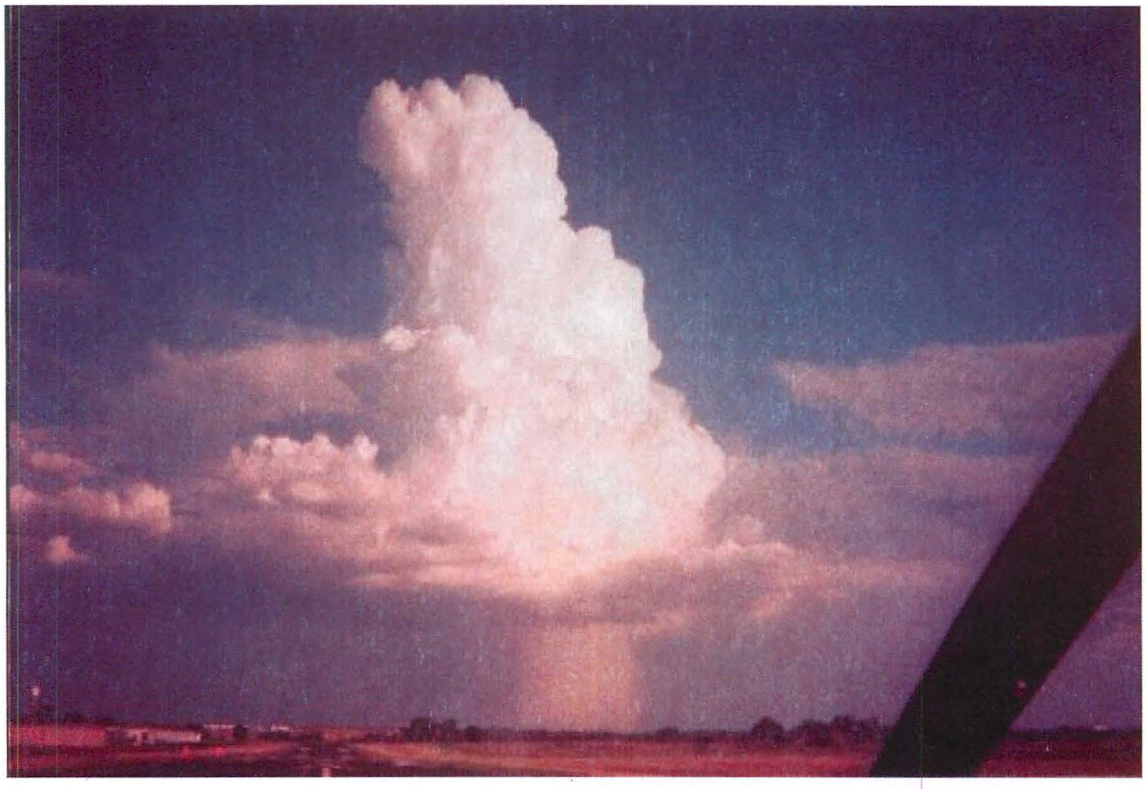
SOUTH TEXAS WEATHER MODIFICATION ASSOCIATION



2002 REPORT

2002 REPORT

of the

SOUTH TEXAS WEATHER MODIFICATION ASSOCIATION

prepared by

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THE YEAR IN REVIEW

STWMA entered year number six in operations in 2002. With a fresh new radar office in place, we eagerly awaited the first day of seedable weather. It wasn't until mid-April before this took place, but what a start: intense thunderstorms developing right over the radar site, prompting warnings by the NWS. Some seeding of this activity took place, and with that, we were well on our way to what would hopefully be a busy year of rainfall enhancement.

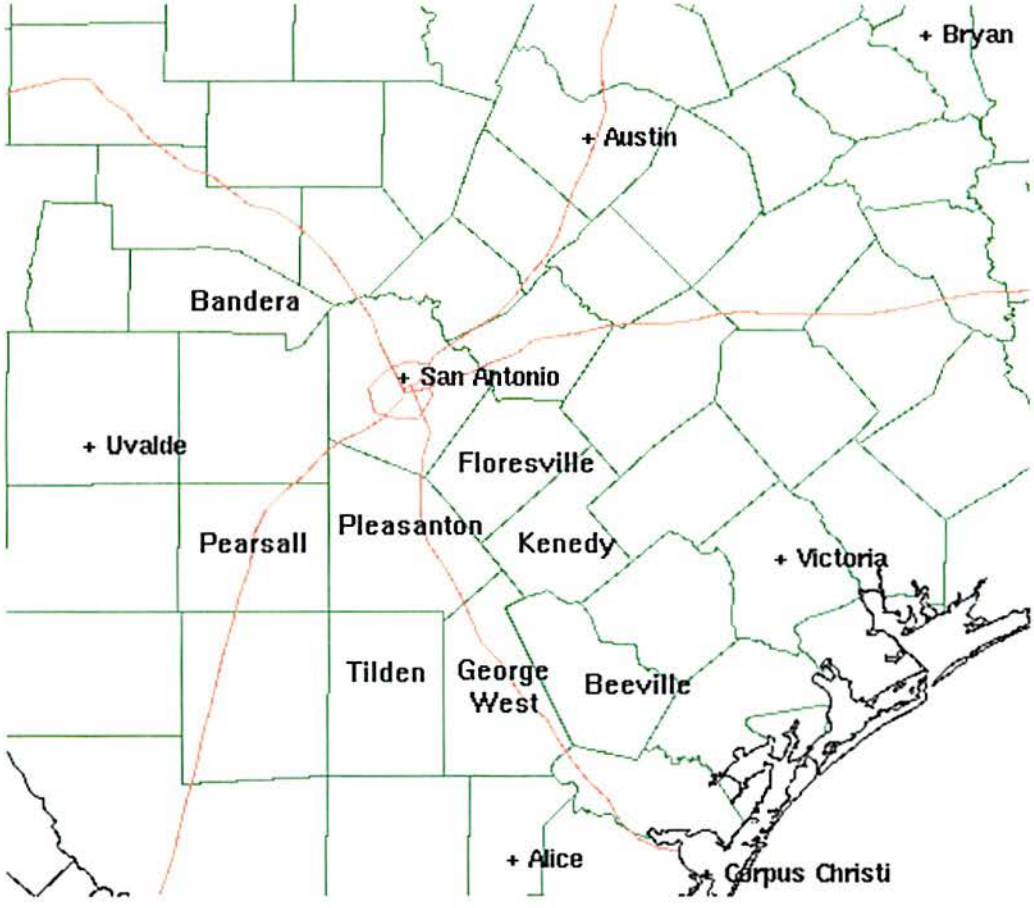
We welcomed two pilots to the association in the spring. Ron Merks, who worked with the program back in 1997-98 when AI was running operations, joined us once again in 2002. In addition, Mickey Chadwell, a flight instructor at Stinson Field, trained with us this year to become STWMA's fifth and newest pilot. With the additional pilots, there came another Comanche. N57AA, also referred to as "Strawberry Five" or "Lipstick Queen" due to its iridescent pink paint, was purchased in the spring and became operational in June.

Mickey Chadwell with N57AA

With the departure of WMI from the EAA Weather Modification project, seeding to our north was halted by the end of 2001. The EAA, however, was still interested in having a weather modification program in some of the counties. Working with the STWMA and the SWTREA (Cotulla)

programs, they developed a contract whereupon the STWMA would annex the counties of Bandera, Bexar and Medina into the target area for the May-September period, and the SWTREA would acquire Uvalde County. This was to be a three-year contract, with one of the planes (N57AA) being located at Stinson Field in south San Antonio.

The idea to develop a mini-mesonet of weather stations across the target area became reality this past year, when several Davis Wireless Weather Stations were purchased. One station was allotted per county, except for Bexar and Medina, where observation sites already exist (San Antonio, Hondo). The stations were to be set up with each transmitting real-time conditions to the STWMA web page every 10 minutes. It took the rest of the year to set up the stations, with a few glitches occurring along the way. It will be a work in progress, but several of the stations are already in place and successfully sending information to the web page (http://www.southtexasweathermodification.com), where a daily discussion and five-day forecast are also located.



Weather stations within the STWMA target area: Bandera, Pearsall, Pleasanton, Floresville, Kenedy, Beeville, George West and Tilden.

Our hopes of having a busy year of seeding went down the river, so to speak, when an upper level low parked itself over the area from the end of June into the first part of July. Tapping into abundant tropical moisture, torrential rainfall began on June 30th and continued into the

first week of July. Some parts of the target area, mainly the northern half, received over two feet of rain in a 10-day period. This caused extensive flooding across the area, with rivers unable to handle the deluge of water. As such, seeding was suspended from July 1st until the second week of August, when the soils were finally dry enough and rivers were down below bankfull levels. Another system in early September brought another one to two feet of rain to parts of the target area, so seeding was suspended once again. As a result of these two flooding events, the 2002 season saw the fewest number of seeding missions in its history. This outcome was bittersweet; we missed several convective events, but the long-term drought was broken with the extended period of heavy rainfall.

Flooding of the Atascosa River in Pleasanton, July 2, 2002

STWMA gained some recognition with the media in 2002. In mid-June, Wallpaper magazine, based out of London and distributed worldwide, came over to Pleasanton and learned more about weather modification in south Texas. We were featured in their September issue. In late June, the EAA set up a media day where the different TV/radio/newspaper networks in San Antonio and surrounding areas came down to see how cloud seeding operations were done and learn a bit more about the program. STWMA was featured on the local FOX, ABC and NBC stations as well as radio stations WOAI (San Antonio) and KBUC (Pleasanton).

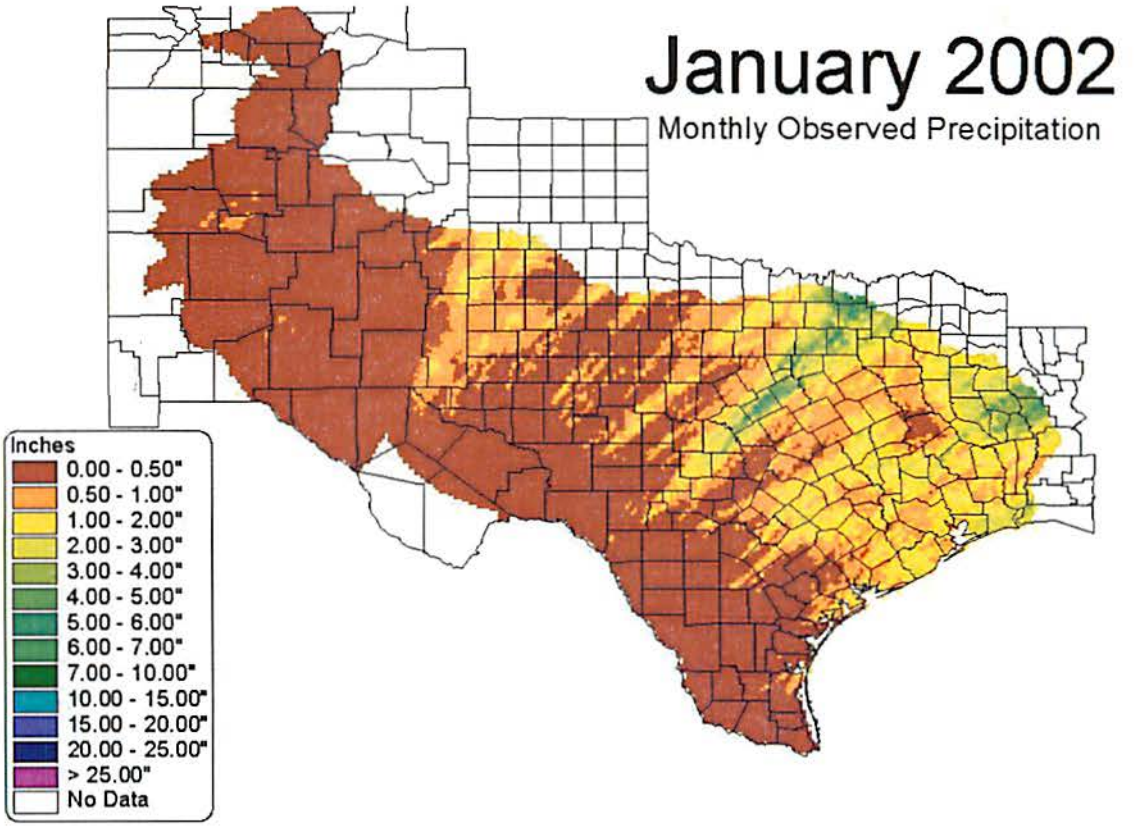
2002 Flight Log -- Missions/Reconnaisance

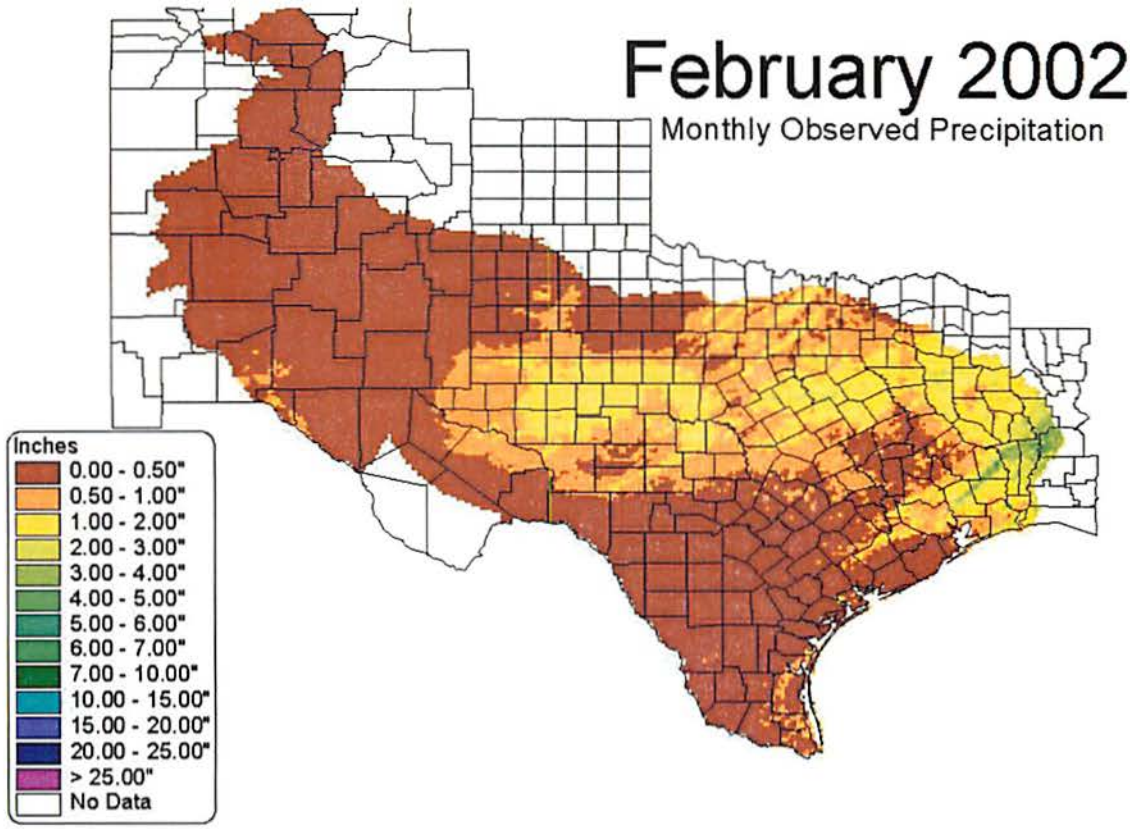
Date	Flight #	Aircraft	Engine On	Engine Off	Hours	Number of Flares	Agl amount (g)
16-Apr	1	09P	18:30	20:30	2	33	1320
13-May	2	47P	14:15	16:15	2	2	80
13-May	3	60P	14:30	16:00	1.5	recon	
17-May	4	60P	15:30	17:30	2	18	720
17-May	5	47P	14:00	16:00	2	30	1200
17-May	6	09P	18:00	20:00	2	20	800
17-May	7	47P	18:45	20:00	1.3	9	400
28-May	8	60P	14:30	17:00	2.5	2	80
28-May	9	47P	14:55	16:25	1.5	1	80
29-May	10	60P	14:10	16:30	2.4	35	1400
29-May	11	47P	14:45	17:30	2.8	28	1520
29-May	12	60P	16:35	18:50	2.4	12	480
15-Jun	13	60P	17:00	19:00	2	5	200
15-Jun	14	47P	17:15	19:00	1.8	10	800
15-Jun	15	09P	17:20	19:30	2.2	23	920
20-Jun	16	47P	13:50	16:30	2.8	12	960
20-Jun	17	09P	13:50	17:00	3.1	12	480
21-Jun	18	60P	12:30	14:00	1.5	1	40
26-Jun	19	60P	14:30	18:00	3.5	18	1440
26-Jun	20	47P	15:30	18:30	3	20	1600
26-Jun	21	09P	16:00	20:00	4	12	480
27-Jun	22	60P	8:30	10:00	1.5	recon	
27-Jun	23	60P	12:30	14:10	1.7	15	1200
27-Jun	24	47P	13:15	14:15	1	3	240
27-Jun	25	47P	16:10	18:10	2	11	880
28-Jun	26	09P	12:00	15:00	3	21	840
28-Jun	27	47P	13:45	16:15	2.5	16	640
28-Jun	28	60P	13:30	16:45	3.3	37	2960
28-Jun	29	7AA	13:50	14:50	1	1	80
30-Jun	30	60P	14:30	16:30	2	8	640
10-Aug	31	7AA	17:30	20:00	2.5	6	480
14-Aug	32	60P	13:00	14:30	1.5	7	560
14-Aug	33	09P	16:35	18:05	1.5	3	240
23-Aug	34	60P	16:00	18:00	2	recon	
29-Aug	35	47P	10:50	13:30	2.6	21	1680
29-Aug	36	7AA	11:00	13:00	2	15	1200
29-Aug	37	09P	11:30	14:30	3	12	960
1-Sep	38	09P	15:30	18:00	2.5	15	1200
5-Oct	39	60P	13:15	16:15	3	22	1760
7-Oct	40	47P	12:30	16:30	4	16	1280
7-Oct	41	09P	14:00	17:00	3	28	1120
7-Oct	42	60P	14:30	16:00	1.5	9	720
7-Oct	43	7AA	15:00	17:30	2.5	10	800

TOTAL	43				97.9	579	34480

JANUARY-FEBRUARY 2002

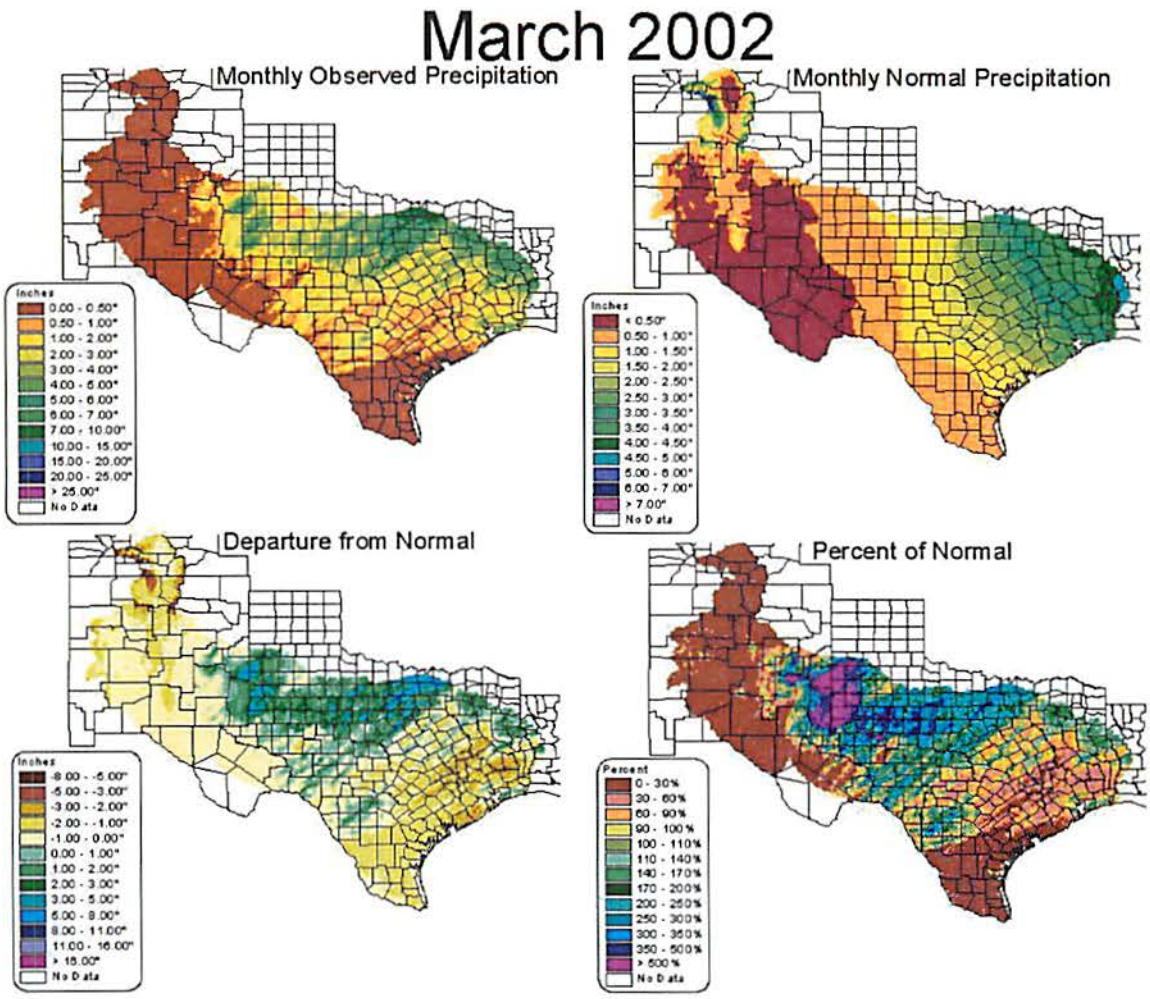
Although there were a couple of rain events during these two months, the mechanism producing the rain was overrunning, with mainly stratiform rain falling. Since seeding works primarily with convective clouds, we did not do any seeding during this time period.




February 2002
Monthly Observed Precipitation
Inches
0.00 - 0.50"
0.50 - 1.00"
1.00 - 2.00"
2.00 - 3.00"
3.00 - 4.00"
4.00 - 5.00"
5.00 - 6.00"
6.00 - 7.00"
7.00 - 10.00"
10.00 - 15.00"
15.00 - 20.00"
20.00 - 25.00"
> 25.00"
No Data

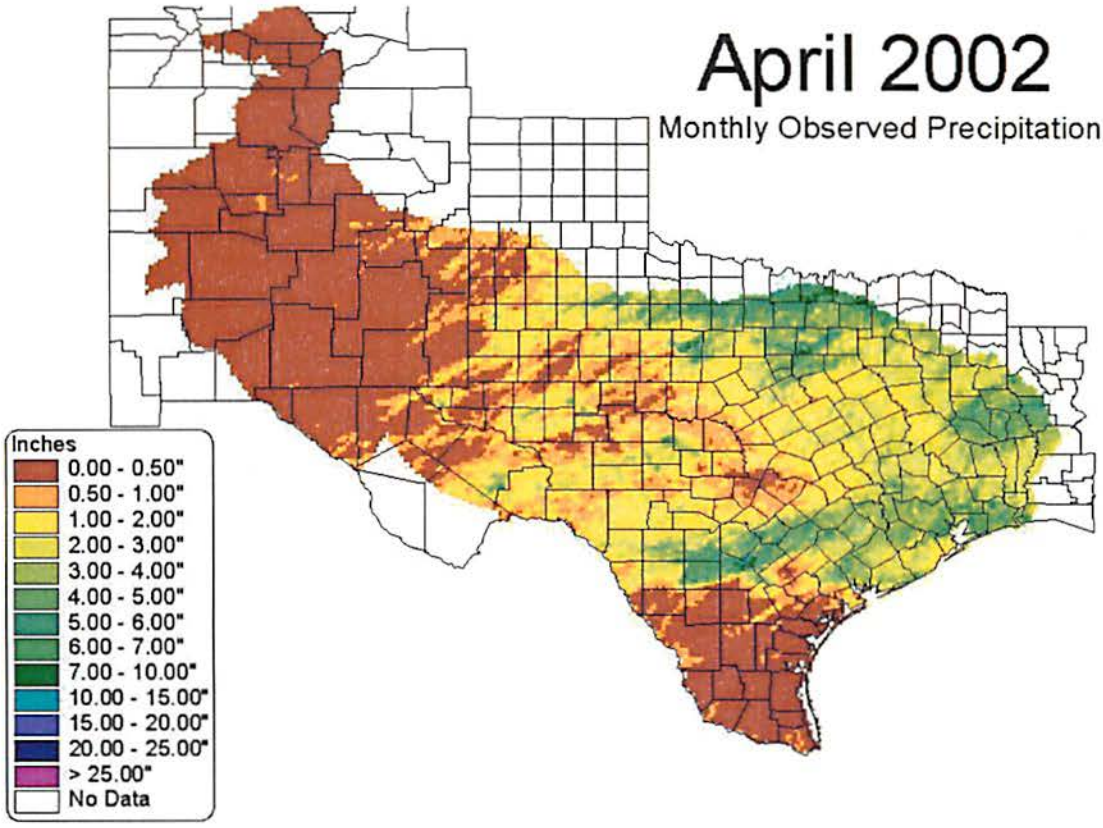
MARCH 2002

March was drier than normal over south Texas. The only convective event took place on the night of the 19th, when a line of severe thunderstorms raced across south-central Texas, producing five tornadoes in Bexar county along with 80 mph wind gusts. No seeding missions were carried out.



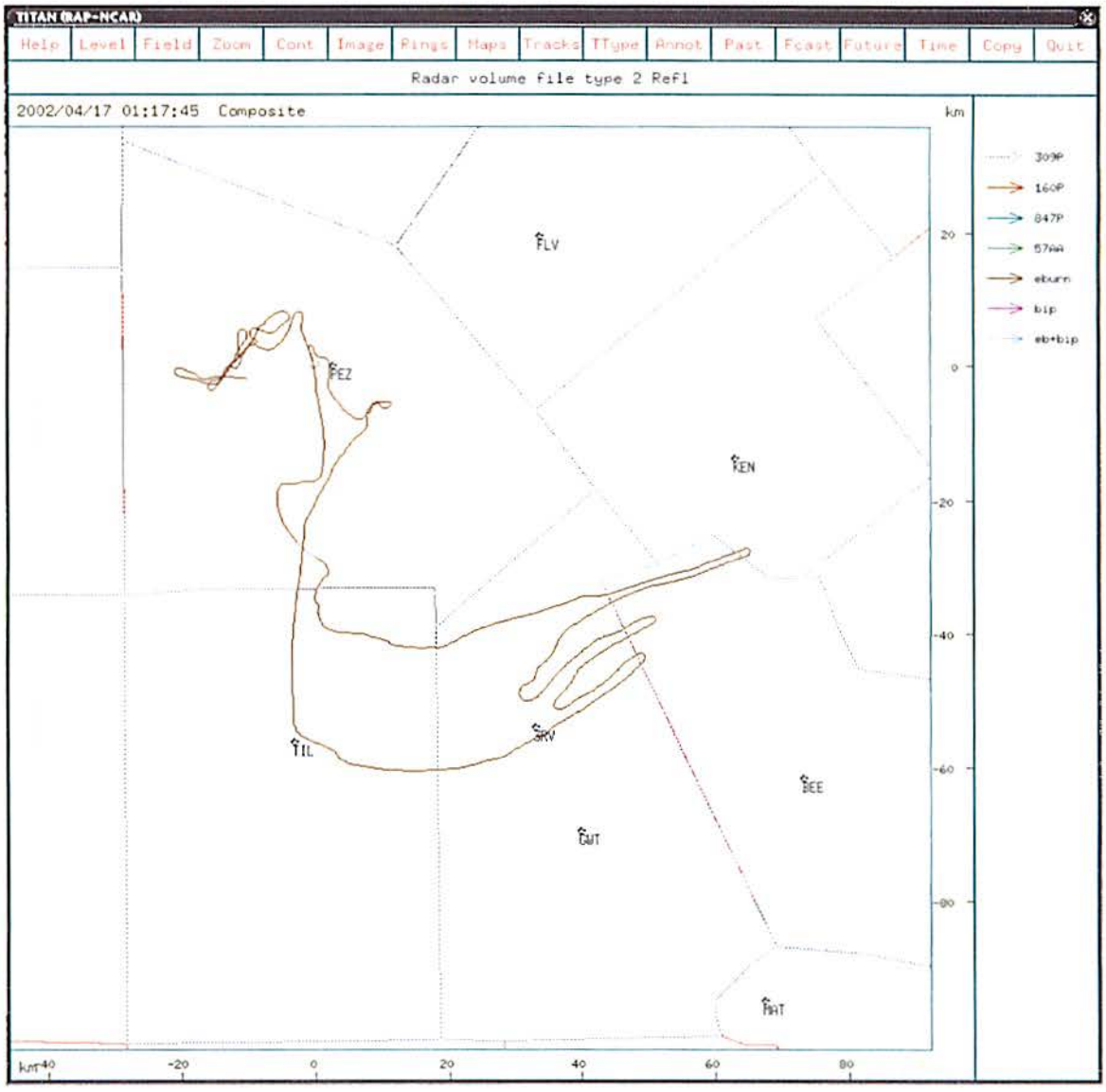
APRIL 2002

We had a few rounds of severe weather this month, but only managed to do seeding on one day this year. This was due primarily to most of the rain events happening after dark. The first day of seeding in the 2002 season happened on April 16, when severe weather rapidly developed in the northern half of the target area.



APRIL 16

A very warm and humid airmass was in place over the target area. Ample sunshine helped with strong destabilization of the atmosphere. An approaching upper level trough from the west was aiding in lift, as was the approaching dryline. Convection erupted virtually right overhead the radar, with storms quickly becoming severe. Hail to half dollar size fell at PEZ, with strong cloud rotation causing the NWS to issue several tornado warnings over the course of the afternoon. 09P took off (a bit late due to wiring problems in the office) and seeded the two main cells that were in the target area. These two cells were originally one cell, but as some intense storms do, they split into two separate cells, with one tracking to the northeast, and the other more intense cell slowly traking east-southeastward. Very intense updrafts in excess of 2000 ft/min were common with these storms. While the first seeded cell died off after about an hour, the second, larger storm lasted long past seeding.
33 - 40g flares were burned over Atascosa, Bee, Live Oak, and McMullen counties, totaling 1320g of AgI.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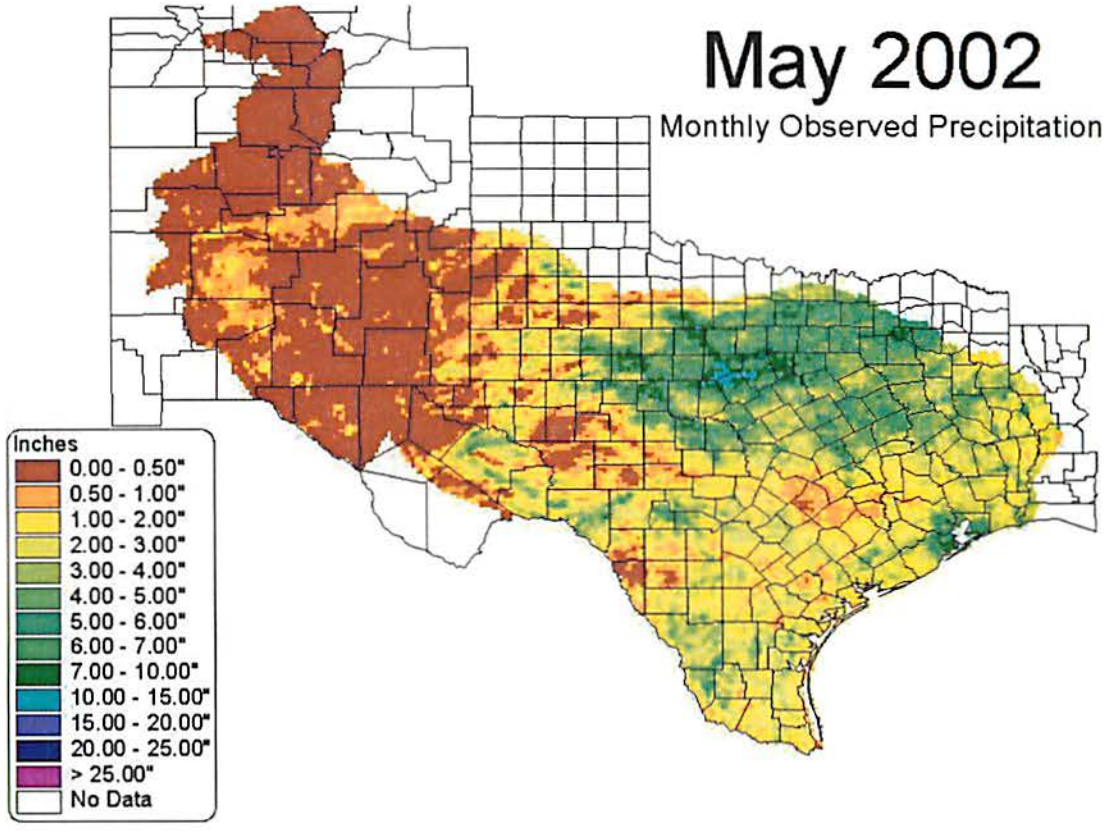
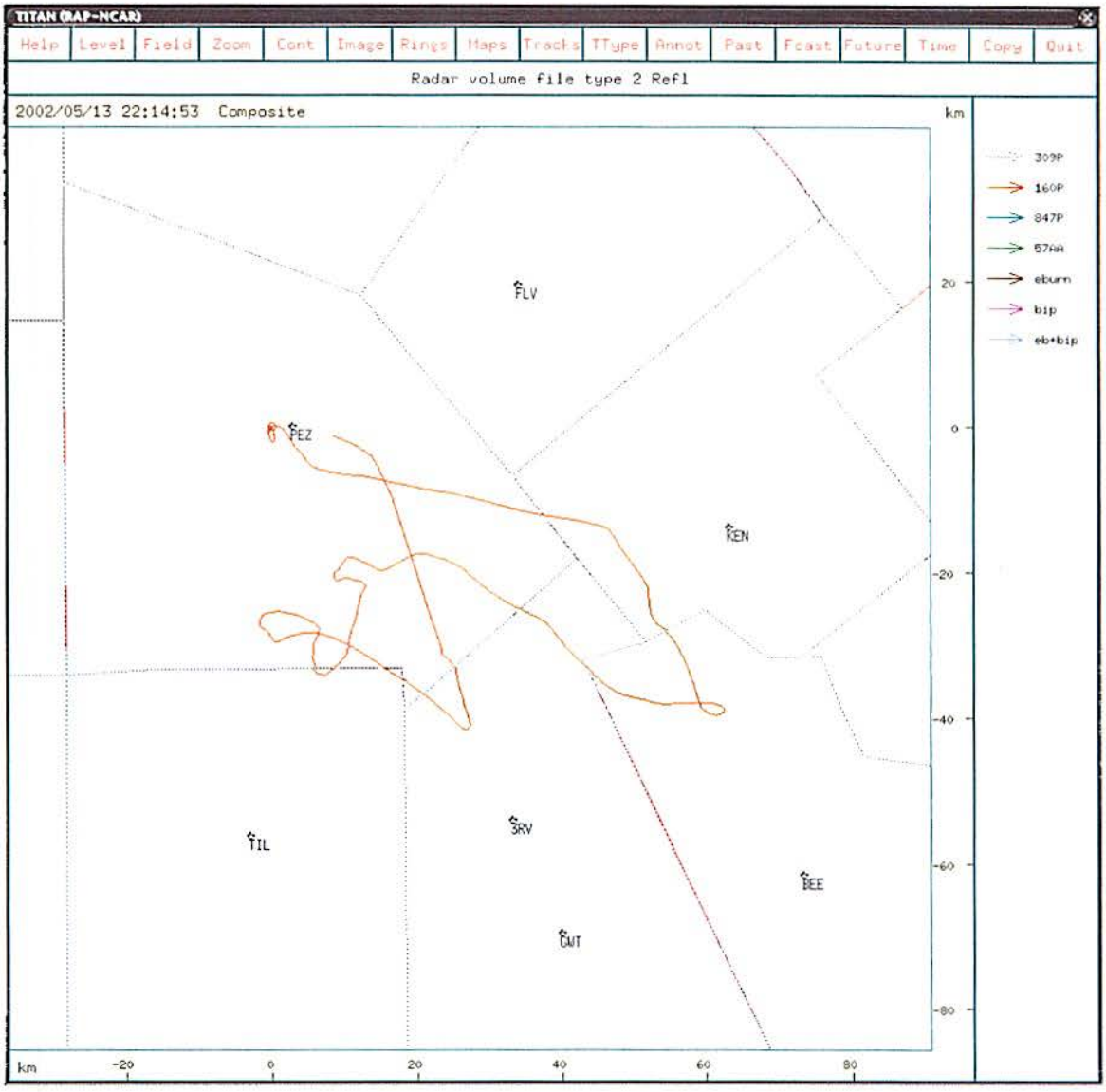
MAY 2002

May was a little more active than April in terms of thunderstorm activity. Seeding was done on four days during the month - around mid-month and at the end. Two of those days were rather busy, with over 70 flares burned each time. Both of these days saw severe weather in the target area. Results from seeding appear very favorable. The other two seeding days were for weak activity, and it did not appear that seeding had much of an effect. For the month, 157 flares were burned, which amounts to 6760g of AgI.



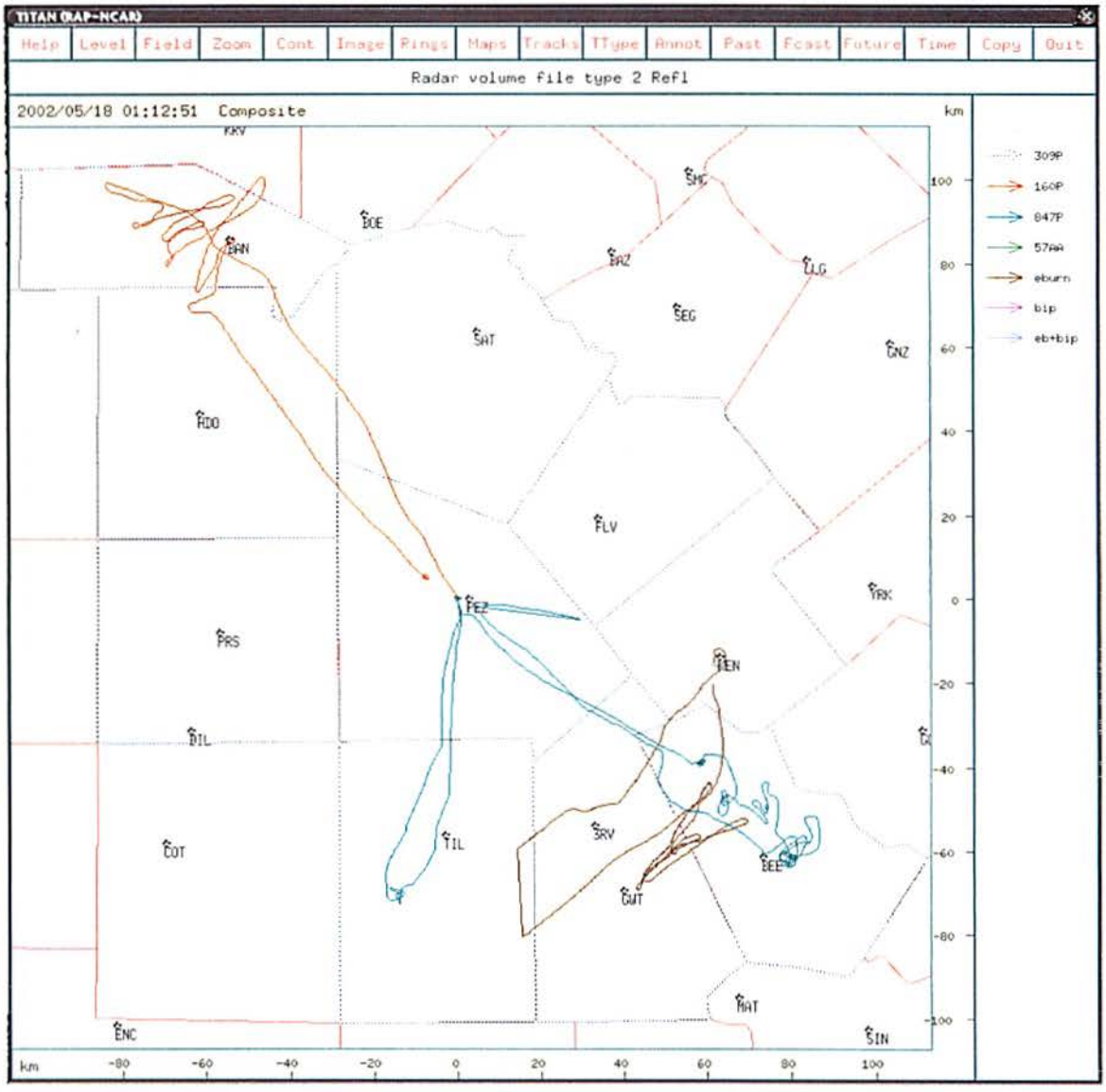
MAY 13

A cold front passed through the area early in the morning with little in the way of precipitation. However, as the 850mb front sagged south after sunrise, a small band of showers and thunderstorms developed across the far northern reaches of the target area and slowly made its way southward. This convection was elevated as the surface boundary layer was cool and stable. 60P and 47P were launched to investigate the activity. Only two flares were fired by 47P as they encountered a small area of inflow, which quickly diminished. 60P did not find any inflow at all. The activity remained rather weak, with very high bases (>10 kft). 2 flares were burned in Atascosa County, totaling 80g of AgI.



MAY 17

An MCS moved through the target area in the early morning hours, which worked over and stabilized the atmosphere. The cluster of storms left several outflow boundaries as it moved east towards Houston. By mid-morning, skies cleared over the target area and strong surface heating commenced. By mid-to-late afternoon, a cold front approached from the north. With the strong heating and the lift associated with the approaching cold front, thunderstorms began to fire off just north of the target area, moving into Bandera County. These storms intensified rapidly to severe levels. Before this occurred, 60P was launched to treat a large storm as it entered northern Bandera County. These intense storms were slow movers, and eventually a Flash Flood Warning went up for Bandera County, ending the seeding mission in that area. Around the same time, thunderstorms began to back-build along an outflow boundary across the southern target area, with storms entering Bee County from the east. 47P was launched to treat these rapidly developing storms. 09P was launched to take over for 47P in the southern target area, with 47P launching again later in the evening to continue seeding the storms to the south, where numerous severe weather warnings were being issued. Seeding of the southern storms continued up to near sunset, at which time the storms were exiting the extreme southern target area.
77 flares were burned in Bandera, Bee, Live Oak, and McMullen counties, totaling 3120g of AgI.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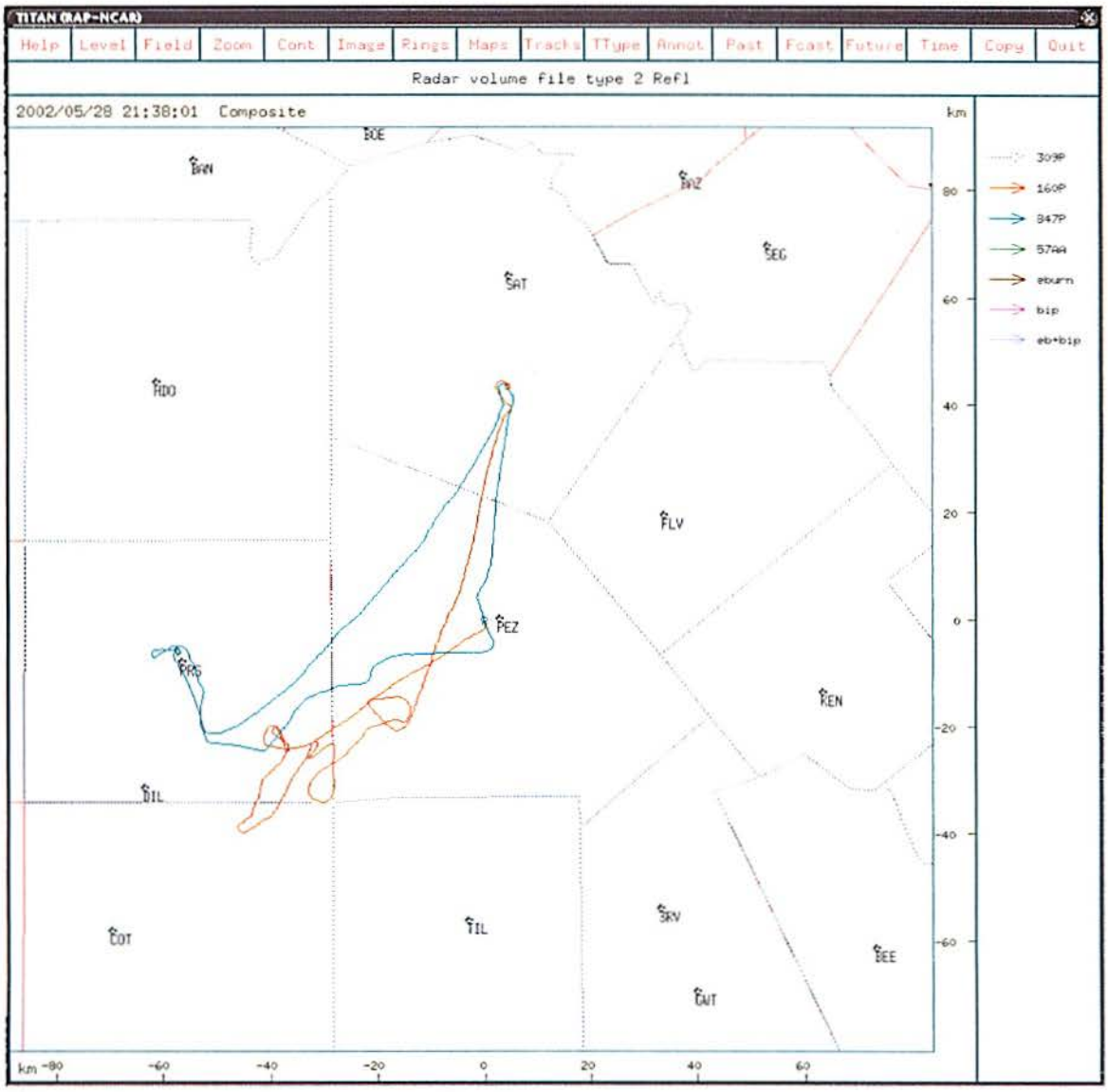
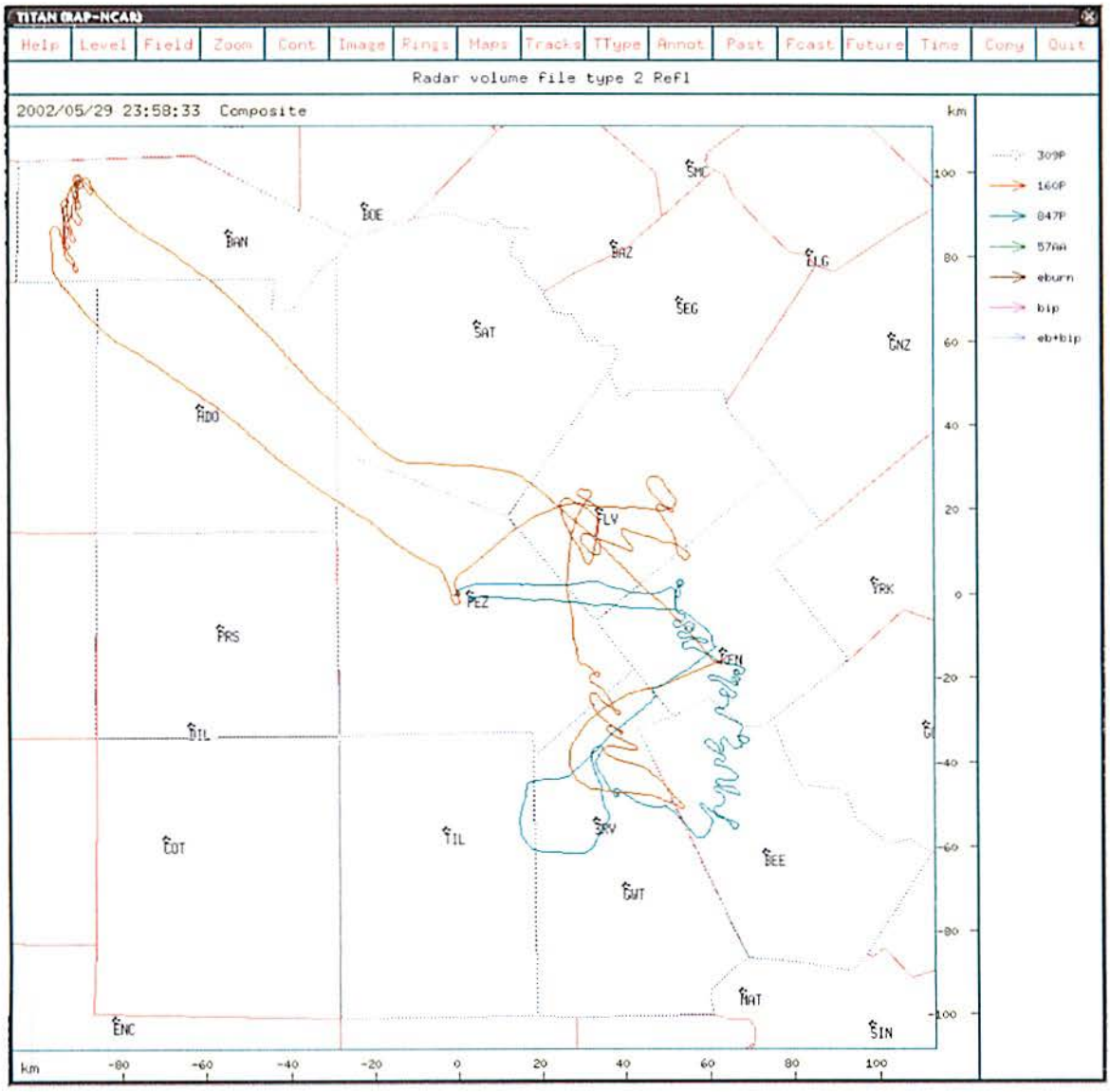
MAY 28

A weak shortwave rotating around the large upper level low over Oklahoma was traversing the target area. This feature sparked a few showers and thunderstorms over the western part of the target area during the afternoon. The activity was on the weak side in terms of intensity, and cells were rather small. Nevertheless, 60P and 47P were launched to investigate activity in Frio County. With only weak inflow present, only 3 flares were fired.
3 flares were burned in Frio County, totaling 160g of AgI.



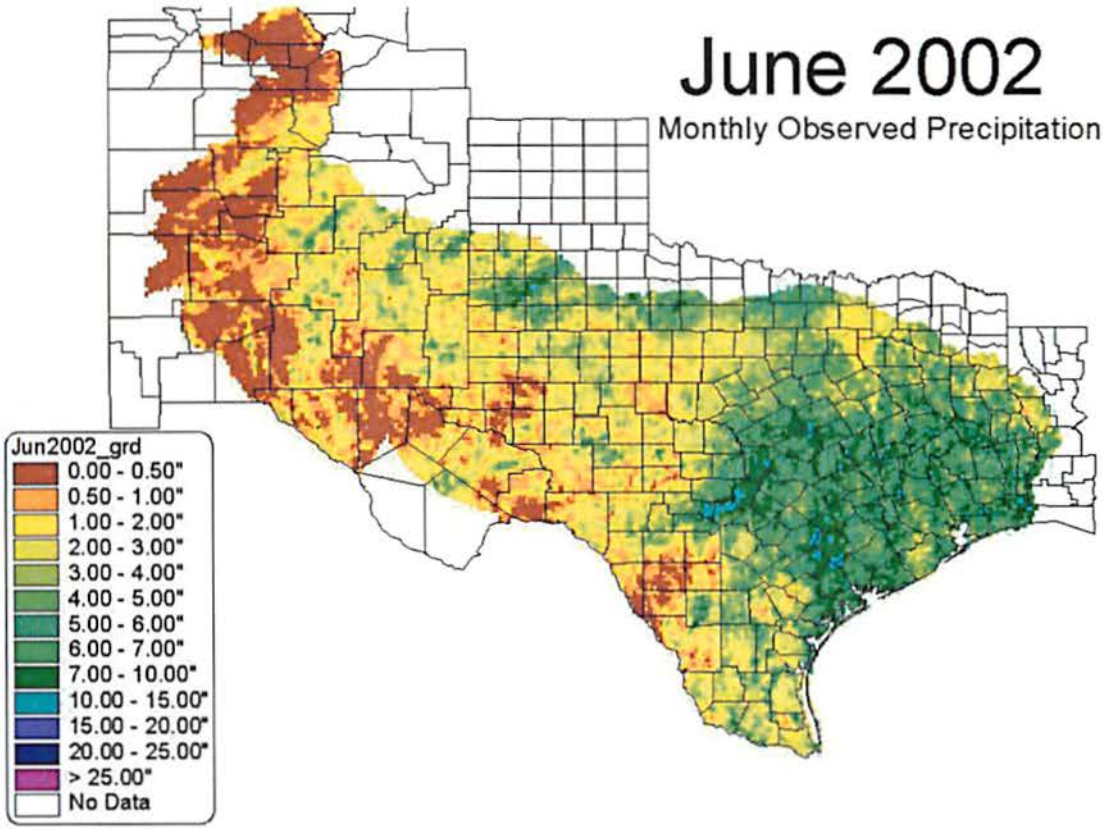
MAY 29

A large MCS over southeastern Texas threw out an outflow boundary which moved south-southwestward into the target area. A Severe Thunderstorm Watch was issued for the entire target area as thunderstorms developed along the boundary and moved with the outflow, feeding from the highly unstable and very moist airmass over the target area. The eastern half of the target area saw a line of storms move through, and intensify upon collision with the seabreeze boundary moving inland. 60P and 47P were launched to seed activity along the outflow boundary as it moved through the eastern half of the target area. Later on in the afternoon, a lone storm sparked up along the outflow boundary over Kerr and Bandera counties, with seeding of this cell as it moved through Bandera County before dissipating.
75 flares were burned in Atascosa, Bandera, Bee, Karnes, Live Oak, and Wilson counties, totaling 3400g of AgI.



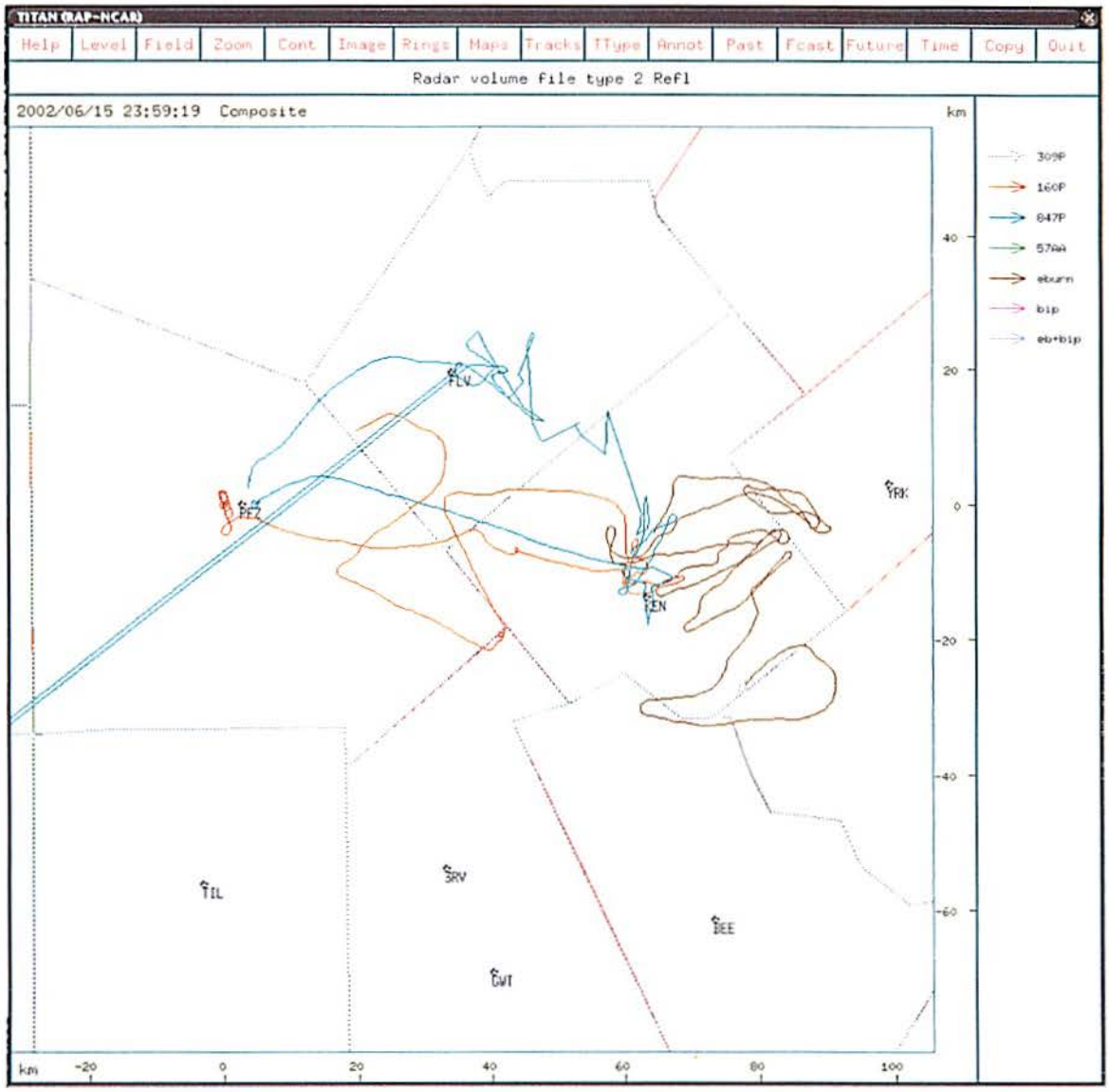
JUNE 2002

June got off to a dry start, with no rain or seeding during the first half of the month. By mid-month, however, NW flow aloft brought several mesoscale convective systems (MCS) into the area, with the first seeding mission of the month taking place on the 15th. A tropical tap began around the 20th and continued through the remainder of June, with an upper level low affecting the area during the last week of the month, resulting in several days of rain. A total of 225 flares were burned during the month, amounting to 14,400g of AgI.



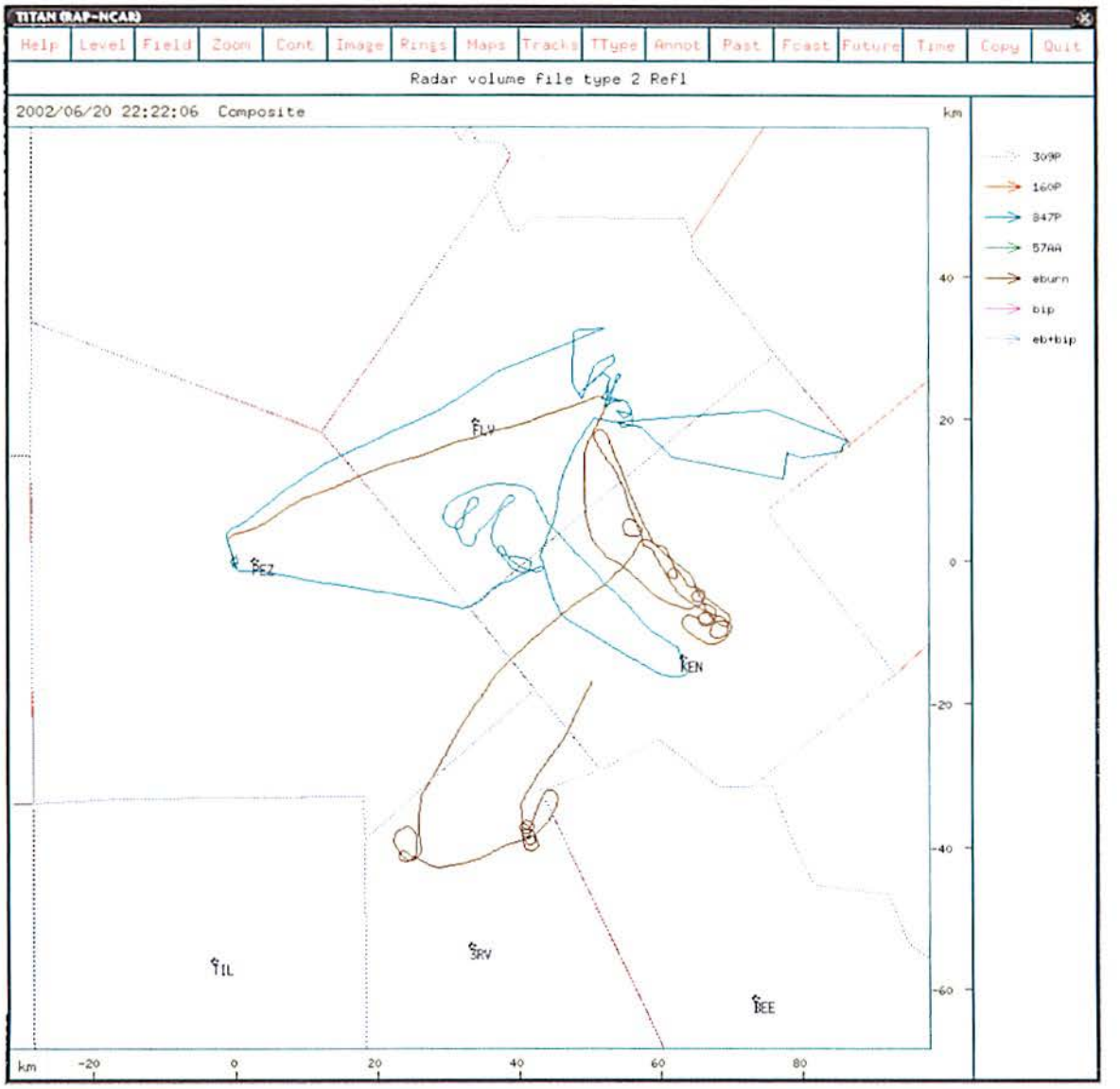
JUNE 15

A frontal boundary was lying across part of the target area and was stationary. An MCS moved down from northern Texas in NW flow aloft, weakening as it approached central/SE Texas. An outflow boundary pushed out ahead of the storm complex, and as it encountered a more unstable airmass over our area, new storms developed along the boundary. 60P, 09P, and 47P were all launched to investigate and eventually seed the incoming activity. One storm became supercellular in nature as the outflow boundary ran into the frontal boundary. This storm appeared to do well with seeding, and was the last storm to dissipate on the radar scope.
38 flares were burned in DeWitt, Karnes, and Wilson counties, totaling 1920g of AgI.



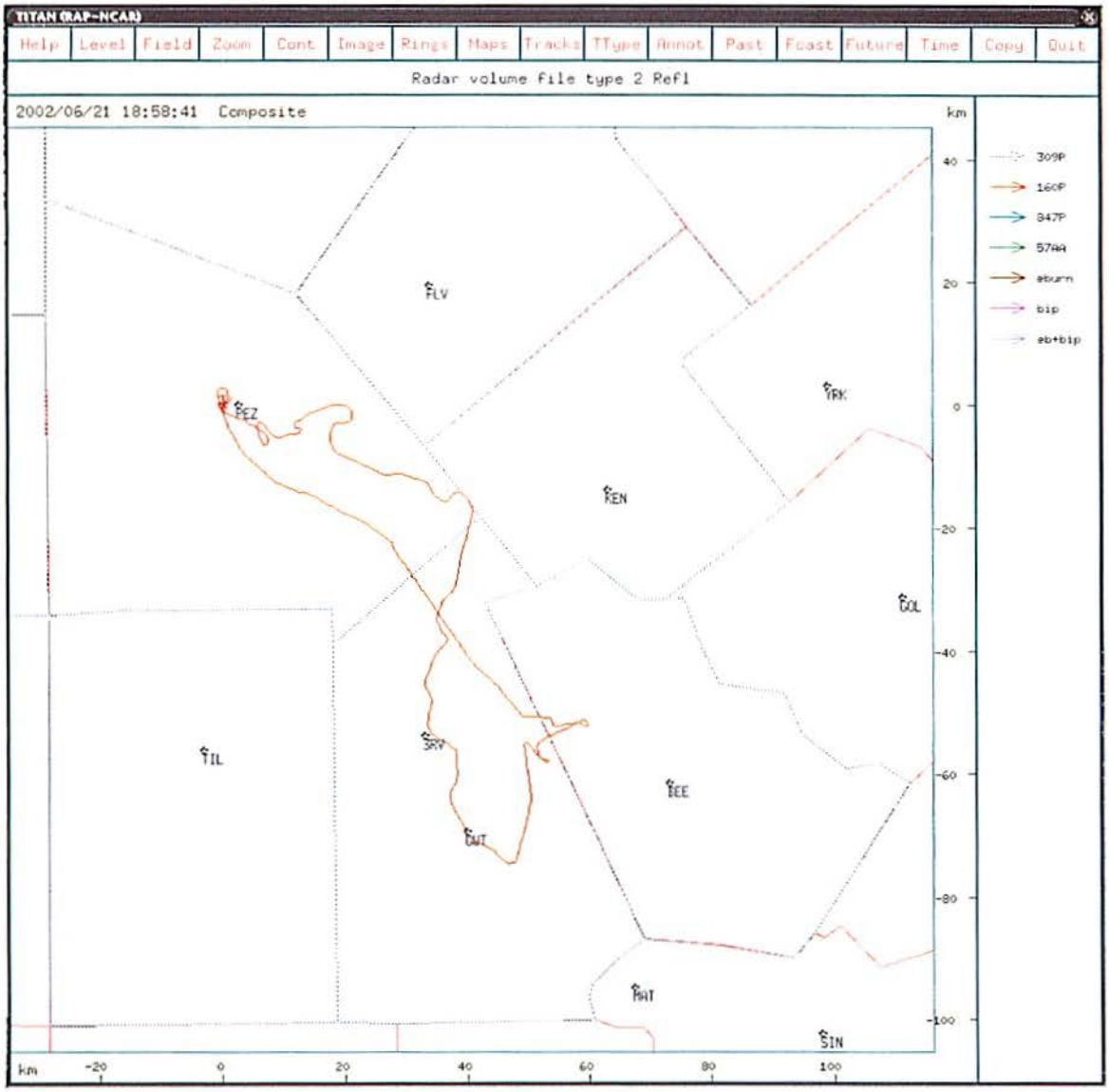
JUNE 20

With a tropical airmass in place and little in the way of a cap, showers and a few thunderstorms developed late morning through mid afternoon across the eastern part of the target area. Most of the activity was along the seabreeze or near small outflow boundaries. There were three flights to seed activity over Wilson and Karnes counties. Activity began to diminish as the seabreeze moved further inland and previous convection stabilized the atmosphere.
24 flares were burned in DeWitt, Karnes, Live Oak, and Wilson counties, totaling 1440g of AgI.



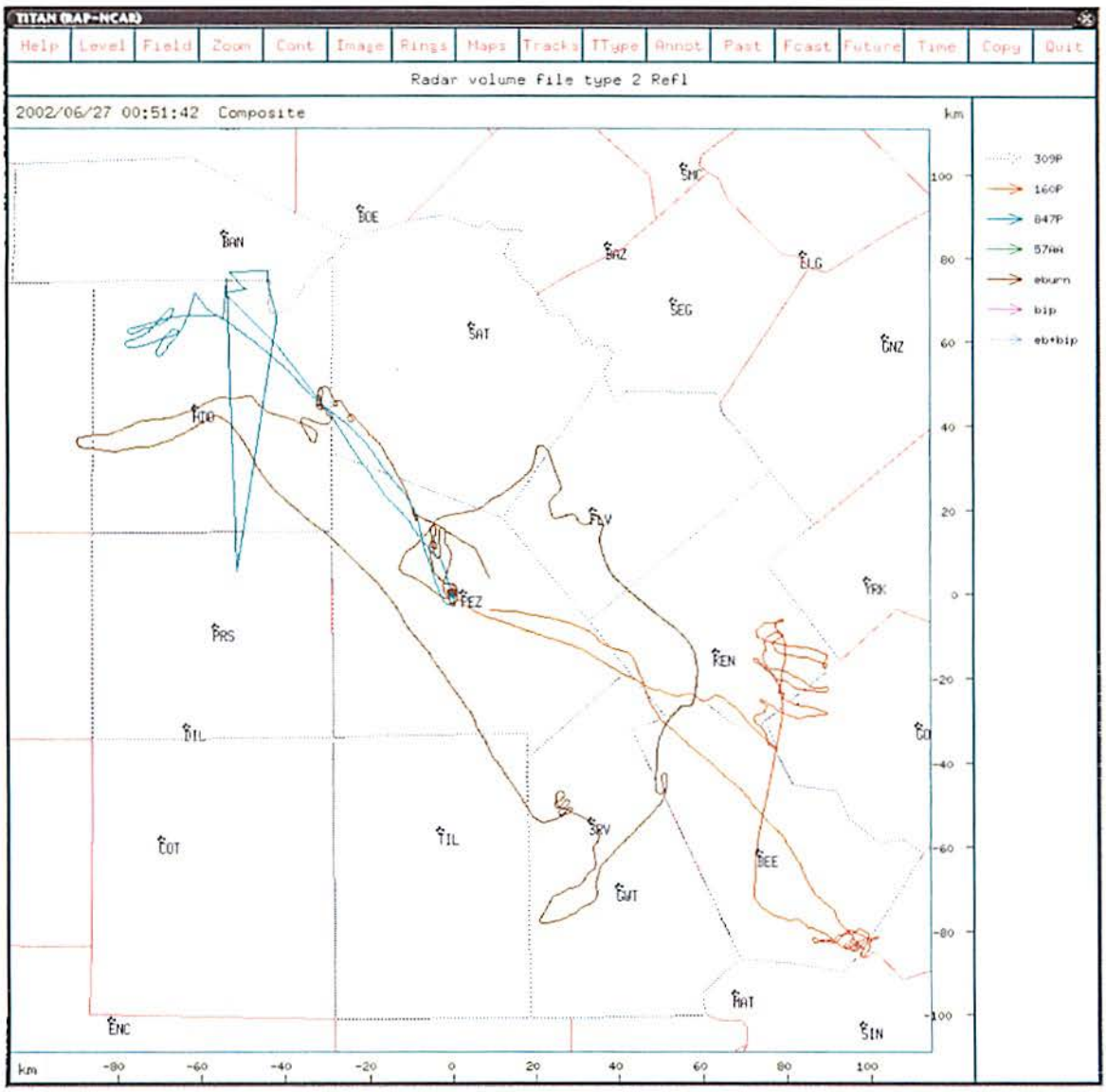
JUNE 21

A trough axis over SE Texas was moving SSW into the far western Gulf, closer to our SE target area. With plenty of Gulf moisture, little to no cap, and convergence along the seabreeze, a few showers and thunderstorms popped up and moved west into the southeastern target area. Little inflow was found, but one flare was fired into activity in Bee County.
One flare was burned in Bee County, accounting for 40g of AgI.



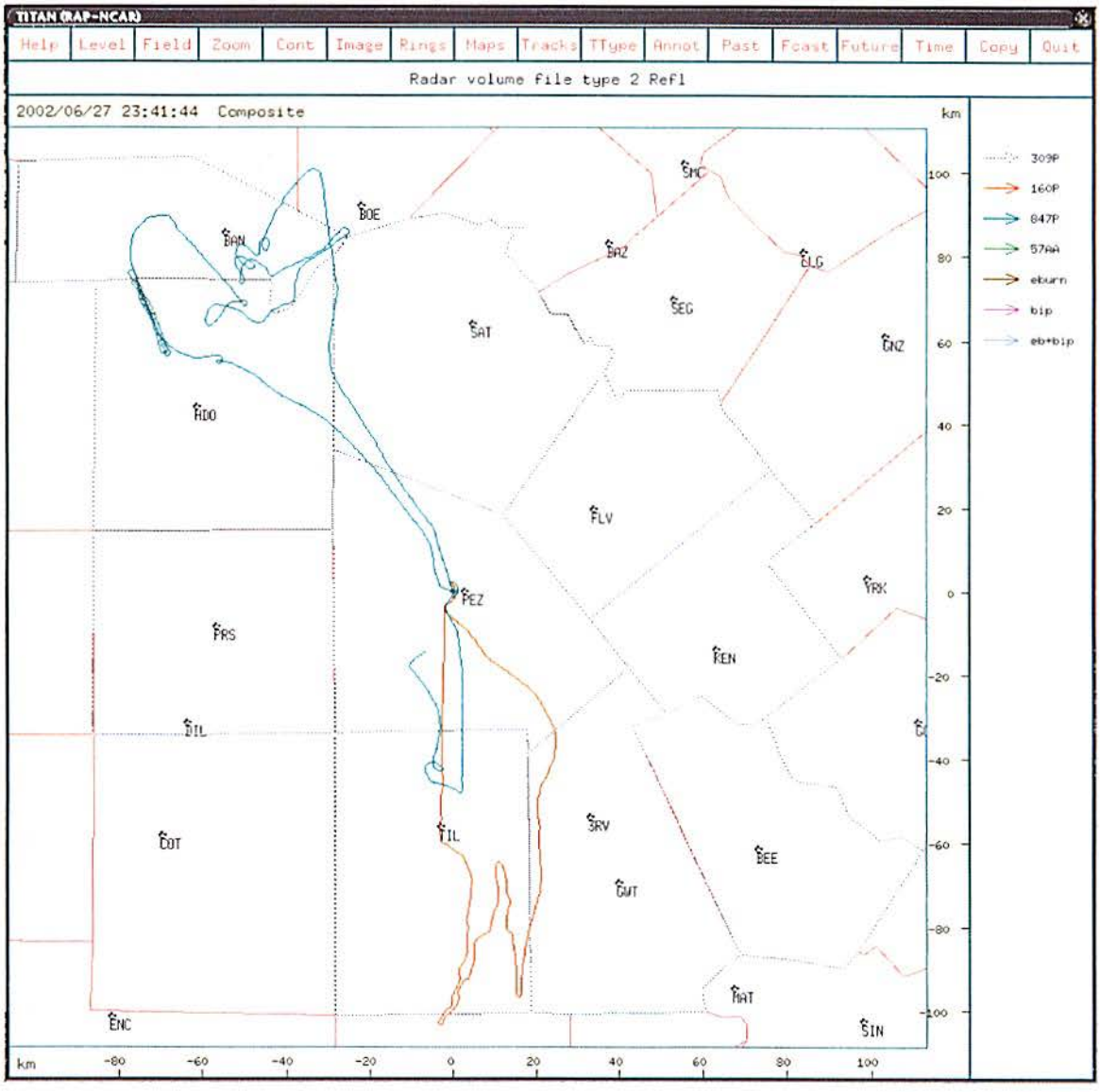
JUNE 26

Upper level low over NE Texas was helping to pull in copious amounts of Gulf moisture. Cooler mid level temperatures resulted in a very weak cap overhead, and with a combination of strong surface heating, a weak impulse dropping down the west side of the low, and the inland-bound seabreeze, showers and thunderstorms rapidly developed over the area from east to west and moved southward. There were three flights for the day, with activity being seeded throughout much of the target area. Activity lasted up until around sunset, when heating ceased.
50 flares were burned in Atascosa, Bandera, Bee, Bexar, Goliad, Karnes, Live Oak, and Wilson counties, totaling 3520g of AgI.



JUNE 27

An upper level low cutoff from the main steering currents continued to spin over NE Texas, with minor disturbances rotating around the western edge of the low. Overnight an MCS developed in west Texas and pushed southward, with an outflow boundary ahead of the complex. The outflow boundary collided with another outflow boundary from an MCS that affected the southeastern target area, and thunderstorms developed northwest of the target area, pushing south. An early morning flight to activity approaching Bandera County revealed little inflow and high bases, so it was written off as a recon mission. Early in the afternoon, thunderstorms moved into McMullen County from the west, with 60P launching to treat activity in that area as it moved east towards Live Oak County. 47P also launched to treat activity in that area. After 2100 UTC (4pm local), new activity developed in northern Medina/southern Bandera counties, and 47P was launched again to treat cells in those counties.
29 flares were burned in Bandera, Bexar, Duval, Live Oak, McMullen, and Medina counties, totaling 2320g of AgI.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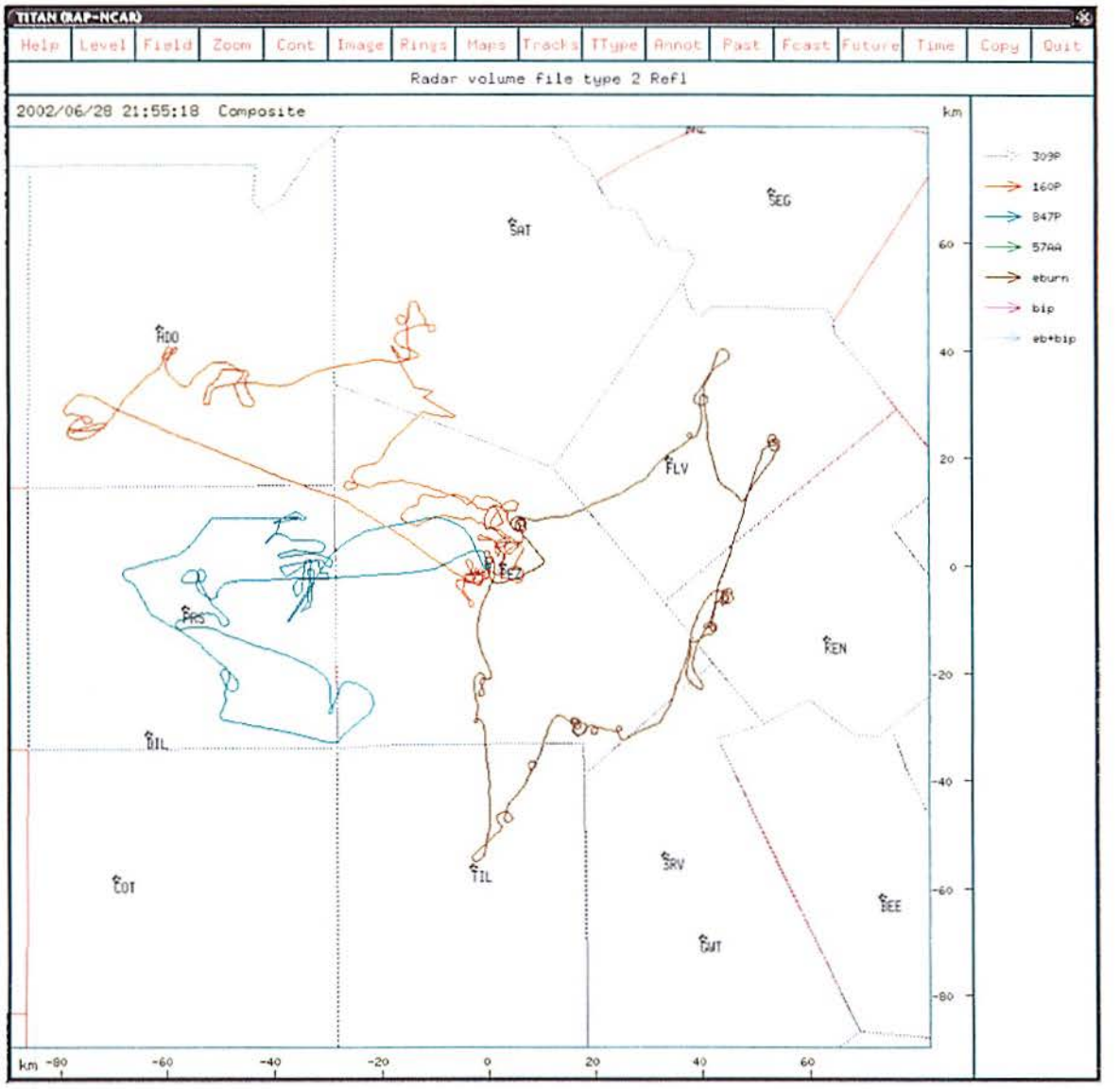
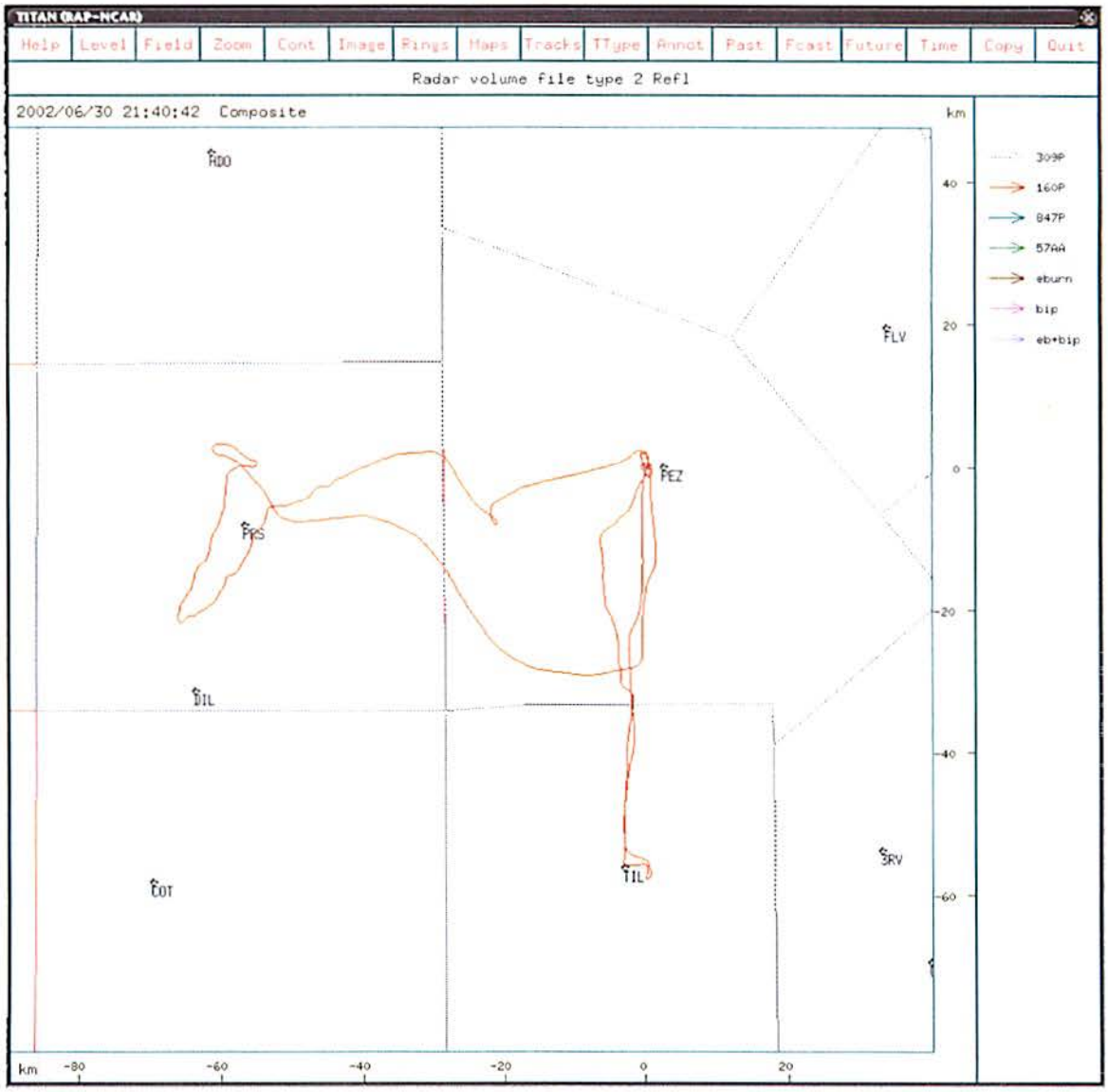
JUNE 28

The upper level low that has sat over east Texas for a couple of days now continued its slow trek west. Overnight an MCS developed over the western Gulf and impacted the coast near Corpus Christi. An outflow boundary emanating from the decaying MCS pushed northward through the area, sparking off showers and thunderstorms in the tropical environment. Strong surface heating also helped to form activity across the area. During the noon hour, 09P launched to look at activity developing in the highly-tropical airmass. 60P soon followed, as did 47P. Activity was dispersed throughout the entire target area, with seeding taking place in all but the far southeast target area. Activity was dying down by mid to late afternoon, so all planes returned to Pleasanton.
75 flares were burned in Atascosa, Bexar, Frio, Karnes, McMullen, Medina, and Wilson counties, totaling 4520g of AgI.



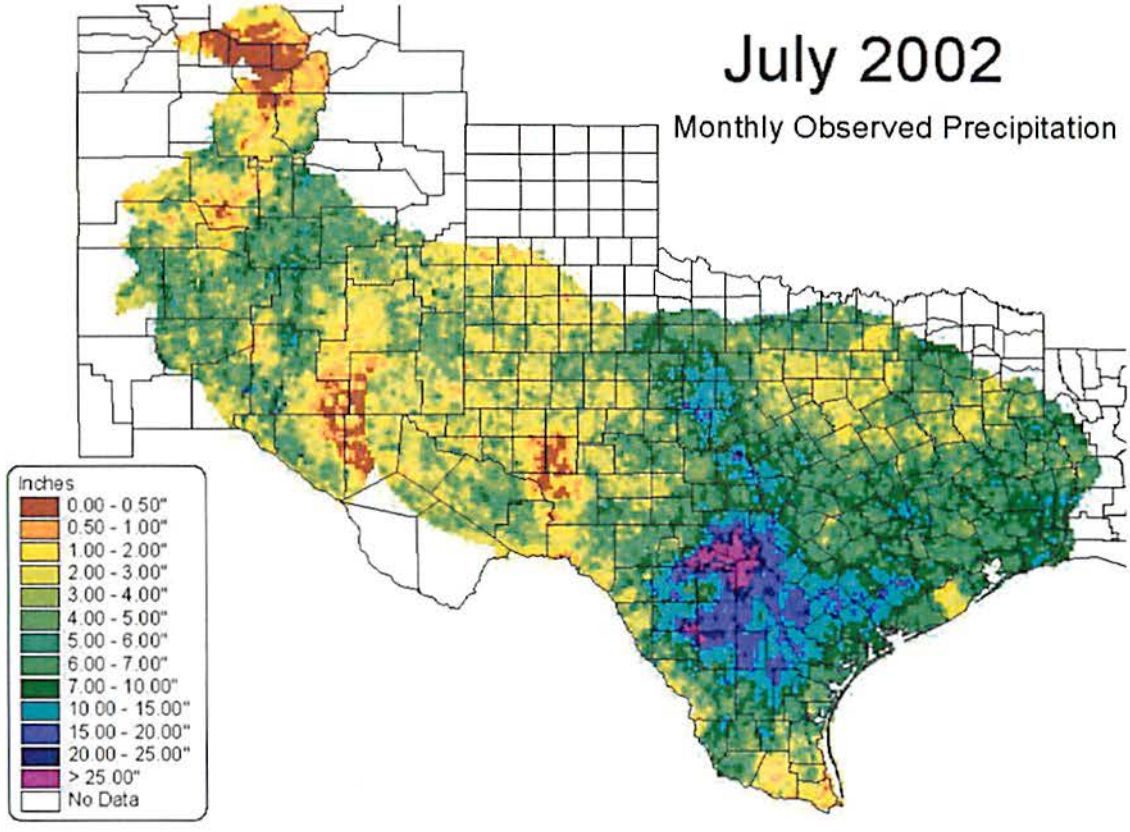
JUNE 30

Activity in the morning and early afternoon had produced plenty of rainfall over the northern target area, where Flash Flood Warnings were in place. By mid-afternoon, a vort max moving north from the lower Valley sparked a few cells over the central and western target area. 60P launched to seed a couple of cells in Frio County. Marginal inflow was found, and eight flares were burned. Activity remained weak, and with ceilings and visibilities lowering, the mission ended shortly after 2100 UTC.
8 flares were burned in Frio County, totaling 640g of AgI.



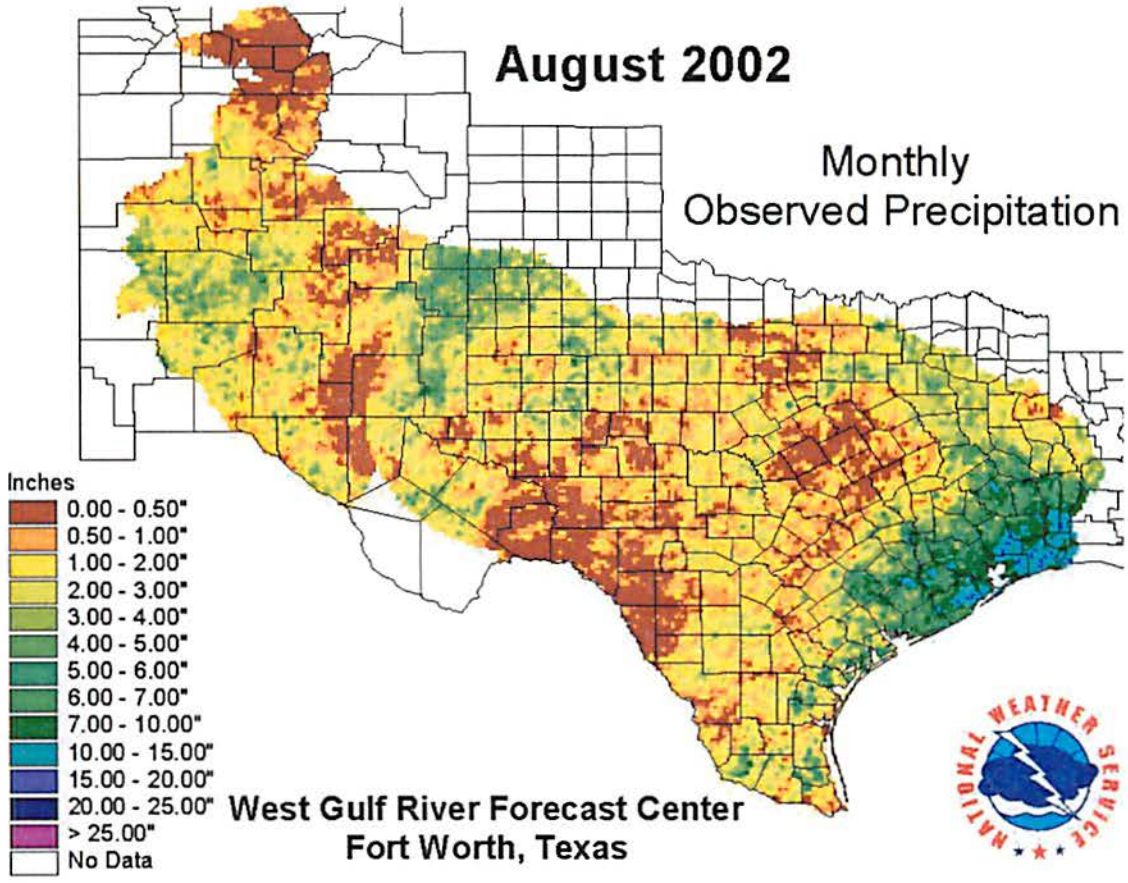
JULY 2002

The first half of the month saw torrential rainfall across parts of the target area due to a very slow-moving upper level low with tropical characteristics. Copious amounts of tropical moisture combined with a cool pool of air aloft and surface heating to produce heavy showers and thunderstorms on a daily basis during the first half of July. While the Pleasanton area was one of the few locations to see under 10 inches of rain, many other areas saw upwards of a foot of rain. Extreme rainfall amounts over the northern part of the target area (up to 3 feet) resulted in severe river flooding in parts of the target area. As a result of the unusually high amounts of rain that fell during the end of June and the first part of July, the program was voluntarily suspended for the entire month; ergo, no seeding flights were logged.



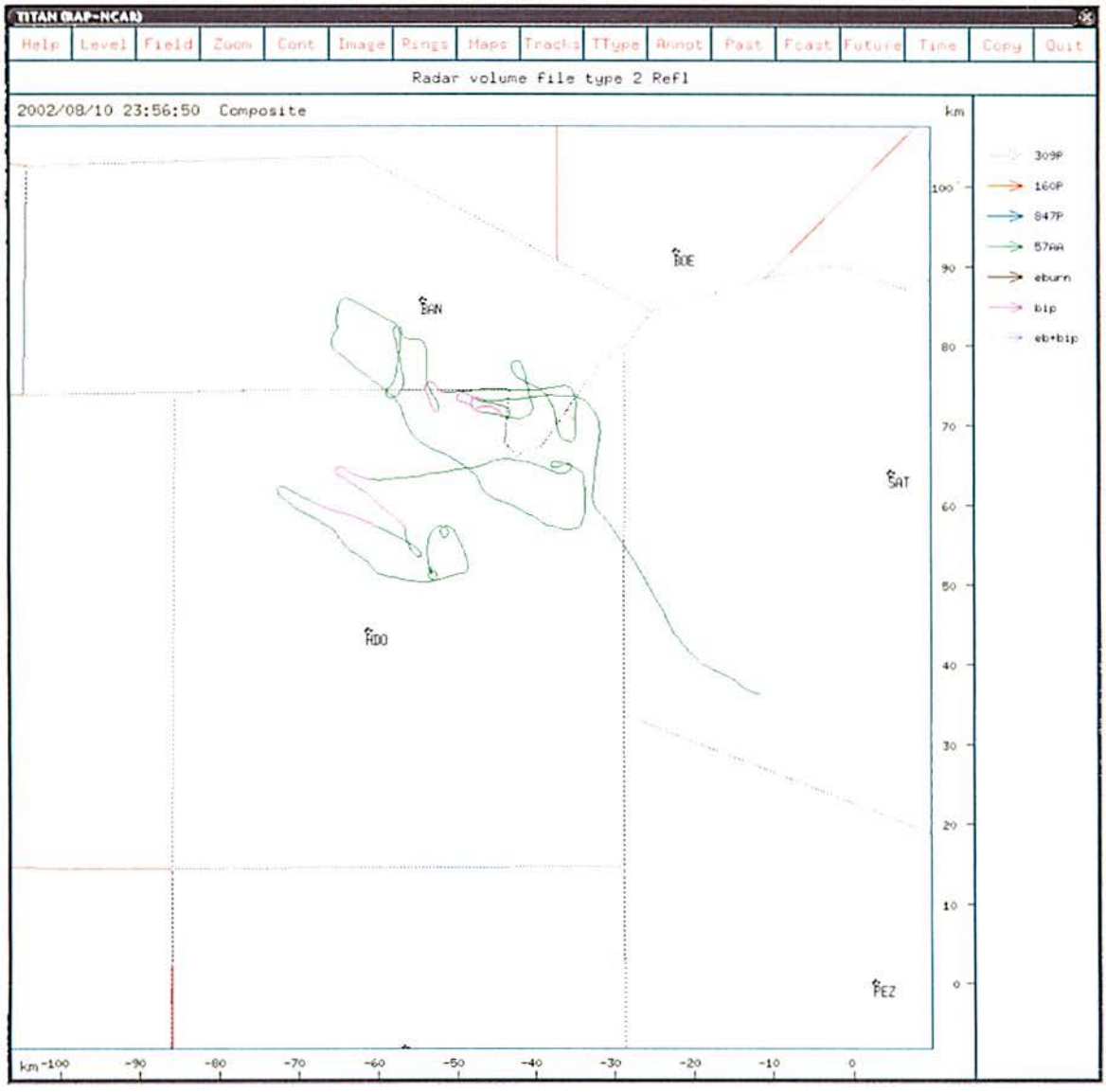
AUGUST 2002

After a break from seeding due to the flooding rains in July, we returned to seeding once again after the first week of August. True to the trend of the past couple of years, August was not very active, with only three days seeing seeding take place. We had tropical moisture as a result from a dying Tropical Storm Bertha, which made landfall in northeast Mexico on the 10th. Outflow boundaries helped initiate convection on the 14th, while on the 29th, a rare NW flow event MCS moved through the area.



AUGUST 10

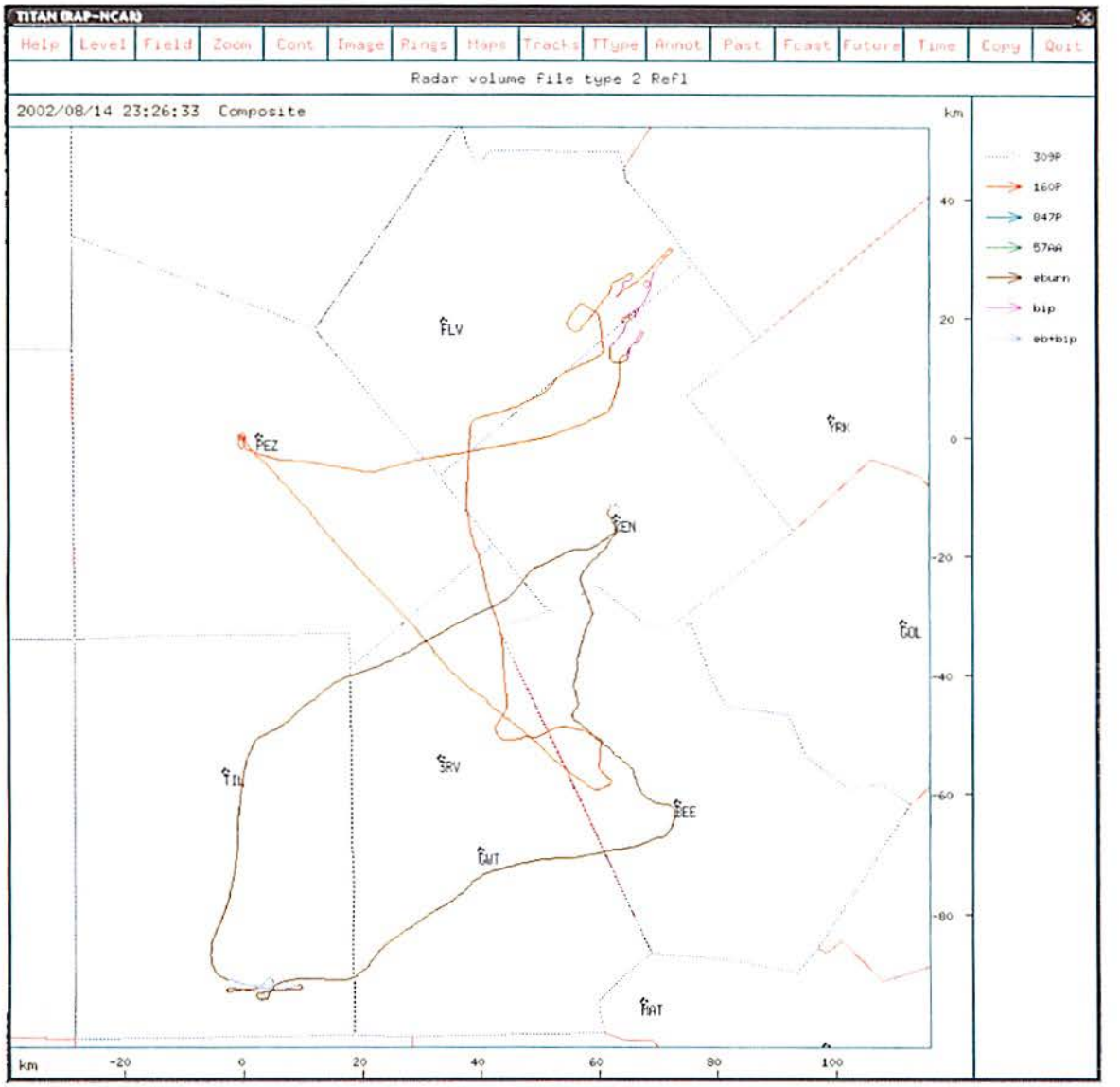
The remains of Tropical Storm Bertha were centered over northeast Mexico, south of Brownsville. This system provided a large slug of tropical moisture which, when combined with daytime heating, sparked numerous showers and thunderstorms across the eastern part of the target area. In addition, an outflow boundary from thunderstorms in east Texas was propagating to the south and west towards the target area, and thunderstorms fired along it. 7AA was launched to investigate activity in the Medina Lake area, with some flares being fired into inflow which averaged around 800 ft/min.
6 flares were burned in Bandera and Medina counties, totaling 480g of AgI.



AUGUST 14

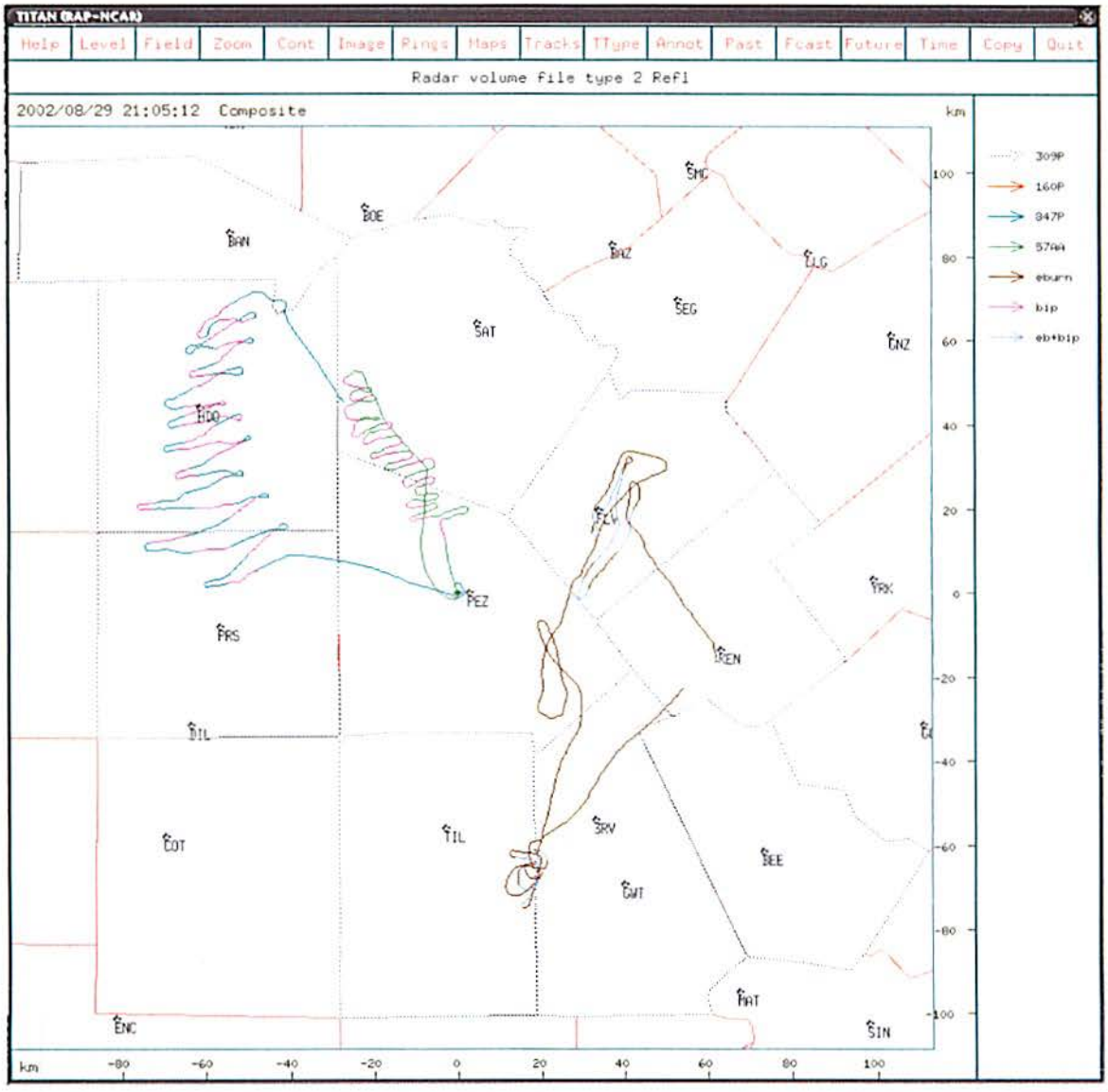
Showers and thunderstorms close to the coast in the morning hours sent out an outflow boundary northward across the eastern target area. This boundary interacted with daytime heating and abundant moisture to produce scattered showers and thunderstorms across the eastern counties. Later in the day, the seabreeze boundary began its trek across the southeastern target area, with more activity developing along it. Both convective events were seeded, with marginal results noted on radar.

10 flares were burned in Karnes, McMullen, and Wilson counties, totaling 800g of AgI.



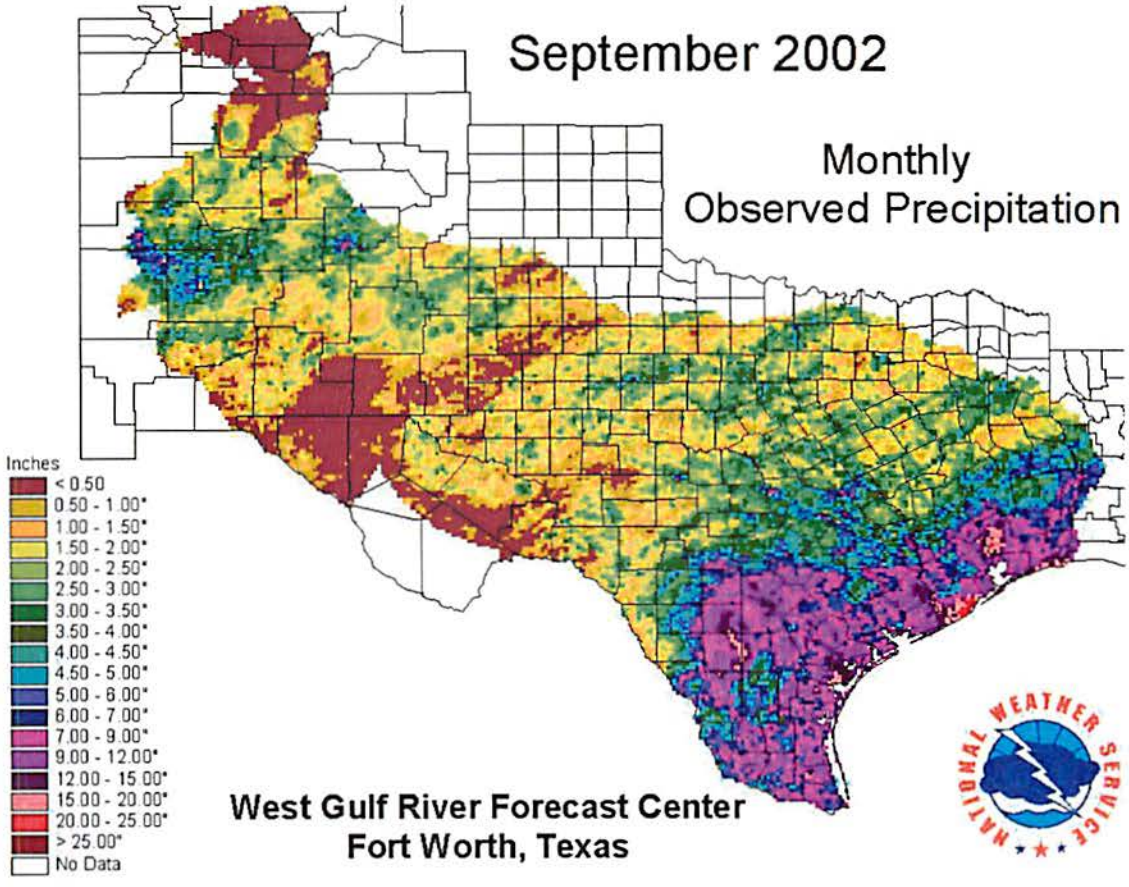
AUGUST 29

N/NW flow aloft, resulting from a low to the east and a high to the west, allowed an MCS to propagate southward into our area from NW Texas. Theta-e ridging across the area allowed the MCS to survive during the morning/early afternoon hours as opposed to dying out like most MCS' do. The system affected the central and western parts of the target area from late morning through mid-afternoon, and several planes were launched to seed the incoming complex. Seeding ceased as the complex continued on to the southwest of the target area, towards Laredo.
48 flares were burned in Atascosa, Bexar, Frio, Live Oak, McMullen, Medina, and Wilson counties, totaling 3840g of AgI.



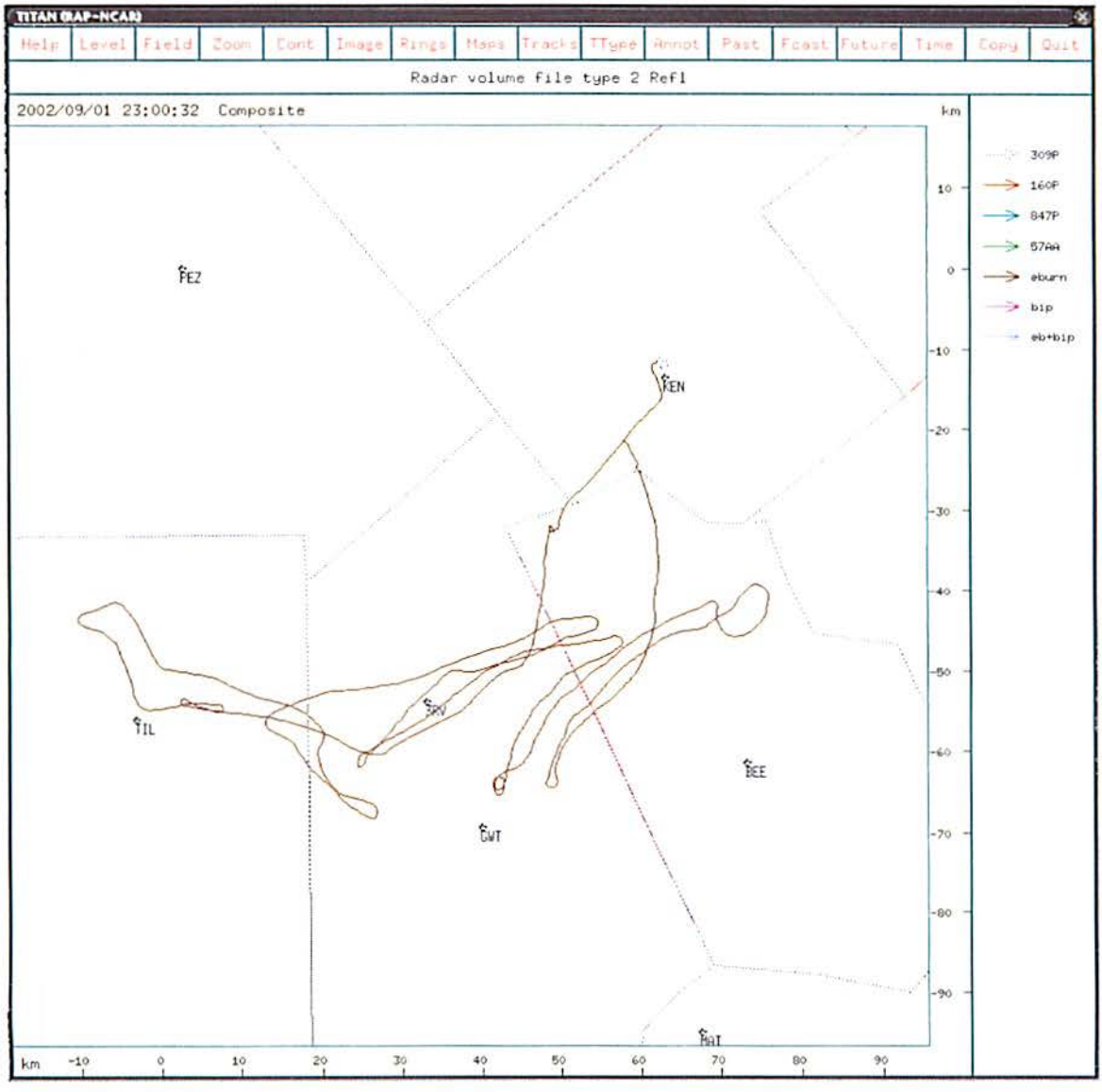
SEPTEMBER 2002

September turned out to be a wet month in terms of total rainfall, although most of the rain fell during the first half of the month. Despite the abundance of rain, seeding was only able to take place on the first of the month, when a tropical disturbance affected south Texas. Otherwise, it was a rather uneventful month seeding-wise. Cold fronts began to once again make their presence in our area by the second half of the month, marking a transition from summer to fall.



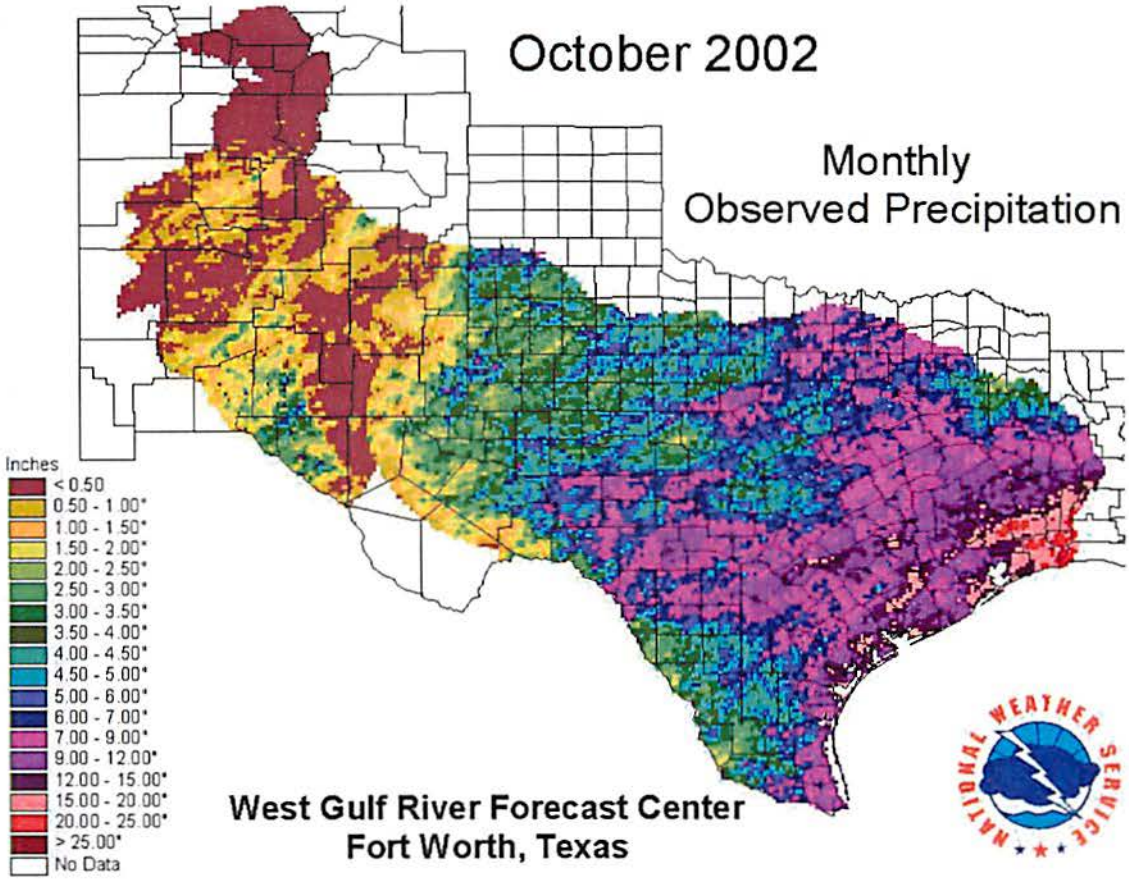
SEPTEMBER 1

A very tropical airmass resided over the area today, with precipitable water values well over 2 inches. A TUTT (Tropical Upper Tropospheric Trough) was approaching south Texas from the Gulf, helping with the abundance of tropical moisture. Deep but light easterly flow was present, with activity moving almost due westward. The light winds also allowed for the seabreeze to develop and push well into the target area. Activity developed just to the east of the target area early in the afternoon and pushed westward along the seabreeze across the southern counties. 09P took off from Kenedy and treated the activity that moved across Bee, Live Oak, and McMullen counties.
15 flares were burned in Bee, Live Oak, and McMullen counties, totaling 1200g of AgI.



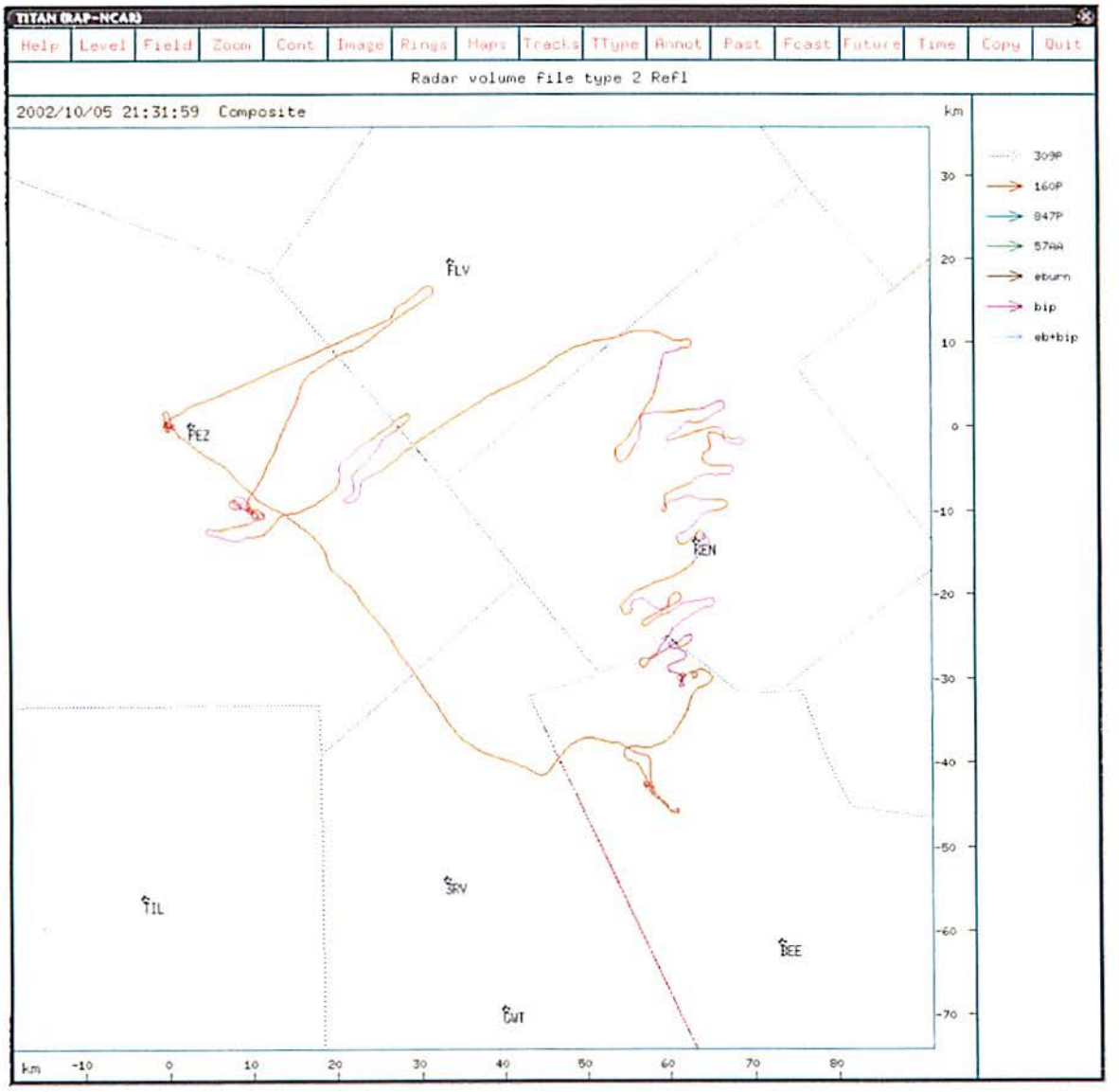
OCTOBER 2002

October ended up being a very wet month, with over eight inches of rain falling at the radar site in Pleasanton. Some areas totaled more than this. Despite the copious rainfall, seeding was only done on two days of the month, as flooding had once again reared its ugly head, and restrictions were imposed in areas that were experiencing flooding problems.



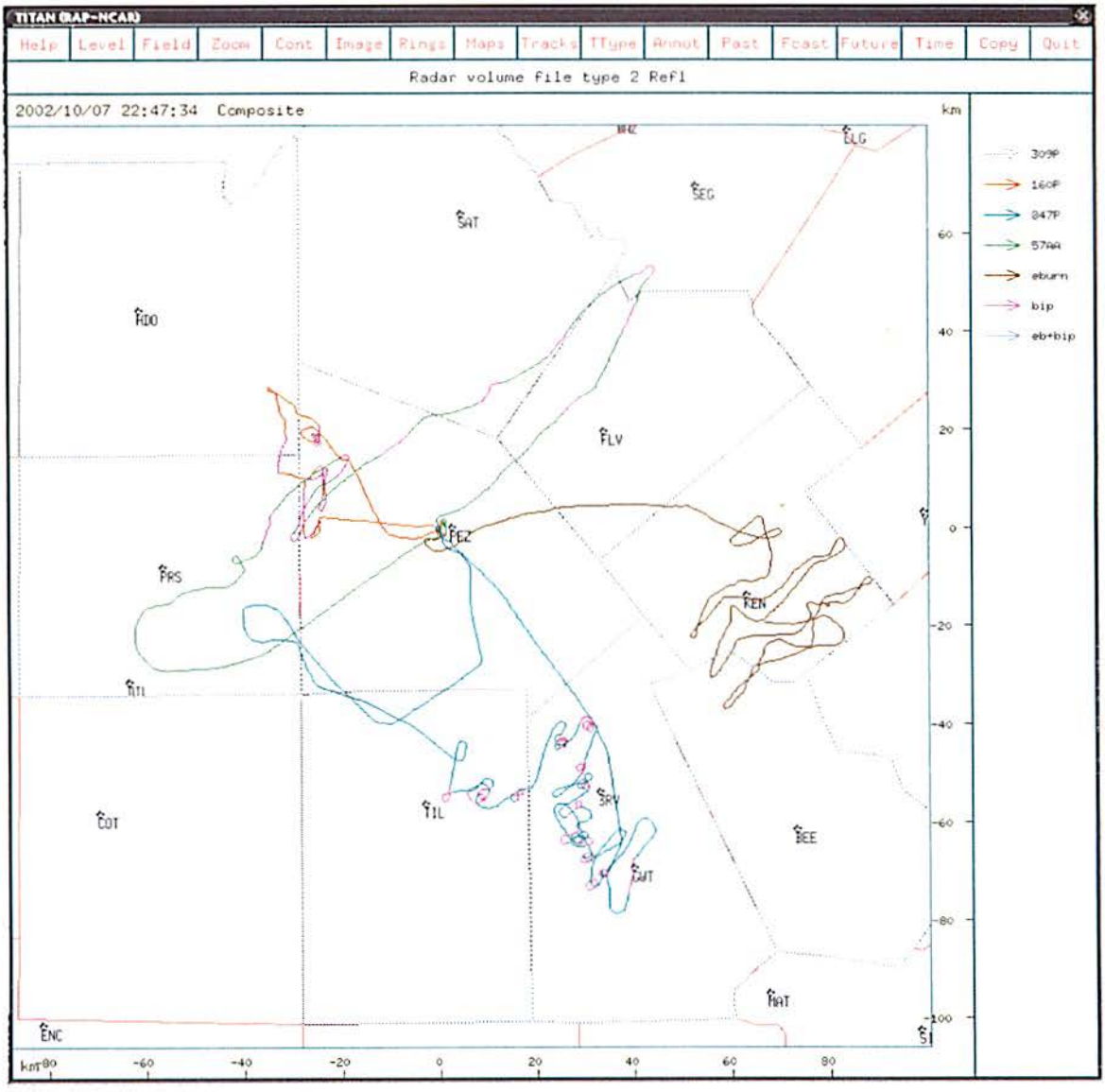
OCTOBER 5

Abundant tropical moisture associated with a shear axis over the western Gulf had overspread the region, with precipitable water values in excess of 1.8 inches. Moisture pooling was also evident along the frontal boundary, which stretched across the north-central part of the target area. As the shear axis moved inland, a seabreeze developed in roughly the same area and pushed northward into the southeastern target area. 60P was launched near the end of the noon hour to treat the activity that was approaching from the south. Seeding took place for approximately 90 minutes as the activity moved across the eastern half of the target area.
22 flares, totaling 1760g of AgI were burned in Atascosa, Bee and Karnes counties.



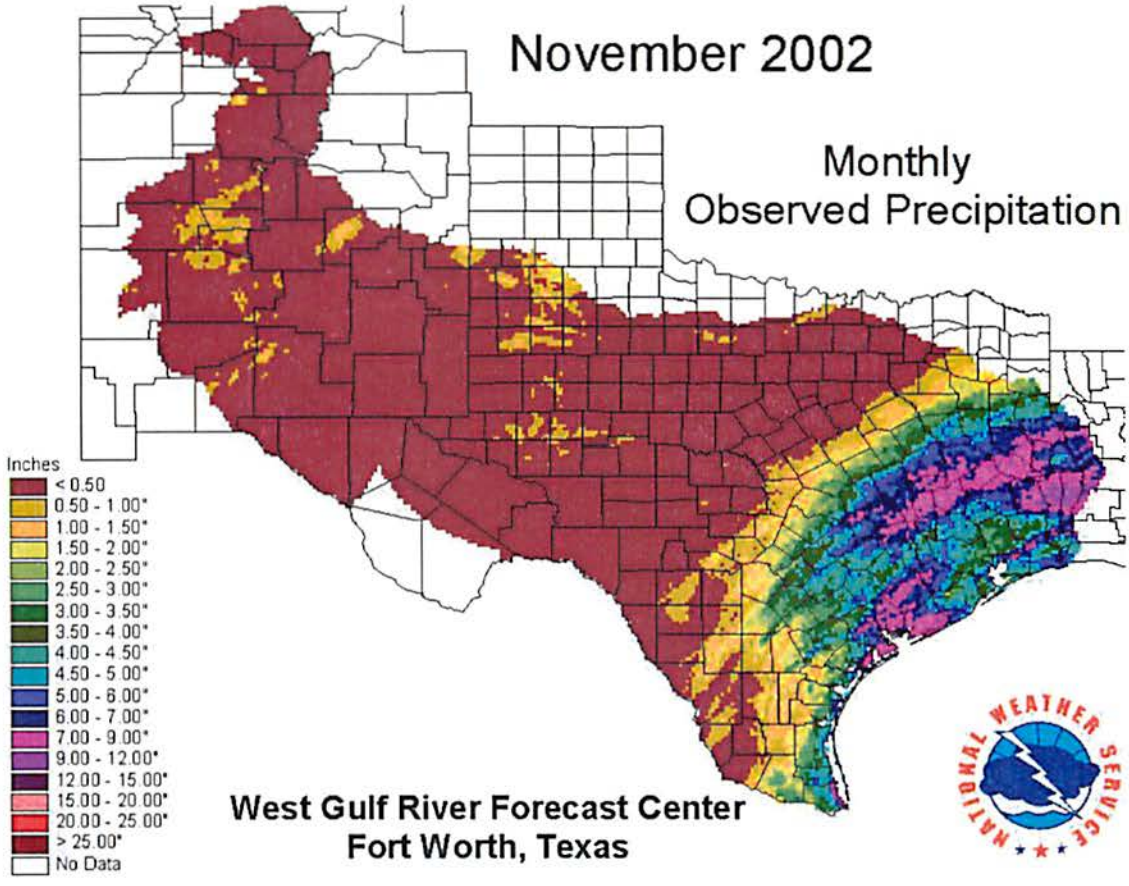
OCTOBER 7

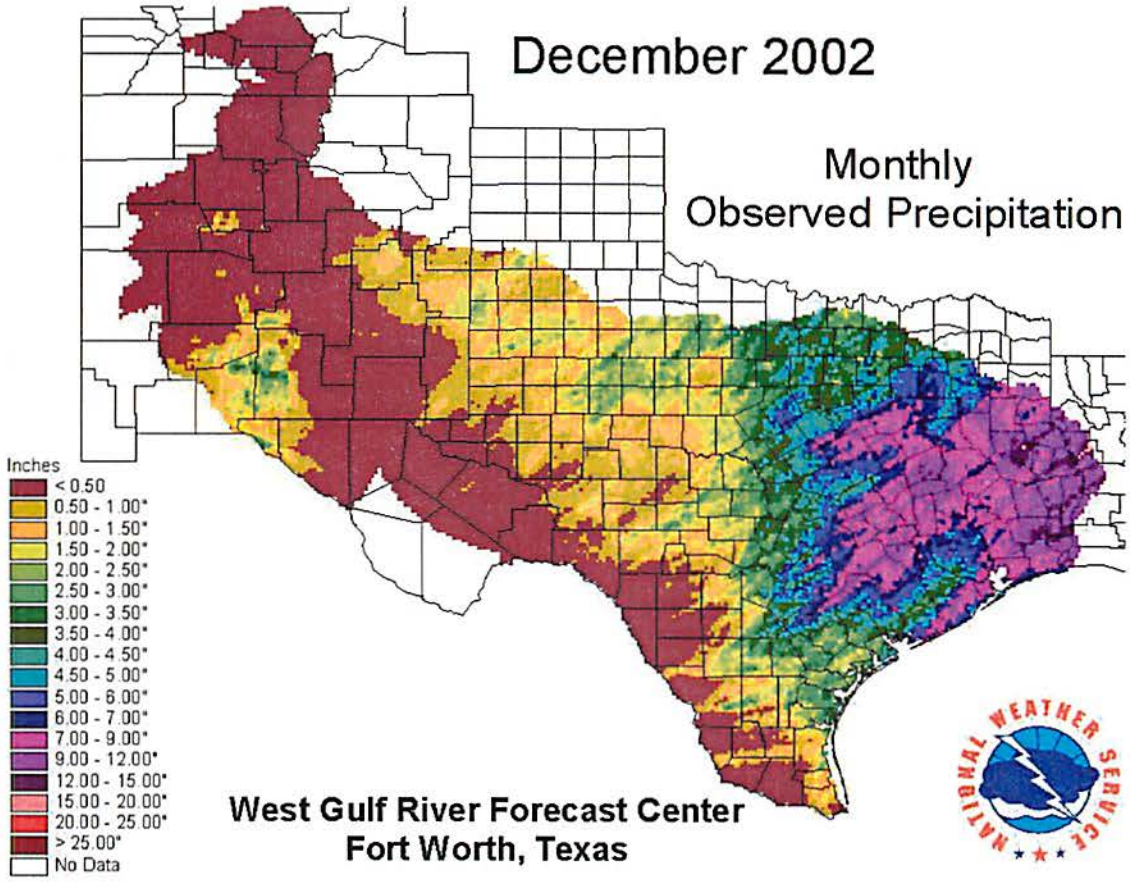
Once again, copious amounts of tropical moisture were in place across south Texas. A cold front was situated north of the target area, with a prefrontal trough just touching the northern counties of the target area. Convection developed along the inland-bound seabreeze, for which two planes were launched to treat cells. In addition, once locations in the vicinity of the trough began to see some sun/surface heating, additional convection developed, for which the remaining two planes were launched. Activity waned by late afternoon as the convection weakened and moved north of the area.
63 flares, totaling 3290g of AgI were burned in Atascosa, Bee, Bexar, DeWitt, Frio, Gonzales, Karnes, Live Oak, McMullen, Medina and Wilson counties (basically the entire target area!)



NOVEMBER-DECEMBER 2002

Although November and December were wetter than normal, the convective activity occurred during the nighttime hours, and rainfall which fell during the day was stratiform in nature, which is not seedable. As such, there were no seeding missions during the final two months of 2002.




December 2002
Monthly
Observed Precipitation
Inches
< 0.50
0.50 - 1.00"
1.00 - 1.50"
1.50 - 2.00"
2.00 - 2.50"
2.50 - 3.00"
3.00 - 3.50"
3.50 - 4.00"
4.00 - 4.50"
4.50 - 5.00"
5.00 - 6.00"
6.00 - 7.00"
7.00 - 9.00"
9.00 - 12.00"
12.00 - 15.00"
15.00 - 20.00"
20.00 - 25.00"
> 25.00"
No Data
West Gulf River Forecast Center
Fort Worth, Texas
NATIONAL WEATHER SERVICE

RADAR ANAYSIS FOR 2002

Radar data collected during the 2002 season was once again sent to San Angelo for analysis using software within the TITAN program. As in previous years, analysis of the radar data showed that the STWMA project did fairly well with treatment of clouds. Below are the numbers the 2002 season, which included most, **but not all**, seeded clouds.

Variable	Seeded Sample	Control Sample	% change
Lifetime	125 minutes	77 minutes	62
Area	87.1 km^2	66.5 km^2	44
Volume	317.5 km^3	191.6 km^3	74
Top Height	8.9 km	7.9 km	13
Max dBZ	48.8	45.1	1
Hgt. of max dBZ	4.1 km	4.3 km	-9
Vol. over 6 km	80.2 km^3	35.3 km^3	106
Precip Flux	482.3 m^3/s	257.7 m^3/s	76
Precip Mass	3175.5 kton	988.5 kton	172

Lifetime
This variable indicates the life span of a cloud from the first scan that it is identified on TITAN to the last scan that it remains identified. In 2002 we see that seeded clouds were lasting much longer compared to the untreated, or control clouds.

Area
This variable tells how large of a space (two-dimensional) the clouds occupied. Seeded clouds, on average, were 44% larger in 2002 when compared to control clouds.

Volume
This variable shows how large of a space (three-dimensional) the clouds occupied. Seeded clouds were, on average, 74% larger compared to control clouds.

Top Height
Maximum cloud height is indicated by this parameter, which, for 2002, showed that seeded clouds were 13% higher, on average, compared to control clouds.

Max dBZ
This parameter shows the highest reflectivity value as indicated by radar that the cloud obtained, and is a function of rainfall intensity. Analysis showed that seeded clouds had a slightly higher maximum reflectivity during their lifetime.

Height of max dBZ
This variable describes the height at which the maximum reflectivity in the cloud was located. Seeded clouds had a max reflectivity that was 9% lower in seeded clouds versus control clouds.

Volume over 6 km
This parameter shows the volume of the cloud that is higher than 6 km AGL. We use 6 km because, in Texas during the summer, the freezing level is approximately at 6 km (or 19,700 ft); as such, any portion of

cloud above this level is either ice or supercooled water. 2002 analysis shows that seeded clouds had 106% more supercooled volume compared to control clouds.

Precip Flux
The potential volume of water falling through the bottom of the cloud per second is what this variable describes. This parameter appears to be nearly twice as large in seeded clouds.

Precip Mass
This variable is defined as the total mass of water/ice contained within the cloud, as measured by the radar. Analysis showed that in 2002, the seeded clouds contained 172% more water/ice on average when compared to untreated clouds.

Overall the numbers indicate that favorable results were obtained for the 2002 season. In the case of the height of max dBZ being lower in seeded clouds, this may be an indication of more ice/water being transported to the lower levels of the cloud compared with untreated clouds, and thus resulting in maximum reflectivities being located lower in the seeded cloud.

If one takes the Precipitation Mass averaged for seeded/control clouds in the STWMA target area in 2002 and divides it by the average area of seeded/control clouds, then a number can be derived which gives a "virtual layer depth" of water below a cloud. Taking all clouds into account for 2002 yields the following:

Seeded Sample	Control Sample	Increase	% Increase
2.39 inches	1.75 inches	0.75 inch	31

It is important to note here that these numbers do not indicate how much extra rainwater reached the ground. Studies have shown that radar-derived rainfall estimates do not always match what has been measured on the ground. This is attributed to various factors, such as rain gauge density and amount of dry air beneath cloud base. However, with positive changes in cloud parameters as shown in this section, one may postulate that seeding did, in fact, result in extra rainfall over the target area.

ACKNOWLEDGEMENTS

2002, although not as busy in terms of seeding missions, was deemed another successful year for the STWMA. The success of the project comes about through the hard work of many people, and it is here where gratitude must be expressed.

Our two "heads of state", if you will, Tommy Shearrer and Mike Mahoney, continue to do many hours of work to ensure that the project gets past any red tape and runs as smoothly and efficiently as possible. Many thanks go their way, as the project would likely be lost without them. Thanks also go to the board members who regularly meet to discuss purchases, improvements, seeding methods, and any other factors that affect the way the program is run. Their input in the past has helped run a successful program, and we hope they will continue their good work. We certainly couldn't have the great planes and the successful flights without the hard work of Tim Pickens, our chief pilot, and the four other pilots: Jim Transue, Larry Dement, Ron Merks and Mickey Chadwell. They deserve many thanks. Thanks must also go out to Melissa Royal, who handles much of the laborious paperwork for the project, and to Larry Akers, who keeps our radar in tip-top shape. An expression of gratitude is extended to Archie Ruiz, who performs the ever-challenging radar analysis. With his work, we may yet find a way to prove once and for all the true success of cloud seeding. The cloud seeding projects may not be here had it not been for two valuable people, George Bomar and Jane Lee (who recently returned to TNRCC), who work with the projects and the Department of Agriculture - thank you both. A very important person in our project is James Hayden, who has kept the computers working wonderfully, and has given much help in the continued running of our web site. Many thanks to him. Thanks also to Rick Illgner and the EAA for working with us this year and in the years to come. Finally, thanks go out to the public, most of whom continue to believe in our project and our mission. Without your approval, our project would cease to exist. Thank you all!

Rainfall maps for 2002 came from the following website:
http://www.srh.noaa.gov/wgrfc/depart_norm/monthly_summary.htm

Radar analysis numbers came from Archie Ruiz's final report of the 2002 season for the STWMA (13 pp.)