

P2.18 A Case Study of the Great Plains Blizzard of 27-28 November 2005

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Introduction

On 28 November 2005, blizzard conditions existed over much of central Nebraska. Situated west of a 985-mb low, Nebraska came under the influence of a *trowal* structure. In addition to several instances of lightning near the height of the snowstorm, surface wind gusts across the area exceeded 50 knots and in one instance reached as high as 64 knots in the LBF CWA (Fig. 1a). A broad swath of snowfall in excess of 8" (20 cm) accompanies this storm (Fig. 1b).

Later on the 28th, a unique trowal structure developed, which influenced the organization of precipitation over Minnesota and Wisconsin.

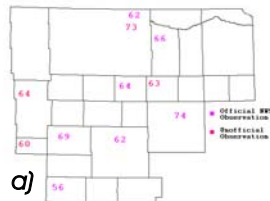
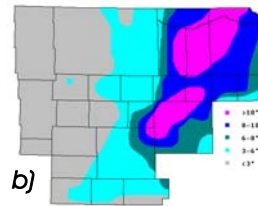


Fig. 1. Plots of a) maximum surface wind gusts (mi hr^{-1}) and b) storm total snowfall (in.) for the Blizzard of 28 November 2005 across the North Platte, NE, County Warning Area.



Synopsis

Significant divergence is diagnosed at 300 mb (Fig. 2a) on the northern periphery of a deep circulation. A trowal structure at 700 mb (Fig. 2b) suggests low-level forcing for ascent coincident with the favorable 300-mb kinematics across MN and SD. A significant area of snowfall is occurring in response to this forcing (Fig. 2c).

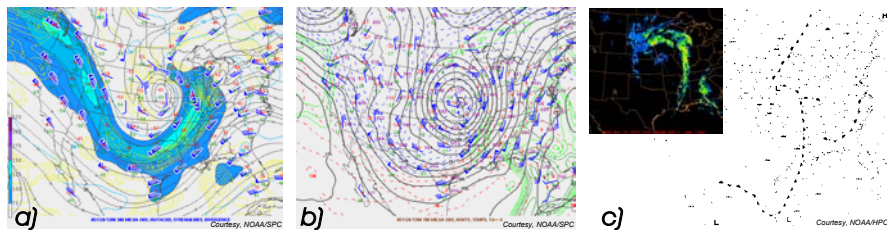


Fig. 2. Plots of a) 300-mb streamlines, isotachs (kt), and divergence (10^{-5} s^{-1}), b) 700-mb geopotential heights (solid, black; gpm) and isotherms (dashed, blue and red; $^{\circ}\text{C}$), and c) surface weather observations and radar summary (inset) valid at 1200 UTC 28 Nov 2005.

Trowal Features

By 21Z 28 November 2005, two axes of enhanced warm air were found within the larger *trowal* structure (Fig. 3a). This is a solution that had been suggested by several mesoscale model simulations from earlier on that date (Fig. 3b), and we focus on the thinned 40-km NAM results for further analysis. The 09 hr solution for the 308-K θ_e surface from the 12Z/28 run of the NAM reveals this double trowal structure most clearly in the 700-775-mb layer (Fig. 3c). The more southern of the two axes was quick to develop and decay, and radar observations from that time show that the bulk of the precipitation did, in fact, occur with the primary, more northern axis. Yet, a second, lesser precipitation band also appears over SW MN and NW IA (Fig. 3c), which persisted for several hours. This second band appears to have occurred in response to the area of frontogenesis along and north of the trowal axis (Fig. 3d).

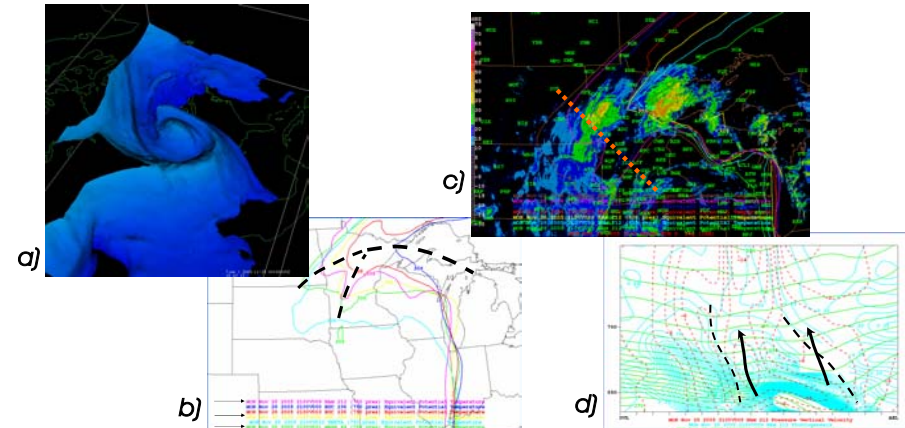


Fig. 3. a) 3-D rendering of the 308-K θ_e surface from the 09-hr solutions of the 15Z/28 RUC valid at 00Z/29, b) Solutions from various models for the 308-K θ_e contour at the 750-mb level, all valid at 21Z/28, c) Radar summary and 09-hr solutions from the 12Z/28 NAM for the 308-K θ_e surface; orange dashed line represents cross section line in Fig. 3d, d) Cross section from DVL to AEL of θ_e (K; green, solid), vertical motion ($\mu\text{b s}^{-1}$; red, dashed) and frontogenesis ($\text{K } 100 \text{ km}^{-1} \text{ 3 hr}^{-1}$; cyan, solid).

Conclusions

This study documents the occurrence of a temporary meso- β enhancement of the larger trowal structure. Frontogenesis in response to the distortion of the thermal pattern appears to have had a substantive impact on the precipitation regime.

Acknowledgements The authors thank the [National Science Foundation](#) for their support of this work.

