



NOAA Technical Memorandum NWS SR – 228

**THE HISTORIC CHRISTMAS 2004 SOUTH TEXAS SNOW EVENT:
MODEL PERFORMANCE, FORECASTER RESPONSE AND PUBLIC
PERCEPTION**

Gregory E. Wilk
Ronald F. Morales Jr.
Jason Runyen
Robert Burton

National Weather Service
Weather Forecast Office
Corpus Christi, Texas

Scientific Services Division
Southern Region
Fort Worth, Texas

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*UNITED STATES
DEPARTMENT OF COMMERCE
Carlos M. Gutierrez, Secretary*

*National Oceanic and
Atmospheric Administration
Conrad C. Lautenbacher*

*National Weather Service
David L. Johnson, Assistant
Administrator for Weather Services*

This publication has been reviewed
and is approved for publication by
Scientific Services Division
Southern Region

David B. Billingsley, Chief
Scientific Services Division
Fort Worth, Texas

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I. Introduction

a. Historical Overview

On 24 and 25 December 2004, portions of South Texas, in particular the county warning area (CWA) of the National Weather Service Office in Corpus Christi (WFO CRP), TX (Fig. 1), experienced a snow storm of record breaking proportions. This storm produced measurable snow across four different CWAs: Brownsville (BRO), Corpus Christi (CRP), San Antonio/Austin (EWX), and Houston/Galveston (HGX) (Fig. 2). By the end of the event, WFO CRP observed a 24 hour snowfall total of 4.4 inches (11.2 cm), breaking the previous record of 4.3 inches (10.9 cm) set in February 1895. This event also marked the heaviest snowfall in recorded history for Christmas Day in Corpus Christi; the previous record was only 0.1 inches (0.25 cm) set back in 1918.

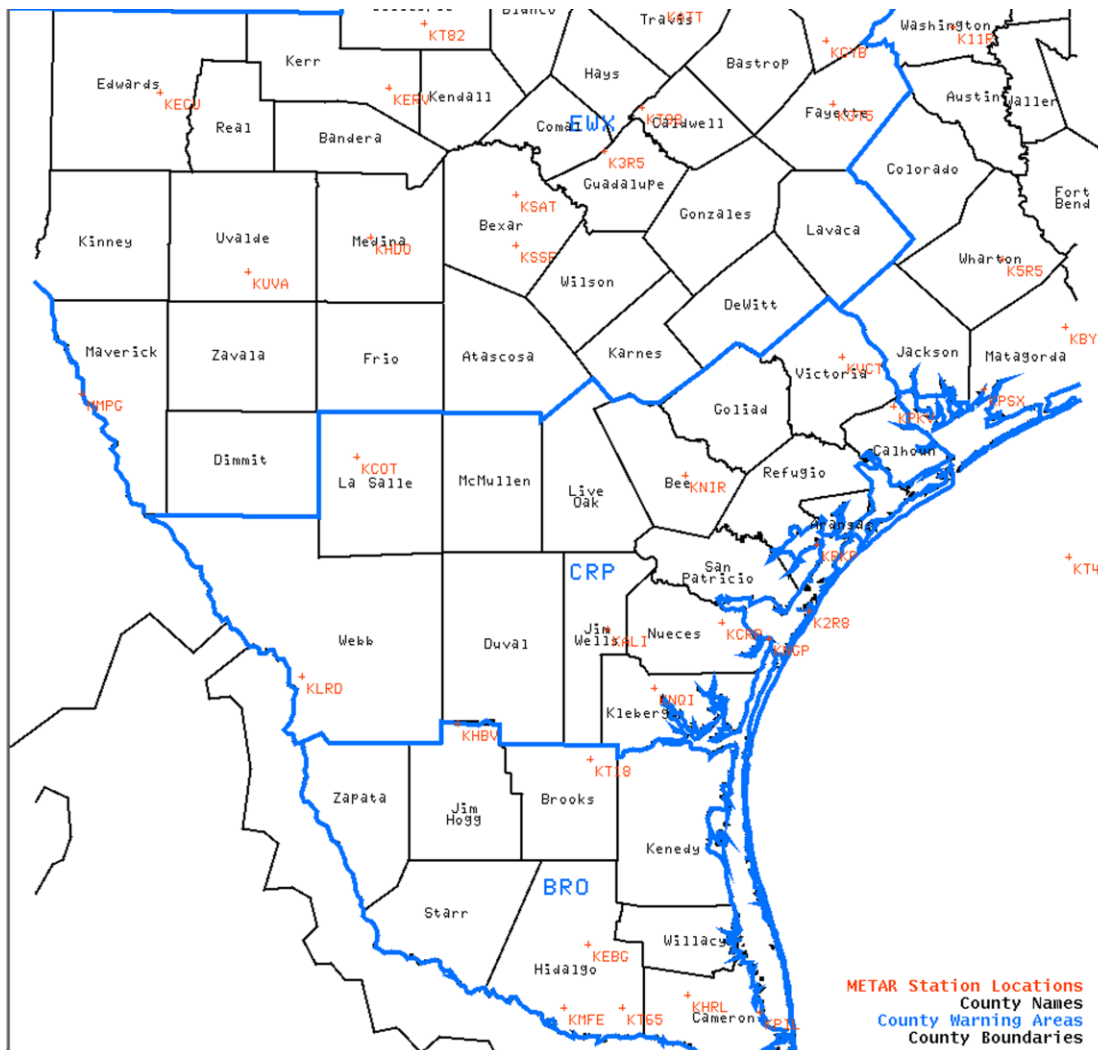


Fig. 1. A portion of South Texas, including the Corpus Christi County Warning Area (CWA). The Corpus Christi CWA is the area indicated by 'CRP', and bordered by the blue lines. County names are in black, and observation sites (METARS) are labeled in red.



Fig. 2. Visible satellite image of snowfall at 1730 UTC 25 December. Image courtesy of University of Wisconsin – Madison.

Climatological records dating back to 1888 for Corpus Christi, TX indicated that measurable snow has occurred about once every four years. Nearly three quarters of those events had snowfall totals of one inch or less. Prior to the 24-25 December 2004 storm, the last 3-4 inch (7-10 cm) snowfall in Corpus Christi occurred in January of 1897, a period spanning 107 years between events. Although historically snowfall over the extreme northern CWA of CRP is not unusual, this was the first time it had snowed 12 or more inches in the Victoria area since February 1895. It was also the first time on record that snowfall was observed on Christmas Day in Victoria.

b. Motivation for the Study

The motivation for this study was to document or investigate the following: 1) the variability in the model guidance's probability of precipitation (POP) output leading up to the event, 2) the low quantitative precipitation (QPF) output from the models, 3) the timing differences between the models to what actually occurred, and 4) forecaster performance at WFO Corpus Christi. In addition, the study highlights some of the societal impacts and perceptions of this rare event.

Another motivation for this study was to determine the cause of the narrow band of heavy snowfall which fell approximately 30 to 40 miles (48-64 km) west-northwest of Corpus Christi (Fig. 3). The heavy snow band extended for more than 200 miles (320 km) along a line from near Lake Jackson (south of Houston) to Victoria to around Alice (just west of CRP). Results from this study will be discussed in a future paper.

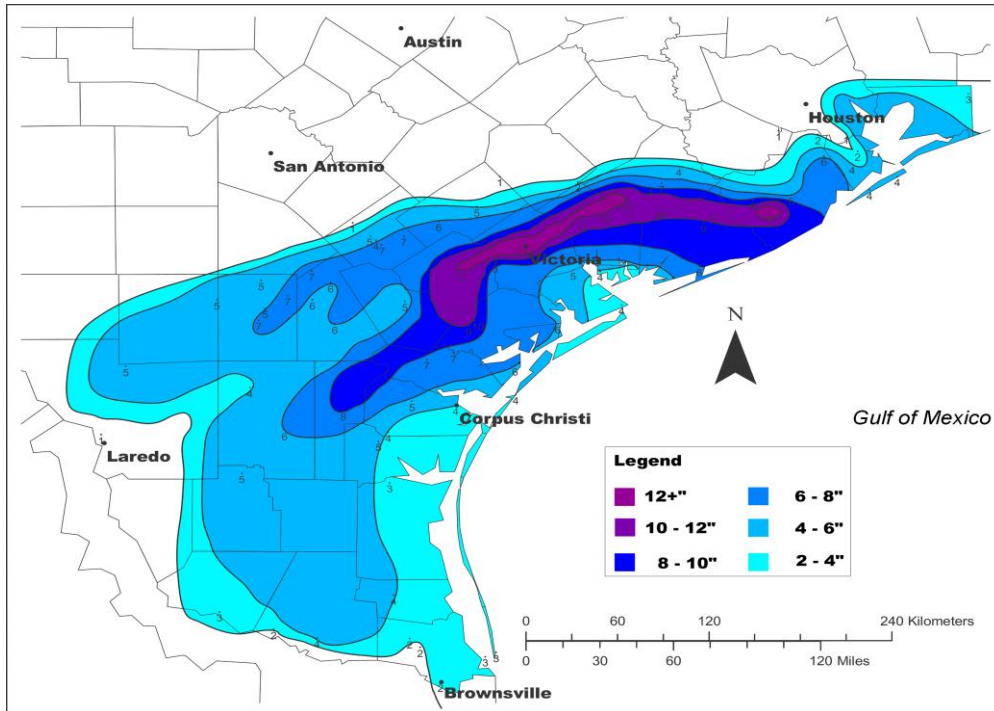


Fig. 3. Snowfall analysis (inches) showing the primary heavy snowfall band across South Texas.

II. Synoptic Overview

Beginning at 1200 UTC 23 December 2004, the central and southwestern portions of the United States were dominated by a full latitude middle and upper level trough. The trough axis extended from central Canada, just west of the Great Lakes, southwestward to Baja California (Fig. 4). At 500 hPa (Fig. 4B), the feature of note was the strong short wave at the base of the large scale trough, just offshore of the southern California coast. It was this short wave feature that would eventually help produce synoptic scale lift over South Texas during the snow event. The absolute vorticity analysis at 500 hPa shows a maximum centered over the western side of the shortwave trough, revealing the strong potential for additional southward digging of the shortwave. The extent to which the upper trough would be able to dig southward was crucial for the maintenance of a deep freezing/subfreezing air mass over South Texas. A deep, digging southward trough would not only allow the cold air to plunge farther south (with the more southward reflection of the surface low), but would also provide stronger synoptic scale upward forcing. The 500 hPa pattern was very similar to that observed by McFarland (1976) for South Texas major freeze events.

At 300 hPa (Fig. 4A), the base of the trough was beginning to push southward into a strong subtropical jet axis over extreme southern Texas and northern Mexico. It was likely that the merging of the northern/Polar Jet with the southern/Subtropical jet combined to produce a stronger low latitude upper jet core later in the period (Figs. 5A and 6A). By 24 December (Figs. 5 and 6), the right entrance region of this upper jet maximum moved across northern Mexico and southern Texas, which likely enhanced the

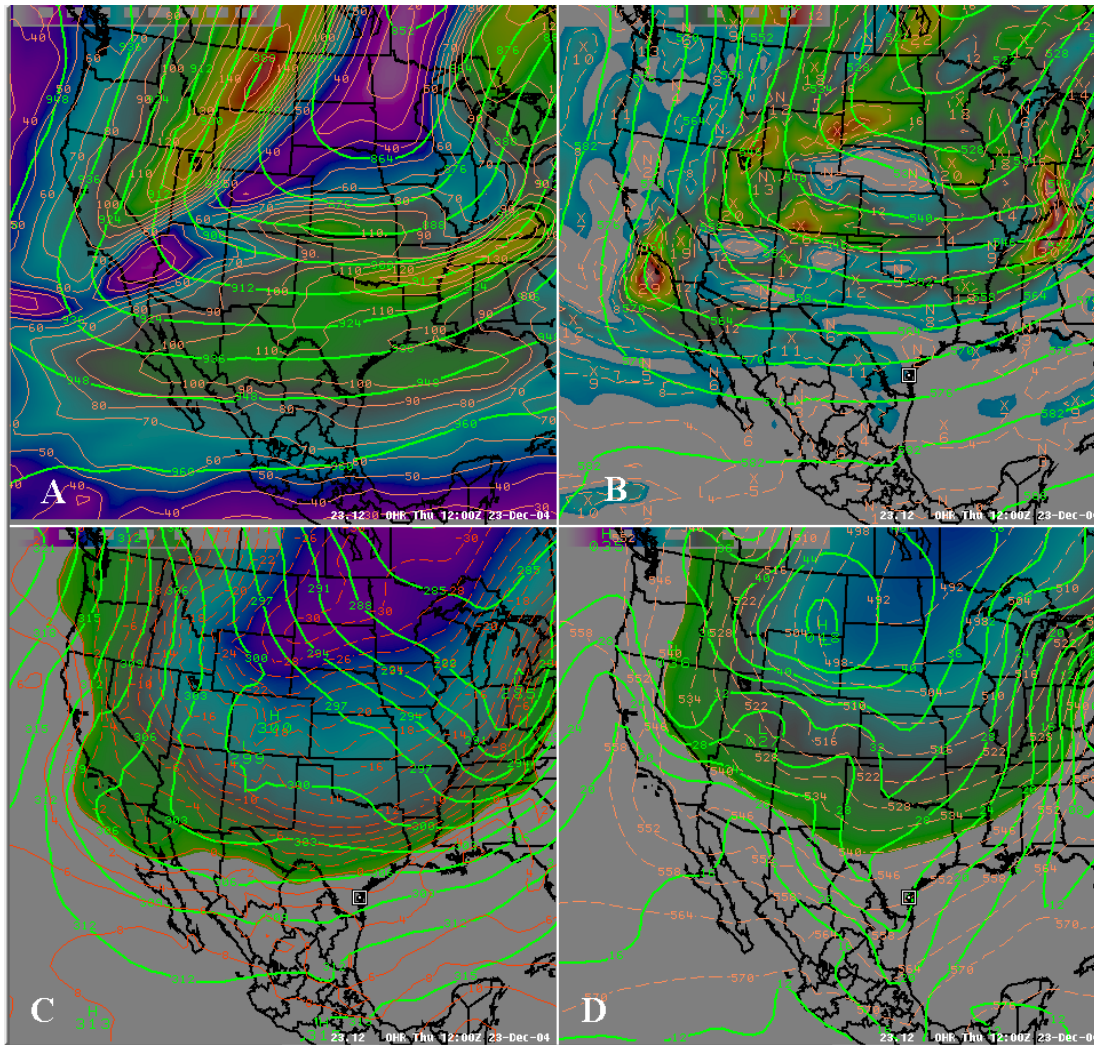


FIG. 4. GFS40 analysis of: (A) 300 hPa geopotential height (dm) and wind speed (dashed orange, shaded, kts), (B) 500 hPa geopotential height (dm) and absolute vorticity (dashed orange, shaded, 10^{-5} s^{-1}), (C) 700 hPa geopotential height (dm) and temperature $^{\circ}\text{C}$ (dashed red, shaded areas are less than 0°C), and (D) mean sea level pressure (hPa) and 1000-500 hPa thickness (dm) (dashed orange, shaded areas are less than 540 dm), all valid for 1200 UTC 23 December 2004.

synoptic scale lift across the region. See Bluestien (1993) and Uccellini and Kocin (1987) for a description of the transverse circulation patterns that result due to a straight upper jet streak.

At lower levels, the first push of cold air had begun to surge southward into southern Texas during the late afternoon on 22 December. By 1200 UTC 23 December, the depth of the polar airmass was very shallow, and the sub-freezing layer was confined from just above the surface to 3500 feet. The center of the surface ridge was still well north over south central Canada (Fig. 4D). The 700 hPa temperature and the 1000-500 hPa

thickness analyses show the deeper sub-freezing layer still confined to central and northern Texas and higher latitudes.

By 0000 UTC 24 December, the positively tilted upper level trough continued to progress southeastward (Fig. 5). The wind analysis at 300 hPa (Fig. 5A) indicates a strong jet on the east side of the upper trough, reflecting the merging of the polar and subtropical jet

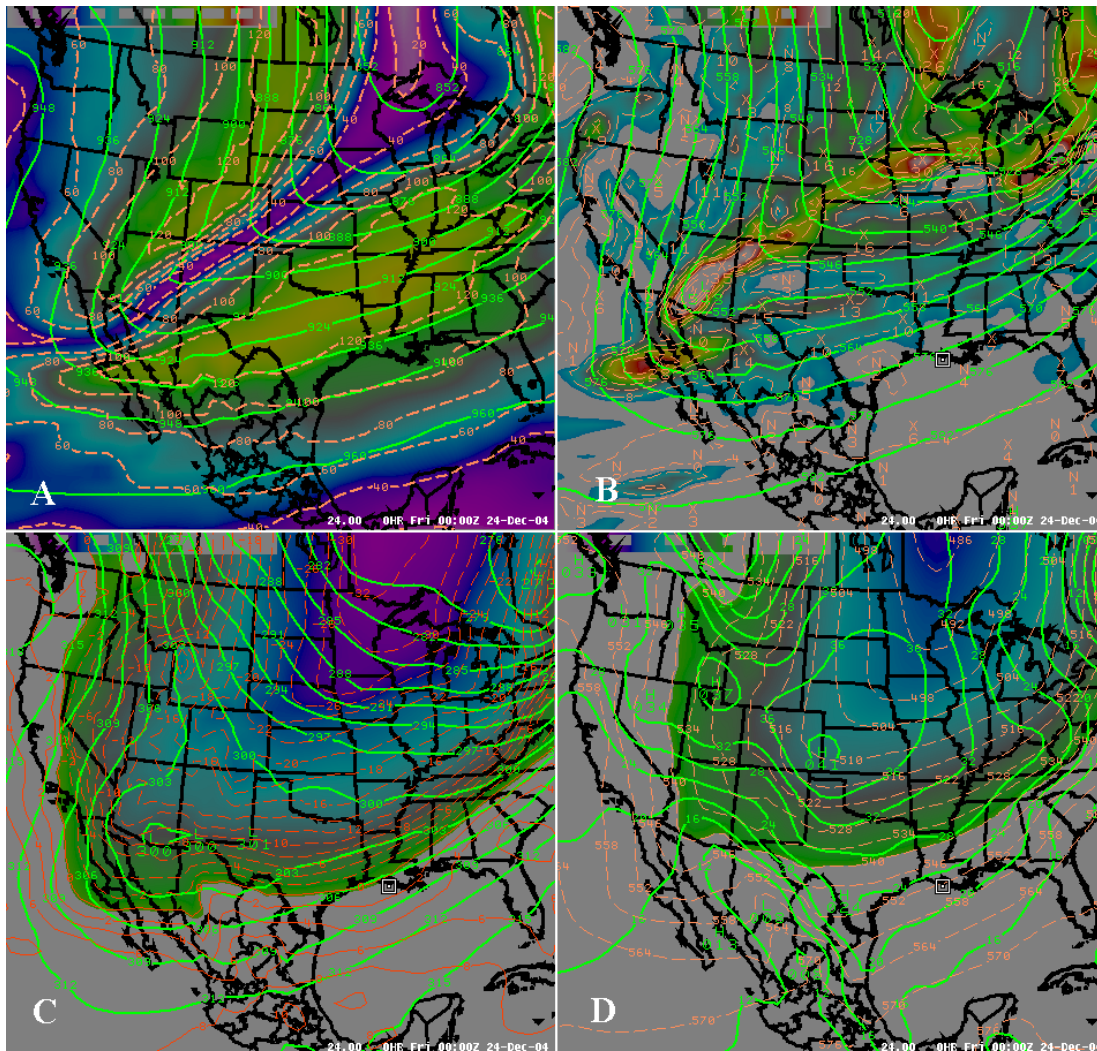


Fig. 5. Same as Fig. 4 except for 0000 UTC 24 December.

streams across northern Mexico and Texas. An up-stream wind speed maxima across southwest Canada and into the central Rockies indicated the potential for the upper trough to continue digging southward. At 500 hPa (Fig. 5B), the vorticity fields show one distinct maximum at the base of the trough over central Baja California, and another elongated maximum upstream over Arizona. Once again, this pattern signified the tendency for the upper trough to dig southward into northwest Mexico. At the middle levels of the atmosphere, the deeper freezing/subfreezing air mass, as shown by the

700 hPa 0°C isotherm and the 540 dm thickness contour (i.e., the demarcation between the shaded and un-shaded areas in Fig. 5C and 5D, respectively), had moved farther south into southern Texas. Meanwhile, the center of the surface ridge had now moved into the Southern Plains and North Texas.

Twelve hours later at 1200 UTC 24 December, the upper trough began to show signs of closing off (Fig. 6). The strongest winds at 300 hPa (Fig. 6A) shifted toward the eastern side of the trough axis across central Mexico and southern Texas, indicating the southward progression of the upper trough was nearing completion. The slowing of the southward digging of the upper trough is also supported by the 500 hPa vorticity analysis

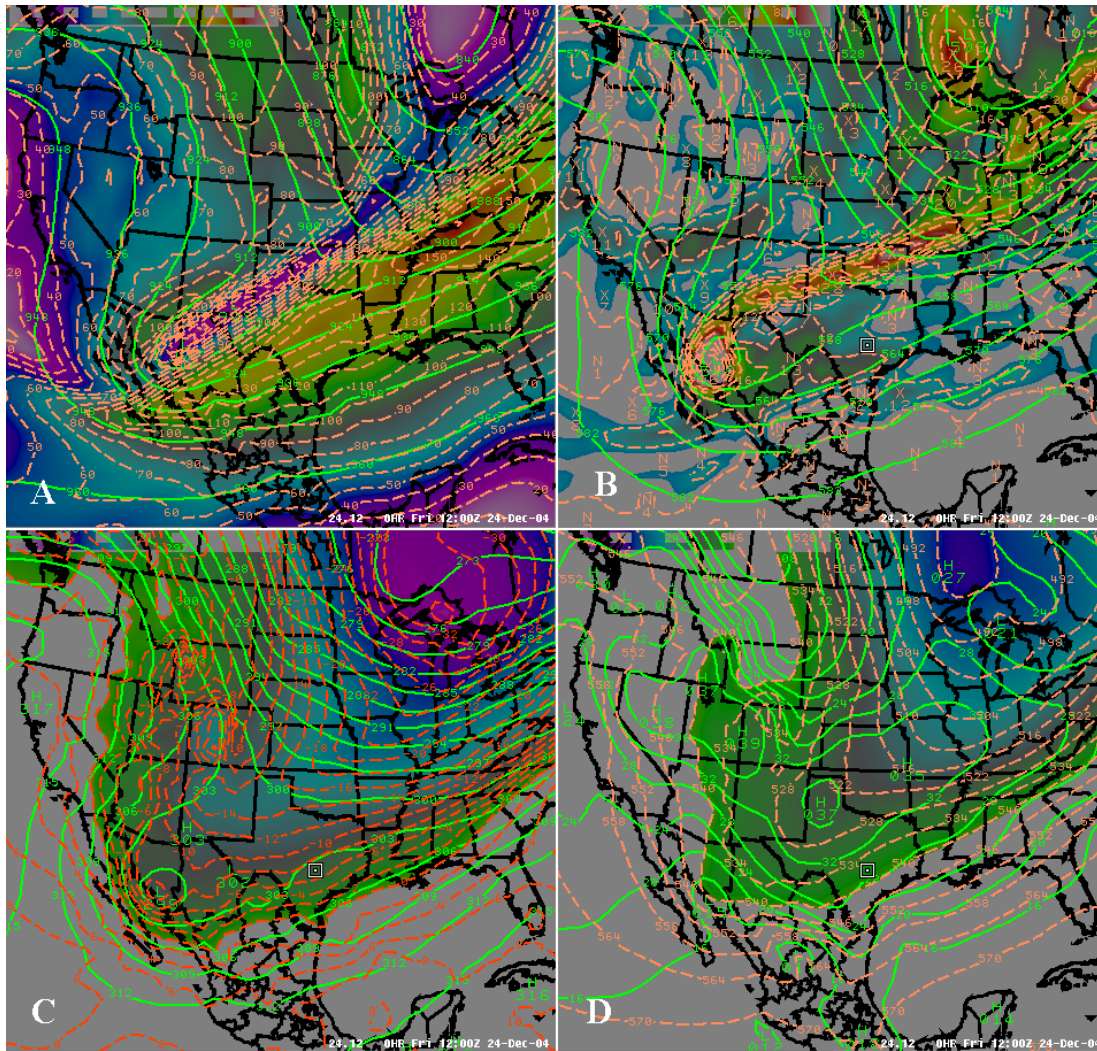


Fig. 6. Same as Fig. 4 except for 1200 UTC 24 December.

(Fig. 6B), which shows a more consolidated vorticity center located closer to the base of the short wave trough over northwest Mexico. The cold air at the surface (Fig. 6D) continued to filter southward into South Texas as the surface ridge center moved into the southern Plains. The depth of the cold air is well depicted by the 1200 UTC 24

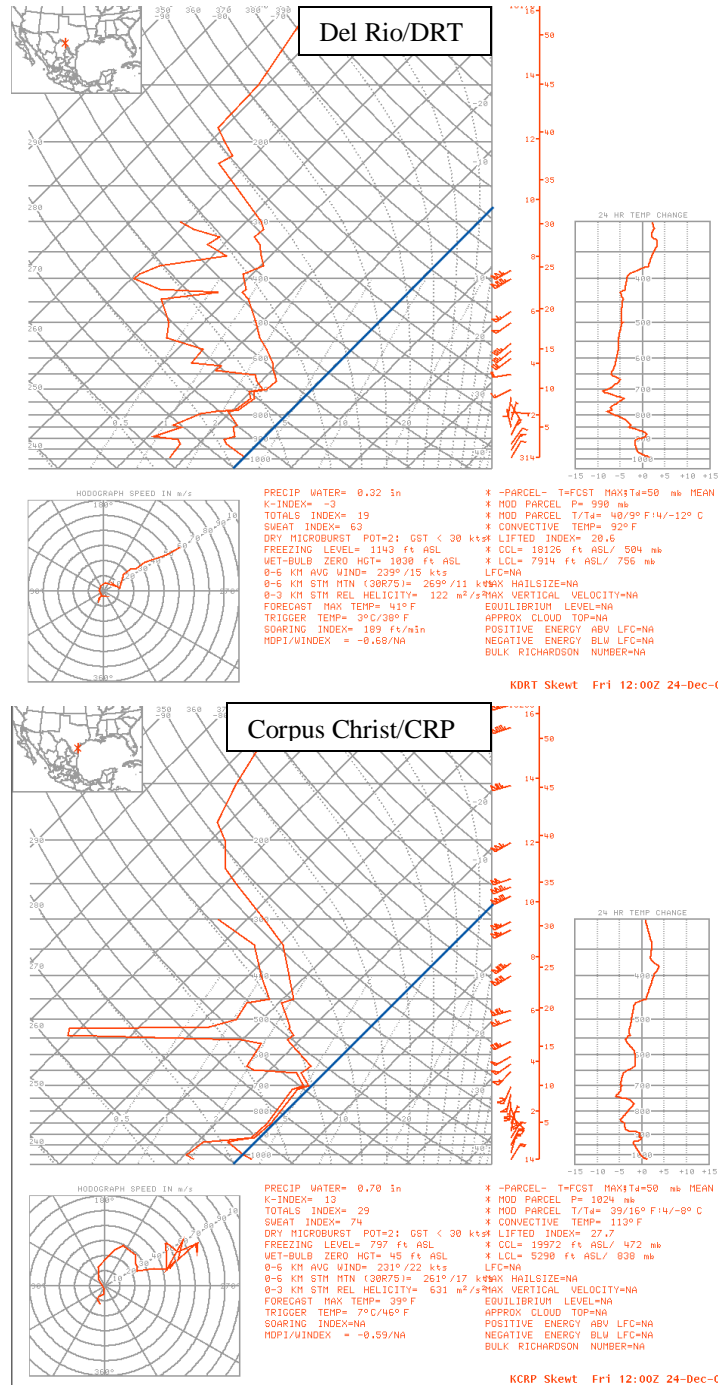


Fig. 7: The 1200 UTC 24 December observed soundings at Del Rio (DRT) TX (top), and Corpus Christi (CRP) TX (bottom). The blue line indicates the 0°C isotherm.

December soundings at Corpus Christi (CRP) and Del Rio (DRT), as shown in Figure 7. Over the next 12 hours, the upper trough at 300 hPa and the resultant upper low moved eastward across northern Mexico and extreme southern Texas in concert with the corresponding 500 hPa low center (Figs. 8A and 8B). Significant upper level forcing enhanced by cyclonic vorticity advection (Fig. 8B) as well as a strong upper level jet (Fig. 8A) were evident over South Texas at this time. Also, the 700 hPa 0°C isotherm

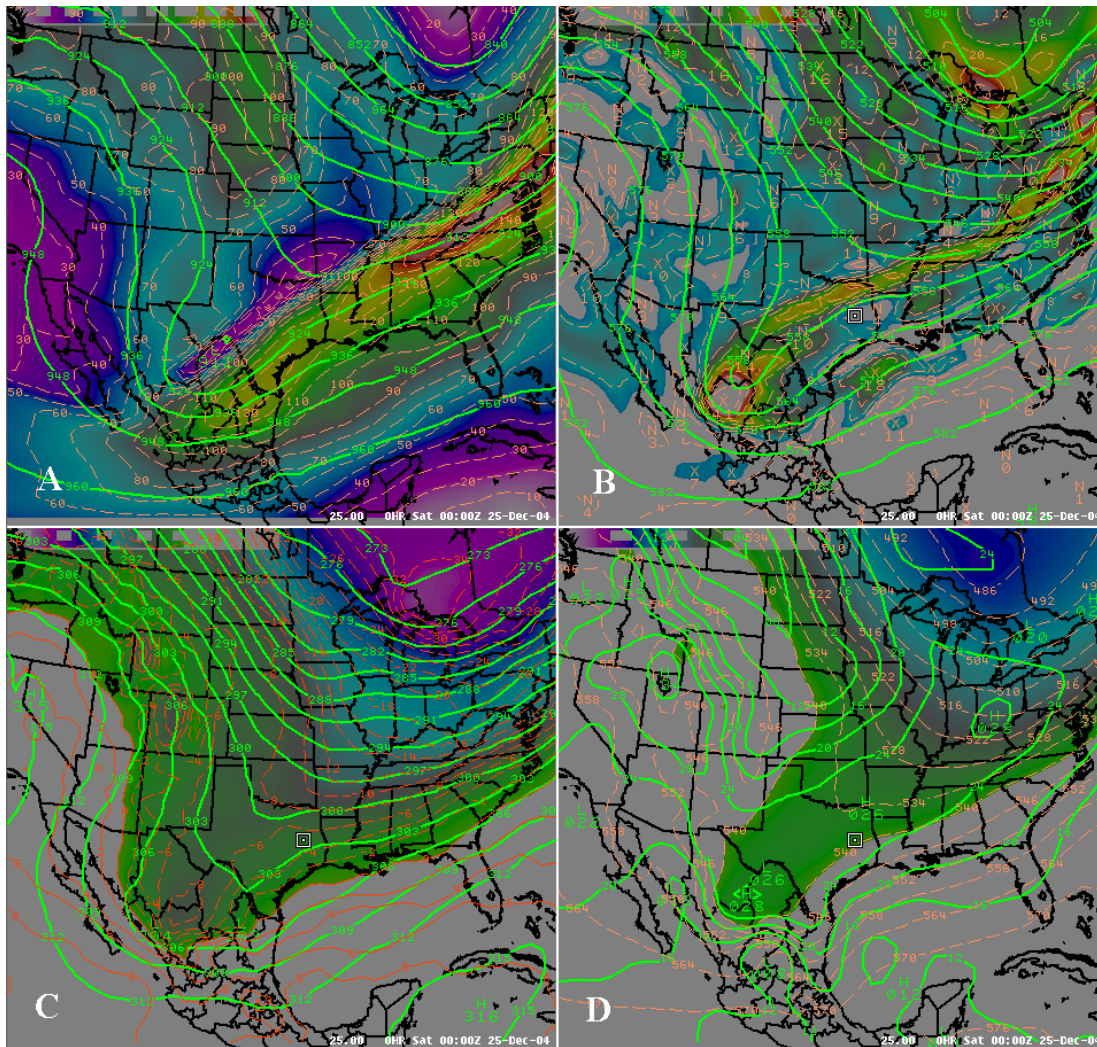


Fig. 8. Same as Fig. 4 except for 0000 UTC 25 December.

had moved south to near Brownsville (Fig. 8C), with the 540 dm thickness contour over the extreme northwestern portions of the CWA (Fig. 8D). Thus, a deep arctic air mass now coincided with strong upper level forcing over South Texas.

At the surface (Fig. 8D), an inverted trough of low pressure had become well defined over the western Gulf of Mexico, with a surface cyclone approximately 400 miles southeast of the CWA near the Bay of Campeche. At that time, forecasters felt that the

moisture available to produce widespread significant wintry precipitation was too far south of the CWA (as shown in the next section). Thus, it was not apparent to forecasters that synoptic conditions would converge toward a significant snowfall event in South Texas. Also, forecasters lacked the experience to anticipate the potential for the production of a mesoscale heavy snow band(s). Conditions which evolved to produce widespread snow, including the heavy snow band(s), will be discussed in detail in a future paper.

III. Model Guidance and Corpus Christi Forecaster Performance

Public forecasts for this winter weather event at WFO CRP began with the afternoon forecast package on 17 December. Initially, a slight chance of rain was forecast for much of South Texas on 24 December. Forecasters did acknowledge the arctic air mass building over northwest Canada, and the potential for frozen and/or freezing precipitation across South Texas in the area forecast discussion. The models were already indicating a sufficiently deep and favorable isentropic up-glide regime, which could be capable of producing frozen precipitation across South Texas. However, forecasters were still reluctant to include wintry precipitation in their suite of products through 20 December. This reluctance was due to model inconsistencies with the depth and strength of the arctic air mass, as well as moisture availability. Initially, long-range MOS guidance from the Global Forecast System (GFSX) on 19 December was forecasting 12 hour POPs below 20% for the 0000 UTC 24 December through 0000 UTC 25 December interval. However, for the 0000 UTC 20 December model run, GFSX POPs increased to near or above 30 percent over the eastern sections of the CWA. Since the GFSX forecast minimum temperatures below freezing for 24 December, there was a potential for wintry precipitation. However, due to the aforementioned model inconsistencies (and perhaps the rarity of such an event), forecasters opted to mention the potential for a Christmas Eve winter weather event only in the 20 December Hazardous Weather Outlook (HWO), with no mention of wintry precipitation in the Zone Forecast Product (ZFP).

By 21 December, forecasters began to forecast the chance for wintry precipitation for Christmas Eve in their suite of public products, including the Zone Forecast Product (ZFP). Forecast models continued to show that a strong upper level trough would affect South Texas during the daytime and evening hours of 24 December, with the strength and depth of the arctic air mass becoming more apparent. As figure 9 shows, the 500 hPa flow allowed the deep, cold arctic air to plunge south deep into Texas, bringing the surface high into central Texas. GFSX-MOS 12-hour POPs increased slightly, but remained below 50% for the 24 hour period ending 0000 UTC 25 December. At this time, CRP forecasters were calling for a 40% chance of precipitation consisting of a mixture of rain, sleet and snow during the day on Christmas Eve over the eastern CWA. Forecasters also issued a Special Weather Statement (SPS), highlighting the chance for wintry precipitation on 24 December. In this statement, forecasters stated this wintry mix of precipitation would occur mainly before 6 PM LST 24 December, since the main energy from the upper trough was expected to be east of the forecast area by early evening. Due

to the warm soil temperatures, widespread significant accumulations were not expected. It was becoming apparent to forecasters on 22 December that a wintry mix of precipitation would affect South Texas on Christmas Eve. Forecast models indicated favorable thickness values (near 540 dm), appreciable isentropic up-glide, and synoptic scale ascent (the latter mainly due to the approaching upper trough and the right-entrance region of an upper-level jet streak).

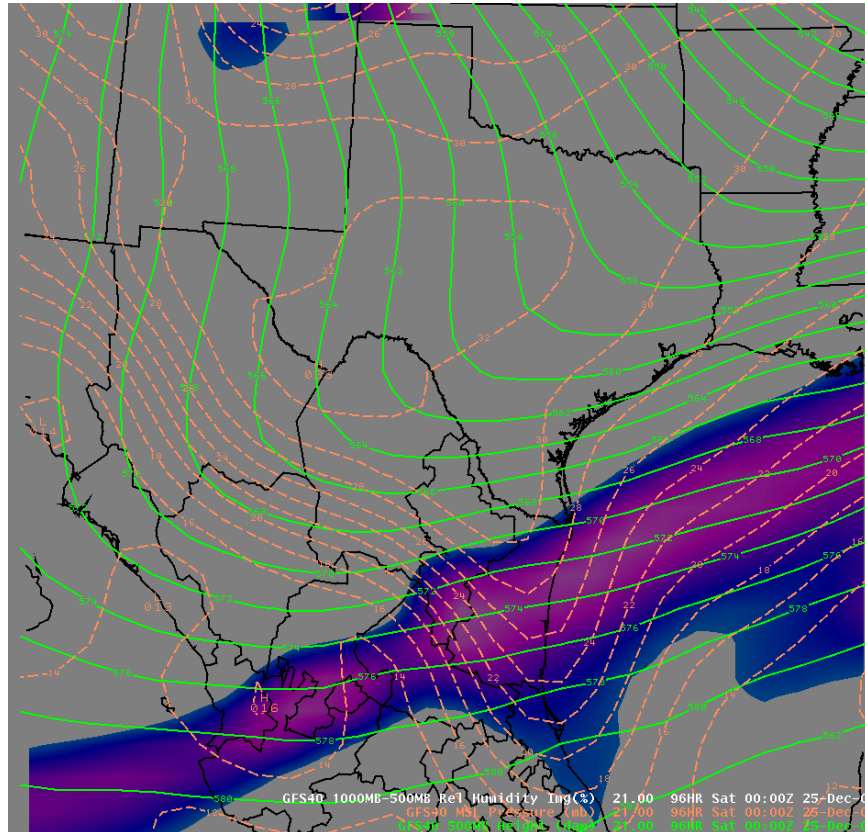


Fig. 9: The GFS forecast position of the 500mb trough (green), surface pressure field (dashed orange) and 1000mb – 500mb Relative Humidity 70% or higher (shaded), valid at 0000 UTC 25 December 2004 from the GFS 0000 UTC 21 December model run. Note that the trough is positively tilted, with the high moisture fields well south of the Corpus Christi CWA.

Model soundings for the 0000 UTC December 22 GFS model run were also showing the potential for wintry/frozen precipitation (Figs. 10 and 11). GFS model soundings at CRP showed the potential for sleet and freezing rain early in the morning of Christmas Eve (Fig. 10), changing to snow in the afternoon (Fig. 11). However, the evening sounding at VCT was not as moist as the sounding at CRP (Fig. 11).

By this time, short-term MOS guidance from the GFS (MAV), ETA/NAM (MET), and NGM (FWC) were available. Fig. 12 illustrates the 12-hour MOS POP values for Corpus Christi and Victoria. (Victoria was used to represent the heavy snow region, with Corpus Christi representing the coastal areas.) Except for the 0000 UTC December 24 model runs, MAV-MOS POPs were decidedly higher than MET-MOS POPs for the 12 hour period ending at 0000 UTC 25 December (the beginning of the heavy snow period) for

both the 0000 UTC and 1200 UTC model runs. Also, MAV QPF values from the 0000 UTC December 22 model run valid for the 12 hour period ending 0000 UTC 25 December were also very high (Fig. 13), with liquid water equivalents between 1 and 1.99 inches (these would be the highest model QPF values for this event).

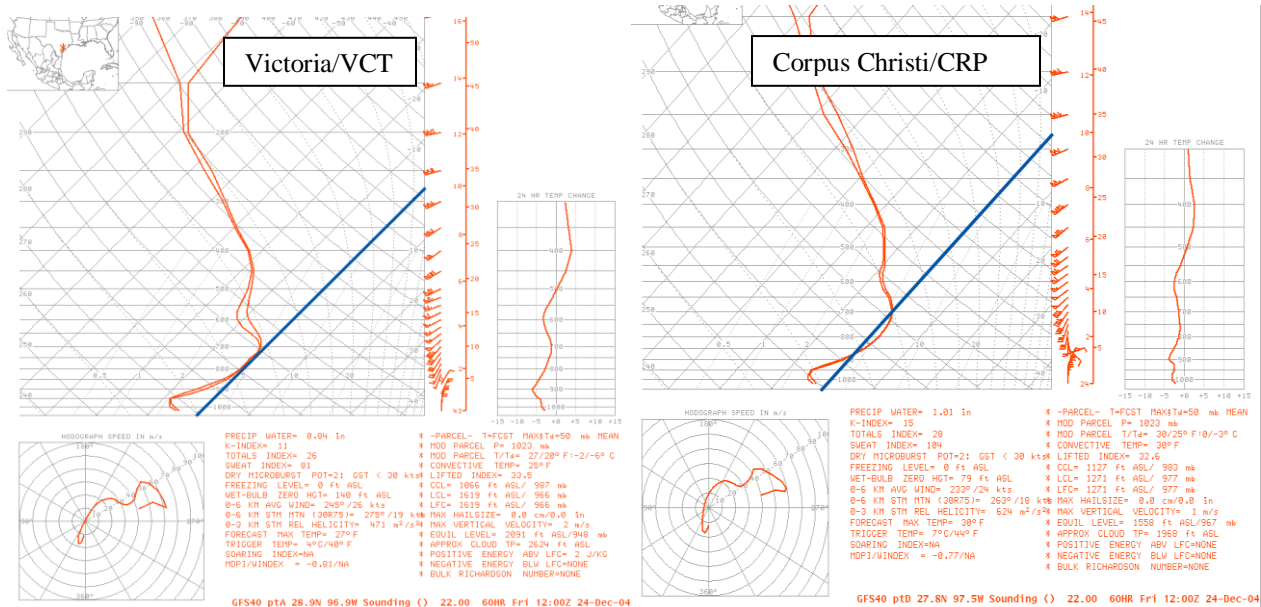


Fig. 10: GFS forecast soundings from the 0000 UTC 22 December model run for Victoria (left) and Corpus Christi (right), valid at 1200 UTC 24 December. The blue line denotes the 0C isotherm.

The expectation of a Christmas Eve winter weather event was conveyed with Special Weather Statements, issued 1121 UTC and 2257 UTC 22 December. One of these statements noted that “brief bursts of snow could accumulate for short periods of time on rural grassy surfaces and bridges”. Significant accumulations of ice or snow were still not expected, since the ground was very warm (observations from cooperative observers indicated soil temperatures four inches below the ground were mainly in the 50s). Although model QPF and POP values decreased significantly between the 0000 and 1200 UTC 22 December runs (see Figs. 12 and 13), forecasters increased the POPs for the eastern areas of the CWA for the 22 December afternoon suite of public forecast products. According to the Area Forecast Discussion (AFDCRP) issued at 315 PM CST Wednesday 22 December, POPs were increased because the forecaster felt that the strength of the upper low, combined with the isentropic lift pattern would result in measurable precipitation. However, significant accumulations were not expected due to the more limited moisture fields between the 0000 UTC and 1200 UTC runs, and the warm soils. Also, most of the precipitation was expected to occur before 0000 UTC 25 December, with the greatest upper level forcing expected to be east of the area by this time.

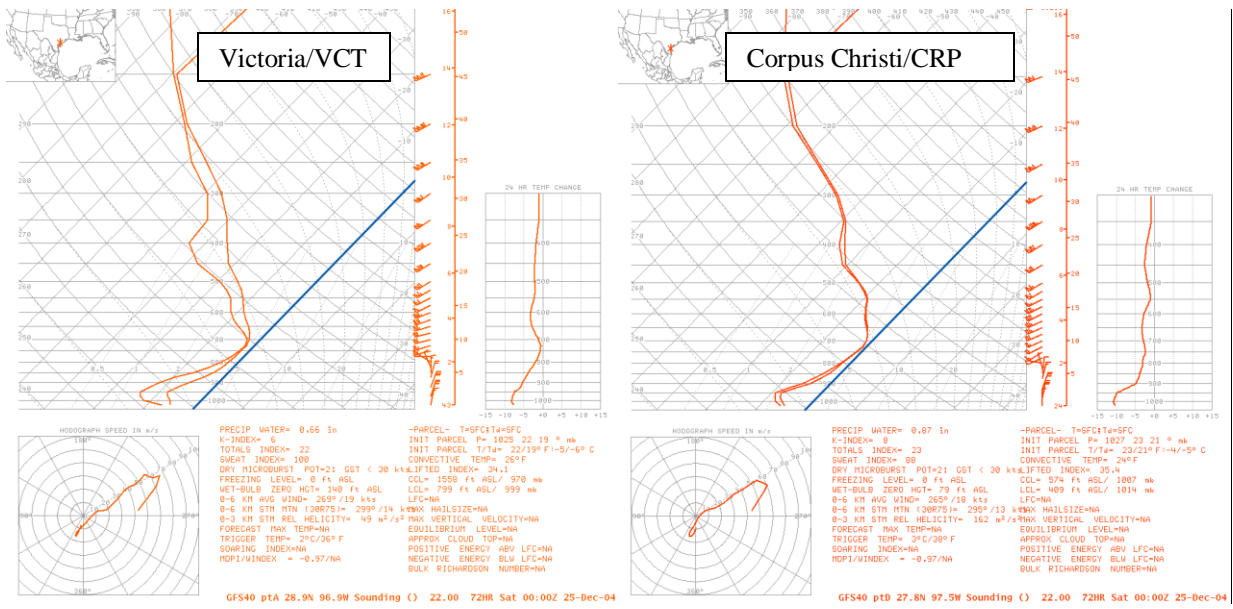


Fig. 11: GFS forecast soundings from the 0000 UTC 22 December model run for Victoria (left) and Corpus Christi (right), valid at 0000 UTC 25 December. The blue line denotes the 0C isotherm.

On 23 December, forecasters still expected the bulk of the precipitation to occur during the day on 24 December. However, the models were trending a little slower with the 500 hPa shortwave trough, hinting that the trough would dig farther south before moving east (Fig. 4B). This slower trend was reflected in the increase in MOS POPs for the 12 hour period ending 1200 UTC 25 December (Fig. 12). A deepening surface cyclone over the southwestern Gulf of Mexico was expected to increase the low-level dry air convection across South Texas (upstream surface dew points were in the single digits and teens), and continue to limit liquid equivalent precipitation amounts.

A Winter Weather Advisory was issued at 2241 UTC 23 December, valid between 0000 UTC and 1800 UTC 24 December for the southern Coastal Bend. (The event covered in this advisory was separate from the main precipitation event, which was expected to occur during the afternoon and evening hours of Christmas Eve.) Through the duration of this advisory, light rain was expected to change to freezing rain, sleet, or snow overnight and during the morning hours of Christmas Eve. No significant accumulations were expected (and none were observed). However, any precipitation which froze was expected to impact holiday travelers, mainly on bridges and overpasses.

Forecasters using the 0000 UTC 24 December model runs were becoming concerned for the potential for frozen and/or freezing precipitation on Christmas Eve. The 0000 UTC 24 December upper-level analyses (Figs. 5A and B) indicated much stronger height falls than previously forecast by the models near El Paso, Texas and Tucson, Arizona (70 dm and 90 dm respectively), associated with the 500 hPa shortwave trough over northern Mexico. Water vapor imagery (not shown) also supported the stronger 0000 UTC 24 December GFS solution of a more vigorous upper level trough moving from northern Mexico and across South Texas Christmas Eve night (Figs. 14 and 15).

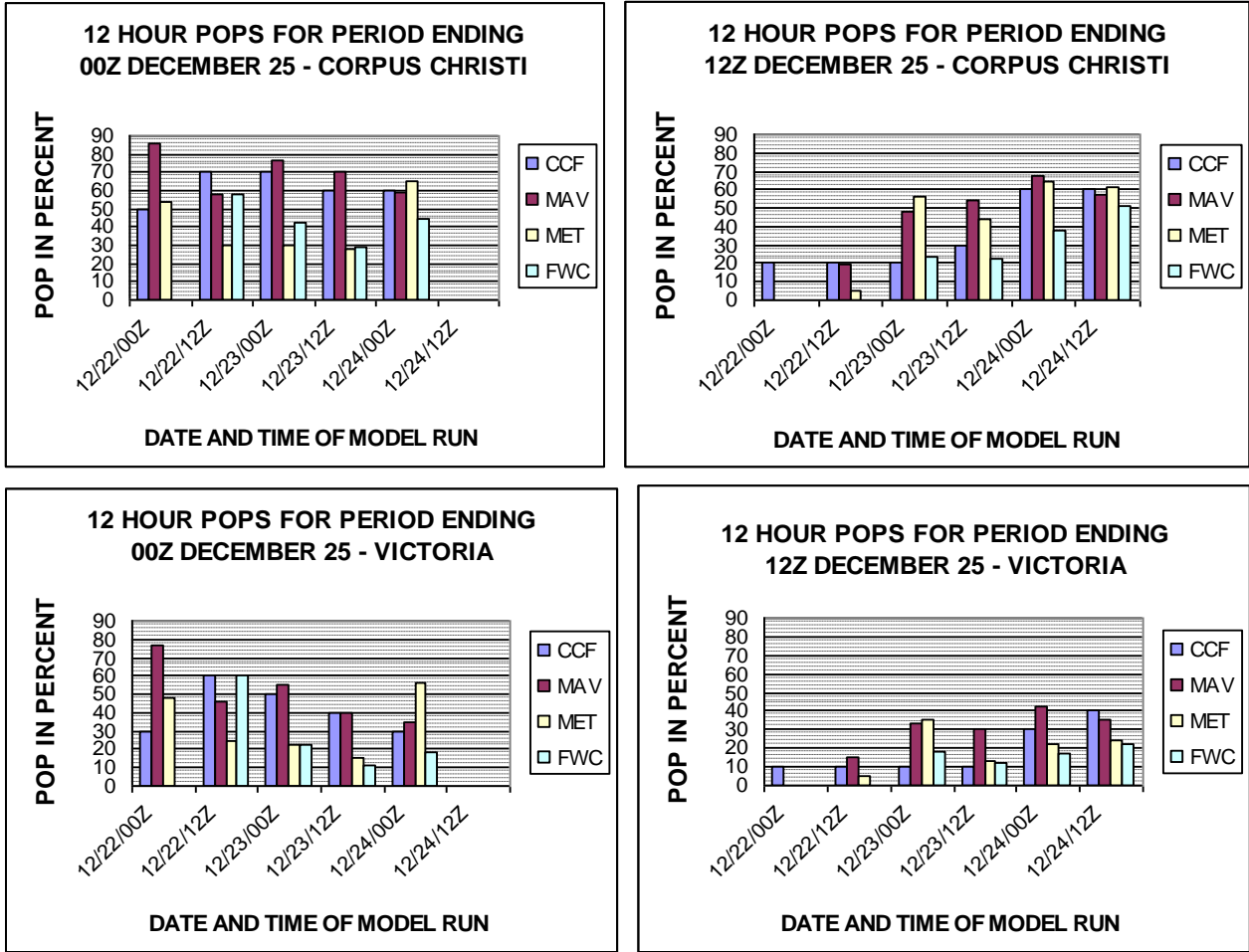
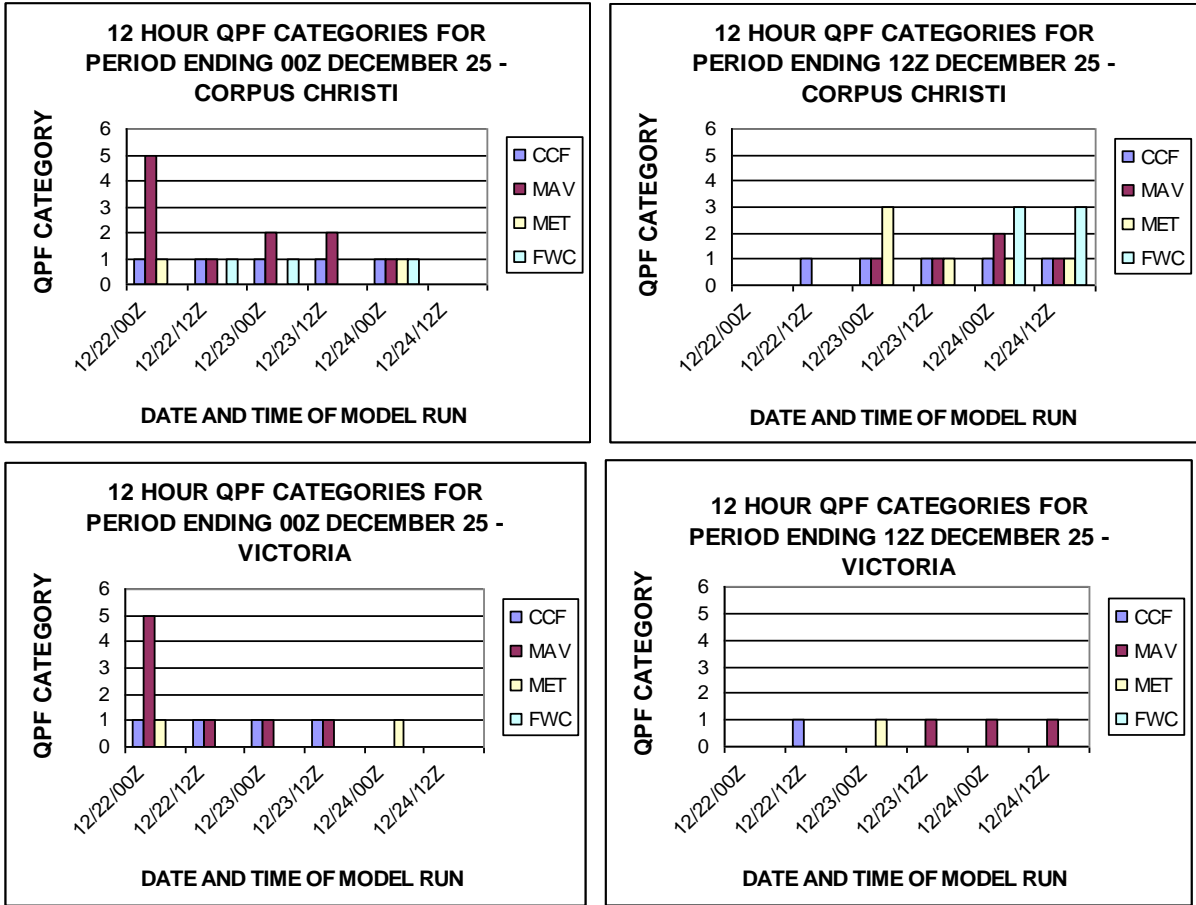


Fig. 12. Twelve hour probability of precipitation (POP) for the Christmas snow event at Corpus Christi (Top) and Victoria (bottom). The graphs on the left represent the POP forecast for the 12 hour period ending 0000 UTC 25 December, and the graphs on the right are POP forecast for the 12 hour period ending 1200 UTC 25 December. CCF values are the forecast POPs issued by WFO CRP.

Model guidance noted these changes, as MOS POPs continued to trend higher for the 12 hour period ending at 1200 UTC 25 December. However, because the models forecast the highest moisture fields farther south and east, MAV and the MET QPF values were below 0.25 inches for this 12 hour period, especially at VCT (see Fig. 13). Schumacher (2003) noted a similar bias for the models to predict heavy precipitation bands too far south and east. Although the FWC continued to have the lowest POPs for measurable precipitation, it did forecast the highest QPF values for Christmas Eve night, predicting up to 0.50 inches of water equivalent at CRP, but zero QPF at VCT. Although the dry air at the surface was still expected to be a limiting factor for accumulating precipitation, forecasters felt that the models may have been overdoing low-level drying, given ceilings lowering below 3000 feet from Falfurrias to Kingsville (southern portion of CRP’s CWA). Nevertheless, the 24 December morning suite of WFO forecast products called for wintry precipitation to be likely over the southeastern sections of the CWA through



CATEGORY	RAINFALL RANGE (INCHES)
0	None or Trace
1	0.01 – 0.09
2	0.10 – 0.24
3	0.25 – 0.49
4	0.50 – 0.99
5	1.00 – 1.99
6	2.00 or more

Fig. 13: Same as Fig. 12, except for 12 hour QPF categories for forecasted water equivalent precipitation for the Christmas snow event at Corpus Christi (top) and Victoria (bottom).

the evening hours of Christmas Eve, with diminishing probabilities farther north and west. As reports of light accumulations of sleet and snow were received early in the afternoon on Christmas Eve, a Winter Weather Advisory was issued at 2048 UTC 24 December for the entire CWA through 1000 UTC 25 December. At that time, accumulations were expected to remain below one inch. Late in the afternoon, forecasters recognized that a more significant winter weather event was developing. Satellite imagery showed cooling cloud tops and a cellular (convective) cloud structure over South Texas and northern Mexico in association with the strong 700 to 500 hPa

cyclone (not shown). Additionally, there was a concern that precipitation of sufficient intensity falling into a dry boundary layer would allow for evaporative cooling to change precipitation to snow and sleet (occurring at Hebbronville, Texas, approximately 50 miles east of Laredo at that time). Accordingly, the Winter Weather Advisory was updated 0018 UTC 25 December to include snowfall accumulations up to 2 inches across all of South Texas for Christmas Eve night. Short-term forecasts were also issued to highlight the location of the heavier snow bands, and the potential for higher accumulations of snow and sleet.

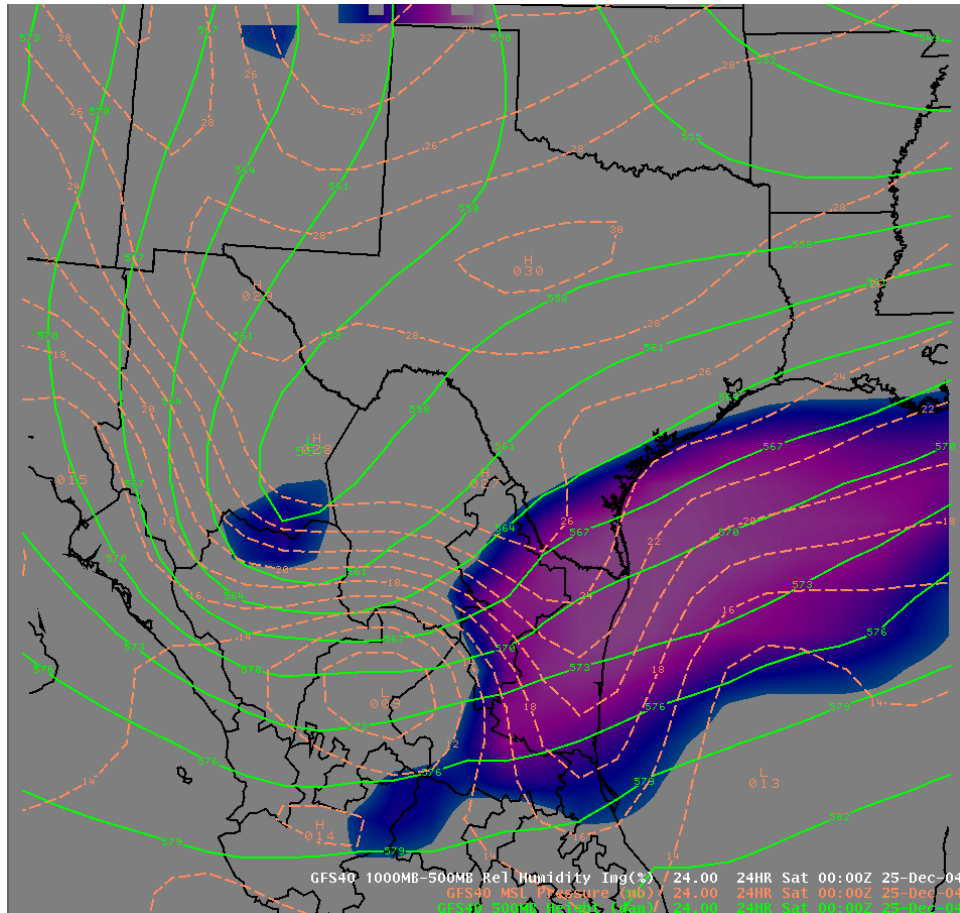


Fig. 14: The GFS forecast position of the 500mb trough (green), surface pressure field (dashed orange) and 1000mb – 500mb Relative Humidity 70% or higher (shaded), valid at 0000 UTC 25 December 2004 from the 0000 UTC 24 December model run. Note that the trough is deeper and farther west from the 0000 UTC 21 December model run (Fig. 9), with the highest moisture fields closer to the Coastal Bend, but still mainly south of Corpus Christi.

At 0155 UTC 25 December, the Winter Weather Advisory was upgraded to a Winter Storm Warning for the northeastern CWA (in Fig. 1, these include counties of Live Oak, Bee, Goliad, Victoria, San Patricio, Aransas, Refugio, and Calhoun). During the middle and late evening hours, the Winter Storm Warning was then updated to include all of the CWA, except for Webb and La Salle counties (in Fig. 1, the western two counties of the

CWA), as forecasters monitored the persistent snow bands. These bands were suspected to be at least partly attributable to convective symmetric instability (discussed in a later study). Throughout the evening hours of Christmas Eve, forecasters continued to issue timely and informative short-term forecasts which focused on the heavy snow bands. Another Winter Weather Advisory was issued around 4 AM LST 25 December for all but the western four counties of the CRP CWA. This advisory, valid until 10 AM LST, forecast the possibility for one to two additional inches of snow before mid morning. The last Short-Term Forecast was issued at 9:19 AM LST 25 December, indicating that the snow had moved east and skies were clearing.

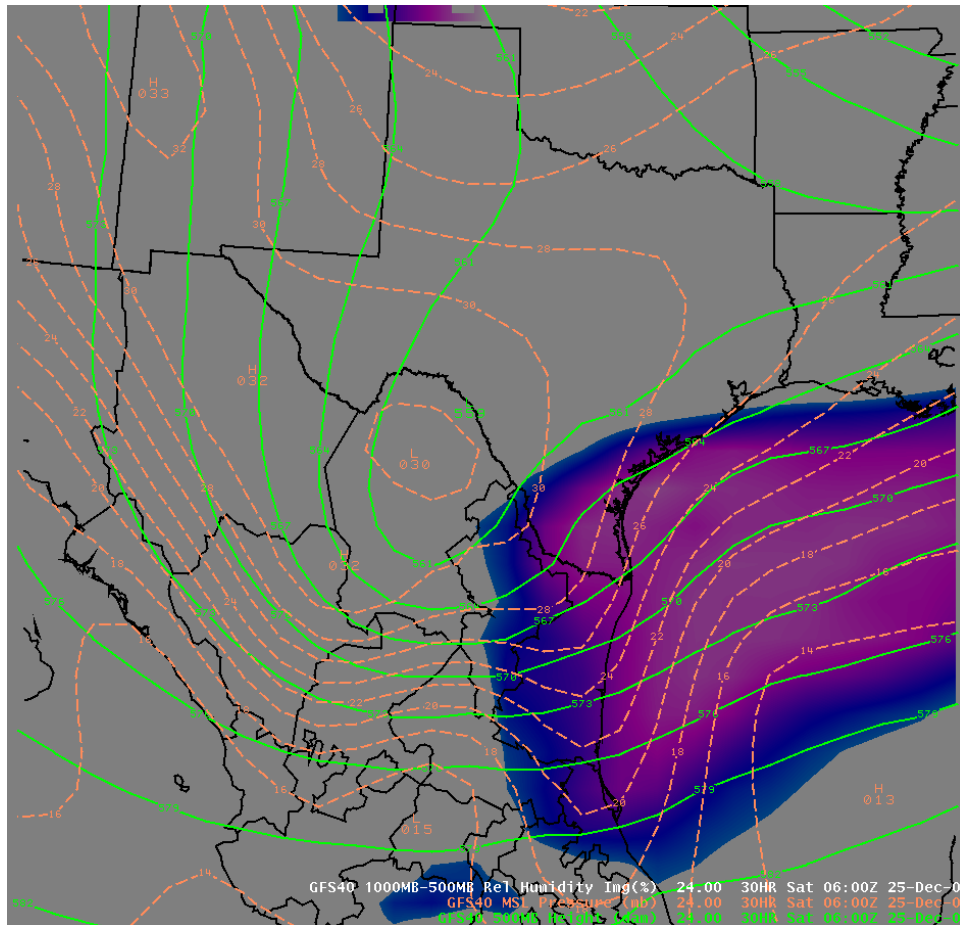


Fig. 15: The GFS forecast position of the 500mb trough (green), surface pressure field (dashed orange) and 1000mb – 500mb Relative Humidity 70% or higher (shaded), valid at 0600 UTC 25 December 2004, from the 0000 UTC 24 December model run.

IV. Public Perception and Impact

The societal response to and perception of the extremely rare snow event across South Texas was generally positive. The response by community businesses and other government agencies was timely, even though the magnitude and timing of the event was

difficult to forecast. Texas Department of Transportation (TXDOT) maintenance crews reacted to National Weather Service (NWS) forecasts as early as Thursday 23 December by placing extra personnel on standby, and stockpiling sand and other traction improvement materials. TXDOT also unfolded “Watch for Ice on Bridge” signs during the days leading up to Christmas, which area residents were not used to seeing. Accumulations proved to be too high for crews to handle, since most municipalities did not have access to snow plows or salt trucks. As a result, many roadways were eventually closed by TXDOT. In the City of Corpus Christi, there were so many vehicle accidents on Christmas Eve that local police urged motorists to exchange insurance information on their own.

Area airports were also impacted during the holiday weekend. In the days leading up to the snow event, airport officials were in contact with WFO CRP concerning the possibility of snowfall accumulations. Flights on Christmas morning were canceled at the Corpus Christi International Airport (CCIA) because runways were covered with snow and ice. The airport was not equipped with snow clearing equipment, so crews improvised by driving up and down the runways in vehicles to melt the snow. The CCIA Director was quoted as saying, “It’s something we aren’t used to.”

Emergency management officials generally thought positively of the NWS forecasts. In the *Kingsville Record* and *Bishop News*, Emergency Management Coordinator Tom Sanchez issued a front page warning for residents to prepare for snow. Mr. Sanchez was quoted saying: “I think all the agencies cooperated very well for this. Of course, I didn’t put out any information until John Metz (Warning Coordination Meteorologist) of the NWS contacted me and said snow warnings were serious...I’ve got to hand it to TXDOT, they went all out on this. There was constant communication between various emergency and law enforcement agencies...we were prepared to open the basement of the Kleberg County Courthouse as a shelter if needed.”

There were a few economic upsides to the snow event. Photo processing outlets in many cities saw a large increase in business as residents recorded their once in a lifetime white Christmas on film. One-hour photo labs were so backlogged that some said it would take days to process film instead of a few hours. There was a “run” at grocery and convenience stores with people buying food, hot chocolate and disposable cameras. Home Depot officials indicated customers were “expecting a hard freeze...and they are protecting their plants, animals and pipes.” Items such as water-repellant fiber glass sheeting for plants, outdoor faucet covers, and heater hoses were popular purchases in the days before Christmas.

Media and the general public response were also positive. Area newspapers highlighted the rarity of the event with such headlines as: “Christmas Miracle 2004”, “The Greatest Gift”, “It Really Snowed!”, “A White Christmas in ‘Saltwater Heaven’”, “A Winter Wonderland”, “Gift-wrapped in white”, “Palacios gifted with first ever White Christmas” and “The Perfect Christmas”. For many residents across South Texas, this was not only their first white Christmas, but also their first time ever witnessing snow. Due to this rarity, most greeted the snow with eagerness and delight. In fact, some residents from

Austin, San Antonio and Houston drove south on Christmas Day to experience the snow. The Wednesday 23 December edition of the *Laredo Morning Times* demonstrated area residents' excitement with the snow by printing, "The NWS in Corpus Christi did post a potentially exciting forecast for the city of Laredo...a 20% chance of light snow Christmas Eve." In the Sunday 26 December edition of the *Corpus Christi Caller Times*, residents were quoted: "(the snow) made for the perfect Christmas present.", "So what? How often does this happen?" and "It's the best Christmas ever."

Three factors likely resulted in the overall positive response towards the NWS's under-predicted snowfall amounts, particularly north and west of Corpus Christi. The first, and arguably the biggest, was that most of the snow fell on the night before Christmas. While this did inconvenience some holiday travelers, for most it was considered a gift to be able to play in the snow with family on Christmas. Second, schools, most businesses, and government offices were closed for the Christmas holidays, which meant the snow had little to no impact on the daily routine of many South Texas residents. The third was the extreme rarity of the event. As mentioned, this was the first time many South Texans had ever seen snow. It is believed that such a rare event may have contributed to a heightened public awareness, or even an eagerness and excitement toward the prospects of a white Christmas.

V. Summary and Conclusions

On Christmas Eve and early Christmas morning of 2004, an extremely rare and historic snow storm affected South Texas. Records for 24 hour snowfall accumulations, which had stood for more than 100 years, were exceeded at Corpus Christi and Victoria. Model guidance three or more days prior to the event had the highest POPs 12 to 18 hours prior to the actual heavy snowfall period, but eventually became more in phase with the event 36 to 48 hours in advance of the snow storm. However, for all but one model run, MOS QPF values were generally less than 0.25 inches for this event. While forecasters at WFO CRP noted the potential for a winter weather event several days in advance, they did not expect the accumulations observed until the event had already initiated. However, as the event progressed, forecasters issued timely warnings and statements. Media response and public perception was generally positive, likely because many south Texans had never experienced snow, especially a white Christmas.

VI. Acknowledgements

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7. References

McFarland, M. J., 1976: Useful Relationships Between 500 mb Features and Major Freeze Events in the Lower Rio Grande Valley of Texas. *NWS Technical Memorandum [NWS SR 88](#)*.

Schumacher, P. N., 2003: An Example of Forecasting Mesoscale Bands in an Operational Environment. *AMS Preprint 10th Conference of Mesoscale Processes*, p1.11.

Uccellini, L. W., and P. J. Kocin, 1987: The interaction of jet streak circulations during heavy snow events along the east coast of the United States. *Wea. Forecasting*, **2**, 289–308.