Introduction

Measurable snowfall is very rare in Brownsville, TX, owing to its subtropical latitude (25°55' N) and proximity to the Gulf Coast. However, on 08 Dec 2017, widespread snowfall occurred across the Lower Rio Grande Valley (RGV) of Texas. For Brownsville, this represented the first measurable snowfall since 25 Dec 2004, and only the second recorded since 1899!

The “McFarland Signature”

McFarland (1976) identified several correlations between certain 500-hPa features and the occurrence of major freezes in the RGV:

1. A short-wave omega-block superimposed on a long-wave ridge through central Alaska with a deep low between Hudson Bay and Greenland.
2. An east-west oriented trough line over southern Canada/northern United States with zonal flow and a strong jet to the south and northerly flow to the north.
3. A closed low moving southward through the Prairie Provinces of Canada developing into a long-wave trough, without cyclogenesis.
4. Discontinuous retrogression of a full-latitude trough over the western United States involving a closed low or major east-west short-wave moving southward without cyclogenesis.

Such Arctic-air outbreaks are a necessary, but not sufficient, condition for snowfall events in the RGV.

Methodology

Five additional instances of significant freezes or snowfall events occurring in the Lower RGV of Texas since 1976 were identified:

1. 20-25 Dec 1983: One of the most well known Arctic air outbreaks on record; Harlingen, TX remained below 32°F all on both 25 & 26 Dec.
3. 22-26 Dec 2004: Christmas Eve-Christmas Day snow in the RGV.
4. 02-05 Feb 2011: Freezing rain; 30-33 hour duration of freezing temperatures.
5. 07-08 Dec 2017: Current study; widespread snowfall over Deep South Texas.

The timing of the initial Arctic frontal passage (FROPA) through the RGV for both the “old” and “new” cases (nine in total) was similar. After collaborating with the Weather Prediction Center’s Winter Forecasters by the afternoon of Tue, 05 Dec. Other deterministic model guidance (not shown) was similar. After collaborating with the Weather Prediction Center’s Winter Weather Desk, confidence in accumulating snow was high enough to add it to Winter Storm Warnings.

The Forecast

A pattern favoring possible snowfall in the RGV was noted by several experienced forecasters by the afternoon of Tue, 05 Dec. Other deterministic model guidance (not shown) was similar. After collaborating with the Weather Prediction Center’s Winter Weather Desk, confidence in accumulating snow was high enough to add it to Winter Storm Warnings.

The NBM forecast probability of snow was 100% in this area. Assuming a 5:1 snow-to-liquid ratio, it also produced reasonably accurate snow accumulation totals across the swath 24 hours in advance.

In addition, the NBM forecast a high probability (60-70%) of sleet to fall over eastern Cameron County during the early morning hours of 08 Dec, an element not included in National Digital Forecast Database (NDFD) grids. Sleet was observed around 08-09Z, by both the author and ASOS at KPIL. This is consistent with the shallow warm layer on the 12Z KBRO sounding.

Conclusions

• Recognition of the McFarland Signature continues to be a useful forecast tool, even more than 40 years after it was first identified.
• The NBM qualitatively performed well in capturing both spatial placement and snowfall amounts 24 hours prior to this rare snow event for Deep South Texas.
• Even for rare cases such as this, synoptic pattern recognition can add skill and confidence to forecasts.
• The NBM 3.0 correctly forecast a period of transitional sleet with 24h lead-time, which was not included in official NWS forecasts.
• An AWIPS tool such as ForecastBuilder, had it been available, may have assisted in including a period of forecast sleet in the NDFD grids.

References