ft	9/2
Navidad River at Sublime	36.35 ft	8/28
Navidad River at Speaks	32.79 ft	8/28
Navidad River at Morales	35.83 ft	8/29
Navidad River at Strane Park	31.27 ft	8/29

+ Indicates the gauge was damaged before the crest (crest likely higher)

*Indicated date of crest TBD

Above: Preliminary Crest Table for Record Crests of River Forecast Points
Below: River & Bayou Measuring Points as of 8/27 at 5AM



Hurricane Harvey — Houston/Galveston Region Impacts

Storm Reports

The list below is preliminary and may not contain the entirety of the damage associated with Harvey. Additional storm reports may be added in the coming days and weeks.

TORNADOES

(DIST)CITY/TOWN	COUNTY	DATE/ TIME(UTC)	EF SCALE (IF KNOWN)
LAT LON (DEG DECIMAL)			
DESCRIPTION			
9 NE GALVESTON	GALVESTON	25/1923	EF0
29.22 -94.89			

PUBLIC REPORTS A FUNNEL CLOUD AND A METAL FENCE DAMAGED NEAR FERRY RD IN GALVESTON

1 WSW JONES CREEK	BRAZORIA	25/2025	EF0
0.00 0.00			

A VERY BRIEF EF-0 TORNADO TOUCHED DOWN NEAR COUNTY RD 301 AND HWY 36 WITH NUMEROUS TREES SNAPPED AND/OR DOWNED. ONE BARN WAS ALSO DAMAGED.

5 NE MATAGORDA	MATAGORDA	25/2030	EF0
0.00 0.00			

SHED AND FENCE DAMAGE REPORTED FROM A TORNADO IN SARGENT.

1 SSE BRAZORIA	BRAZORIA	25/2030	EF0
0.00 0.00			

A BRIEF TORNADO CROSSED HWY 36 WITH ONE DOWNED POWERLINE AND SEVERAL TREES SNAPPED AND/OR DOWNED.

9 NE GALVESTON	GALVESTON	25/2047	EF0
0.00 0.00			

TORNADO DAMAGED MCDONALDS SIGN AT SEAWALL BLVD AND BROADWAY AVE. ALSO DAMAGE TO AWNINGS AT APARTMENT COMPLEX.

17 SW JONES CREEK	MATAGORDA	25/2114	EF1
0.00 0.00			

A BRIEF YET STRONG TORNADO MOVED ONSHORE ALONG THE COAST IN SARGENT CAUSING SIGNIFICANT DAMAGE TO ONE HOME AS WELL AS OVERTURNING A MOTOR HOME. NUMEROUS TREES WERE SNAPPED AND/OR DOWNED ALONG THE PATH AS WELL AS MINOR ROOF DAMAGE TO SEVERAL HOMES AND BUSINESSES.

5 SW ANGLETON	BRAZORIA	25/2309	EF0
0.00 0.00			

A HIGH-END EF-0 TORNADO TOUCHED DOWN JUST EAST OF WEST COLUMBIA DAMAGING NUMEROUS TREES... ROOFS... AND OUT-BUILDINGS IN A NEIGHBORHOOD OFF OF HIGHWAY 35 AND RIVER ROAD. A BARN AND SEVERAL OUTBUILDINGS WERE ALSO DE-STROYED ON THE EAST SIDE OF THE BRAZOS RIVER.

1 SSW DANBURY	BRAZORIA	26/0244	EF0
0.00 0.00			

THE TORNADO BEGAN IN DANBURY AND DAMAGED A BARN ALONG WITH SEVERAL TREES OFF OF COUNTY ROAD 207. THE TORNADO THEN CROSSED HIGHWAY 35 AND MOVED OVER AN OPEN FIELD. THE TORNADO THEN SNAPPED AND/OR DOWNED SEVERAL TREES ALONG COUNTY RD 45 BEFORE LIFTING AT THE CROCODILE ENCOUNTER ON COUNTY RD 48.

2 W LIVERPOOL	BRAZORIA	26/0428	EF0
29.29 -95.31			

AN EF-0 TORNADO TOOK DOWN 4 POWER POLES ON HIGHWAY 35 ALONG WITH SEVERAL TREES NEAR THE GULF COAST SPEEDWAY. THE TORNADO THEN TRAVELED ACROSS GENERALLY OPEN FIELD BEFORE DAMAGING SOME BARNS AND OUTBUILDINGS AS WELL AS TREES ON COUNTY ROAD 511.

2 W IOWA COLONY	BRAZORIA	26/0552	EF0
0.00 0.00			

A STRONG EF-0 TORNADO STRUCK A FAIRLY NEW SUBDIVISION ALONG COUNTY ROAD 56 AND HIGHWAY 288. DAMAGE WAS MOSTLY CONFINED TO ROOFS..FENCES...AND SEVERAL TREES SNAPPED AND/OR DOWNED.

Storm Reports from Hurricane Harvey

5 SW FRESNO FORT BEND 26/0600 EF1
0.00 0.00

HOMES DAMAGE ON VIEUX CARRE. DAMAGED HOMES ALSO IN SIENNA PLANTATION. MINOR INJURIES. RESPONDING DEPUTY BLOWN OFF THE ROAD.

5 WNW PECAN GROVE FORT BEND 26/0710 EF0
0.00 0.00

MINOR ROOF DAMAGE IN LOST CREEK SUBDIVISION. HOME NEAR WESTPARK TOLLWAY AND THE GRAND PARKWAY.

4 S EGYPT WHARTON 26/0716 EF0
0.00 0.00

BASED ON TORNADO DAMAGE SIGNATURE ON RADAR. DAMAGE JUST WEST OF GLEN FLORA.

4 SE HUMBLE HARRIS 26/0930 EF0
0.00 0.00

BROADCAST MEDIA REPORTING TORNADO TOUCHDOWN RESULTING IN ROOF...TREE... AND FENCE DAMAGE IN LAKESHORE SUBDIVISION. ALSO FUNNEL CLOUD SIGHTED IN THE AREA.

1 WSW KATY WALLER 26/0957 EF1
0.00 0.00

SIGNIFICANT DAMAGE TO A RV BOAT AND STORAGE FACILITY. DAMAGE PATH EXTENDED ACROSS I10 TO PEPPERL FACILITY. ESTIMATED ON THE GROUND FROM 457 AM TO 505 AM CDT.

8 S COLLEGE STATION BURLESON 26/1305 EF0
0.00 0.00

TREE DAMAGE REPORTED NEAR OLYMPIA BUDDY ROAD. POSSIBLE BRIEF SPIN UP.

8 W JERSEY VILLAGE HARRIS 26/2032 EF1
0.00 0.00

TREES BLOWN OVER AND MINOR ROOF DAMAGE REPORTED NEAR BARKER CYPRESS AND TUCKERTON.

7 NW JERSY VILLAGE HARRIS 26/2110 EF0
0.00 0.00

ANOTHER TORNADO CONFIRMED ON THE GROUND IN THE VICINITY OF HIGHWAY 290 AND BARKER CYPRESS.

2 NW EAST BERNARD WHARTON 26/2223 EF0
0.00 0.00

TREES DOWN SE-NW PATH...DAMAGED HOME AND HORSE TRAILER OVERTURNED.

1 S STAFFORD FORT BEND 27/0115 EF1
0.00 0.00

DAMAGE TO 28 HOMES REPORTED IN THE WOODLAND WEST SUBDIVISION. DAMAGE PATH EXTENDS INTO MISSOURI CITY. HIGH END EF1 DAMAGE IN SPOTS. TORNADO ON GROUND FOR ESTIMATED 15 MINUTES.

WEBSTER HARRIS 27/0500 EF0
0.00 0.00

NWS EMPLOYEE REPORTS THE AWNING ON A GAS STATION RIPPED AND FLIPPED OVER. FUNNEL CLOUD SIGHTED IN THE AREA.

EAST BERNARD WHARTON 27/0642 EF1
0.00 0.00

THE TORNADO BEGAN AS A WEAK EF-0 IN DOWNTOWN EAST BERNARD AND THEN TRAVELED NORTHWEST ACROSS ALT HWY 90 WHERE IT STRENGTHENED TO AN EF-1 SNAPPING SEVERAL LARGE MATURE OAK AND PECAN TREES. A HOUSE SUFFERED SIGNIFICANT BRICK FACADE DAMAGE TO ONE SIDE OF THE HOME. SEVERAL TREES WERE DOWNED AND/OR SNAPPED ALONG THE PATH. FOUR APARTMENTS DAMAGED ON COLLEGE STREET.

1 NW BACLIFF GALVESTON 27/0905 EF0
0.00 0.00

SHORT DAMAGE PATH. TREES DOWN...MINOR DAMAGE TO ROOF.

Storm Reports from Hurricane Harvey

1 ENE WEST UNIVERSITY HARRIS 27/1515 EF0
0.00 0.00

PUBLIC REPORTS WINDOWS BLOWN OUT AT THE TORCHYS TACOS AND BANANA REPUBLIC IN RICE VILLAGE AND DEBRIS LODGED IN BUSHES VIA TWITTER.

4 ESE HOUSTON HARRIS 27/1627 EF0
0.00 0.00

TORNADO DOWNED A TREE IN EASTWOOD NEAR THE MEAT MARKET AND PUT A TREE THROUGH A ROOF IN THE FIFTH WARD.

1 WSW NEEDVILLE FORT BEND 27/1713 EF0
0.00 0.00

TORNADO SPOTTED BY A DEPUTY NEAR FM 442 AND FM 360.

Storm Surge Reports

MAXIMUM STORM SURGE ABD STORM TIDE….
OFFICIAL TIDE GAUGES NOTED WITH LEADING G

COUNTY	CITY/LOCATION	SURGE (FT)	TIDE (FT)	DATE/TIME	EROSION
HARRIS	G MORGANS POINT	3.88	3.53	27/1930	UNKNOWN
HARRIS	LYNCHBURG LANDI	7.70	7.27	29/0706	UNKNOWN
HARRIS	MANCHESTER	11.44	10.35	29/0318	UNKNOWN
GALVESTON	HIGH ISLAND	5.03	4.00	31/0306	UNKNOWN
GALVESTON	ROLLOVER PASS	3.61	2.99	26/1830	UNKNOWN
GALVESTON	EAGLE POINT	4.18	3.67	29/0224	UNKNOWN
GALVESTON	GALVESTON BAY E	2.73	2.58	29/0354	UNKNOWN
GALVESTON	GALVESTON PIER	3.76	3.57	26/0200	UNKNOWN
GALVESTON	GALVESTON RAILR	3.14	2.76	29/1606	UNKNOWN
BRAZORIA	SAN LUIS PASS	3.22	3.32	26/0042	UNKNOWN
BRAZORIA	FREEPORT	3.19	2.52	25/2200	UNKNOWN
MATAGORDA	SARGENT	3.19	2.97	29/2118	UNKNOWN
MATAGORDA	MATAGORDA CITY	3.27	3.12	26/0854	UNKNOWN

Hurricane Harvey — Widespread Flooding across Houston/SE Texas

By Ron Havran
CoCoRaHS Houston/Galveston Regional Coordinator

Note: Data & information from local National Weather Service offices

POLK...MODERATE LOWLAND FLOODING OCCURRED ON LONG KING CREEK WITHLOW LYING ROADS FLOODED WITHIN THE REACH AND THE SOUTHERN FM 1988 BRIDGE FLOODED. LOWEST HOMES AND A CONVENIENT STORE IN THE VICINITY OF THE FM 1988 BRIDGE FLOODED. MAJOR LOWLAND FLOODING OCCURRED ON THE TRINITY NEAR GOODRICH WITH DAMAGE AND DEBRIS NOTED NEAR THE BOAT RAMP AND CHANNEL NEAR THE GAUGE. MAJOR FLOODING OCCURRED UPSTREAM NEAR LAKE LIVINGSTON AS WELL. MANY ROADS AND HOMES BELOW LAKE LIVINGSTON WERE INUNDATED. LAKE LIVINGSTON HAD SOME INUNDATION OF LOW LYING SPOTS DOWNSTREAM OF THE DAM IN PARKS. FM 3278 WAS INACCESSIBLE. MAJOR LOWLAND FLOODING OCCURRED ALONG MENARD CREEK NEAR RYE (RECORD) IN THE VICINITY OF THE GAUGE BUT ONLY MINIMAL IMPACTS WERE OBSERVED. SIGNIFICANT IMPACTS WERE FURTHER DOWNSTREAM NEAR FM 2610. LOWEST HOMES NEAR FM 2610 AND BRIDGE AT FM 2610 FLOODED. THIS WAS FROM BACKWATER FROM THE TRINITY RIVER WHEN LAKE LIVINGSTON BEGAN RELEASES. THE LOWEST HOMES IN SIX LAKE ESTATES, SPECIFICALLY ON LAKESHORE DRIVE, FLOODED AS WELL.

SAN JACINTO...LAKE LIVINGSTON HAD SOME INUNDATION OF LOW LYING SPOTS DOWNSTREAM OF THE DAM IN PARKS. FM 3278 WAS INACCESSIBLE. MAJOR LOWLAND FLOODING OCCURRED ON THE TRINITY NEAR GOODRICH WITH DAMAGE AND DEBRIS NOTED NEAR THE BOAT RAMP AND CHANNEL NEAR THE GAUGE. MAJOR FLOODING OCCURRED UPSTREAM NEAR LAKE LIVINGSTON AS WELL. MANY ROADS AND HOMES BELOW LAKE LIVINGSTON WERE INUNDATED. ACCORDING TO EM, NEARLY 400 HOMES WERE AFFECTED, 100 HOMES HAVING MINOR DAMAGE, 125 HAVING MAJOR DAMAGE, AND 2690 HOMES WERE DESTROYED. IN ADDITION, NEARLY 1000 HOMES WERE ISOLATED DUE TO ROAD CLOSURES FROM HIGH WATER.

LIBERTY...MAJOR/RECORD FLOODING OCCURRED ALONG THE TRINITY RIVER WITH NUMEROUS ROADS INUNDATED INCLUDING FM 787. MANY HOMES AND SUBDIVISIONS WERE EITHER CUT OFF OR INUNDATED, SPECIFICALLY NORTH OF LIBERTY, TX, AND IN GRENADA LAKES ESTATES SUBDIVISION. SIGNIFICANT DAMAGE OCCURRED ALONG THE BANK DUE TO HIGH FLOWS AND SEVERAL UTILITY LINES WERE SEVERED DUE TO THE LOSS OF POLES IN THE VICINITY OF THE ROMAYOR GAUGE. IN ADDITION TO THE TRINITY, MAJOR/RECORD LEVELS WERE OBSERVED ON THE EAST FORK OF THE SAN JACINTO RIVER CAUSING SIGNIFICANT FLOODING IN CLEVELAND, WILLIAMS AND PLUM GROVE. LOWEST HOMES AND BUSINESSES ALONG THE FOLLOWING ROADS WERE EITHER INUNDATED OR THREATENED: BUSINESS 105 (SIGNIFICANT SCOURING OF THE ROADWAY DUE TO HIGH FLOWS), HWY 59 FEEDER ROADS, FM 1725, 1010, 2090, WALLIS AVENUE, MAGNOLIA ROAD, DOGWOOD STREET, CR 388, 381, 3880, 332, 3664, 361, 3610, 3611, 3661, 349, 3612, AND 3600.

CHAMBERS...MAJOR LOWLAND FLOODING OCCURRED ALONG THE TRINITY RIVER (RECORD). OUT OF BANK CONDITIONS OCCURRED ON CEDAR BAYOU WITH NO SIGNIFICANT IMPACTS NOTED AT CROSBY BUT SIGNIFICANT FLOODING OBSERVED IN BAYTOWN. SEVERAL ROADS AND HOMES WERE INUNDATED INCLUDING EXTENSIVE FLOODING IN MILAM BEND SUBDIVISION. HIGH FLOWS FROM THE TRINITY IMPACTED THE NAVIGATION COMMUNITY FOR SEVERAL WEEKS.

AUSTIN...MODERATE, YET RECORD, FLOODING ALONG THE BRAZOS AT SAN FELIPE CAUSED SEVERAL HOMES TO FLOOD ALONG FM 1458. INUNDATION RANGED FROM 4 TO 7 FEET OF WATER. MINIMAL IMPACTS WERE OBSERVED AT MILL CREEK NEAR BELLVILLE.

WALLER...MODERATE, YET RECORD, FLOODING ALONG THE BRAZOS AT SAN FELIPE CAUSED SEVERAL HOMES TO FLOOD ON THE LEFT UPSTREAM SIDE OF THE GAUGE ON FM 3318. FM 3318 FLOODED, CUTTING OFF OTHER HOMEOWNERS . MAJOR/RECORD FLOODING ON THE SAN BERNARD AT EAST BERNARD CAUSED FLOODING UPSTREAM INTO AUSTIN COUNTY. SIGNIFICANT FLOODING OF HOMES, BUSINESSES, AND ROADS ALONG SPRING CREEK AND TRIBUTARIES SUCH AS BRUSHY, WALNUT, MOUND, LIVE OAK, WILLOW FORK CREEKS, BUFFALO AND CANE ISLAND BAYOUS. NO IMPACTS WERE OBSERVED FROM THE MINOR FLOODING AT THE BRAZOS RIVER NEAR HEMPSTEAD.

FORT BEND...MAJOR FLOODING OCCURRED ACROSS THE COUNTY WITH BOTH THE BRAZOS AND SAN BERNARD EXPERIENCING RECORD FLOODING. MAJOR FLOODING OCCURRED ALONG THE BRAZOS RIVER FROM RICHMOND (RECORD) TO ROSHARON. SIGNIFICANT HOME FLOODING OCCURRED AT VALLEY LODGE IN SIMONTON, ALONG EDGEWOOD AND BAUDET ROADS IN RICHMOND, ALONG BAR, BARKER, CUMINGS, SIXTH STREET, AVENUE B, AND RIO BRAZOS ROADS IN ROSENBURG, AND ON FM 2759 AS WELL AS IN GRAND RIVER, RIVERS EDGE, AND PECAN ESTATES SUBDIVISIONS IN THOMPSONS. MANY ROADS WERE IMPASSABLE INCLUDING, BUT NOT LIMITED TO, 90A, PITTS ROAD, FM 1489, FM 723, FM 1093, FM 359, SH6 FEEDER ROADS, SIENNA PARKWAY, CARROL ROAD, MCKEEVER ROAD, KNIGHTS COURT, MILLER ROAD, RIVER OAKS ROAD, THOMPSONS FERRY ROAD, STRANGE DRIVE, GREENWOOD DRIVE, SECOND STREET, AND LOW LYING ROADS IN QUAIL VALLEY. MANY SUBDIVISIONS WERE CUT OFF DUE TO ROAD CLOSURES. NEARLY 200,000 PEOPLE WERE EVACUATED DUE TO LEVEE RESTRICTIONS. MAJOR/RECORD FLOODING ALSO OCCURRED ON THE SAN BERNARD AT BOTH EAST BERNARD AND BOLING WITH THE HARDEST HIT AREA IN FORT BEND COUNTY FROM THE SAN BERNARD RIVER BEING TIERRA GRANDE. FLOOD WATERS WERE EXACERBATED DUE TO FLOW FROM THE MIDDLE SAN BERNARD RIVER AND SNAKE CREEK CONTRIBUTIONS AS WELL AS THE RICE FIELDS TO THE NORTHWEST OF BOLING, TX. MAJOR LOWLAND FLOODING OCCURRED IN EAST BERNARD WITH SEVERAL HOMES AND BUSINESSES INUNDATED, AS WELL AS NUMEROUS ROADS INCLUDING FM 2919 AND HWY 90A. LIVESTOCK WAS SEVERELY IMPACTED. SIGNIFICANT FLOODING ALSO OCCURREDBEHIND BARKER RESERVOIR, INCLUDING CINCO RANCH, DUE TO RECORD POOL ELEVATIONS. BIG CREEK IN NEEDVILLE CAUSED WATER IN HOMES ON ANSEL ROAD, BUT THIS IS NOT A FORECAST POINT.

BRAZORIA...MAJOR/RECORD FLOODING OCCURRED ACROSS THE COUNTY WITH BOTH THE BRAZOS AND SAN BERNARD RIVERS EXPERIENCING RECORD FLOODING. WIDESPREAD MAJOR FLOODING ON THE BRAZOS RIVER AND OYSTER CREEK, ESPECIALLY ON THE EAST SIDE, LED TO NUMEROUS ROADS AND HOMES IN COLUMBIA LAKES, MALLARD LAKES, GREAT LAKES, RIVERSIDE ESTATES, AND BAR X RANCH SUBDIVISIONS TO FLOOD, AS WELL AS HOMES ON CR 39. OTHER ROADS THAT WERE INUNDATED INCLUDE BUT ARE NOT LIMITED TO FM 1462, HWY 35, CR 25, 380A, AND 42. THE BRIDGE OVER COW CREEK AT CR 25 WAS ALSO IMPASSABLE. MANY SUBDIVISIONS WERE CUT OFF NEAR SH 35 AND CR 35 DUE TO HIGH WATER. LIVESTOCK WAS SEVERELY IMPACTED. MAJOR FLOODING ALSO OCCURRED ALONG THE SAN BERNARD AT SWEENY. WIDESPREAD INUNDATION OF THE LEFT FLOODPLAIN OCCURRED. HWY 35 AND FM 521 WERE INUNDATED. HOMES WERE INUNDATED ON AVENUE A. PHILLIPS 66 REFINERY TOOK ON WATER FROM THE WEST NEAR LITTLE LINVILLE BAYOU. HANSON RIVERSIDE COUNTY PARK WAS INUNDATED, AND WATER OVERTOPPED THE PHILLIPS TERMINAL, HALTING ALL VESSEL TRAFFIC. HIGH FLOWS FROM THE BRAZOS AND SAN BERNARD RIVERS IMPACTED THE NAVIGATION COMMUNITY FOR SEVERAL WEEKS. COLORADO...MAJOR FLOODING OCCURRED ALONG THE COLORADO RIVER WITH WIDESPREAD INUNDATION OF CROP LAND NEAR EAGLE LAKE, AS WELL AS NUMEROUS ROADS INUNDATED INCLUDED US HWY 90, FM 950 AND LOWEST HOMES FLOODED IN THE VICINITY OF THE GAUGE OR IN THE FLOODPLAIN. COLORADO OVERTOPS ITS LEVEES AROUND 47 FEET FROM COLUMBUS DOWN TO BAY CITY, CAUSING EXTENSIVE FLOODING IN LOW LYING AREAS ALONG THE LEFT BANK.

WHARTON...WIDESPREAD CATASTROPHIC FLOODING ACROSS THE COUNTY FROM BOTH THE COLORADO AND SAN BERNARD RIVERS WITH HWY 59 CLOSED BETWEEN **CONTINUED ON PAGE 15—>**

Harvey causes widespread flooding across greater Houston area

FROM PAGE 14——>
HUNGERFORD AND EL CAMPO. MAJOR FLOODING OCCURRED ON THE COLORADO RIVER AT WHARTON WITH ROADS, HOMES, AND BUSINESSES WEST AND SOUTHWEST WHARTON FLOODED AND ALONG THE RIVER REACH, INCLUDING HOBBEN OAKS AND BEAR BOTTOM, ELM GROVE, RIVER VALLEY, AND PECAN VALLEY. MOST STREETS BETWEEN SUNSET ST, ELM STREET, FM 102, NORTH ALABAMA ROAD, AND US HWY 59 WERE INUNDATED AND HUNDREDS OF HOMES AND BUSINESS WERE FLOODED. IN ADDITION TO FLOODING FROM THE MAIN CHANNEL, FLOOD WATERS APPEAR TO HAVE ESCAPED THE MAIN CHANNEL UPSTREAM OF WHARTON NEAR GLENFLORA AND BEGAN FLOWING DOWN BAUGHMAN SLOUGH, CANEY CREEK, AND PEACH CREEK, CAUSING CATASTROPHIC FLOODING OF ROADS INCLUDING CR 135, 150, 166, 133, 153, 102, 232, 244, 228, 137, AND 249, AS WELL AS FM 640. SIGNIFICANT FLOODING OF HOMES AND BUSINESSES OCCURRED ON THE NORTHERN, EASTERN, AND SOUTHERN (IAGO) SIDES OF WHARTON, TX, INCLUDING THE CITY OF GLENFLORA, PEACH ACRES, AND THE ORCHARD. MAJOR/RECORD FLOODING ALSO OCCURRED ON THE SAN BERNARD AT BOTH EAST BERNARD AND BOLING WITH THE HARDEST HIT AREAS BEING EL LOBO AND NEW GULF. FLOOD WATERS WERE EXACERBATED DUE TO FLOW FROM THE MIDDLE SAN BERNARD RIVER AND SNAKE CREEK CONTRIBUTIONS AND THE RICE FIELDS TO THE NORTHWEST OF BOLING, TX. MAJOR LOWLAND FLOODING OCCURRED WITH MANY HOMES, INCLUDING SOME TWO STORY HOMES, AND BUSINESSES BEING INUNDATED, AS WELL AS NUMEROUS ROADS INCLUDING HWY 90A, FM 2919 AND 442, AND CR 151, 1096, AND 101. BACKWATER ISSUES WERE ALSO NOTED ON BRITT BRANCH, BRATCHER SLOUGH, PEACH CREEK, WEST SAN BERNARD RIVER AND SNAKE CREEK. FM 1161 DIVIDES THE SAN BERNARD BASIN FROM THE COLORADO BASIN BETWEEN THE BOLING, TX AND WHARTON, TX, GAUGES. FM 1161 DID NOT FLOOD ACCORDING TO THE EM. COTTON CROPS TOOK A HUGE HIT. NO IMPACTS TO NOTE ON THE WEST/EAST MUSTANG AND SANDY CREEKS.

MATAGORDA...MAJOR LOWLAND FLOODING OCCURRED IN MATAGORDA ALONG THE TRES PALACIOS RIVER. PORTIONS OF FM 1468, 5764, 2853 AND 456 APPROACHES FLOODED. HOMES IN THE EL DORADO COUNTRY, OAK GROVE, AND TRES PALACIOS OAKS SUBDIVISIONS FLOODED. MAJOR FLOODING ALSO OCCURRED ON THE COLORADO RIVER AT BAY CITY AS LEVEES WERE OVERTOPPED BY 2FT. HIGH FLOWS FROM THE COLORADO AND TRES PALACIOS RIVER IMPACTED THE NAVIGATION COMMUNITY FOR SEVERAL WEEKS.

JACKSON...MAJOR LOWLAND FLOODING OCCURRED ON THE NAVIDAD RIVER (RECORD) WITH CR 283, 284, 401, AND 127, AS WELL AS SH 111, INUNDATED. HOMES DID NOT FLOODED BUT MANY WERE INACCESSIBLE. LIVESTOCK WAS SEVERELY IMPACTED. MAJOR LOWLAND FLOODING ALSO OCCURRED ON THE LAVACA RIVER AND SANDY CREEK IN JACKSON COUNTY. NUMEROUS ROADS AND BRIDGES SPECIFICALLY NORTH OF HWY 59 AND WEST OF FM822, INCLUDING CR 112, 110, 120, AND 311, AS WELL AS FM616 AND 710 RAILROAD BRIDGE, WERE INUNDATED LEAVING HOMES INACCESSIBLE. LIVESTOCK WAS SEVERELY IMPACTED. MINOR FLOODING OCCURRED ON THE EAST AND WEST MUSTANG CREEKS BUT ONLY MINIMAL IMPACTS WERE OBSERVED. HIGH FLOWS FROM THE LAVACA AND NAVIDAD RIVERS IMPACTED THE NAVIGATION COMMUNITY FOR SEVERAL WEEKS.

HARRIS...CATASTROPHIC FLOODING OCCURRED ON NEARLY EVERY ONE OF THE 22 WATERSHEDS IN HARRIS COUNTY. OF THE 19 OFFICIAL FORECAST LOCATIONS ON THE HARRIS COUNTY BAYOUS, 10 LOCATIONS REACHED RECORD CRESTS. WIDESPREAD FLOODING OF HOMES AND BUSINESSES OCCURRED ACROSS THE COUNTY. HCFCD ESTIMATES NEARLY 136,000 STRUCTURES WERE FLOODED. PORTIONS OF MAJOR ROADWAYS INCLUDING I-45, US 59, BELTWAY 8, I-10, AND SH 6 WERE INUNDATED. TWO LEVEES, NORTHGATE LEVEE ON SPRING CREEK AND INVERNESS FOREST ON CYPRESS CREEK, WERE IN DANGER OF OVERTOPPING, LEADING TO EVACUATION ORDERS NEAR THESE AREAS. ON BUFFALO BAYOU, THE ADDICKS AND BARKER RESERVOIRS, BOTH, REACHED RECORD POOL ELEVATIONS, CAUSING WIDESPREAD FLOODING OF HOMES AND BUSINESS BOTH UPSTREAM AND DOWNSTREAM OF THE RESERVOIRS. MAJOR FLOODING ALSO OCCURRED ON THE SAN JACINTO RIVER DUE TO HEAVY RAINFALL, LAKE CONROE RELEASES AND BACKWATER FROM LAKE HOUSTON. OVER 664 HOMES WERE DAMAGED ALONG THE RIVER. SOME OF THE HARDEST HIT AREAS EXTEND FROM HUMBLE TO LAKE HOUSTON INCLUDE NORTHSHORE, BELLAEU WOODS, RIVIERA, TREASURE COVE, KINGS LAKE ESTATES, KINGS RIVER, KINGS CROWN ESTATES, KINGS RIVER ESTATES, ATASCOCITA SHORES AND WEST, RAMBLEWOOD, WALDEN SUBDIVISIONS, AS WELL AS US 59, WEST LAKE HOUSTON PARKWAY, NORTH HOUSTON AVENUE, THELMA ROAD, HAMBLEN ROAD, AND AQUA VISTA DRIVE. MAJOR/RECORD FLOODING ALSO OCCURRED ALONG THE EAST FORK OF THE SAN JACINTO RIVER CAUSING HOMES IN NORTHWOOD COUNTRY ESTATES AND RIVER TERRACE TO FLOOD. BELOW LAKE HOUSTON, MAJOR FLOODING CONTINUED WITH ROADS AND HOMES INUNDATED NEAR HWY 90B BRIDGE, INCLUDING THE UPSTREAM RAILROAD BRIDGE AND GARRETT ROAD. THE HWY 90B BRIDGE WAS DAMAGED BY HIGH FLOWS. HIGH FLOWS FROM THE SAN JACINTO RIVER AND HARRIS COUNTY BAYOUS, IN PARTICULAR BUFFALO BAYOU, IMPACTED THE NAVIGATION COMMUNITY FOR SEVERAL WEEKS.

GALVESTON...CATASTROPHIC FLOODING OF HOMES, BUSINESS, AND ROADS OCCURRED ACROSS THE COUNTY FROM A COMBINATION OF FLASH FLOODING, SHEET FLOW, AND FLOODING FROM CREEKS AND BAYOUS, INCLUDING CLEAR CREEK AND DICKINSON BAYOU. NEARLY 6,963 HOMES AND 123 BUSINESSES WERE EITHER AFFECTED OR DAMAGED TO SOME DEGREE. CLEAR CREEK SAW RECORD LEVELS ACROSS THE WATERSHED, LEADING TO SIGNIFICANT FLOODING OF THE FOLLOWING AREAS: FRIENDSWOOD AND LEAGUE CITY, TX. A RAPID DEPLOYMENT GAUGE WAS USED TO MONITOR WATER LEVELS ON DICKINSON BAYOU DURING THE EVENT. MAJOR FLOODING WAS OBSERVED FROM CEMETERY ROAD PAST HWY 3. OTHER MAJOR IMPACTS INCLUDE THE INUNDATION OF I-45, BAY AREA BOULEVARD, FM 528 AND 518, AND OTHER PRIMARY AND SECONDARY ROADS IN THE AREA.

MONTGOMERY...RECORD POOL ELEVATIONS WERE OBSERVED ALONG LAKE CONROE LEADING TO A RECORD RELEASE +70,000 CFS, WHICH EXACERBATED THE FLOODING DOWNSTREAM. MAJOR/RECORD FLOODING OCCURRED ALONG THE SAN JACINTO RIVER AND ITS TRIBUTARIES CAUSING CATASTROPHIC FLOODING ACROSS THE COUNTY. SOME OF THE HARDEST HIT AREAS ALONG THE MAINSTEM INCLUDE BUT ARE NOT LIMITED TO MCDADE PARK AND ESTATES, HWY 105, FM 284, AND SH 336 IMMEDIATELY DOWNSTREAM OF THE RESERVOIR; I-45, FM 1488, SH242, CALHOUN, EAST RIVER, LYRIC, MCGREGOR, AND WALKER ROADS, AND THE RIVER PLANTATION, FORREST HILLS, WOODLOCH, WHISPERING OAKS, CHATEAU WOODS SUBDIVISIONS NEAR CONROE, TX; AND SH 99, AMAZON DRIVE, HOLLOW OAKS CIRCLE, AS WELL AS THE PORTER HEIGHTS AND RIVER RIDGE SUBDIVISIONS IN PORTER, TX. MAJOR FLOODING ALSO OCCURRED ALONG THE EAST FORK OF THE SAN JACINTO RIVER AND ALONG LAKE, SPRING, CANEY, AND PEACH CREEKS. MODERATE, YET RECORD, FLOODING OCCURRED ALONG LAKE CREEK AT SENDERA RANCH ROAD IMPACTING THE LOWEST ROADS AND HOMES ALONG THE FOLLOWING ROADS: EAST BLUFF DRIVE, PEBBLE LAKE, HONEAEGYPT ROAD, BOAR`S HEAD PLACE, CIRCLE DRIVE, WILDERNESS WAY, WINDMILL LANE, LAKE FOREST CIRCLE, AND CONASTAGA COURT. MAJOR FLOODING OCCURRED ON SPRING CREEK AND ITS TRIBUTARIES IMPACTING THE FOLLOWING AREAS: STAGECOACH, DECKER PRAIRIE, OKLAHOMA, THE WOODLANDS, RAYFORD, AND I-45. MAJOR/RECORD FLOODING ALONG THE EAST FORK SAN JACINTO RIVER CAUSED HOMES IN THE EAST RIVER ESTATES, IDLE WILD, PINE VALLEY ESTATES, AND NORTHWOOD COUNTRY ESTATES SUBDIVISIONS TO FLOOD, AS WELL AS FM 1482. CANEY CREEK CAUSED MAJOR FLOODING FOR THE GRANGERLAND AND NEW CANEY AREAS, INCLUDING THE BAPTIST ENCAMPMENT SUBDIVISION, BUCKINGHAM PLACE ROAD, CROCKETT MARTEN ROAD, RUSSEL DRIVE, LINDA LANE, TOMMY SMITH ROAD, FM 1485 AND 2090, SH 494, 242, AND 105, FIRETOWER AND MILLMAC ROADS, AND US 59. PEACH CREEK CAUSED MAJOR/RECORD FLOODING FOR THE SPLENDORA, MIDLINE, PATTON VILLAGE, WOODBRANCH AREAS INCLUDING WOODBRANCH VILLAGE AND BAPTIST ENCAMPMENT SUBDIVISIONS, ROMAN FORECAST BOULEVARD, PEACH DRIVE, PINE DRIVE (WATER RESCUES), WILDERNESS PARK, FM 1485 AND 2090, REDBUD LANE, MORGAN CEMETARY ROAD, AND US 59.

Flying through Hurricane Harvey

By J. Raymond Schiflett, III
***Wimberley View* weather reporter**

"Harvey is a tropical storm, but likely will be a hurricane by the time we get there, so be alert, be aware, and let's have a good mission," advised Flight Director Michael Holmes at the pre-flight briefing at Lakeland, Florida Regional Airport, home base for the NOAA team and its Lockheed WP-3D Orion Hurricane Hunter aircraft quixotically named *Kermit*.

As a 30 year weekly weather reporter for *The Wimberley View*, I had petitioned for years to be allowed to fly with and observe a hurricane hunter operation; finally the time had arrived. Hurricane Harvey had been a long-lived storm emerging from the coast of Africa as a tropical wave 13 days earlier. While it had showed early signs of formation and had actually achieved tropical storm status as it moved past the Windward Islands into the warm Caribbean Sea, upper level winds had inhibited its development and eventually strangled it into submission, officially dropping it out of even a depression category and back to its birth status of tropical wave as it sailed southeast of Jamaica at 20 mph. However, Harvey, unlike the invisible rabbit with the same name in Jimmy Stewart's 1950 movie, was not going to just vanish. It reappeared and soon arrived at the Cancun/Belize region with a sudden rejuvenation thanks to the dwindling of those once powerful upper level winds.

In my 56 years of hurricane observation, I believed this storm was not dead----far from it. Conditions were ripe and the Yucatan peninsula, known for tearing apart lesser storms, was merely a speed bump for this system. The National Hurricane Center (NHC) had begun to warn that Harvey had the capability to regenerate over the warm waters of the Bay of Campeche but was still forecast to move to a quick death impacting the coast near Tampico, Mexico. However, conditions were brewing 1,000 miles to the north that would change all of that. Two typical summer high pressure systems, one over the lower Mississippi Valley and another over New Mexico had allowed a low pressure highway to become available all the way to the Texas coast (tropical systems almost always follow the line of least pressure resistance).

Given these criteria, I thought this storm had a real possibility to become a threat to our state and specifically our region. I contacted the National Oceanic and Atmospheric Administration (NOAA) headquarters Tuesday afternoon, August 22, requesting that I (and my photographer son, Ray Schiflett, IV) might be allowed to join their team to hunt, find, and help gather data on Harvey.

Media credentials to a storm are very limited, but most papers were not seeing this storm as a danger yet; *Wimberley View* editor Dalton Sweat and I had reached an earlier different conclusion and were ahead of most other media sources in making this request. At 1 PM the next day, an email from David Hall at the NOAA center in Washington D.C. asked me, "Can you be in Lakeland, Florida, at 7:30 AM tomorrow?"

That provoked a flurry of frantic preparations that culminated in my son and me being airborne only hours later, arriving in Orlando at midnight. Seven hours later we were in the NOAA CONTINUED Page 17———>

The Lockheed WP-3D Orion Hurricane Hunter aircraft and crew preparing to fly into Hurricane Harvey

Flying through Hurricane Harvey

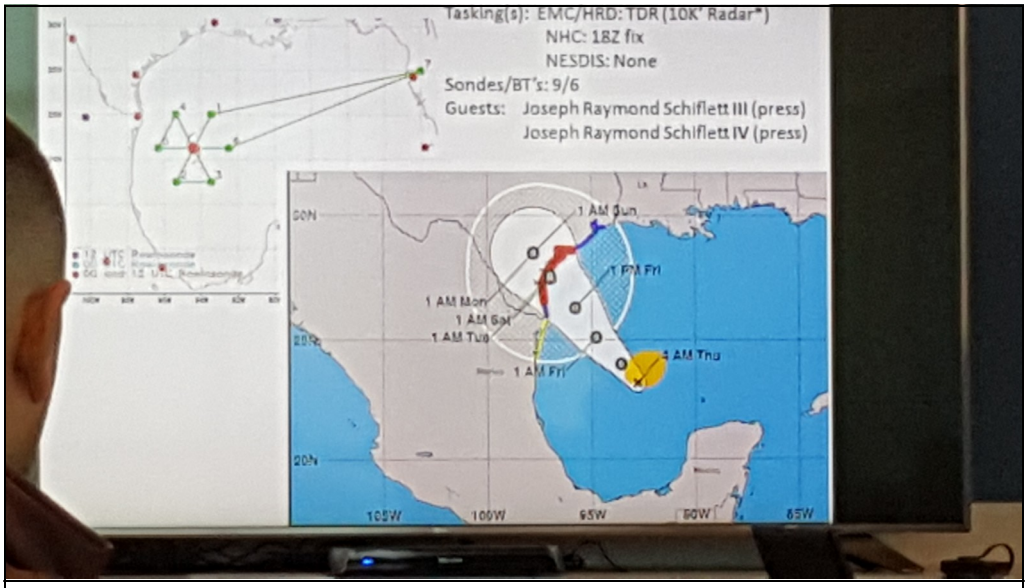
headquarters meeting our contact, LCDR Paul Hemmick, who gave us a cordial hello, a quick preview of the day's activities, and then required us to pass two mandatory written tests to ensure our competency before we could join the flight crew. Next came the pre-flight briefing that verified our determination of Harvey's growing power had been correct, and the NHC needed data to determine how quickly Harvey would strengthen and exactly where it would unleash its power. That was the mission---to collect real time data from all four quadrants of the storm and from the eye of this growing monster.

Flight Director Mike Holmes announced that our hurricane hunter plane *Kermit*, a P3 Orion, although 60 years old had recently been refurbished with new wings, four more powerful propeller-driven engines, upgraded technology capabilities, and would follow the standard flight path for surveying a tropical system. Our course was to enter Harvey through its NE quarter (usually where the highest winds would be), fly 200 miles to the SW through the center to the SW corner, turn east and go to the SE zone, fly back through the eye on course to the NW section, back to a point due west of the eye, then east through its middle for a third time going to a final station exactly east of the system and then back home. From take off to landing would be approximately eight hours: two hours out, two hours back, and four hours "on station." By flying through the eye of the storm three times we would be able to take three measurements over a four hour period which would assist in determining the storm's development, direction, and size.

It was exciting and made us proud to be Americans as we walked through the hangar with a gigantic US flag adorning the wall next to two smaller Gulfstream jets used to investigate lesser storms. We climbed aboard *Kermit* at 0900 and met the 18 other members of the crew and research scientists who were going to be part of this important mission. We learned that the reason both the US Air Force (based at Keesler AFB in Biloxi, Miss.) and NOAA send planes into storms (first one, and then six hours later the other) is that NOAA not only plots the systems, but also will do research to better understand the dynamics of hurricanes and how to improve their forecasting abilities, whereas the USAF's main purpose is to track and gather current data on the storm.

The safety briefing definitely drew our close attention as it covered what could go wrong: ditching procedures, the location of two life rafts, and survival procedures after a sea landing for what could be an extended period of time (we were going to be hours away from any land-based assistance). It was the only time we thought maybe this had not been the best of ideas (but then new commercial flyers probably have the same thoughts the the first time flight attendants announce how to exit a crashed plane, but they are not flying on purpose into a growing beast like Harvey).

Having gathered our thoughts and rearranged our courage, we took our seats and lifted off the tarmac at 10:25 AM headed for a date with a dangerous combatant. The outbound flight was smooth and gave us time to meet several of our fellow passengers and pilots. Included in that latter group were LCDR Nate Kahn, LT Danny Rees, and LT Kevin Doremus. We also met Science Tech/ AVAPS operator Michael "Mac" McAlister who was on his first hurricane mission and was tasked with handling the instruments that would be jettisoned from *Kermit* directly into the storm at 9 points. The instruments were dropsondes (sondes) and AXBTs (Airborne eXpendable Bathy Thermographs, aka BTs). A sonde is a 2 foot long tube dispatched through a hole in the bottom center of the *Kermit's* fuselage, and it parachutes for 90 to 120 seconds sending back a continuous stream of barometric pressure, wind speed, air temperature, humidity, and other factors before it falls into the sea where it sinks and disintegrates (it is biodegradable). CONTINUED PG 18——->



Flight maps and reports during a recently flight into Hurricane Harvey

Flying through Hurricane Harvey

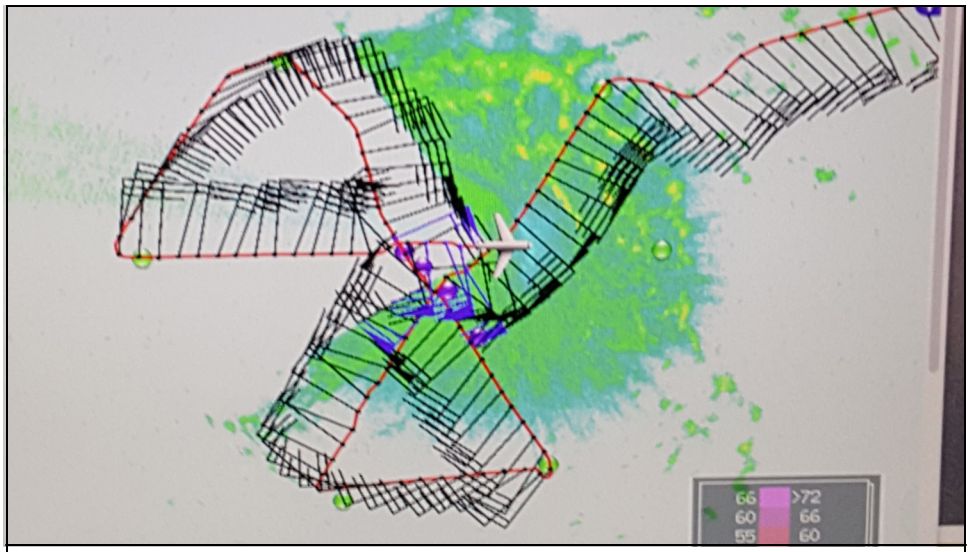
FROM PG 17—>BTs are pre-loaded on the exterior of *Kermit* before takeoff and fall for about 30 seconds into the ocean sending back sea temperatures potentially down to 1,000 meters (3,300 feet) before they disintegrate. We were advised the first 50 meters is most important for knowing the potential for storm enhancement (warmer water means a stronger storm).

Flying through the outer bands of Harvey toward the first drop point at 12:30 PM, the "workfrog" plane, *Kermit*, was slowed to 220 mph from its approach speed of 380 mph and descended to 7,000 feet as those factors had been determined to be the most effective and safe criteria for a hurricane hunter plane to enter a storm, maintain stability, and do the least possible damage to the aircraft, passengers, and equipment. We had been warned that the next four hours could be rough and occasionally terrifying; this proved to be untrue only because of the unerring skills of our pilots. Over those four hours, while we were bumped around the atmosphere on multiple occasions, we found our crew was extraordinarily adept at using *Kermit's* radar to avoid every storm cell that appeared to be too menacing (in truth, the flight home to Austin was almost as rough as what we experienced on the hunter aircraft). Their expertise cannot be underestimated. These pilots are among the best America has to offer. Listening through the headsets as we flew repeatedly into and out of the danger zones, they communicated constantly and thoroughly with one another about the best course to blaze as they knifed the aircraft through the maze of wind-forced squalls. They were like surgeons with their aircraft, precise and always alert to the best possible course which was no small feat, as a hurricane is a dynamic system with unstable writhing tentacles changing by the second as we approached and exited our assigned stations and drop zones for the sondes and BTs.

It was during our mission on Thursday afternoon that Harvey transitioned from tropical storm to hurricane. Our crew noted sustained winds of 83 mph in the band just to the NNW of the center with gusts to 105 mph. During the time we were on site, the barometric pressure dropped precipitously from 982 to 976 millibars. The 86 degree warm Gulf soup was allowing Harvey to go from threat and annoyance to dangerous Category 4 status (I found it interesting that after a storm goes above 111 mph it is re-designated from an "H" for "hurricane" on the NHC charts to "M" which means "major" but could easily be mistaken for the word "monster."

While the NOAA team on board *Kermit* do not make the official predictions as to the future of maelstroms like Harvey (they procure the data and transmit it to the NHC for analysis) the consensus of our crew was that this storm would likely intensify rapidly and inflict a significant disaster upon the central Texas coast. This real threat was further enhanced by our finding on the first pass through the eye that it had repositioned itself 52 miles to the east of its position noted only 6 hours earlier by the USAF. With this relatively moderate shift and new projected direction, the central coast from Corpus Christi to Port Lavaca were now the most probable landfall targets as opposed to the less densely populated areas between Brownsville and Corpus Christi. This also meant that if the relentless track to the NW was maintained, Victoria, Houston, and to a lesser extent, Austin, San Antonio, and yes, Wimberley, could soon be facing strong tropical storm force winds, 10-40 inches of rain, and several days of flooding. With the expected stalling of the storm southeast of San Antonio, what could already be a major weather event now had the potential for doubling its impact as a destructive wind machine and flood maker, especially for the areas along and east of the I-35 corridor and as far north as Killeen.

It was apparent to all on board that the relatively small 25 mile wide eye was just awakening. The eye wall (the bands around the center of a hurricane) was growing with each pass, pulsing like a heart beat. I was proud to know that this crew's warnings to our neighbors would also allow them to open their eyes wider to the immediate and rapidly worsening situation that was to be flung at their homes and families COINTINUED PG 19—->

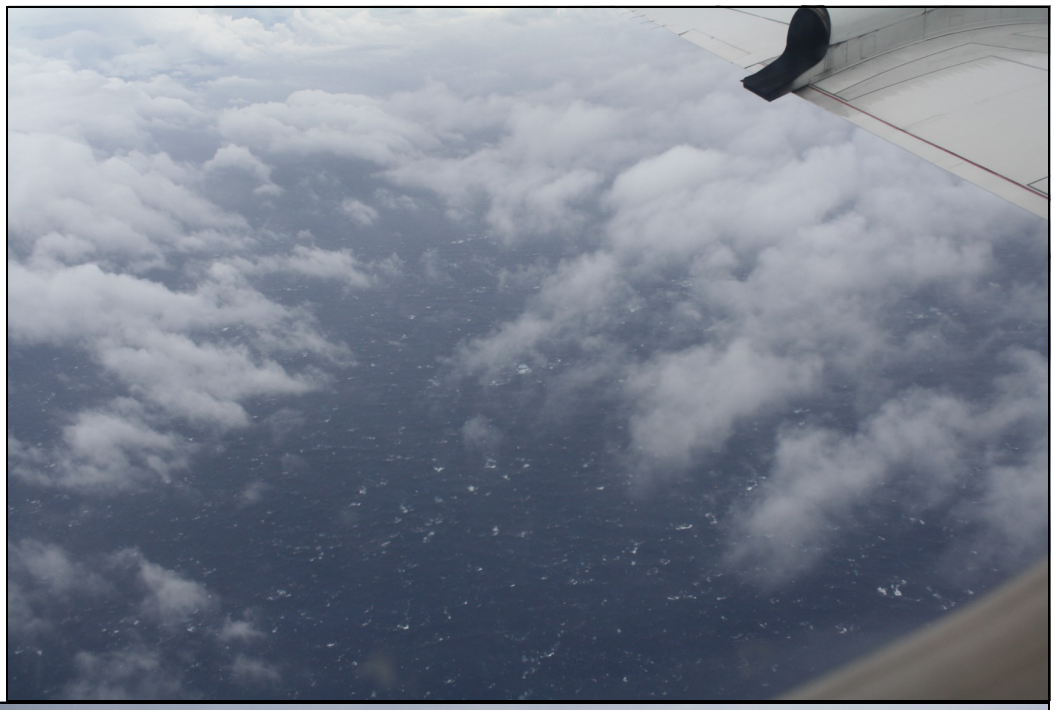


The hurricane Hunter's Flight Path through Hurricane Harvey

Flying through Hurricane Harvey

FROM PG 18—>within the next 36 hours. As we exited Harvey and flew back into the smooth air of the central Gulf, we observed the unthinkable---a fully laden container ship 60 miles east of the eye wall was steaming directly toward the center of the spiraling titan. One could only be amazed at such maritime ignorance and why a captain with modern weather radar would endanger his vessel, crew, and cargo to engage in this outright foolishness. In direct contrast one could only admire and appreciate the skills and intelligence of each member of the NOAA team. They are all smart, mission-focused, efficient, and take the business of hunting hurricanes very seriously. With individuals like these ready to stand on weather guard for the US, we will never be caught unaware or unprepared for the effects of a disastrous hurricane. These men and women take risks so that we do not have to, and so we never again have to experience the catastrophic loss of 6,000 lives as happened in the Galveston hurricane of 1900. These hurricane hunters are the best, and we are all in their debt..

(END)



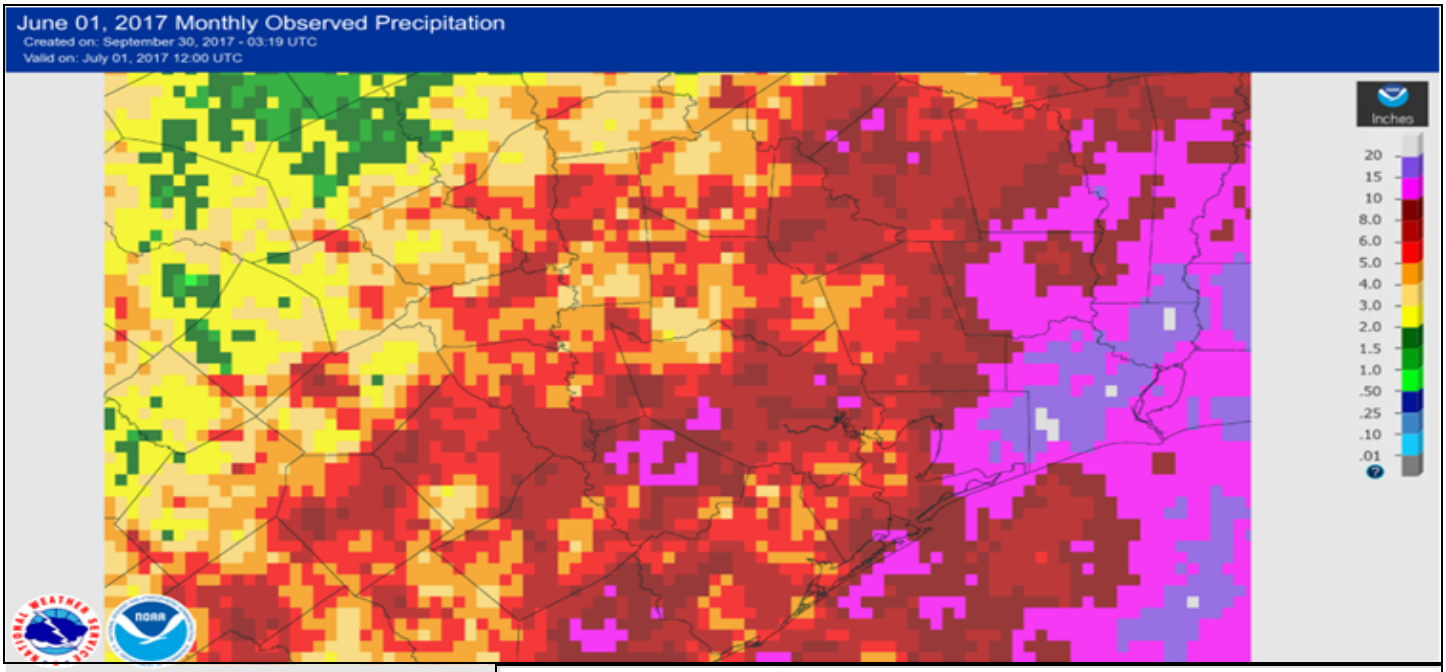
The surface of the Gulf of Mexico is visible through the eye of Hurricane Harvey (top),, as the Orion Hurricane Hunter aircraft flies through Hurricane Harvey's eye wall. (above).

Southeast Texas Summer Climate Summary

By Ron Havran
CoCoRaHS Houston/Galveston Regional Coordinator

June climate highlights

Tropical Storm Cindy passed near the Upper Texas Coast before making landfall on the 22nd near Sabine Pass.
Eastern counties received about 2 inches of rain from Cindy.
Central and coastal parts of the region had above normal rainfall for the month.
Northwestern and northern parts of the region had below normal rainfall.
Temperatures averaged near normal in most areas.
Cooler and rainy periods in the first part of the month and again at the end of the month were mainly from upper level disturbances.
Hot and dry conditions from an upper level ridge over Texas in the middle of the month kept CoCoRaHS gage dry.
CoCoRaHS observer county region wide rainfall averaged 5.18".
Highest CoCoRaHS county rainfall average was Galveston with 7.54".
Lowest CoCoRaHS county rainfall average was Montgomery with 1.85".

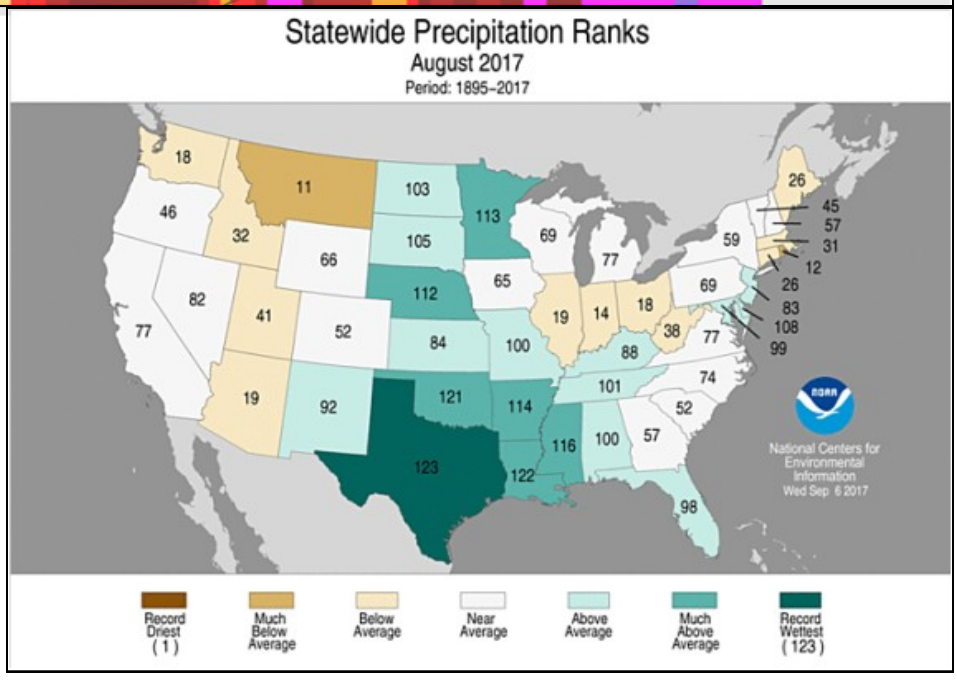


July climate highlights

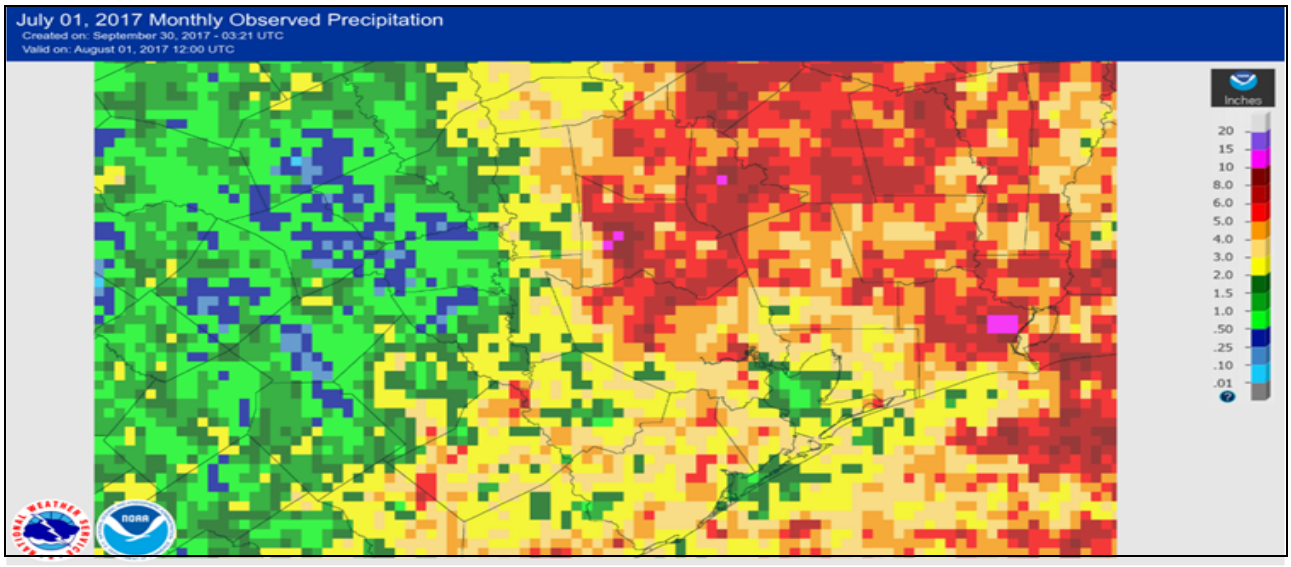
Western half of the region had below normal rainfall.

Scattered heavier amounts of rain fell in southern counties with mostly below normal rainfall; rain was from daily sea breeze convection.

Central and northeastern counties had normal to above normal rainfall.
Lack of rainfall caused temperatures to be 2-4 degrees above normal region wide.
100 degree days recorded in the region at climate sites from the 15th through the 29th.
CoCoRaHS observer county region wide rainfall averaged 2.96".
Highest CoCoRaHS county rainfall average was Polk with 7.21".
Lowest CoCoRaHS county rainfall average was Austin with 1.02".

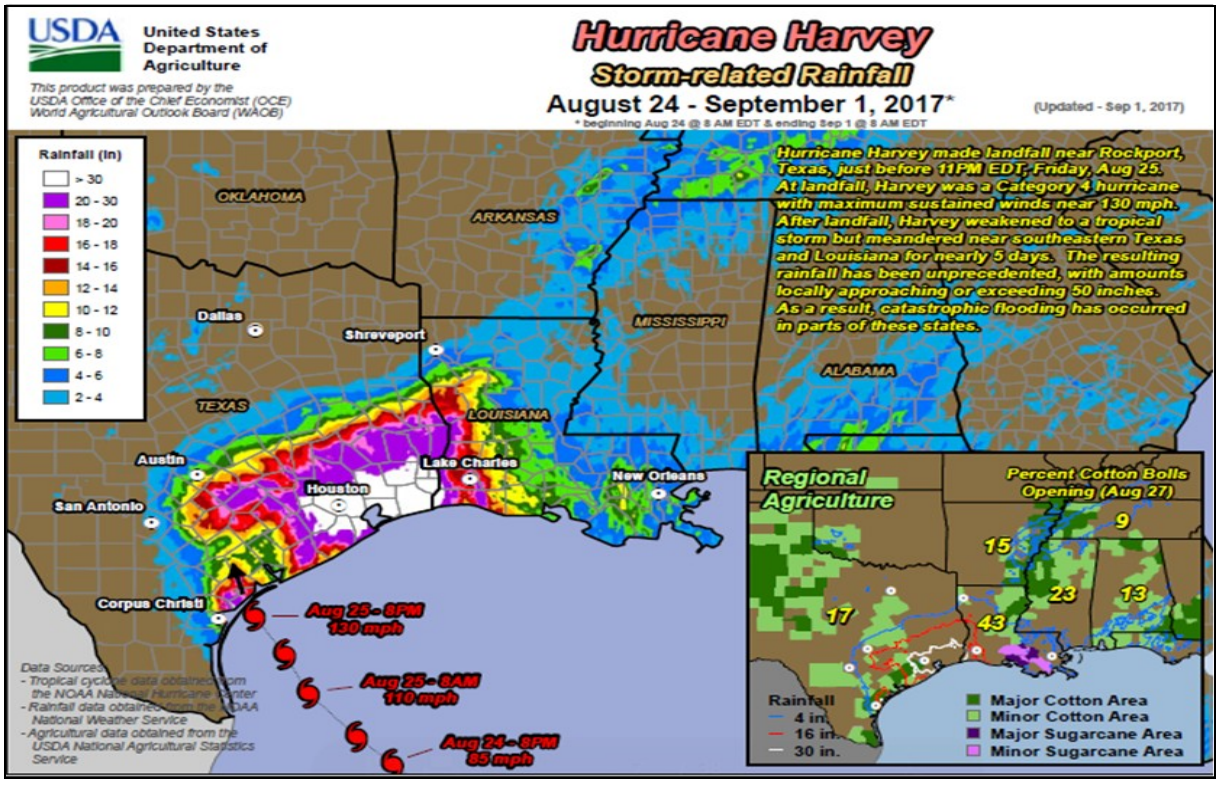


Southeast Texas Summer Climate Summary



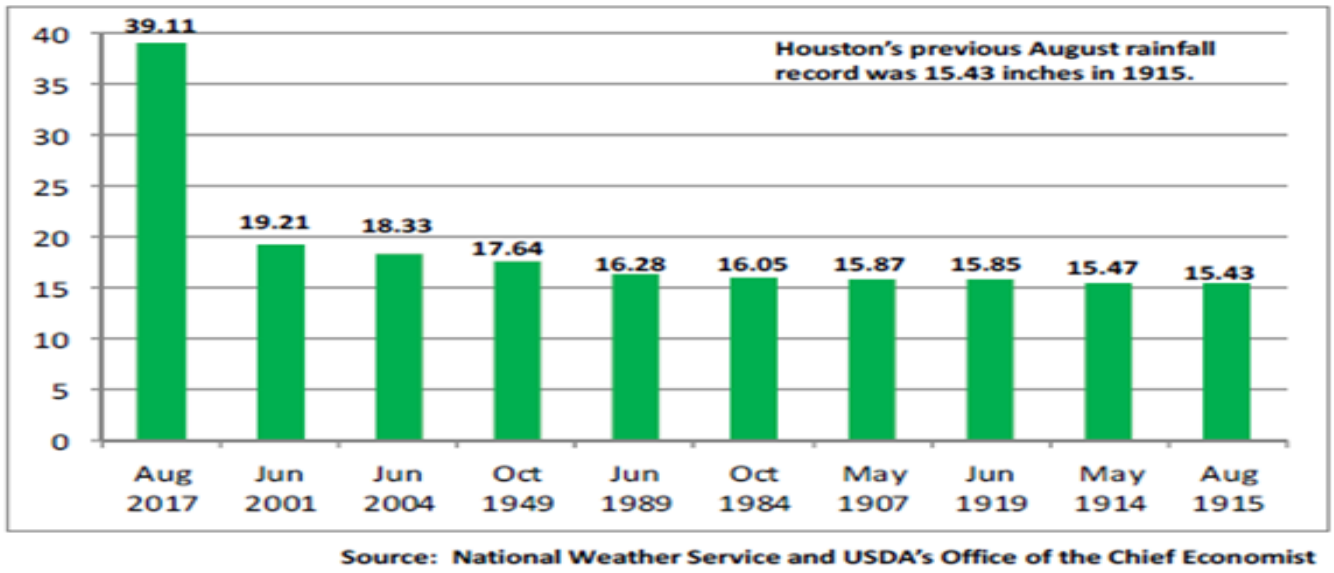
<u>August climate highlights</u>

Most of the region had average temperatures for the month.
Abnormally dry across western and NW counties at the start of the month.
All parts of the region had abnormally high rainfall totals with many record high amounts for the month.
Significant rainfall days in the region on the following days: 2nd - 9th and the 25th- 31st.
CoCoRaHS observer county region wide rainfall averaged 31.37".
Highest CoCoRaHS county rainfall average was Harris with 41.37".
Lowest CoCoRaHS county rainfall average was Wharton with 20.68".
Liberty County had a CoCoRaHS station record 56.01" for the month.
Hurricane Harvey was in the region from August 25th – August 31st.
August was the wettest month on record in Houston since 1892.
The month of August 2017 was the wettest on record in Texas since 1895



Houston/Galveston Summer Climate Summary

Summer highlights
Three month summer CoCoRaHS observer county rainfall average was 39.50".
Harris County had the highest 3-month CoCoRaHS rainfall average with 51.33".



Summer 2017 CoCoRaHS Houston/Galveston Region Rainfall

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

County	June		July		August		Summer Total
	AVG.	MAX.	AVG.	MAX.	AVG.	MAX.	3-Month Rain Total
Austin	4.21	5.22	1.02	2.04	26.16	28.66	31.39
Brazoria	6.09	6.85	3.39	4.62	28.44	36.42	37.92
Chambers	N/A	7.54	N/A	4.96	N/A	44.16	N/A
Colorado	4.88	5.77	1.13	1.59	26.37	28.12	32.38
Fort Bend	6.76	9.57	2.39	3.09	38.12	43.17	47.27
Galveston	7.54	12.13	2.74	3.87	39.71	50.07	49.99
Harris	6.02	10.53	3.94	7.54	41.37	49.18	51.33
Jackson	N/A	4.79	N/A	0.68	N/A	12.78	N/A
Liberty	5.52	7.94	2.87	3.83	41.07	56.01	49.46
Matagorda	N/A	5.72	N/A	4.13	N/A	15.98	N/A
Montgomery	1.85	2.54	3.29	4.77	28.15	36.49	33.29
Polk	5.74	4.23	7.21	5.22	24.32	25.70	37.27
San Jacinto	5.16	9.34	3.85	5.44	25.65	33.11	34.66
Waller	3.89	3.89	1.92	1.92	38.23	39.23	44.04
Wharton	4.49	6.11	1.73	3.57	20.68	23.79	26.90
Region Totals	5.18	12.13	2.96	7.54	31.37	56.01	39.50

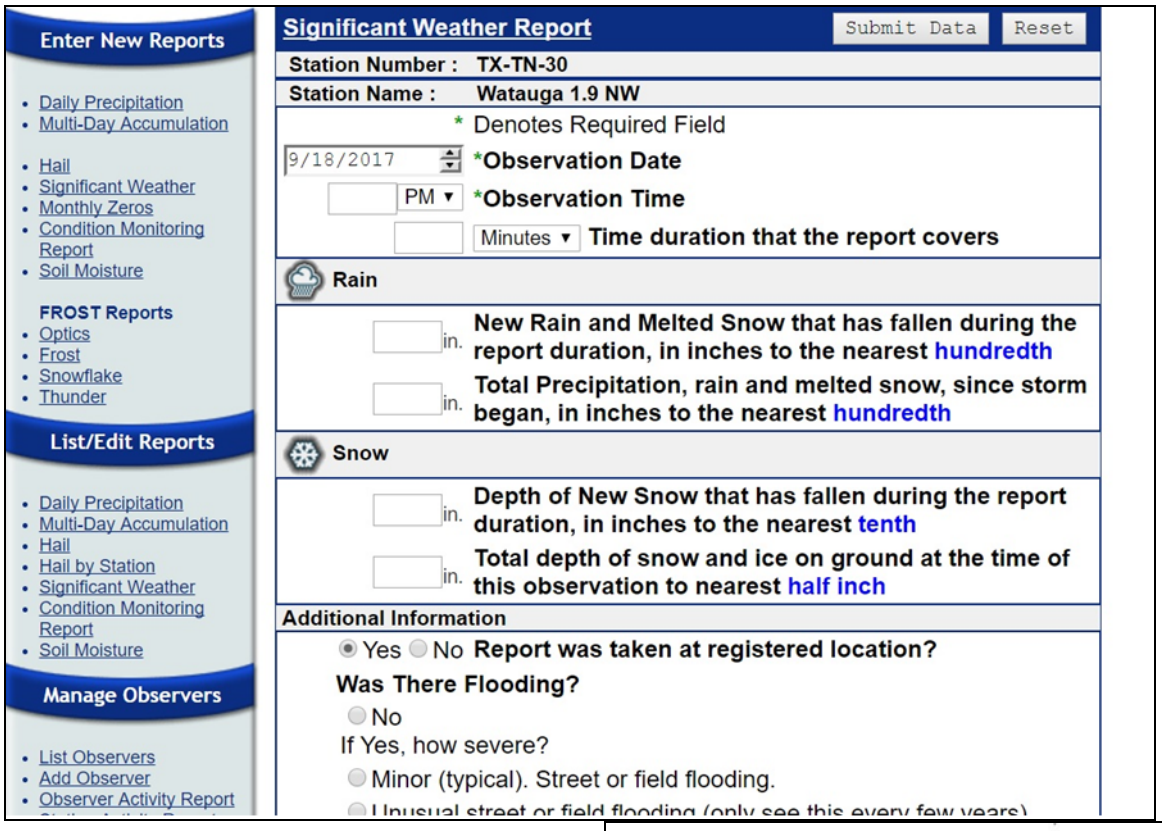
Importance of CoCoRaHS during hurricane and flood events

By Greg Story
Meteorologist
National Weather Service West Gulf River Forecast Center—Fort Worth

I would like to tell each of you how important YOUR CoCoRaHS observations are. It is our job to determine what is going to happen to the rain water once it hits the ground. Will it flood? Which rivers will be affected, what will the crests be, and when? Those are the questions we face with each rainfall event.

Back in the pre-internet days, it was extremely difficult to determine this. The River Forecast Centers were faced with using 24 hour rainfall totals from but a few sources, such as airport rain gauges, automated river rain gauges and NWS COOP observers. The chances were very good that these rain gauges would not be under an intense rainfall core, and we'd find out about it days later when "bucket surveys" were performed. This, in turn, would lead us to be too low and too slow on our river flood forecasts. With the advent of the WSR-88D radars, we were able to receive precipitation estimates each hour. And while these estimates show us *where* the heavy rainfall is occurring, the estimates can be in considerable error. So here is where your observations help us:

First, we receive the intense rainfall reports from CoCoRaHS spotters. These reports are invaluable! We have these reports "alarm" on our NWS workstations. And any observer can make such an observation. On the CoCoRaHS web site, under "Enter New Reports" click on the "Significant Weather" link. Then fill out and submit this form:



These reports are often a first "heads up" to us that rainfall may be exceeding our first estimates. It allows us to raise or lower our hourly estimates of rainfall in near real time, thus allowing us to issue a better flood forecast! An example from hurricane Harvey is shown at right:

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NZUS45 KBOU 280509
CCRAHS

intense rain report from CoCoRAHS spotter:

08/28/2017 12:00 AM local time
County: Brazos TX
College Station 1.6 S (number TX-BZS-92)
Latitude: 30.577365
Longitude: -96.31456
15.33 inches so far, with 0.28 inches in the past 60 mins
Flooding: Unusual
Comments: Hurricane Harvey rainfall from 2300-2359 on 8/27

Received NWS Boulder Sun Aug 27 23:09:31 2017 MDT
Sent to WFOs: HGX,FWD,FWR

All of today's CoCoRAHS observations are in WRKCCR (Boulder and Pueblo only)
Or at http://www.cocorahs.org (click on reports)
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CONTINUED ON PAGE 24——->

Why your CoCoRaHS reports matter to forecasters

FROM PAGE 23——>Radar estimates have become the initial basis for determining the location of flood producing rains. However, these estimates are usually too low, especially during intense rainfall events! So what I do in my job in the NWS is to take your CoCoRaHS observations and compare them to the radar-based estimates. We consider the Co-CoRaHS rain gauge data to be ground truth, our absolute eye on the sky and one of our best data sources. When Co-CoRaHS observations come in higher than what we originally estimated, we go back and raise our initial estimates. This information is then put into our hydrologic model, and it leads to a more accurate river flood forecast. At right (figure 1) is an example from 2012 when CoCoRaHS reports from Ellis County helped us improve a flood forecast.

Now let me show a couple of examples from Hurricane Harvey: On August 26 heavy rain from Harvey fell as it made landfall over parts of southeast Texas. Our initial estimates were from 4 to 8 inches (figure 2). Then we got the reports shown in figure 3 (bottom of page). On August 26, We were too low in our initial estimates and we beefed them up! CONTINUED PAGE 25->

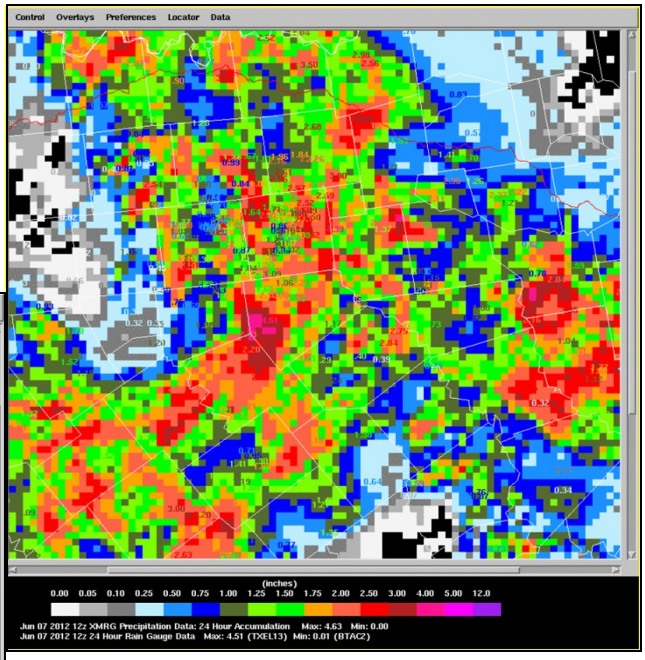


Figure 1 Above

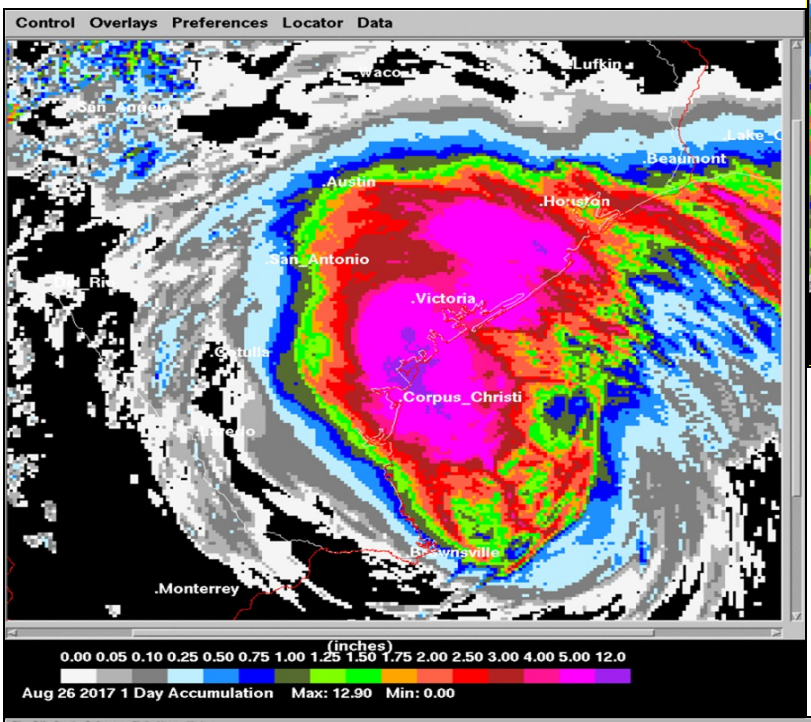


Figure 2 Left

Figure 3 Below

COCO - Data Type

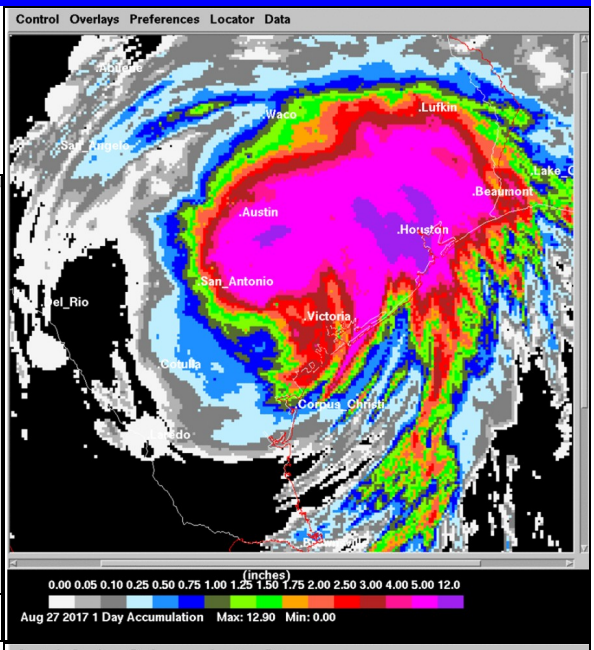
LID	GAGE	MPE	Q2	RAW	TS	HSA	LAT/LON	HRAP	LOCATION
TXFB17	9.60	8.63	9.49	0.00	RZ	HGX	(29.62 95.73)	(635 167)	Richmond 3.4 NE
TXGD15	8.92	5.35	3.95	0.00	RZ	CRP	(28.89 97.38)	(596 140)	Weser 1.9 NW
TXFB18	8.69	8.63	9.49	0.00	RZ	HGX	(29.61 95.73)	(635 167)	Richmond 2.9 NE
TXFB05	8.22	6.80	7.94	0.00	RZ	HGX	(29.58 95.59)	(638 167)	Sugar Land 3 SSE
TXFB12	7.61	6.74	8.38	0.00	RZ	HGX	(29.62 95.63)	(637 168)	Sugar Land 1 W
TXWH18	7.60	9.67	8.41	0.00	RZ	HGX	(29.42 96.06)	(627 160)	East Bernard 7.6 S
TXCLR10	7.50	4.99	3.53	0.00	RZ	HGX	(29.82 96.48)	(615 170)	New Ulm 5.1 S
TXCLR06	7.45	5.90	4.40	0.00	RZ	HGX	(29.79 96.48)	(615 169)	New Ulm 7.2 S
TXFB51	7.45	8.20	9.24	0.00	RZ	HGX	(29.64 95.74)	(634 168)	Richmond 4.4 NNE
TXDW19	7.41	5.31	4.11	0.00	RZ	EWX	(28.97 97.28)	(598 143)	Cuero 8.4 S
TXAS17	7.25	8.60	6.77	0.00	RZ	HGX	(29.64 96.05)	(626 166)	Wallis 1.1 NE
TXFB22	7.17	8.65	9.08	0.00	RZ	HGX	(29.53 95.72)	(635 165)	Richmond 4.6 SE
TXWL09	6.80	5.95	6.41	0.00	RZ	HGX	(29.87 96.00)	(627 173)	Brookshire 6.9 NNW
TXFB42	6.61	8.65	9.08	0.00	RZ	HGX	(29.56 95.74)	(635 165)	Richmond 2.3 SE
TXGD31	6.53	5.57	3.64	0.00	RZ	CRP	(28.79 97.45)	(595 137)	Goliad 8.7 NNW
TXAS02	6.36	4.37	3.01	0.00	RZ	HGX	(29.89 96.49)	(614 172)	New Ulm 0.1 ENE
TXGD25	6.13	5.38	3.77	0.00	RZ	CRP	(28.86 97.33)	(597 139)	Goliad 14.3 NNE
TXBRZ18	5.90	6.37	7.85	0.00	RZ	HGX	(29.42 95.27)	(647 163)	Alvin 1.6 SW
TXAS06	5.65	6.84	5.53	0.00	RZ	HGX	(29.80 96.12)	(624 171)	San Felipe 1 WNW
TXWH02	5.46	6.13	5.23	0.00	RZ	HGX	(29.13 96.26)	(623 151)	El Campo 4.9 SSE
TXAS05	5.45	6.41	4.85	0.00	RZ	HGX	(29.78 96.16)	(623 170)	Sealy 0.3 WNW
TXGV05	5.33	4.31	5.19	0.00	RZ	HGX	(29.49 95.21)	(648 166)	Friendswood 1.9 SSW
TXGV60	5.12	3.62	4.75	0.00	RZ	HGX	(29.37 95.10)	(652 163)	Santa Fe 0.7 S
TXHRR122	5.05	5.33	5.67	0.00	RZ	HGX	(29.71 95.67)	(636 170)	Mission Bend 0.8 N
TXAS03	5.00	5.48	3.98	0.00	RZ	HGX	(29.88 96.33)	(618 172)	Cat Spring 3.8 N
TXCLR09	4.95	5.16	2.88	0.00	RZ	HGX	(29.68 96.60)	(612 166)	Columbus 3.2 WSW
TXFY42	4.92	3.93	2.25	0.00	RZ	EWX	(29.90 96.80)	(607 171)	La Grange 4.7 E
TXAS12	4.91	5.48	3.98	0.00	RZ	HGX	(29.87 96.33)	(618 172)	Cat Spring 1.4 N
TXDW12	4.90	4.30	3.34	0.00	RZ	EWX	(29.08 97.25)	(599 146)	Cuero 2.5 ESE
TXDW14	4.90	4.30	3.34	0.00	RZ	EWX	(29.08 97.25)	(599 146)	Cuero 2.7 ESE
TXFB53	4.90	5.90	5.67	0.00	RZ	HGX	(29.78 95.82)	(632 171)	Katy 7.3 SSE
TXAS04	4.89	4.67	3.98	0.00	RZ	HGX	(29.95 96.25)	(620 175)	Bellville 0.4 NE
TXHRR223	4.80	5.15	5.20	0.00	RZ	HGX	(29.77 95.71)	(634 172)	Mission Bend 5.6 NNW
TXFY30	4.75	4.32	2.82	0.00	RZ	EWX	(30.02 96.85)	(605 174)	La Grange 7.8 NNE
TXAS18	4.70	4.67	3.98	0.00	RZ	HGX	(29.95 96.25)	(620 175)	Bellville 0.9 ENE
TXFY52	4.63	5.08	2.40	0.00	RZ	EWX	(29.93 96.82)	(606 172)	La Grange 3.5 ENE

FROM PAGE 24—>The next day, August 27 we saw similar estimates. We initially estimated 8 to 13 inches of rain over southeast Texas (figure 4 right), but the CoCoRaHS reports were much higher (figure 5 below):
Again since we were too low in our initial estimates we beefed them up, allowing for flood forecasts which were improved.

COCO - Data Type

LID	GAGE	MPE	Q2	RAW	TS	HSA	LAT/LON	HRAP	LOCATION
TXGV44	21.62	12.90	12.90	0.00	RZ	HGX	(29.50 94.99)	(654 167)	Bacliff 0.5 SSE
TXHRR32	20.84	12.90	12.90	0.00	RZ	HGX	(29.61 95.26)	(646 169)	South Houston 4 SSW
TXHRR93	20.54	12.90	12.90	0.00	RZ	HGX	(29.68 95.22)	(647 171)	Pasadena 4.4 WNW
TXHRR31	19.41	12.90	12.90	0.00	RZ	HGX	(29.55 95.18)	(649 167)	Friendswood 2.5 NNE
TXGV60	19.38	12.90	12.90	0.00	RZ	HGX	(29.37 95.10)	(652 163)	Santa Fe 0.7 S
TXGV64	18.20	12.90	12.90	0.00	RZ	HGX	(29.34 95.03)	(653 162)	Hitchcock 1.6 NNW
TXHRR139	17.98	12.90	12.90	0.00	RZ	HGX	(29.79 95.20)	(647 174)	Cloverleaf 1.7 W
TXGV51	17.57	8.74	8.68	0.00	RZ	HGX	(29.36 94.96)	(655 163)	La Marque 1.8 E
TXHRR28	17.00	12.90	12.90	0.00	RZ	HGX	(29.54 95.12)	(650 167)	Webster 0.4 NW
TXGV63	16.59	12.90	12.90	0.00	RZ	HGX	(29.50 95.19)	(649 166)	Friendswood 1 SE
TXLR13	15.43	12.26	12.44	0.00	RZ	HGX	(30.36 95.08)	(647 191)	Cleveland 3.6 S
TXGV46	14.91	12.90	12.90	0.00	RZ	HGX	(29.52 95.04)	(652 167)	League City 3.6 ENE
TXMNG51	14.72	12.90	12.90	0.00	RZ	HGX	(30.17 95.76)	(631 183)	Magnolia 2.8 S
TXFY03	14.69	12.43	7.85	0.00	RZ	EWX	(30.01 97.01)	(601 174)	La Grange 10.2 NW
TXHRR165	14.20	12.90	12.90	0.00	RZ	HGX	(29.79 95.37)	(643 174)	Houston 1.4 NE
TXHRR119	14.10	12.90	12.90	0.00	RZ	HGX	(29.72 95.44)	(641 171)	West University Place 0.4 WNW
TXWL12	14.07	12.90	7.73	0.00	RZ	EWX	(30.04 95.97)	(627 178)	Waller 3 WSW
TXBST21	14.00	12.90	9.08	0.00	RZ	EWX	(30.02 97.44)	(590 172)	Rockne 1.9 NNW
TXCHM08	13.99	12.90	12.90	0.00	RZ	HGX	(29.87 94.89)	(654 178)	Mont Belvieu 1.6 NNW
TXHRR238	13.65	12.90	12.90	0.00	RZ	HGX	(29.59 95.14)	(649 169)	Webster 3.9 NNW
TXHRR124	13.48	12.90	12.90	0.00	RZ	HGX	(30.01 95.48)	(639 179)	Spring 7.1 WSW
TXBST98	13.44	10.29	6.19	0.00	RZ	EWX	(30.14 97.18)	(596 177)	Circle D-KC Estates 3.6 ESE
TXBST117	13.40	12.84	8.01	0.00	RZ	EWX	(30.07 97.28)	(594 174)	Bastrop 3 SSE
TXBST24	13.26	12.90	8.39	0.00	RZ	EWX	(30.00 97.29)	(594 172)	Rosanky 4.5 N
TXBST35	12.97	12.90	8.66	0.00	RZ	EWX	(30.04 97.36)	(592 173)	Bastrop 5.7 SW
TXBST07	12.96	11.32	6.99	0.00	RZ	EWX	(30.13 97.30)	(593 176)	Bastrop 1.2 N
TXFY54	12.85	10.44	5.79	0.00	RZ	EWX	(29.85 97.18)	(597 168)	Flatonia 11.9 NNW
TXHRR95	12.80	12.90	12.90	0.00	RZ	HGX	(29.60 95.12)	(650 169)	Taylor Lake Village 4.1 WNW
TXLR10	12.79	12.90	12.90	0.00	RZ	HGX	(30.27 95.07)	(648 189)	Cleveland 5 S
TXHRR164	12.65	12.50	11.32	0.00	RZ	HGX	(29.93 95.63)	(636 177)	Jersey Village 4.6 NW
TXFY30	12.42	9.97	6.28	0.00	RZ	EWX	(30.02 96.85)	(605 174)	La Grange 7.8 NNE
TXHRR212	12.40	11.12	8.62	0.00	RZ	HGX	(29.91 95.87)	(630 175)	Katy 9.3 NE
TXGV29	12.00	12.90	12.90	0.00	RZ	HGX	(29.53 95.02)	(653 168)	Kemah 0.2 WNW
TXGV71	12.00	12.90	12.90	0.00	RZ	HGX	(29.41 95.03)	(653 164)	Texas City 4.4 W
TXHRR217	12.00	12.90	12.90	0.00	RZ	HGX	(29.55 95.13)	(650 168)	Webster 1.6 NNW
TXBST90	11.94	12.90	8.18	0.00	RZ	EWX	(29.98 97.45)	(590 171)	Red Rock 1.2 N
TXWA12	11.91	7.58	5.68	0.00	RZ	HGX	(30.28 96.17)	(621 184)	Washington 3.1 SSW

CoCoRaHS Reports and Radar Estimates for 27 August (above and right)

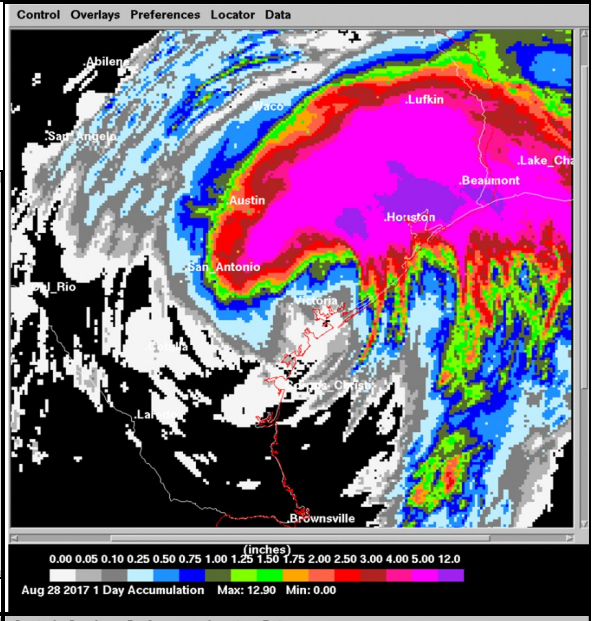


The rainfall estimates for August 28 – 31 and the CoCoRaHS observations are shown below. When all was said and done, record flooding occurred on 21 of our official river forecast points. Your observations helped give the NWS lead time on the magnitude of this flooding. Again, with our initial estimates being low we were able to make adjustments in real time!

COCO - Data Type

LID	GAGE	MPE	Q2	RAW	TS	HSA	LAT/LON	HRAP	LOCATION
TXHRR116	18.35	12.90	12.90	0.00	RZ	HGX	(29.81 95.82)	(631 172)	Katy 1 NNE
TXWL12	17.33	11.57	8.22	0.00	RZ	HGX	(30.04 95.97)	(627 178)	Waller 3 WSW
TXWL09	16.75	12.90	10.56	0.00	RZ	HGX	(29.87 96.00)	(627 173)	Brookshire 6.9 NNW
TXSJ12	16.50	9.75	6.79	0.00	RZ	HGX	(30.69 95.29)	(640 200)	Oakhurst 3.6 SSE
TXFB53	16.43	12.90	12.90	0.00	RZ	HGX	(29.78 95.82)	(632 171)	Katy 7.3 SSE
TXWK26	14.75	9.46	8.36	0.00	RZ	HGX	(30.68 95.44)	(637 199)	Huntsville 7.1 ESE
TXWK18	14.30	9.53	7.41	0.00	RZ	HGX	(30.70 95.54)	(634 199)	Huntsville 1.3 SSE
TXFB51	14.06	12.90	12.90	0.00	RZ	HGX	(29.64 95.74)	(634 168)	Richmond 4.4 NNE
TXLR13	13.53	11.74	10.98	0.00	RZ	HGX	(30.36 95.08)	(647 191)	Cleveland 3.6 S
TXHRR228	13.48	12.90	12.90	0.00	RZ	HGX	(29.79 95.74)	(633 172)	Katy 5.2 E
TXHRR15	13.44	12.90	12.90	0.00	RZ	HGX	(30.00 95.20)	(646 180)	Kingwood 3.9 S
TXFB18	13.37	12.90	11.70	0.00	RZ	HGX	(29.61 95.73)	(635 167)	Richmond 2.9 NE
TXWK05	12.74	9.44	6.93	0.00	RZ	HGX	(30.70 95.60)	(633 199)	Huntsville 2.8 WSW
TXHRR212	12.72	12.90	12.34	0.00	RZ	HGX	(29.91 95.87)	(630 175)	Katy 9.3 NE
TXWK20	12.50	8.89	7.02	0.00	RZ	HGX	(30.68 95.52)	(635 198)	Huntsville 2.8 SE
TXHRR222	12.47	12.90	12.90	0.00	RZ	HGX	(29.77 95.71)	(634 172)	Mission Bend 5.7 NNW
TXJJ09	12.38	11.29	12.12	0.00	RZ	LCH	(30.05 94.18)	(671 186)	Beaumont 3.3 SW
TXLR14	12.27	12.90	12.90	0.00	RZ	HGX	(30.05 94.89)	(653 183)	Dayton 0.2 E
TXWK13	11.65	9.19	6.67	0.00	RZ	HGX	(30.77 95.58)	(633 201)	Huntsville 4.8 NNW
TXWK15	11.65	9.97	8.81	0.00	RZ	HGX	(30.72 95.40)	(637 200)	Dodge 1.6 S
TXWK03	11.60	9.38	7.61	0.00	RZ	HGX	(30.63 95.71)	(630 196)	Huntsville 11.5 WSW
TXCHM08	11.30	12.90	12.90	0.00	RZ	HGX	(29.87 94.89)	(654 178)	Mont Belvieu 1.6 NNW
TXWK11	11.24	8.66	7.34	0.00	RZ	HGX	(30.54 95.44)	(637 195)	New Waverly 2.6 E
TXMNG30	11.00	10.82	10.30	0.00	RZ	HGX	(30.14 95.47)	(638 183)	The Woodlands 1.8 SE
TXWK12	11.00	10.58	6.95	0.00	RZ	HGX	(30.76 95.58)	(633 200)	Huntsville 3.6 NNW
TXFY53	10.95	8.88	4.59	0.00	RZ	EWX	(29.80 96.92)	(604 170)	La Grange 3.5 SW
TXFY42	10.91	6.94	3.36	0.00	RZ	EWX	(29.90 96.80)	(607 171)	La Grange 4.7 E
TXHRR124	10.83	11.94	10.84	0.00	RZ	HGX	(30.01 95.48)	(639 179)	Spring 7.1 WSW
TXAS03	10.80	6.63	3.59	0.00	RZ	HGX	(29.88 96.33)	(618 172)	Cat Spring 3.8 N
TXAS04	10.65	8.53	4.05	0.00	RZ	HGX	(29.95 96.25)	(620 175)	Bellville 0.4 NE
TXHRR139	10.60	12.90	12.90	0.00	RZ	HGX	(29.79 95.20)	(647 174)	Cloverleaf 1.7 W
TXFB17	10.50	12.90	11.70	0.00	RZ	HGX	(29.62 95.73)	(635 167)	Richmond 3.4 NE
TXWK25	10.43	9.07	7.16	0.00	RZ	HGX	(30.68 95.56)	(634 198)	Huntsville 2.3 S
TXAS18	10.39	8.53	4.05	0.00	RZ	HGX	(29.95 96.25)	(620 175)	Bellville 0.9 ENE
TXHRR95	10.33	8.86	8.36	0.00	RZ	HGX	(29.60 95.12)	(650 169)	Taylor Lake Village 4.1 WNW
TXAS12	10.32	6.63	3.59	0.00	RZ	HGX	(29.87 96.33)	(618 172)	Cat Spring 1.4 N

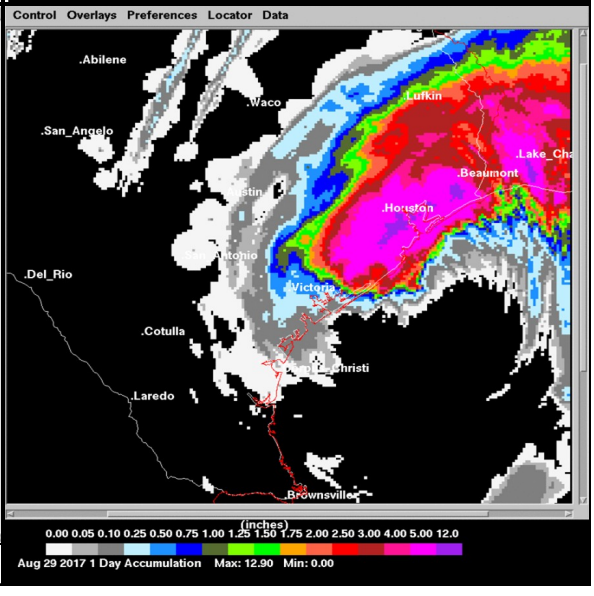
CoCoRaHS Reports & Radar Estimates for 28 August 28 (above and right)



COCO - Data Type

LID	GAGE	MPE	Q2	RAW	TS	HSA	LAT/LON	HRAP	LOCATION
TXHRR170	14.88	12.90	12.90	0.00	RZ	HGX	(29.53 95.18)	(649 167)	Friendswood 1.6 NE
TXHRR217	14.38	12.90	12.90	0.00	RZ	HGX	(29.55 95.13)	(650 168)	Webster 1.6 NNW
TXHRR31	14.34	12.90	12.90	0.00	RZ	HGX	(29.55 95.18)	(649 167)	Friendswood 2.5 NNE
TXGV05	14.00	12.90	12.90	0.00	RZ	HGX	(29.49 95.21)	(648 166)	Friendswood 1.9 SSW
TXGV34	13.96	12.90	12.90	0.00	RZ	HGX	(29.54 95.07)	(651 168)	League City 2.7 NE
TXHRR28	13.80	12.90	12.90	0.00	RZ	HGX	(29.54 95.12)	(650 167)	Webster 0.4 NW
TXBRZ25	13.60	12.18	12.09	0.00	RZ	HGX	(29.55 95.35)	(644 167)	Pearland 4.4 W
TXHRR238	13.51	12.28	12.90	0.00	RZ	HGX	(29.59 95.14)	(649 169)	Webster 3.9 NNW
TXGV63	13.04	12.90	12.90	0.00	RZ	HGX	(29.50 95.19)	(649 166)	Friendswood 1 SE
TXHRR32	13.01	11.76	11.89	0.00	RZ	HGX	(29.61 95.26)	(646 169)	South Houston 4 SSW
TXHRR89	12.45	12.90	12.90	0.00	RZ	HGX	(29.53 95.19)	(648 167)	Friendswood 1.4 NNE
TXHRR93	12.30	11.77	12.90	0.00	RZ	HGX	(29.68 95.22)	(647 171)	Pasadena 4.4 WNW
TXGV69	12.25	12.61	12.90	0.00	RZ	HGX	(29.49 95.12)	(650 166)	League City 0.9 WNW
TXGV46	12.10	11.77	12.90	0.00	RZ	HGX	(29.52 95.04)	(652 167)	League City 3.6 ENE
TXGV29	11.90	10.12	11.74	0.00	RZ	HGX	(29.53 95.02)	(653 168)	Kemah 0.2 WNW
TXGV60	11.85	10.94	12.90	0.00	RZ	HGX	(29.37 95.10)	(652 163)	Santa Fe 0.7 S
TXJJ09	11.32	11.07	12.90	0.00	RZ	LCH	(30.05 94.18)	(671 186)	Beaumont 3.3 SW
TXGV70	10.94	10.15	12.30	0.00	RZ	HGX	(29.41 94.89)	(657 165)	Texas City 3.8 E
TXGV73	10.60	7.48	8.43	0.00	RZ	HGX	(29.30 94.78)	(660 162)	Galveston 8.3 NE
TXGV44	10.56	10.18	11.87	0.00	RZ	HGX	(29.50 94.99)	(654 167)	Bacliff 0.5 SSE
TXGV64	10.41	9.15	11.22	0.00	RZ	HGX	(29.34 95.03)	(653 162)	Hitchcock 1.6 NNW
TXGV71	10.34	10.43	12.90	0.00	RZ	HGX	(29.41 95.03)	(653 164)	Texas City 4.4 W
TXCHM08	9.55	7.94	9.34	0.00	RZ	HGX	(29.87 94.89)	(654 178)	Mont Belvieu 1.6 NNW
TXGV51	9.44	8.23	11.35	0.00	RZ	HGX	(29.36 94.96)	(655 163)	La Marque 1.8 E
TXGV55	9.34	10.18	11.87	0.00	RZ	HGX	(29.51 94.97)	(654 167)	Bacliff 1.2 E
TXHRR119	8.67	7.93	8.21	0.00	RZ	HGX	(29.72 95.44)	(641 171)	West University Place 0.4 WNW
TXHRR232	8.29	8.54	8.53	0.00	RZ	HGX	(29.74 95.40)	(642 172)	Houston 2.1 SSW
TXGV18	7.91	6.87	6.81	0.00	RZ	HGX	(29.28 94.81)	(659 161)	Galveston 6.4 NE
TXFB27	7.84	7.46	8.33	0.00	RZ	HGX	(29.58 95.63)	(637 166)	Sugar Land 2.6 SSW
TXGV49	7.69	9.08	12.38	0.00	RZ	HGX	(29.33 94.94)	(656 162)	La Marque 3.9 SE
TXHRR58	7.60	6.95	6.70	0.00	RZ	HGX	(29.81 95.54)	(638 173)	Spring Valley 2.7 NW
TXHRR165	7.56	8.02	8.30	0.00	RZ	HGX	(29.79 95.37)	(643 174)	Houston 1.4 NE
TXHRR218	7.50	7.67	7.37	0.00	RZ	HGX	(29.77 95.42)	(642 173)	Houston 1.9 W
TXFB12	7.40	7.10	7.73	0.00	RZ	HGX	(29.62 95.63)	(637 168)	Sugar Land 1 W
TXHRR209	7.35	8.02	8.30	0.00	RZ	HGX	(29.80 95.37)	(643 174)	Houston 2.1 NNE
TXFB18	7.19	6.29	6.74	0.00	RZ	HGX	(29.61 95.73)	(635 167)	Richmond 2.9 NE

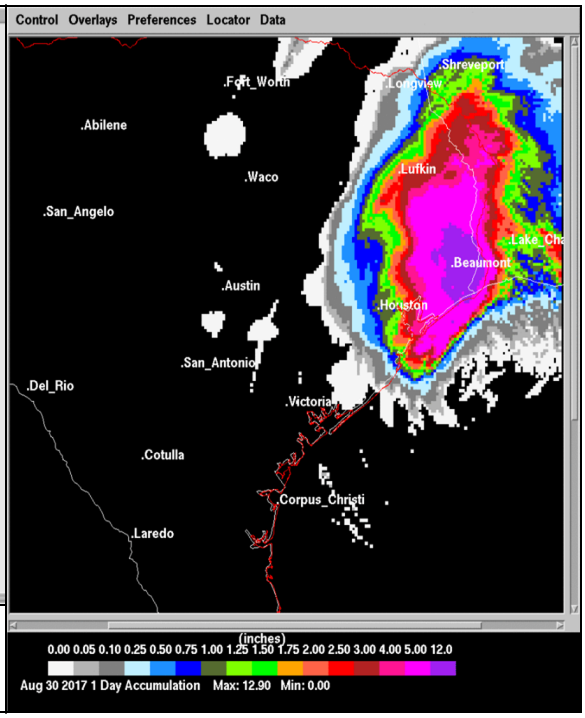
CoCoRaHS Reports & Radar Estimates for 29 August (above and right)



Why your CoCoRaHS reports are important to forecasters

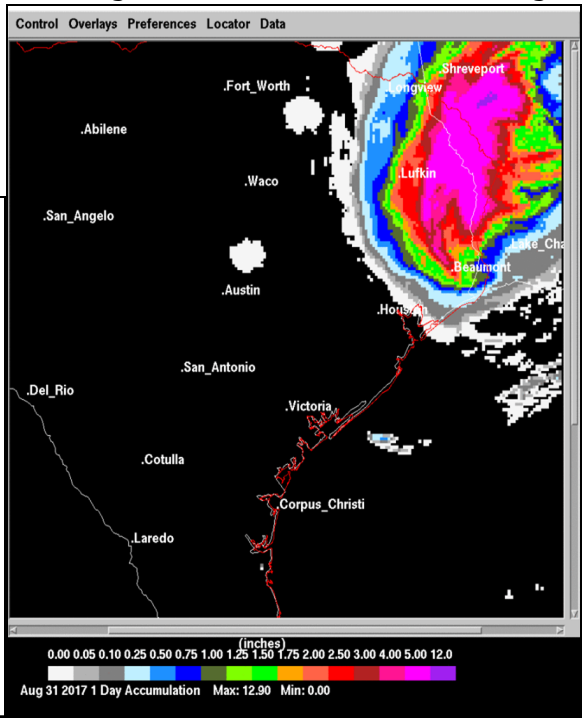
COCO - Data Type

LID	GAGE	MPE	Q2	RAW	TS	HSA	LAT/LON	HRAP	LOCATION
TXJJ11	15.31	12.90	12.90	0.00	RZ	LCH	(30.02 94.16)	(671 186)	Beaumont 4.6 S
TXHRN01	14.81	12.65	12.90	0.00	RZ	LCH	(30.27 94.22)	(669 192)	Lumberton 1.2 WNW
TXJS06	14.10	12.90	12.90	0.00	RZ	LCH	(30.46 93.96)	(674 199)	Buna 1.4 N
TXTR12	11.50	10.96	12.90	0.00	RZ	LCH	(30.60 94.17)	(668 202)	Spurger 6.2 S
TXHRN06	11.00	11.59	12.48	0.00	RZ	LCH	(30.36 94.32)	(666 195)	Kountze 1.1 S
TXOR06	10.60	12.90	12.90	0.00	RZ	LCH	(30.23 93.98)	(675 192)	Vidor 7.2 N
TXJS02	7.43	6.19	7.67	0.00	RZ	LCH	(30.90 94.11)	(668 211)	Jasper 6.7 W
TXTR13	7.12	6.57	8.40	0.00	RZ	LCH	(30.86 94.24)	(665 209)	Colmesneil 11.6 ESE
TXJS03	6.94	12.20	12.90	0.00	RZ	LCH	(30.64 93.89)	(675 204)	Kirbyville 1.5 SE
TXSA01	5.67	4.66	6.24	0.00	RZ	SHV	(31.13 94.11)	(667 217)	Broaddus 15.3 SE
TXNW02	5.50	4.75	5.75	0.00	RZ	LCH	(31.15 93.60)	(679 220)	Burkeville 11.2 NNE
TXTR03	5.36	6.11	7.11	0.00	RZ	LCH	(30.67 94.43)	(661 203)	Woodville 7.2 S
TXTR09	4.70	6.53	8.59	0.00	RZ	LCH	(30.89 94.40)	(661 209)	Colmesneil 2.3 SE
LASN03	4.61	4.28	5.06	0.00	RZ	SHV	(31.70 93.41)	(680 237)	Pleasant Hill 10.2 SE
TXAG02	4.58	3.80	5.34	0.00	RZ	SHV	(31.15 94.39)	(660 217)	Zavalla 2 ESE
TXGV18	4.33	5.14	4.78	0.00	RZ	HGX	(29.28 94.81)	(659 161)	Galveston 6.4 NE
LASN07	4.12	3.65	4.71	0.00	RZ	SHV	(31.68 93.66)	(674 235)	Noble 1.8 ESE
TXPL27	3.55	1.44	1.71	0.00	RZ	HGX	(30.81 95.12)	(644 204)	Onalaska 0.6 WSW
TXGV73	3.41	4.95	4.70	0.00	RZ	HGX	(29.30 94.78)	(660 162)	Galveston 8.3 NE
TXHRR93	3.16	1.18	1.04	0.00	RZ	HGX	(29.68 95.22)	(647 171)	Pasadena 4.4 WNW
TXLR14	3.15	3.08	2.92	0.00	RZ	HGX	(30.05 94.89)	(653 183)	Dayton 0.2 E
TXGV71	2.85	2.63	2.14	0.00	RZ	HGX	(29.41 95.03)	(653 164)	Texas City 4.4 W
TXGV70	2.74	4.06	2.35	0.00	RZ	HGX	(29.41 94.89)	(657 165)	Texas City 3.8 E
TXGV51	2.58	1.86	2.21	0.00	RZ	HGX	(29.36 94.96)	(655 163)	La Marque 1.8 E
TXGV44	2.35	3.41	2.15	0.00	RZ	HGX	(29.50 94.99)	(654 167)	Bacliff 0.5 SSE
TXAG03	2.28	2.26	3.64	0.00	RZ	SHV	(31.30 94.76)	(650 219)	Lufkin 3 SW
TXAG05	2.12	2.30	3.49	0.00	RZ	SHV	(31.32 94.72)	(651 220)	Lufkin 0.9 SSE
TXGV64	2.07	2.06	1.72	0.00	RZ	HGX	(29.34 95.03)	(653 162)	Hitchcock 1.6 NNW
TXCHM08	2.01	2.38	2.37	0.00	RZ	HGX	(29.87 94.89)	(654 178)	Mont Belvieu 1.6 NNW
TXGV46	1.90	2.49	1.78	0.00	RZ	HGX	(29.52 95.04)	(652 167)	League City 3.6 ENE
TXLR13	1.79	1.52	1.72	0.00	RZ	HGX	(30.36 95.08)	(647 191)	Cleveland 3.6 S
TXAG01	1.76	1.54	3.34	0.00	RZ	SHV	(31.32 94.84)	(648 219)	Lufkin 7 W
TXHRR33	1.73	1.74	1.76	0.00	RZ	HGX	(30.06 95.16)	(647 182)	Kingwood 1.8 E
TXGV60	1.68	2.09	1.67	0.00	RZ	HGX	(29.37 95.10)	(652 163)	Santa Fe 0.7 S
TXGV34	1.66	2.11	1.42	0.00	RZ	HGX	(29.54 95.07)	(651 168)	League City 2.7 NE
TXSL01	1.61	1.72	2.02	0.00	RZ	SHV	(31.80 94.19)	(661 236)	Center 0.6 NW
TXHRR15	1.59	1.05	1.06	0.00	RZ	HGX	(30.00 95.20)	(646 180)	Kingwood 3.9 S



CoCoRaHS Reports & Radar Estimates for 30 August (above and right) and for 31 August 2017 (below and below right)

So in conclusion, I want each of you to know how valuable your rainfall reading are to us here at the National Weather Service. Of increasing importance, your rainfall readings contribute greatly to our mission of saving lives and property from floods here in Texas. Quite often the majority of the highest 10 rainfall readings in the state come from CoCoRaHS observers. And please spread the word to your friends and neighbors...we need more observers. The more observers that report, the better the chances of us catching the magnitude of the rainfall. Even when you report a zero rainfall reading for a day you are sending us very useful information. Our final precipitation estimates that we compute go into the making of the state and national drought monitor each week. Thank YOU so much for your efforts. Have a great fall .



COCO - Data Type

LID	GAGE	MPE	Q2	RAW	TS	HSA	LAT/LON	HRAP	LOCATION
LASN03	7.42	8.61	7.76	0.00	RZ	SHV	(31.70 93.41)	(680 237)	Pleasant Hill 10.2 SE
LASN07	6.14	7.37	7.24	0.00	RZ	SHV	(31.68 93.66)	(674 235)	Noble 1.8 ESE
TXTR09	5.36	5.08	5.42	0.00	RZ	LCH	(30.89 94.40)	(661 209)	Colmesneil 2.3 SE
TXTR13	5.34	4.87	4.66	0.00	RZ	LCH	(30.86 94.24)	(665 209)	Colmesneil 11.6 ESE
TXJS02	4.69	5.32	4.74	0.00	RZ	LCH	(30.90 94.11)	(668 211)	Jasper 6.7 W
TXAG02	4.45	3.55	3.95	0.00	RZ	SHV	(31.15 94.39)	(660 217)	Zavalla 2 ESE
TXHRN05	4.09	4.50	5.13	0.00	RZ	LCH	(30.37 94.32)	(666 195)	Kountze
TXHRN06	3.58	4.50	5.13	0.00	RZ	LCH	(30.36 94.32)	(666 195)	Kountze 1.1 S
TXTR12	3.26	2.84	2.53	0.00	RZ	LCH	(30.60 94.17)	(668 202)	Spurger 6.2 S
TXTR03	3.16	3.35	2.70	0.00	RZ	LCH	(30.67 94.43)	(661 203)	Woodville 7.2 S
TXJS03	3.14	3.58	3.42	0.00	RZ	LCH	(30.64 93.89)	(675 204)	Kirbyville 1.5 SE
TXHRN01	2.83	4.55	5.78	0.00	RZ	LCH	(30.27 94.22)	(669 192)	Lumberton 1.2 WNW
TXJS06	2.46	2.43	2.08	0.00	RZ	LCH	(30.46 93.96)	(674 199)	Buna 1.4 N
TXSL01	2.44	3.14	2.47	0.00	RZ	SHV	(31.80 94.19)	(661 236)	Center 0.6 NW
TXNC05	2.06	1.90	1.72	0.00	RZ	SHV	(31.70 94.52)	(654 231)	Nacogdoches 9.5 NE
TXAG06	1.71	1.69	1.66	0.00	RZ	SHV	(31.36 94.81)	(649 221)	Lufkin 5.2 WNW
TXAG03	1.66	1.97	1.98	0.00	RZ	SHV	(31.30 94.76)	(650 219)	Lufkin 3 SW
TXPN03	1.42	0.99	0.95	0.00	RZ	SHV	(32.02 94.43)	(654 241)	Gary City 3.8 W
TXPL27	1.30	0.89	0.97	0.00	RZ	HGX	(30.81 95.12)	(644 204)	Onalaska 0.6 WSW
TXHRS12	1.08	1.00	0.97	0.00	RZ	SHV	(32.44 94.23)	(657 253)	Marshall 9.7 SE
TXOR06	1.05	1.69	1.34	0.00	RZ	LCH	(30.23 93.98)	(675 192)	Vidor 7.2 N
TXPL35	1.05	0.92	0.96	0.00	RZ	HGX	(30.86 95.08)	(645 205)	Livingston 13.4 NW
TXHRS14	0.66	0.59	0.58	0.00	RZ	SHV	(32.71 94.17)	(657 261)	Karnack 2.6 N
TXHRS02	0.54	0.39	0.37	0.00	RZ	SHV	(32.58 94.58)	(648 256)	Hallsville 5.5 N
TXRS08	0.50	0.48	0.34	0.00	RZ	SHV	(32.07 94.86)	(644 240)	Henderson 7 SSW
TXGG07	0.38	0.29	0.27	0.00	RZ	SHV	(32.52 94.75)	(644 253)	Longview 0.9 E
TXGG15	0.35	0.24	0.23	0.00	RZ	SHV	(32.52 94.78)	(643 253)	Longview 1.2 WNW
COSA02	0.26	0.42	0.55	0.00	RZ	PUB	(37.98 105.69)	(386 383)	Crestone 1.2 SSE
TXTT06	0.25	0.35	0.40	0.00	RZ	HGX	(30.94 95.32)	(638 207)	Trinity 2.9 E
NMSF01	0.22	0.12	0.32	0.00	RZ	ABQ	(35.74 106.07)	(377 322)	Santa Fe 7.7 WNW
NMTS33	0.20	0.17	0.18	0.00	RZ	ABQ	(36.52 105.54)	(389 343)	Arroyo Seco 1.4 E
TXSJ12	0.17	0.36	0.32	0.00	RZ	HGX	(30.69 95.29)	(640 200)	Oakhurst 3.6 SSE
COAM10	0.13	0.12	0.16	0.00	RZ	PUB	(37.65 105.58)	(388 374)	Great Sand Dunes 7 SSW
NMTS09	0.13	0.13	0.16	0.00	RZ	ABQ	(36.38 105.57)	(388 339)	Taos 1.6 SSE
NMTS17	0.12	0.00	0.00	0.00	RZ	ABQ	(36.36 105.76)	(384 339)	Ranchos De Taos 2.4 W
TXLR14	0.08	0.11	0.14	0.00	RZ	HGX	(30.05 94.89)	(653 183)	Dayton 0.2 E

How to submit significant weather reports of heavy rain

By Ron Havran
CoCoRaHS Houston/ Galveston Regional Coordinator

Reason and Purpose: During flood events which include Hurricanes, Tropical Storms, Severe thunderstorms, and heavy rain from various weather systems observers need to know how to submit the proper reports of their observations and how often they should report and for how large of amounts of rainfall. This primer will educate the observer of correct procedures to follow on reading their gage and the best times to read their gage when very heavy and extreme rainfall is occurring. Many times in these type of events gages will overflow their capacity. Tips and guidelines to help observers read rainfall totals that exceed the capacity of the gage are discussed. By following these guidelines observers are adding value to their observations which are used by professionals in making critical decisions on flooding and potential impacts of the weather conditions which are being observed.

CoCoRaHS rain gage capacity: The rain collector is 4.25" wide and 14" tall graduated to the nearest inch with .01" intervals for the inner cylinder tube. The inner tube measures 1" of rain and then will overflow into the outer cylinder which will hold an additional 10". The total amount the gage can hold when completely full will be around 11.30" of rain – the 11.00" of the two cylinders plus about 0.30" of rain in the top collection funnel before overflowing. All rain must be read by measuring out in the inner funnel.

Thresholds for Significant Weather Reports (SWR) of very heavy rain events: Typical heavy rain events and storms will exceed the capacity of the CoCoRaHS gage during a 24 hour period before the observer's next observation. **A threshold for reading the rain gage when possible will be at the 6.00" level or just after the gage looks half full.** If the observer is at the location of the gage when this is occurring the observer should try to read and empty the gage at the first possible break in the heavy rain even if just for a few minutes. Make note of the time that this is done and then submit a SWR. Most observers may not be able to do this until later in day or evening. **All observers should read and empty their gages before turning in for the night during very heavy rainfall storms and events to allow for maximum collection of rain in the gage overnight while it may be impossible to read the gage at night**. Make note of all times of reading the gage and please keep a running total of the storm event and submit this each time a SWR is made. Also note that a SWR is not a replacement for a daily report. The two reports serve to different purposes. A daily report is a once a day for a 24 hour period total of rain from the last report made. A SWR report is for the time period entered for the report and how much rain has fallen in that time frame. The SWR is a real time update to forecasters as to the current state of rainfall and flooding at your location. Forecasters use this data on the fly in updating models and forecasting new rainfall effects on a region.

Significant Weather Report

Station Number:	TX-GV-71
Station Name:	Texas City 4.4 W
Date:	8/25/2017 6:09 PM
Submitted	8/25/2017 6:46 PM
Notes:	Will be reporting every 12 hours unless there's an extreme downpour. Much more rain to come
Taken at Registered Location:	True
Precip Duration Minutes:	720
New Precip Amount:	2.92 in.
Total Precip Amount:	NA
New Snow Depth:	NA
Total Snow Depth:	NA
Flooding:	Minor

Significant Weather Report

Station Number:	TX-HRR-116
Station Name:	Katy 1.0 NNE
Date:	8/27/2017 9:00 PM
Submitted	8/27/2017 9:11 PM
Notes:	Water feet from coming into house. This will be last report tonight. Will attempt to update Monday Morning.
Taken at Registered Location:	True
Precip Duration Minutes:	60
New Precip Amount:	3.93 in.
Total Precip Amount:	26.23 in.
New Snow Depth:	NA
Total Snow Depth:	NA
Flooding:	Severe

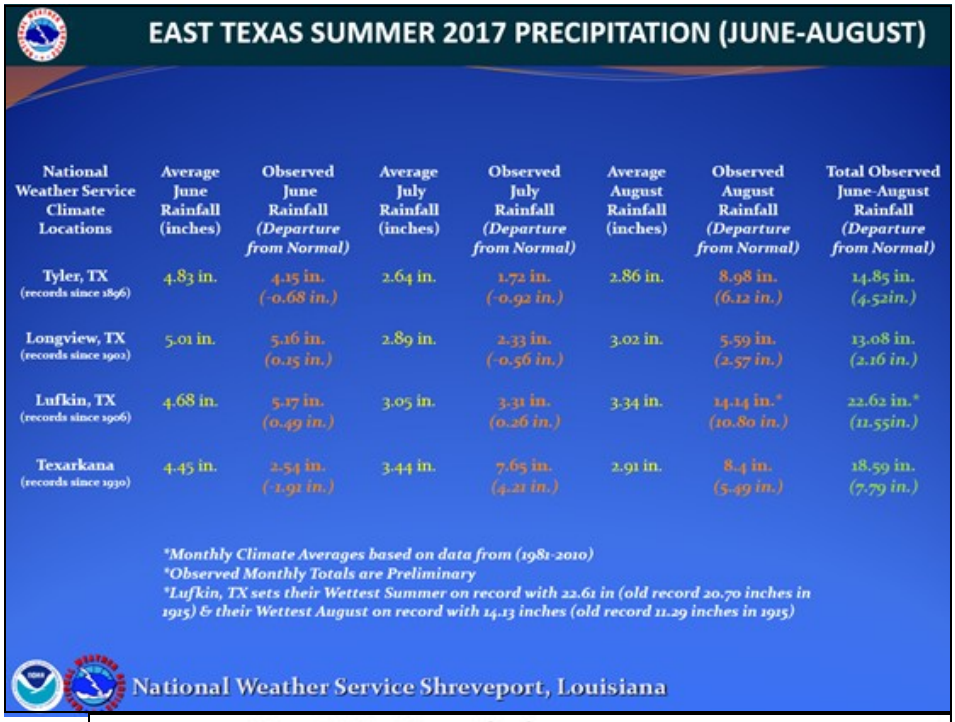
Significant Weather Report

Station Number:	TX-HRR-116
Station Name:	Katy 1.0 NNE
Date:	8/27/2017 8:00 PM
Submitted	8/27/2017 8:05 PM
Notes:	Street completely flooded. Water coming up driveway. Good chance I will have water in house next couple of hours!
Taken at Registered Location:	True
Precip Duration Minutes:	60
New Precip Amount:	2.19 in.
Total Precip Amount:	22.30 in.
New Snow Depth:	NA
Total Snow Depth:	NA
Flooding:	Extreme

Examples of severe weather reports submitted by observers.

East Texas Summer Climate Summary

By Davyon Hill
Meteorologist
National Weather Service WFO Shreveport

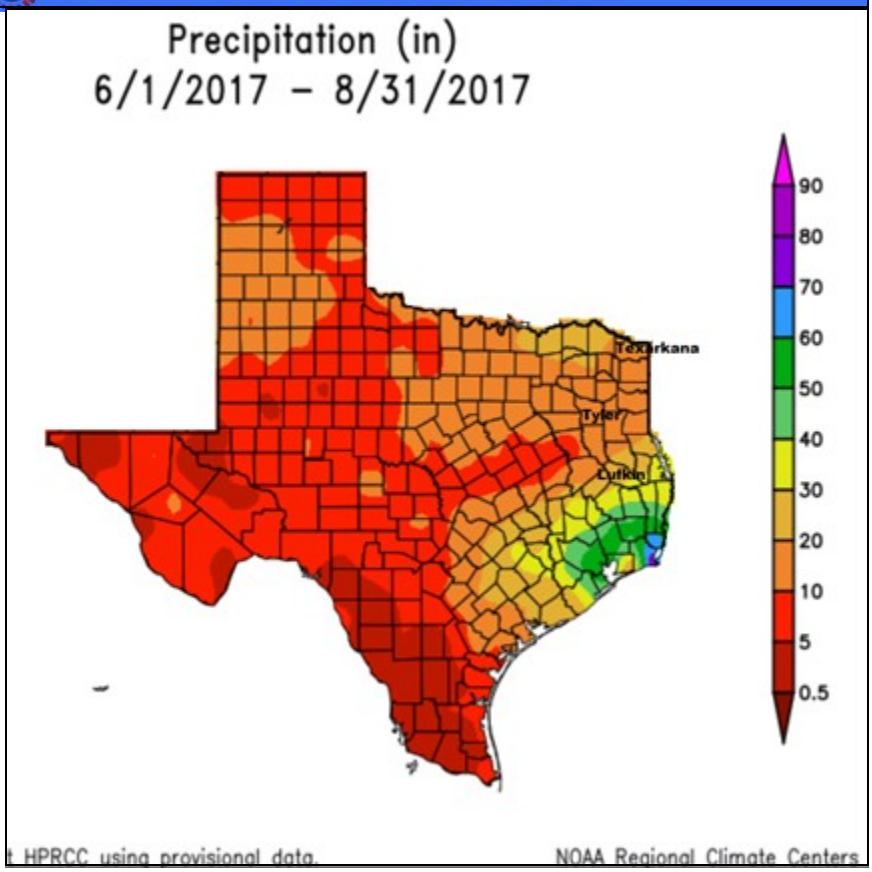


EAST TEXAS SUMMER 2017 PRECIPITATION (JUNE-AUGUST)

National Weather Service Climate Locations	Average June Rainfall (inches)	Observed June Rainfall (Departure from Normal)	Average July Rainfall (inches)	Observed July Rainfall (Departure from Normal)	Average August Rainfall (inches)	Observed August Rainfall (Departure from Normal)	Total Observed June-August Rainfall (Departure from Normal)
Tyler, TX (records since 1896)	4.83 in.	4.15 in. (-0.68 in.)	2.64 in.	1.72 in. (-0.92 in.)	2.86 in.	8.98 in. (6.12 in.)	14.85 in. (4.52in.)
Longview, TX (records since 1902)	5.01 in.	5.16 in. (0.15 in.)	2.89 in.	2.33 in. (-0.56 in.)	3.02 in.	5.59 in. (2.57 in.)	13.08 in. (2.16 in.)
Lufkin, TX (records since 1906)	4.68 in.	5.17 in. (0.49 in.)	3.05 in.	3.31 in. (0.26 in.)	3.34 in.	14.14 in.* (10.80 in.)	22.62 in.* (11.55in.)
Texarkana (records since 1930)	4.45 in.	2.54 in. (-1.91 in.)	3.44 in.	7.65 in. (4.21 in.)	2.91 in.	8.4 in. (5.49 in.)	18.59 in. (7.79 in.)

*Monthly Climate Averages based on data from (1981-2010)
*Observed Monthly Totals are Preliminary
*Lufkin, TX sets their Wettest Summer on record with 22.61 in (old record 20.70 inches in 1915) & their Wettest August on record with 14.13 inches (old record 11.29 inches in 1915)

National Weather Service Shreveport, Louisiana



Quite a rainy Summer 2017 for East Texas. Average rainfall during the meteorological summer (June-August) is generally between 10 to 11 inches across East Texas with June being the wettest ,with an average rainfall between 4 to 5 inches. However, most of East Texas observed above normal precipitation, with top 10 wettest Summers of all time at National Weather Service Climate locations. The climate site at Lufkin, TX recorded its wettest Summer and wettest August on record.

Most of the rainfall observed this summer was due to two distinct features. The first was an unusual summer pattern that usually occurs in fall and spring across the region. This is pattern is known as Northwest Flow Aloft. Under this pattern, a broad, upper level blocking ridge develops over the desert southwest. This results in shortwave troughs (and associated cold fronts) being steered towards the region from Mountain West. Thunderstorms complexes (known as Mesoscale Convective Systems or MCSs) develop along these fronts in the Colorado Front Range and across Western Kansas. These storms propagate southeast toward East Texas during the overnight hours, arriving in the region by early morning. They usually dissipate during the morning hours due to the fact that the atmosphere is usually most stable at this time,. but they leave behind residual mesoscale boundaries the serve as focus for additional thunderstorm develop during the afternoon when the atmosphere destabilize due to diurnal heating. Typically during the summer, High Pressure builds over the southeastern U.S providing a blocking pattern that eliminates Northwest Flow aloft, but this wasn't the case this year as MCSs move through the region day after day as persistent Northwest Flow lasted through late August.

The second distinct feature that brought the region significant rainfall this summer was Hurricane Harvey. Hurricane Harvey made landfall near Rockport, Texas around 10 pm on August 25th. Harvey continued to slowly meander across portions of southeast Texas for several days after landfall. This resulted in areas on Deep East Texas receiving up to 20 inches of rainfall over a 5 day period from August 26 through August 31. This resulted in widespread CONTINUED ON PAGE 29—->

East Texas Summer Climate Summary

FROM PAGE 28—->flooding and several road closures across portions of Deep East Texas.

AUG.25-31ST EAST TEXAS COCORAHS REPORTS (OVER 2 INCHES) FROM HARVEY...

...Angelina County...

2 ESE Zavalla (TX-AG-2)	20.27 in
1 SSE Lufkin (TX-AG-5)	11.96 in
3 SW Lufkin (TX-AG-3)	11.74 in
8 W Lufkin (TX-AG-9)	10.17 in
5 WNW Lufkin (TX-AG-6)	10.00 in

...Nacogdoches County...

Nacogdoches Arbor Oaks (TX-NC-7)	8.35 in
10 NE Nacogdoches (TX-NC-5)	6.38 in

...Panola County...

3 W Gary City (TX-PN-3)	2.29 in

...Sabine County...

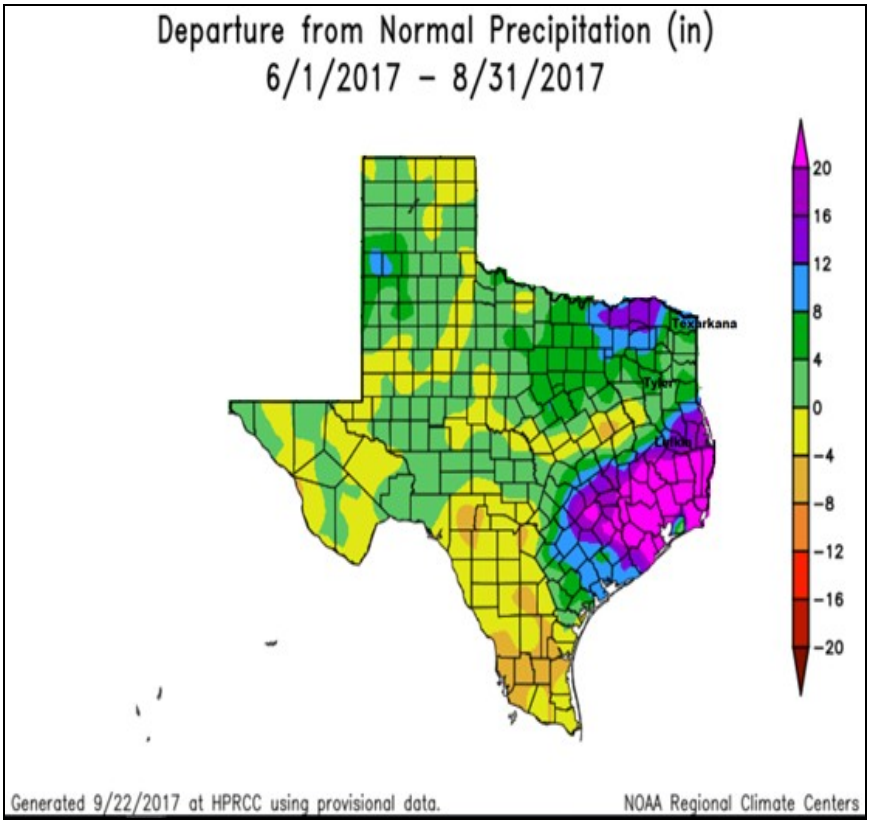
Hemphill 8.6 E (TX-SB-1)	12.20 in

...San Augustine County...

15 SE Broaddus (TX-SA-1)	19.01 in

...Shelby County...

Center 0.6 NW (TX-SL-1)	6.62 in

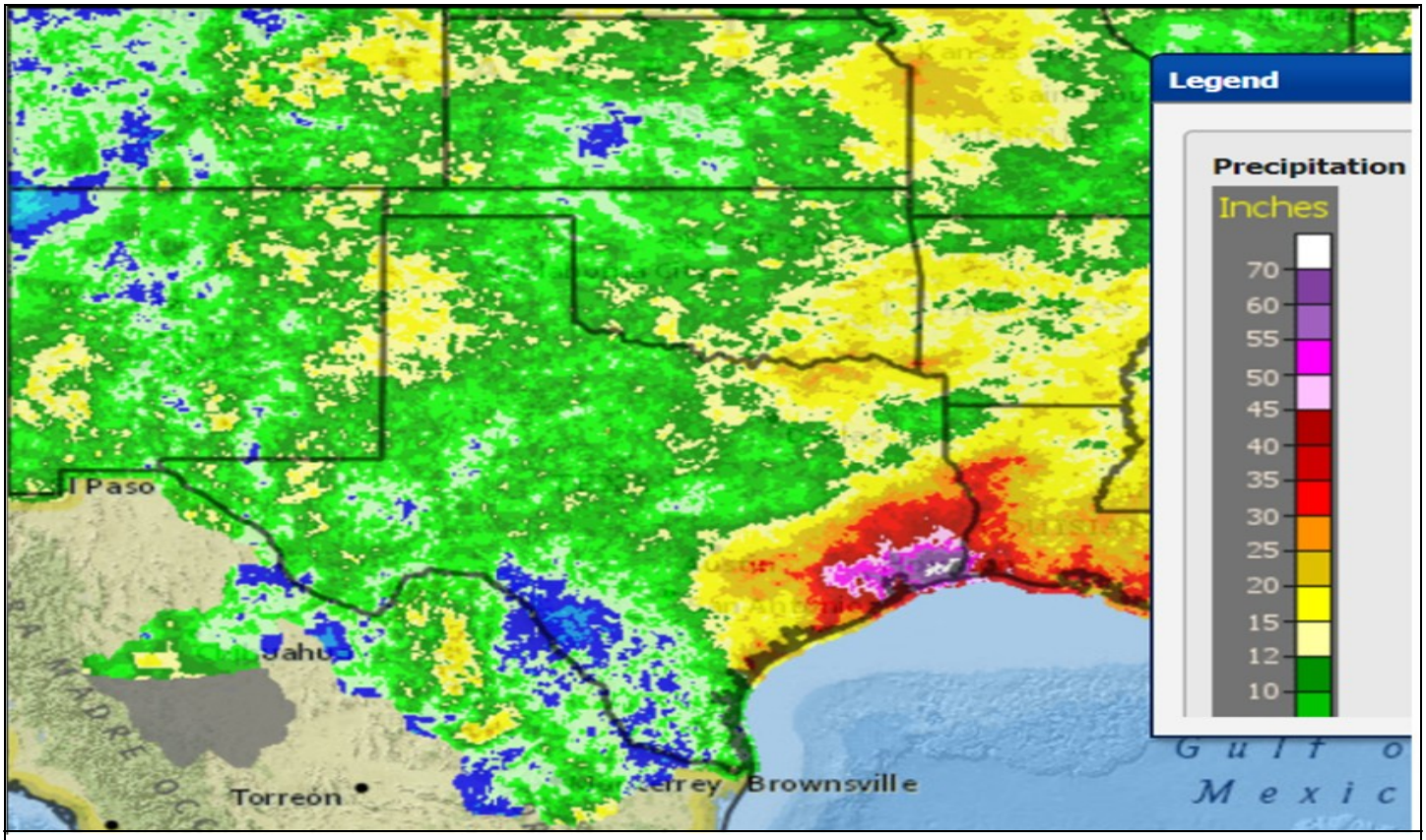


Overall, Summer 2017 was one of the wettest on record for East Texas which resulted in most of the region being void of drought conditions and slightly below normal temperatures.

North Texas Summer Climate Summary

By Greg Story
North Texas Regional Coordinator for CoCoRaHS.

After the North Texas region finished one of the driest springs of record, we ended up with one of the wettest summers. After the fourth driest May of record, parts of north Texas received over 8 inches in June, while normal is around 3.75 inches. Thus June ended the month about 4.25" above normal. At the Dallas/Fort Worth airport, on June 24 a record rainfall fell with 3.67 inches. The previous record for June 24 was 1.76 inches in 1917. Additionally, this became the wettest of any June day ever, eclipsing the previous daily June record of 3.31 inches in 1935. June 2017 ended as the wettest June since 2007. In July it was also a wet month. The region received slightly over 4 inches in July, while normal rainfall is just slightly over 2 inches. Thus July ended the month about 2" above normal and was the wettest July in 10 years. We had the 10th wettest summer of record since 1899, and that was before August even started! And as it turned out August was also wet. Some parts of northeast Texas received 4 to 6 inches of rain August 6 – 7. Then even heavier rains occurred August 12 – 13 when parts of Fannin and Grayson counties received 9 to over 10 inches! The largest amount measured in Dallas County was 6.19 inches in Sunnyvale. DFW Airport set a daily record with 1.78 inches. Another mesoscale convective system invaded Texas August 14. The heaviest rain fell in Mineola in Wood County with 3.31 inches. A CoCoRaHS site near Commerce in Hunt County recorded more than 13.90 inches of rain! The region averaged slightly over 4 inches in August, while normal rainfall is just slightly under 2 inches. Thus August ended the month a little over 2" above normal. DFW airport ended up having its 6th wettest summer of record with 16.80 inches, which is nearly 9 inches above normal."



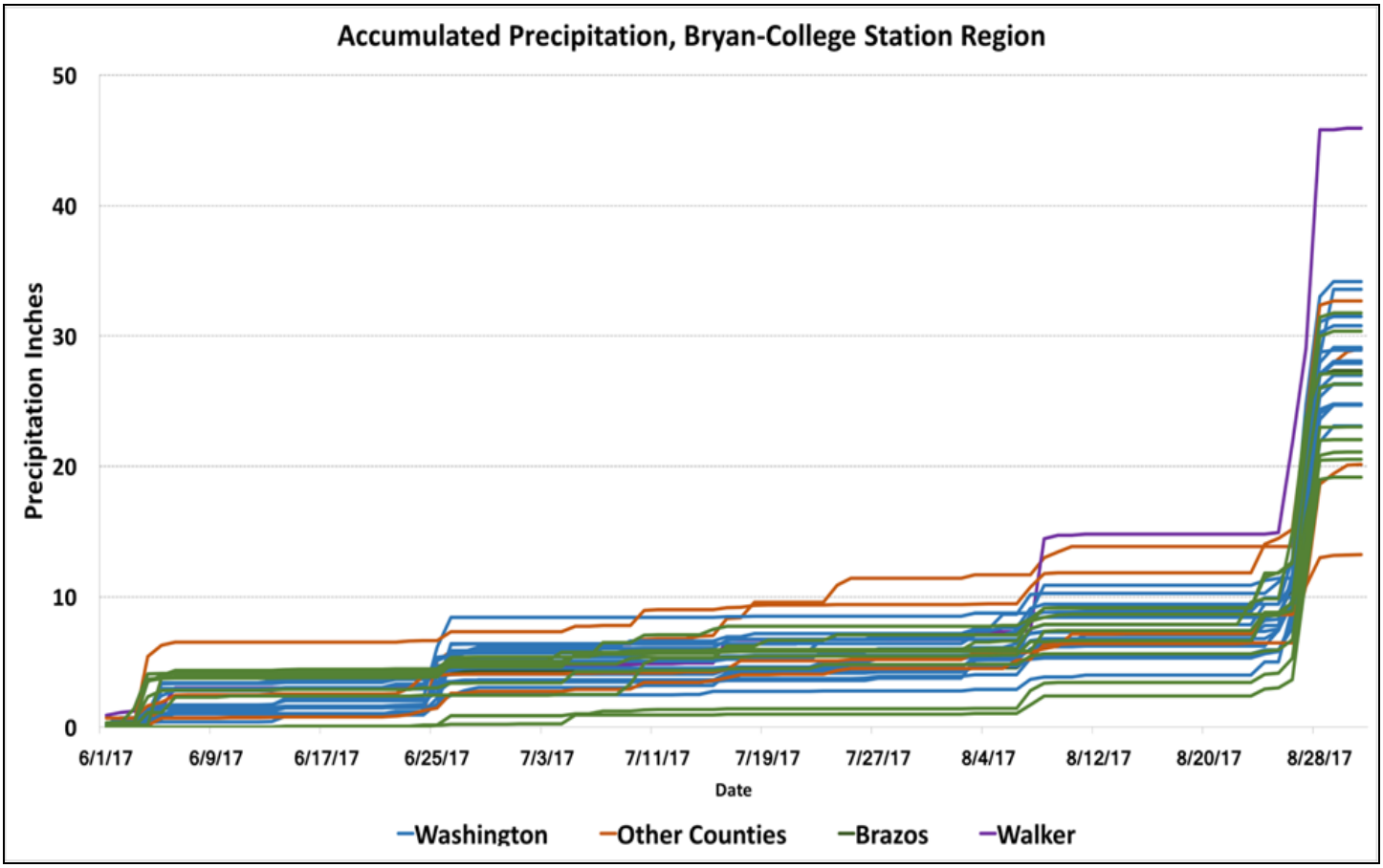
Summer 2017 rainfall across the state of Texas. Heaviest rains have fallen in southeast Texas and northern Texas

Brazos Valley Summer Precipitation Summary

By: Brooke Barker and Jeramy Dedrick, Texas A&M University
Regional CoCoRaHS Coordinator: John Nielsen-Gammon

Summer in the Brazos Valley Region began with temperature values less than the regional average in June, though increased to high maximums as the season progressed through July and August. During the latter days in the month of August, the Brazos Valley experienced torrential rain downpours caused by strong rainbands emanating from Hurricane Harvey as it made landfall and stalled in southeast Texas. These downpours were highly evident in exceptional daily precipitation measurements during the end of the season and represented by the high total precipitation over the 3-month period.

This season's statistics: There were 46 active CoCoRaHS observers during the summer period, an increase of two from the Spring season. 8 observers during this season reported for the full 92 days, while over 20 observers reported for at least 85% during the summer, providing 30 active observers with reliable measurements across 5 counties.



The accumulated precipitation graph from the summer season shows relatively consistent precipitation for most of the summer, where daily totals range zero to two inches. July was comparatively the driest month during the season. As Hurricane Harvey passed during late-August, precipitation totals collectively increased substantially with notable maximums in Walker County.

Wettest day: 16.75", August 28 (Walker County)
Wettest seasonal total: 45.94" (Walker County)
Longest spell of days with measurable rain: 7 (Walker & Washington Counties)
Longest spell of days without measurable rain: 16 (Washington County)

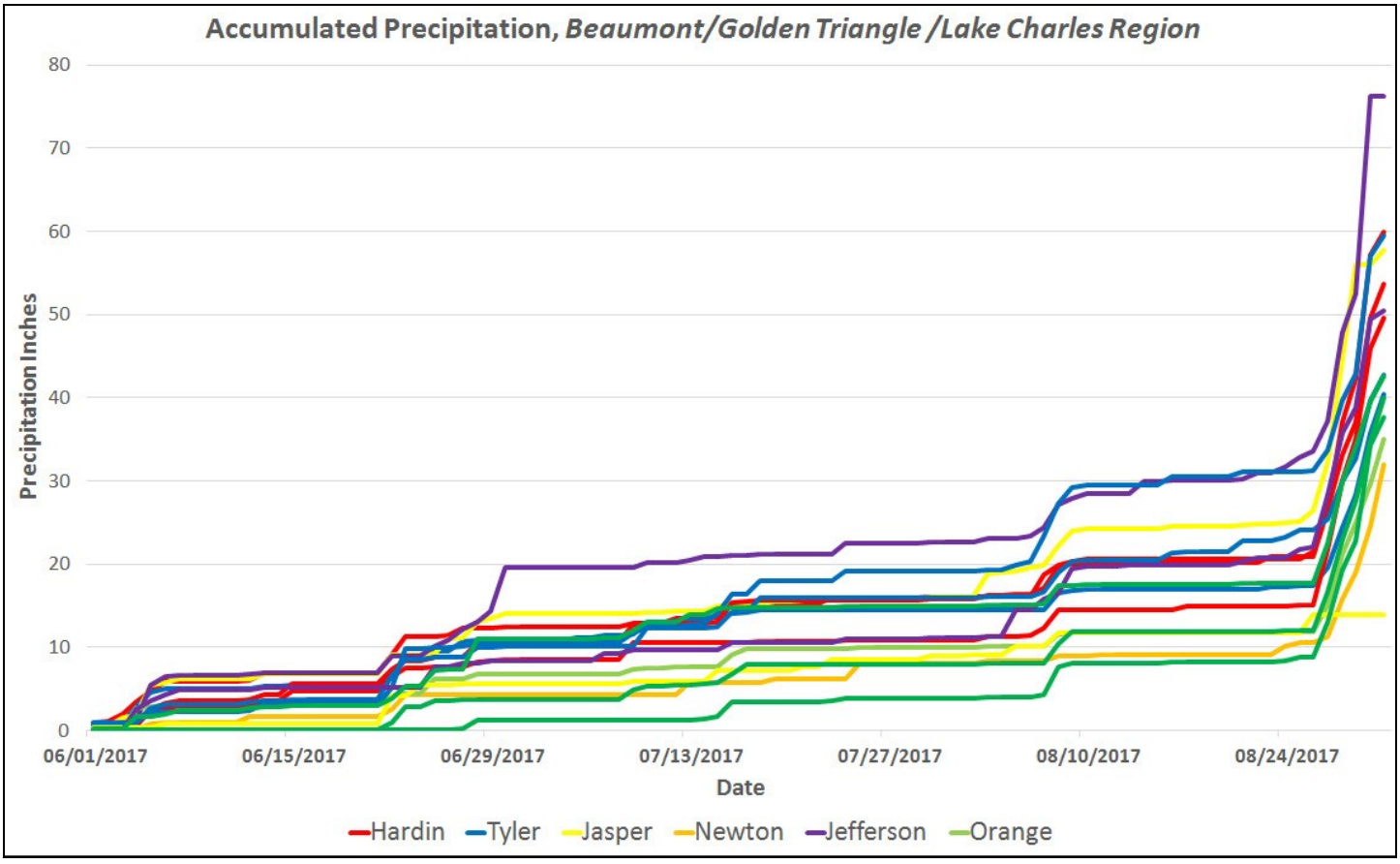
Beaumont/Golden Triangle Region Summer Climate Summary

By Brooke Barker and Jeramy Dedrick, Texas A&M University
Regional CoCoRaHS Coordinators: Jonathan Brazzell and Donovan Landreneau, NOAA/NWS

The Beaumont/Golden Triangle/Lake Charles region (LCH) began the 2017 summer season with warm, though below average temperatures, and dry weather conditions that produced fairly low rainfall amounts for the months of June and July. This region's total accumulated precipitation during the summer was particularly affected by the passage of Hurricane Harvey during the last week of August, evident by accumulation totals for most county observations in the region exceeding 40 inches.

This season's statistics: There were 19 active CoCoRaHS observers during the 2017 summer period, one more than the spring season. Only one observer reported for the entirety of the 92-day season, though over 10 observers reported for nearly 70 percent of the summer, providing 15 active observers with reliable measurements across 6 counties. Precipitation measurements for a large portion of the season from the beginning of June to July were for the most part consistently dry as represented by the accumulated precipitation graph. With the exception of some notable significant rain events in June and July observed intermittently in Orange and Jasper counties, daily precipitation values remained consistently below an inch or two. The landfall of Hurricane Harvey on August 25th, 2017 brought extraordinary rainfall amounts during the final week of the season as daily precipitation total ranges were between four and twenty-three as reported by some observers.

Wettest day: 23.82", August 30 (Orange County)
Wettest seasonal total: 76.24" (Orange County)
Longest spell of days with measurable rain: 9 (Tyler & Hardin Counties)
Longest spell of days without measurable rain: 13 (Tyler County)



Thunderstorms across South Plains bring relief from heat

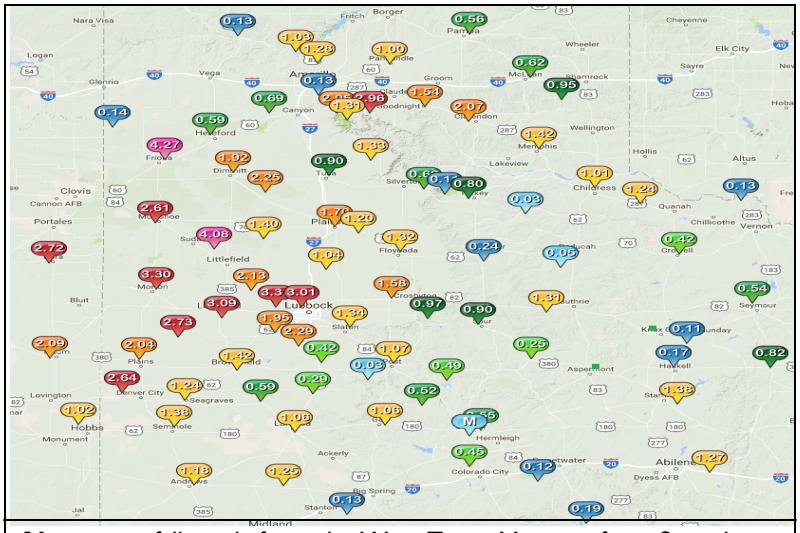
By National Weather Service
WFO Lubbock

After a hot and dry couple of weeks in mid-late July, much of the South Plains of West Texas saw some much needed moisture and cooler temperatures at the very end of July and the start of August. Late on Sunday, the 30th, a cluster of thunderstorms developed across eastern NM, then pushed across the state line Sunday night. Most of the rain from this complex fell early Monday morning the 31st, although another batch of showers pushed east across the western South Plains later in the morning, before dying off across the central and eastern South Plains around midday.

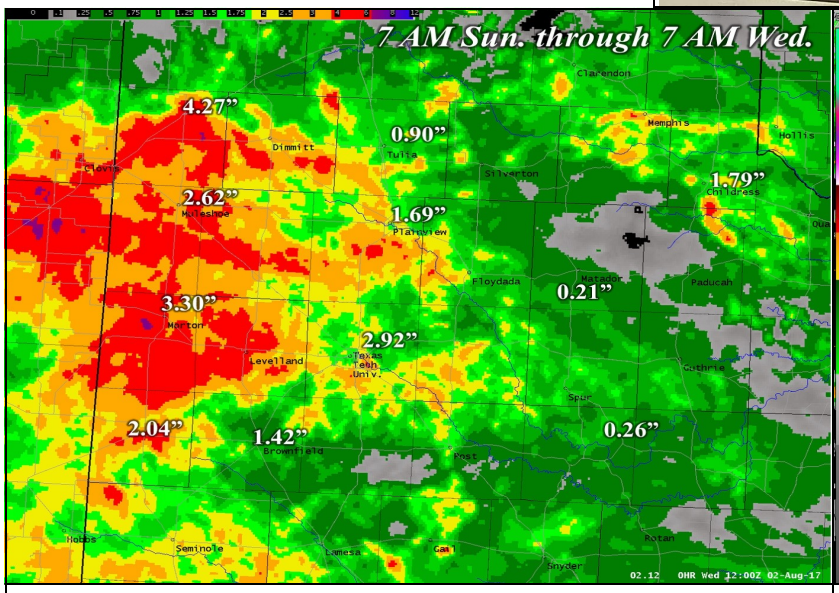
Late Monday night, another storm complex developed across eastern New Mexico. This complex moved more to the south than east, but it did bring some drenching rain to Parmer County. The town of Friona received about two inches of rain from each complex for a total of 4.27 inches.

During the day Tuesday, a west to east line of showers and thunderstorms developed across the north-central South Plains. This line moved to the south through the afternoon and doused parts of Lubbock between 3 and 4 pm. The line eventually moved into the Permian Basin and brought some heavy rain to the Midland-Odessa area.

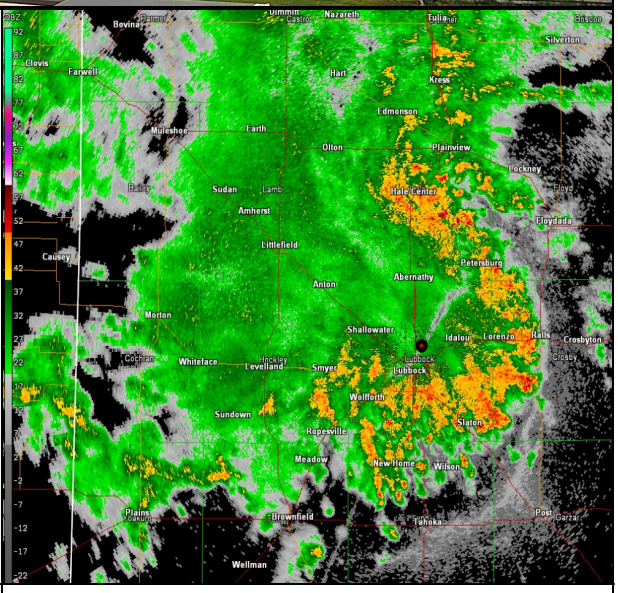
Through the entire 3-day period from Sunday through Tuesday, many locations on the Caprock received between two and five inches of rain. Farther east, Childress did get in on the action, but much of the Rolling Plains missed out on significant rainfall in this pattern. The image below shows radar estimated rainfall amounts which have been calibrated to ground reports.



Above: rainfall totals from the West Texas Mesonet from Saturday morning (29th July) to Tuesday morning (1st August)
Below: View from Wolfforth of a heavy rain shower moving across Lubbock on Tuesday afternoon, August 1st.



Radar and gauge derived map of 72 hour rainfall from 7am July 30th to 7am August 2nd.



Radar image of thunderstorm complex moving across the Caprock at 5am Sunday July 30th.

Rio Grande Valley Summer Climate Summary

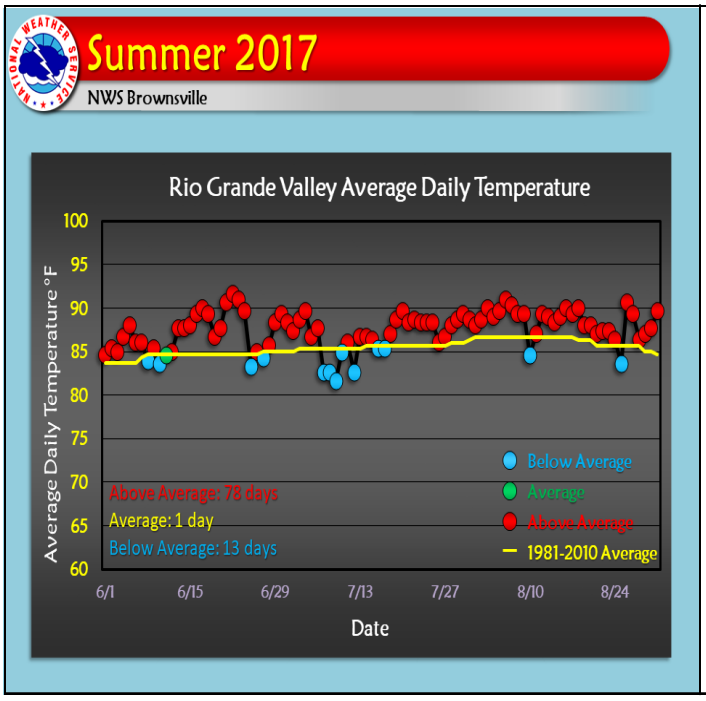
La Canícula Reigns (not Rains) from June-August 2017

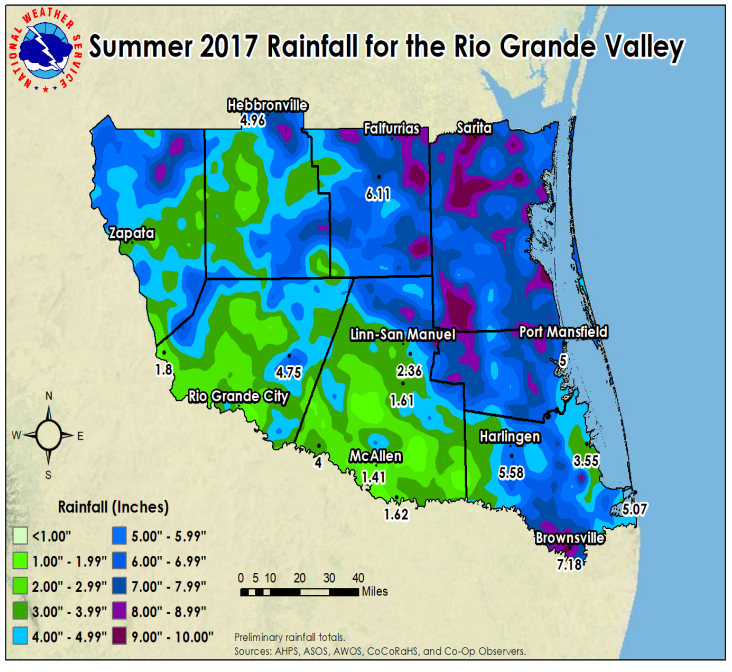
Drought/Dry Conditions Hang Tough for Most of Valley; Temperatures Among Top Ten Hottest for Second Year in Row

By Barry Goldsmith
Warning Coordination Meteorologist
National Weather Service-WFO Brownsville

For the second straight year, the balance of summer featured searing to near-record average heat and generally below average rainfall across the Rio Grande Valley. The pattern known as "La Canícula" began after the first week of June and held forth through the end of August on average – even as the Valley escaped impact from two tropical cyclones – Cindy in June and Harvey at the end of August. Average temperatures ranked among the Top 20 hottest across the Valley, with several locations (below) settling into the Top 5, not too far from other hot summers this century, including 2009, 2012, and 2016. La Canícula, which is coined after Sirius (Dog Star) during a six week period when Sirius rises with the hot summer sun (generally, July 3 through August 11), features a persistent atmospheric ridge across an area that extends from southern New Mexico through west, southwest, and Deep South Texas and into much of northern Mexico. This year, the pattern dominated a thirteen week period from early June through the end of August.

The ridge – which provides subsident air that favors dry air versus cloud/precipitation formation – did its job for the most part across the region. While a few pockets of the Rio Grande Plains and the Lower Valley saw helpful rains at a few points through the summer, the majority of the area ended up below average - even when average for the summer ranges from 6 to 7 inches Valley wide – to the tune of 10 to 50 percent of this value. The dry, hot summer maintained abnormally dry to moderate drought conditions across much of the agriculture and livestock-rich Rio Grande Valley and ranchlands; low soil moisture levels to close August meant that outside of persistent drenching rain, much of the soil would quickly soak in any future scattered thunderstorm rain and dry up quickly. CONTINUED PAGE 35——————————————————————————->





Rio Grande Valley Regional Climate Summary

Maximum 92-Day Mean Avg Temperature for Brownsville Area, TX (ThreadEx)

Click column heading to sort ascending, click again to sort descending.

Rank	Value	Ending Date	Missing Days
1	86.9	1998-08-31	0
2	86.4	1980-08-31	0
3	86.3	1982-08-31	0
4	86.1	2012-08-31	0
5	86.0	2005-08-31	0
6	86.0	2001-08-31	0
7	85.9	2016-08-31	0
-	85.9	1900-08-31	0
9	85.9	2010-08-31	0
10	85.8	2011-08-31	0
11	85.8	2009-08-31	0
12	85.7	1978-08-31	0
13	85.7	2004-08-31	0
14	85.5	2013-08-31	0
15	85.4	2014-08-31	0
16	85.3	1953-08-31	0
17	85.3	2017-08-31	0
18	85.3	1918-08-31	0
19	85.3	1969-08-31	0
20	85.2	1996-08-31	0

Period of record: 1878-01-01 to 2017-09-01

Maximum 92-Day Mean Avg Temperature for MCALLEN MILLER INTL AP, TX

Click column heading to sort ascending, click again to sort descending.

Rank	Value	Ending Date	Missing Days
1	90.8	2009-08-31	0
2	90.1	2017-08-31	0
3	89.9	1998-08-31	2
4	89.6	2016-08-31	0
5	88.8	2012-08-31	0
6	88.5	2015-08-31	0
7	88.1	1980-08-31	1
8	88.0	2014-08-31	0
9	87.9	2011-08-31	0
10	87.5	2013-08-31	0

Period of record: 1961-01-14 to 2017-09-01

June-August Rankings 2017 highlighted

Maximum 92-Day Mean Avg Temperature for PORT MANSFIELD, TX

Click column heading to sort ascending, click again to sort descending.

Rank	Value	Ending Date	Missing Days
1	85.2	2009-09-01	11
2	85.2	2005-09-01	6
3	84.8	2016-09-01	2
4	84.7	2017-09-01	3
5	84.5	2011-09-01	5
6	84.3	1958-09-01	7
7	84.2	1969-09-01	1
8	84.2	1998-09-01	8
9	84.1	2013-09-01	5
10	84.1	2010-09-01	2

Period of record: 1958-02-07 to 2017-09-02

Maximum 92-Day Mean Avg Temperature for HARLINGEN, TX

Click column heading to sort ascending, click again to sort descending.

Rank	Value	Ending Date	Missing Days
1	87.9	1998-09-01	4
2	87.1	2016-09-01	5
3	86.9	2017-09-01	8
4	86.8	2009-09-01	5
5	86.5	2005-09-01	0
6	86.5	2012-09-01	6
7	86.4	1958-09-01	0
8	86.4	1953-09-01	0
9	86.2	1945-09-01	0
10	86.1	2001-09-01	6

Period of record: 1912-02-07 to 2017-09-02

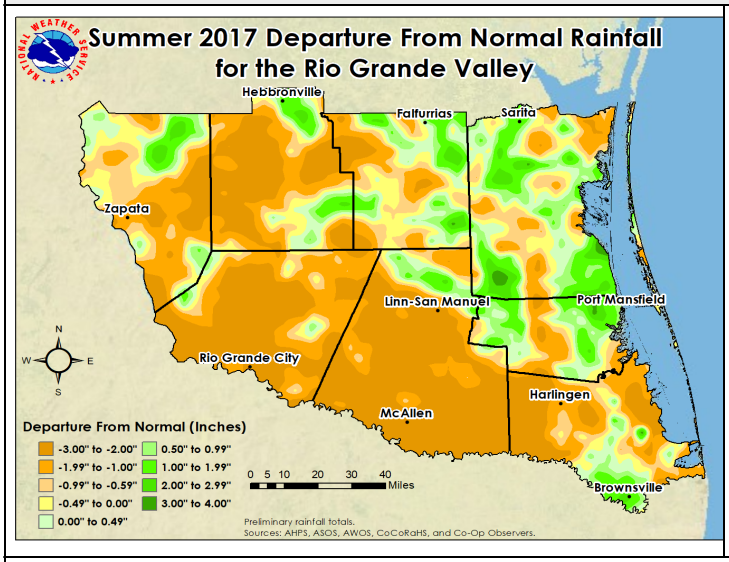
Maximum 92-Day Mean Avg Temperature for RIO GRANDE CITY, TX

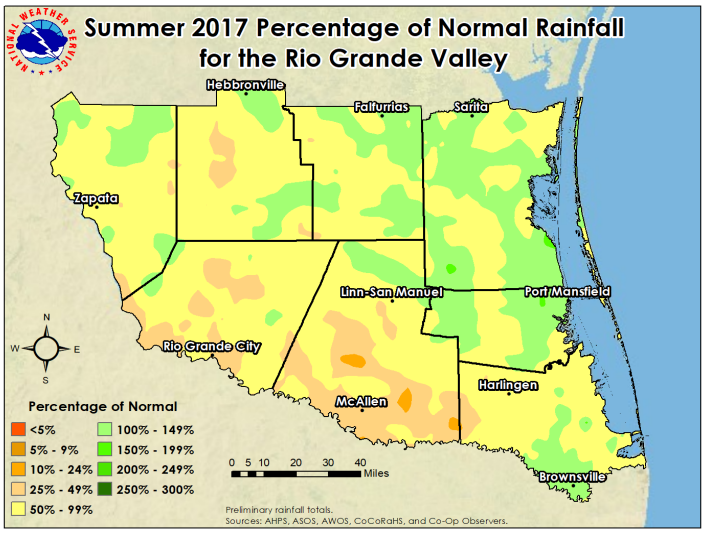
Click column heading to sort ascending, click again to sort descending.

Rank	Value	Ending Date	Missing Days
1	91.5	1998-09-01	17
2	89.5	2009-09-01	2
3	89.2	1996-09-01	5
4	89.1	1901-09-01	0
5	89.1	1997-09-01	7
6	88.9	2012-09-01	26
7	88.8	1990-09-01	62
8	88.8	1999-09-01	5
9	88.8	1928-09-01	0
10	88.8	1950-09-01	61
11	88.7	2001-09-01	13
12	88.7	1902-09-01	2
13	88.6	2017-09-01	3
14	88.4	2000-09-01	5
15	88.4	1948-09-01	1
16	88.2	1947-09-01	1
17	88.2	1958-09-01	0
18	88.0	1946-09-01	0
19	88.0	1960-09-01	0
20	88.0	1953-09-01	0

Period of record: 1897-01-01 to 2017-09-01

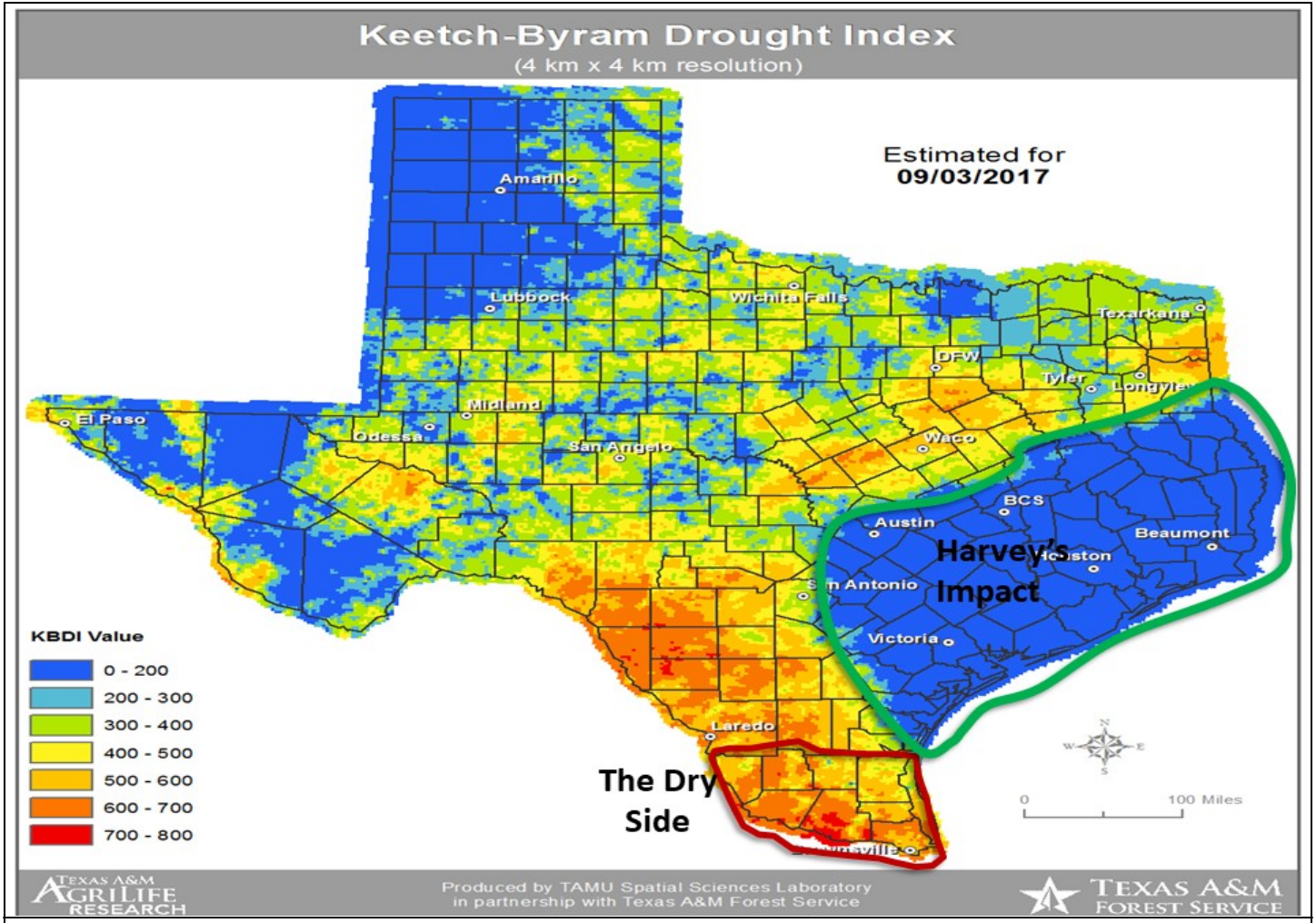
Another Summer of Heat





Above: Top-twenty ranked heat for summer 2017 (top) across the Rio Grande Valley matches closely with the lack of precipitation (bottom), that generally stretched from the Lower Valley west of Brownsville through the Upper Valley and part of the Rio Grande Plains ranchlands. Several locations in Hidalgo County received between 5 and 25 percent of average, placing them in jeopardy of reaching severe drought if rains didn't come in September.

Rio Grande Valley Summer Climate Summary



Above: The Keetch-Byram Drought Index (KBDI), which represents the moisture regime within zero to 8 inches of sub-surface soil, rose toward peak values (above 700 units) in agricultural and population rich Hidalgo County by the start of September 2017. The combination of below average rainfall – and lack of any rainfall consistency when it did rain – with the top twenty hottest temperatures led to the high values. Just 180 miles northeast, Harvey's biblical rainfall brought values to near zero

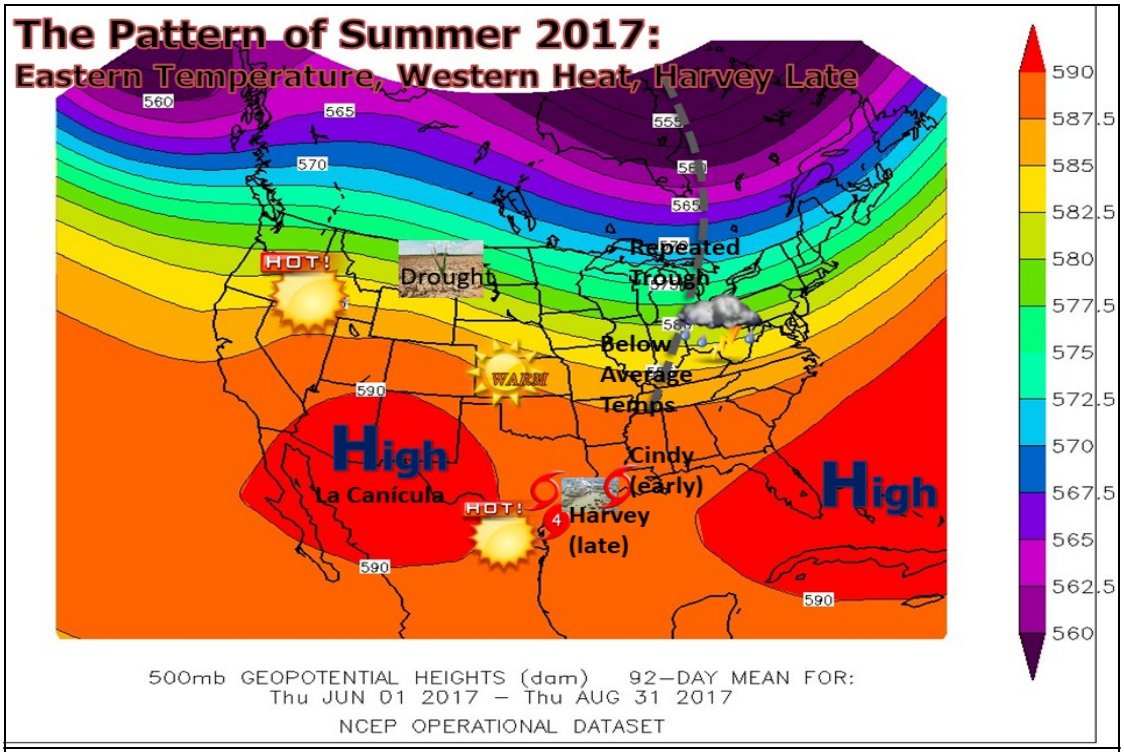
So Close, Yet So Far

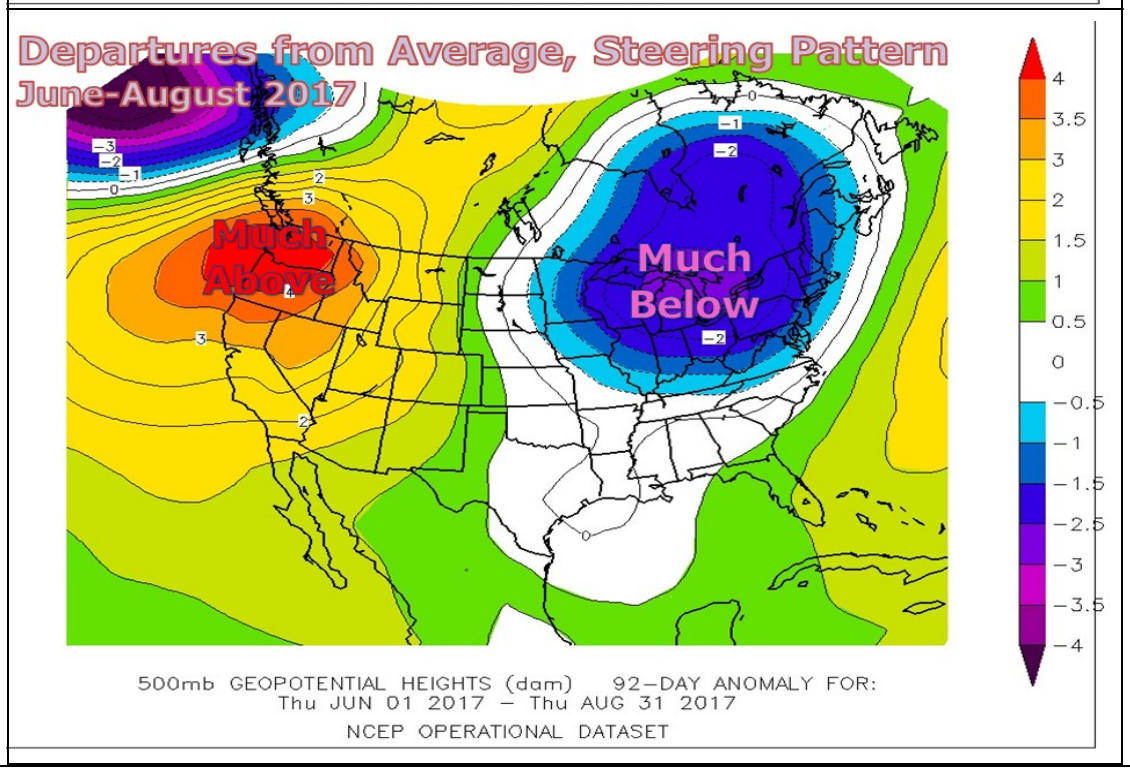
As shown in the KBDI chart above, Harvey's landfall just north of Corpus Christi late on August 25th, followed by nearly stalled movement for the next several days over southeast Texas, dropped several feet of rain in that region. Just 200 to 300 miles southwest, subsiding (downward moving) air aided by sources from the Southwest Texas and Southeast New Mexico deserts, combined with a downslope effect from westerly flow off of the Sierra Madre Oriental mountains just 100 to 150 miles west of the Valley, kept the heat intact; drying of the surface air (afternoon humidity in the 20s) kept unirrigated landscapes starving for water. Just two months prior, the movement of Tropical Storm Cindy from the west central Gulf to the *northwest* into the southwest corner of Louisiana brought a spike of record to all-time record heat to the Rio Grande Valley. For each case, a sliver of La Canícula pinched across the Valley. While Harvey threaded the needle to become the most memorable Texas hurricane of the modern era, that needle was in a tight gap between a westward advancing Atlantic ridge (part of the Bermuda High) and the tough-holding Canicula across southwest Texas and northern Mexico, and the Rio Grande Valley ended up on the dry side once again.

In Harvey's case, no doubt a little bit of luck (serendipity) helped; just a slight nudge westward of all features, including the eastern edge of La Canícula, could have brought the amount of rain to change our dry summer into a wet one.

CONTINUED ON PAGE 22———->

Rio Grande Valley Summer Climate Summary





Above: Summer 2017 pattern matters. *Top* - the persistence of La Canicula (atmospheric ridge centered over west and southwest Texas, southern New Mexico, and northern Mexico often extending toward the Rio Grande Valley) dominated. *Bottom* – The Canícula ridge often expanded north and west into the Pacific Northwest and Great Basin, leading to a record to near record hot summer there as well – while a persistent trough from the U.S. Midwest through the Mid Atlantic and New England kept the fronts coming and led to a comfortable summer overall.

Monsoon Rains across El Paso region

By Connor Dennhardt
National Weather Service
WFO El Paso

The 2017 summer monsoon featured slightly above average precipitation for areas in far west Texas. June through August CoCoRaHS station totals in El Paso and Hudspeth Counties ranged from 3" to over 9". The variable and localized precipitation is common in the southwest, as the majority of rainfall comes from airmass thunderstorms. These thunderstorms are often short-lived but intense.

On the evening of July 26th, this intensity was felt at the weather forecast office in El Paso, TX. Thunderstorms were in the forecast as plentiful moisture lingered over the area. Atmospheric soundings that afternoon showed Precipitable Water values around 1.25" and up to 3000 J/kg of CAPE. Downdraft CAPE values, which are used to forecast the potential for microbursts, were over 1500 J/kg. The ingredients were in place for an active day of thunderstorms.

At around 4:00PM that afternoon, a severe thunderstorm developed directly over the office, resulting in a wet microburst with heavy rain and winds in excess of 75 mph! The storm was seen from miles away and pictures taken of the storm depicted a large rain shaft with rain radiating outward at the surface.**(Fig 1)** Doppler radar imagery of the storm showed outgoing velocities around the radar as the microburst expanded in coverage.**(Fig 2)** For a warning forecaster, these events are often difficult to detect in advance.

Figure 1 (Above) :Severe microburst over Santa Teresa, NM as seen from aircraft. Photo credit: Alfredo Maldonaldo

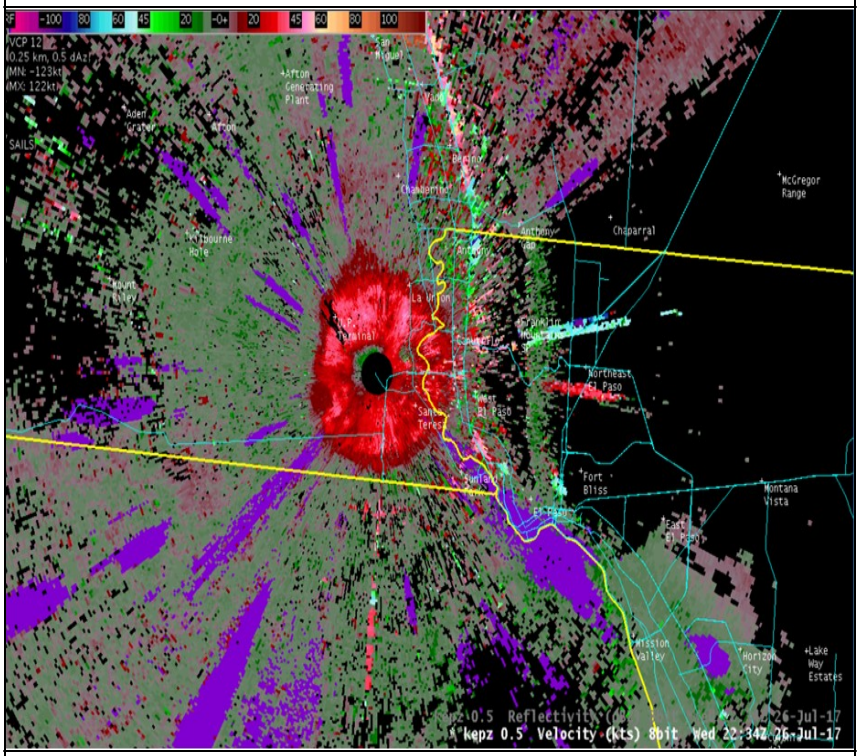


Figure 2: Radial velocity showing strong outbound velocities as a microburst occurred directly over the Doppler radar.

Midland-Odessa Regional Weather Summary

By Jim DeBerry
Meteorologist/Hydrology Program Manager
National Weather Service WFO Midland/Odessa

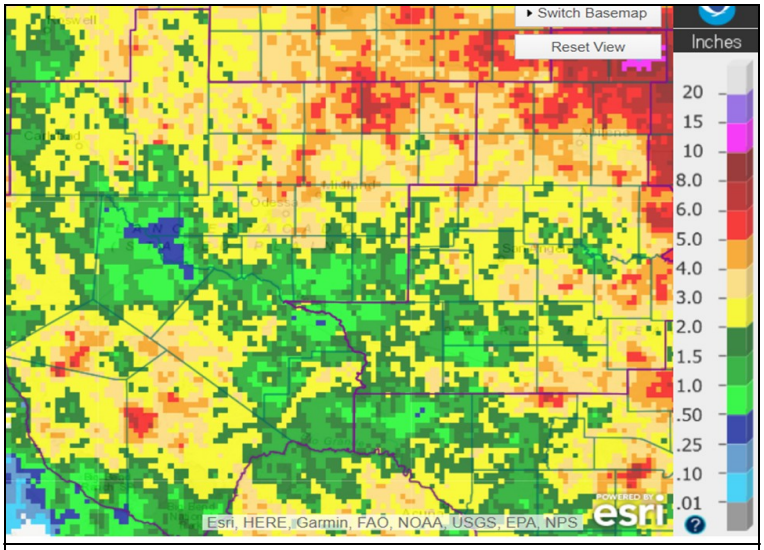
West Texas and Southeast New Mexico saw a more or less typical summer, hydrologically, although Southeast New Mexico fared slightly above average on rainfall, whereas West Texas was below.

In June, the annual upper-level ridge that appears over the desert southwest each summer began trying to develop. However, many convective events still managed to occur, mostly over the eastern HSA, furthest from the influence of the ridge. These were mostly severe storms, producing damaging winds and very large hail, end even a tornado or two. Monthly radar rainfall estimates ranged from as little as 0.25" along the Rio Grande and upper West Texas Trans Pecos to 6-8" over the Davis Mountains and upper Colorado River Valley. Highest observed rainfall was in the 2.25-2.50" range, however. Average rainfall across West Texas and Southeast New Mexico was a little over 1.5". A few minor flooding events were reported, mainly in the Permian Basin.

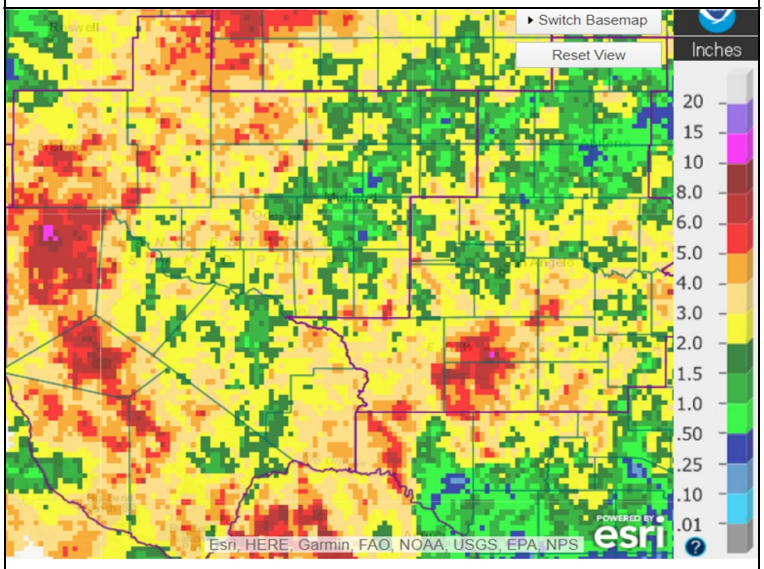
The summertime ridge finally developed over the region in July. While this generally suppresses convective development, what activity does develop tends to be heavy rainfall events, as there is very little shear, resulting in slow storm motions. Monthly radar rainfall estimates ranged from as little as 0.25" in the Permian Basin and and upper Colorado River Valley to 10-15" just south of the Guadalupe Mountains. However, the highest observed rainfall was just over 12" at Mount Locke in the Davis Mountains. Average rainfall across West Texas and Southeast New Mexico was right near 2".

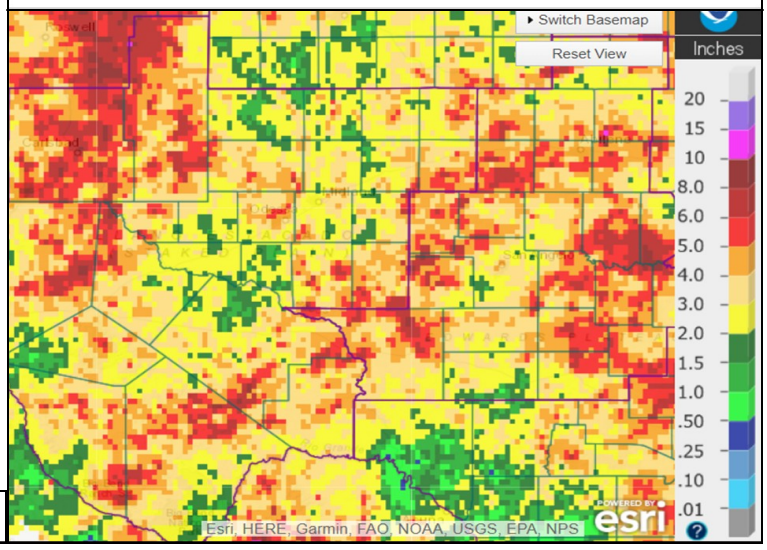
August was near average in terms of rainfall and the synoptic pattern, which consisted mostly of the dominance of the summertime ridge. The last part of the month was spent on the west side of Hurricane Harvey, where subsidence suppressed any convection that might have otherwise developed. Monthly radar rainfall estimates ranged from as little as 0.50" in the southwest to 8-10" over Southeast New Mexico. The highest observed rainfall was 5-6", mainly in Southeast New Mexico and the Davis Mountains. Average rainfall across West Texas and Southeast New Mexico was just over 2.75".

Overall, Summer 2017 leaves West Texas and Southeast New Mexico in good shape for the year. Area reservoirs are at an average of 55% conservation capacity. No drought exists.



Radar estimated rainfall for June (above) and July (below).





Right: Radar estimated rainfall for August 2017

Wet but Relatively Tranquil Summer for the Wichita Falls Region

By Charles Kuster
CIMMS/NSSL

The Wichita Falls Region was fortunate to not experience any widespread damaging weather this summer or see any impacts from Hurricane Harvey, but our thoughts are with those affected across southeast Texas including those in the CoCoRaHS community. In northwest Texas, this summer was marked by multiple rainy periods with only a few severe wind and hail reports. Overall, there were 38 rainy days (one or more CoCoRaHS stations reporting at least 0.05") and 53 dry days (no CoCoRaHS stations reporting 0.05" or higher). Almost the entire region experienced slightly above average precipitation for the season (Fig. 1).

Of all the precipitation events this summer, the two most notable occurred on June 8 and August 13–14, 2017. The June 8th event brought the heaviest rainfall to the area with radar estimates of 6"+ falling in portions of Wichita County in a 24-hour period (Fig. 2). CoCoRaHS stations in Wichita and Archer County reported nearly 2.5" of rain as well. During this event, the heaviest rain was contained to portions of Wichita and Archer County (Fig. 2), but on August 13–14, heavy rain was much more widespread across the area.

During the late evening hours of August 13, thunderstorms developed over the northern Texas Panhandle and then grew in size as they raced southeastwards towards the Wichita Falls Region. This large complex of thunderstorms, known as a mesoscale convective system, can clearly be seen over northwest Texas on infrared satellite and radar imagery (Fig. 3). Doppler radar indicated widespread rainfall totals of 1.5"+ across the area (Fig. 4), with several CoCoRaHS stations reporting between 1.3" and 2.3" of rain. In both of these rainfall events, beneficial rain fell across the region with very little severe weather as no severe weather reports were received during either event.

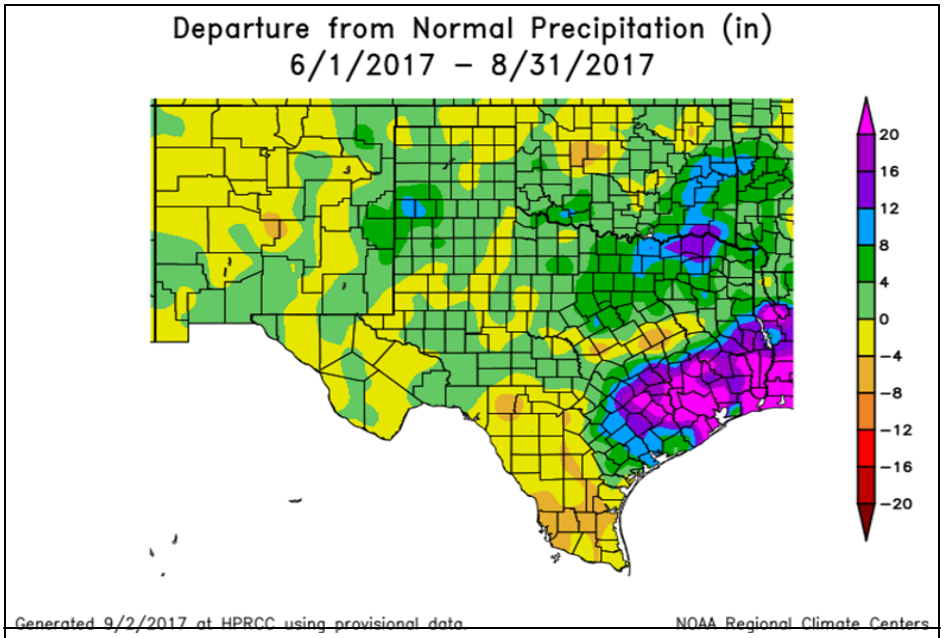
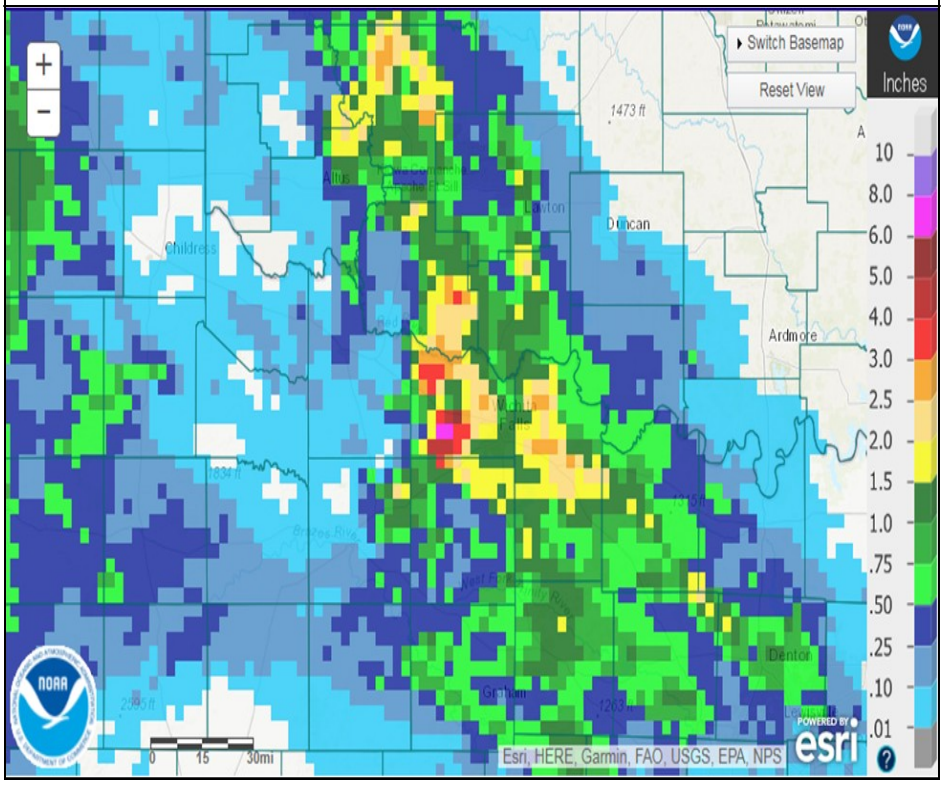


Figure 1 (above) : Departure from normal precipitation for June 2017 through August 2017. Warm colors indicate below normal precipitation and cool colors indicate above normal precipitation.

Figure 2 (below): radar estimated 24-hour rainfall totals for the period ending at 7 am on June 9, 2017



Wichita Falls Summer climate summary

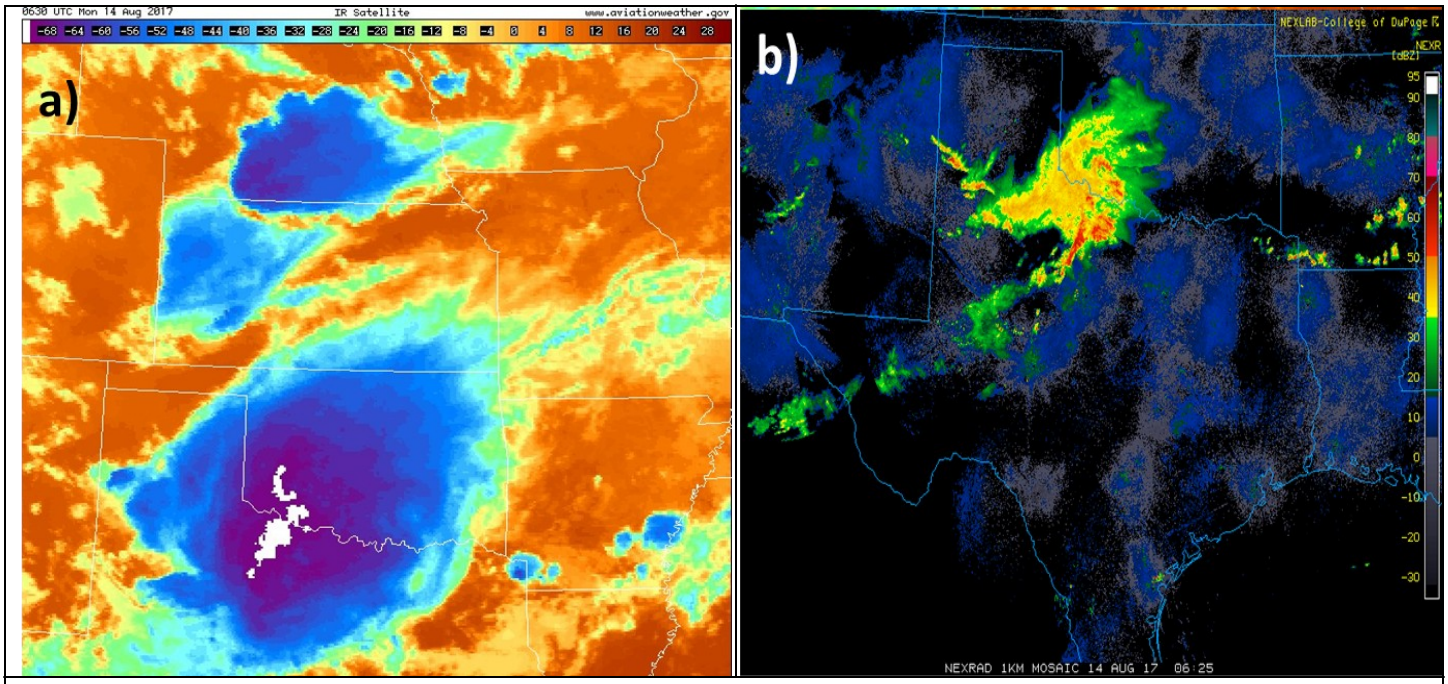
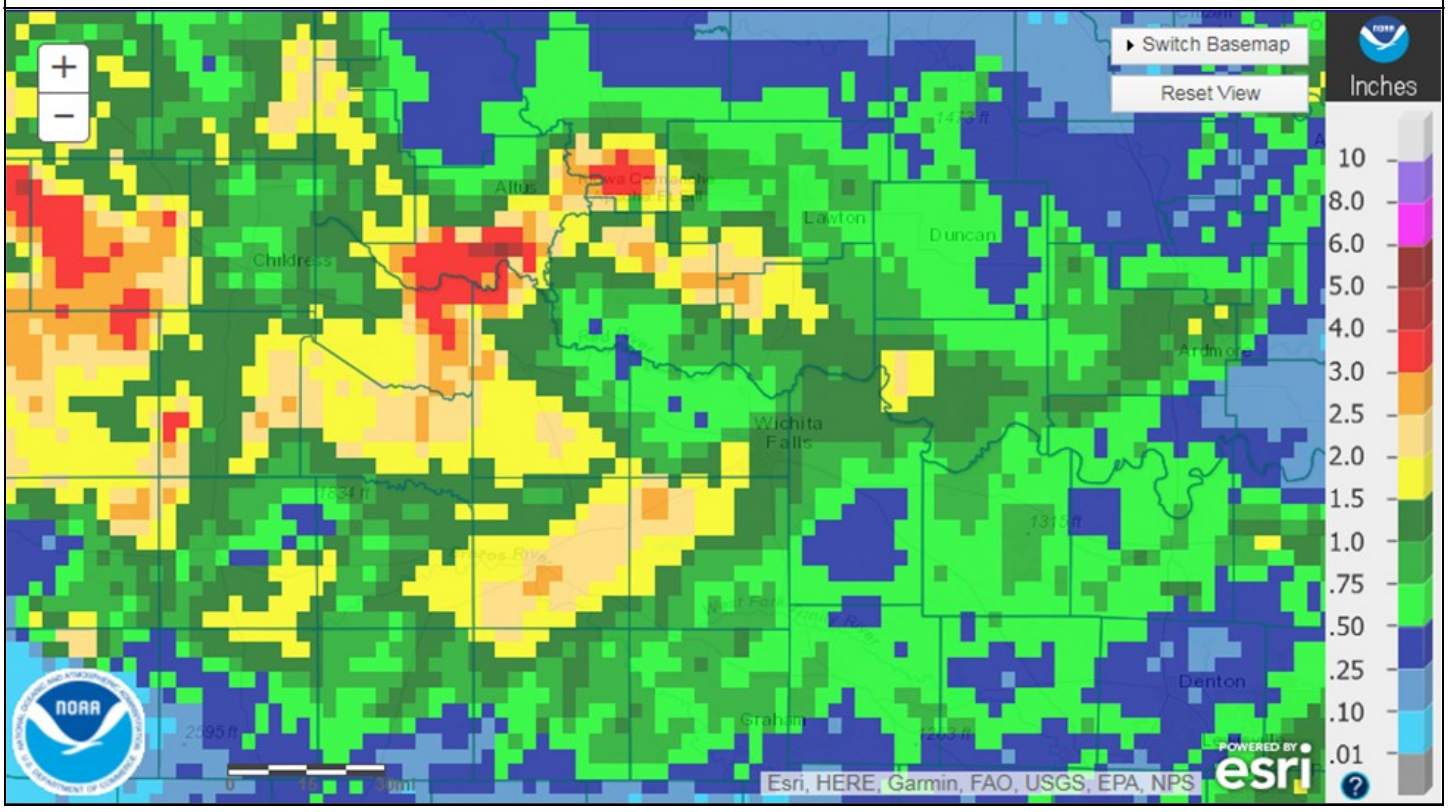


Figure 3 above): August 14, 2017 a) infrared satellite and b) radar imagery showing a mesoscale convective system moving across the region at about 1:25am CDT.

Figure 4 (below): Radar estimated 24-hour rainfall totals for the period ending at 7 am on August 14, 2017.



Fall Outlook

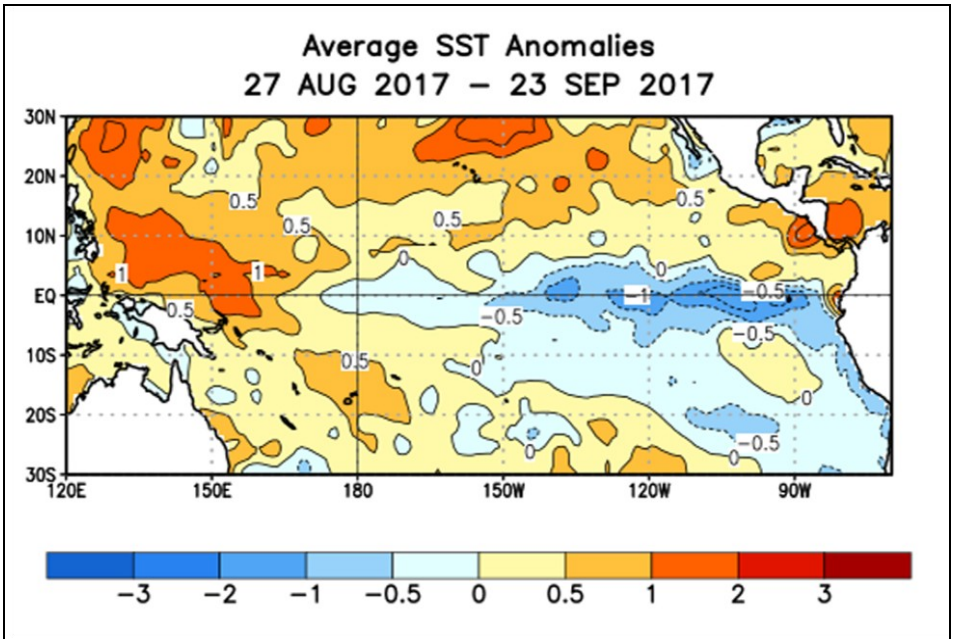
By Bob Rose
Meteorologist, Lower Colorado River Authority

Earlier this year, there was strong evidence an El Niño would return sometime this fall or winter as sea surface temperatures in the tropical Pacific were steadily warming. However, those hopes were dashed by the middle of summer as sea surface temperatures unexpectedly began to cool. This cooling trend has continued into fall and it now appears these waters are on the threshold for La Niña.

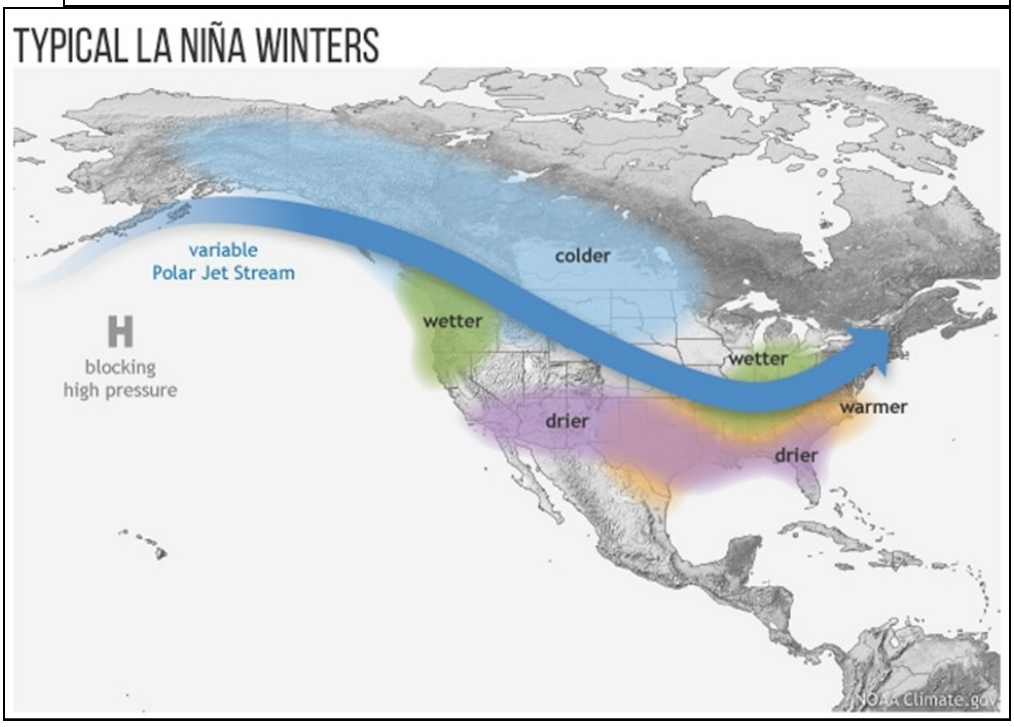
In a recent report released from the National Weather Service's Climate Prediction Center (CPC), sea surface temperatures trended near to below average during August and September over most of the central and eastern tropical Pacific.

Waters just below the surface have also trended cooler than normal. According to CPC forecasters, the Pacific is currently still considered to be ENSO neutral, but based on patterns on rainfall and wind across the Pacific, conditions appear to be quickly trending toward La Niña.

Because of these recent developments, the Climate Prediction Center has issued a La Niña watch, meaning there is an increasing chance (approximately 55-60 percent) of a La Niña developing this fall, continuing through the upcoming winter. In addition, the CPC forecasters favor these newpredictions in part because of the recent cooling of surface and sub-surface temperature anomalies, and also ensemble of climate models from the North American Multi-Model Ensemble (NMME) is predicting that La Niña will develop this fall, and last through the winter. Back-to-back La Niña winters are not uncommon, CONTINUED ON PAGE 43———->



Average sea surface temperature anomalies from August 27, 2017 through September 27, 2017 shown as departure from the long-term (1981-2010) average. Red shading shows where SSTs were above average and blue shading shows where they were below average.



Fall Outlook

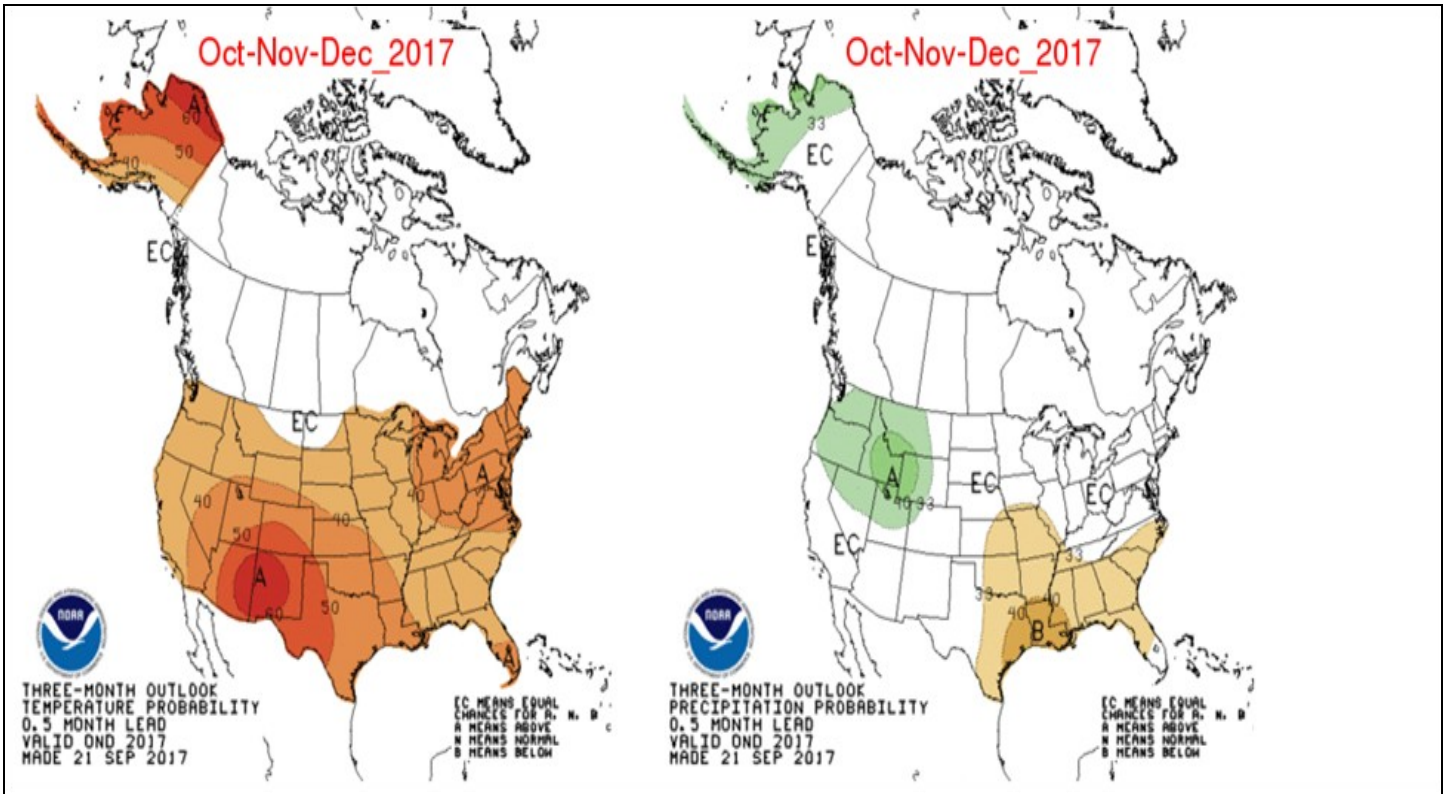
FROM PAGE 42——>and have occurred at least five times since 1950, most recently in 2010-2011 and 2011-2012.

CPC forecasters favor these new predictions in part because of the recent cooling of surface and sub-surface temperature anomalies, and also because of the higher degree of forecast skill at this time of year.

From a historical context, most La Niñas tend to cause below normal rainfall and milder than normal temperatures across much of Texas and the southern US during the fall and winter months. During La Niñas, the normal path of the jet stream across the Pacific is disturbed, causing the jet to flow more toward the Pacific Northwest and western Canada instead of across the southwestern US and into Texas. This means fewer storm systems and less rain for Texas over the fall and winter months. At the same time, the coldest air often stay. s north across Canada and the northern Plains states, having a more difficult time spreading south into Texas. This means fewer intrusions of Canadian and arctic air into Texas.

CPC's rainfall outlook for October, November and December calls for increased chances for below normal rainfall across the eastern half of Texas. No clear trend is indicated for the western half of the state. The temperature outlook shows increased chances for above normal temperatures across all of Texas as well as most of the country.

But do keep in mind that every La Nina event is different as other oscillations in the oceans and atmosphere can at times overwhelm the typical La Niña response. For example, a weak La Niña was in place this past winter, but instead of drier than normal conditions, much of Texas experienced wetter than normal weather from October through March.



Climate Prediction Center temperature and precipitation outlook for October-November

CoCoRaHS Weather Talk Webinars

In December 2011 CoCoRaHS kicked off a new and exciting monthly Webinar series called **CoCoRaHS WxTalk** (wx is shorthand for weather). CoCoRaHS WxTalk consists of a series of monthly one-hour interactive Webinars featuring engaging experts in the fields of atmospheric science, climatology and other pertinent disciplines. These easy to follow presentations are live and approximately sixty minutes long. The audience is given the chance to submit questions which the experts answer live on the air.

Topics have included: Snow, Satellites, Hurricanes, Lightning, Clouds, Tornadoes, Flash Floods, Fire Weather, Weather History, Radar and How to become a Meteorologist, just to name a few.

There are many exciting Webinars on the agenda in the months ahead, so please tell your friends to join us. All WxTalk Webinars are free and most are recorded for later viewing.

Next CoCoRaHS WxTalk

Thursday, November 9, 2017 - 12:00PM CDT

The National Weather Association (NWA) - who are we, what do we do?

Gail Hartfield
President National Weather Association
National Weather Service
Raleigh, NC

"The National Weather Association (NWA) was incorporated in 1975, with just a few hundred members who were committed to growing a strong, vibrant organization created by, and for, operational meteorologists. Today, with membership in the thousands, the dedication to the science and service of operational meteorology remains. The NWA is a non-profit, member-led professional organization with a mission of supporting and promoting excellence in operational meteorology. You don't need to be a meteorologist to join the NWA – you just need to love weather and support and appreciate operational meteorology.

NWA members can share information, news, and studies with others in the operational meteorology community in many ways. Members can contribute and engage with others through committee work, through correspondence or articles in NWA publications such as the Newsletter and the Journal of Operational Meteorology, and via our social media accounts (fb.com/nwasorg on Facebook, @nwas on Twitter, nwasorg on Instagram, and NationalWXAssoc on YouTube). Our highlight of each year is the Annual Meeting, which occurs in early fall and allows members to both lead and attend fascinating presentations on a variety of topics, participate in workshops and short courses, and simply network and have fun with great people from every corner of the weather industry, from well-known senior professionals to weather enthusiasts. Weather broadcasters have the opportunity to earn the NWA Radio and Television Weathercaster Seals of Approval, and those producing digital weather media can earn an NWA Digital Seal of Approval. The NWA also sponsors an Annual Awards program to recognize excellence in operational meteorology. Our collaborative organization, the National Weather Association Foundation, offers college scholarships and grants to K-12 teachers and others through fundraisers and tax-deductible donations.

In this presentation, Gail will look back at a little weather warning and forecasting history. She'll then follow with a look to the future with her "Top 5 Weather Innovations" that promise to revolutionize weather warnings and forecasts over the next 25 years."

Texas CoCoRaHS Observer

The official newsletter of Texas CoCoRaHS

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