

Figure 1. The WRF domains for the (a) 3 km nested domain used during POLCAST3 and the (b) 1 km nested domain used for the case study. The 27 km parent grid and nested 9 km grid were unchanged, while the 3 km grid for the 1 km resolution runs was extended outward to fit the 1 km grid.



Figure 2. The following figure details how the MODE tool analyzes data. MODE begins with the (a) raw data field, (b) applies a circular convolution for object merging, (c) masks data and applies and intensity or area thresholds, and (d) declares objects.



Figure 3. The following figure shows the forecast and observed reflectivity (top row) and clustered objects (bottom row) as

analyzed by the MODE tool.



Figure 4. The following figure shows an example of the simulated reflectivity (left panel), observed reflectivity (central panel), and corresponding traditional skill scores (right panel) where a perfect forecast is a 1. The traditional skill scores are the Critical Success Index (CSI), Hanssen-Kuipers (HK), Heidke Skill Score (HSS), and Gilbert Skill Score (GSS).



Figure 5. 300mb heights, winds, and isotachs are shown for 0000 UTC July 14th, 2010. (SPC)



*Figure 6. 500mb heights and absolute vorticity for 0000 UTC July 14<sup>th</sup>, 2010. (RAP Weather)* 



*Figure 7. The figure shows 850 mb heights and temperature contours for 0000 UTC July 14<sup>th</sup>, 2010 (UNISYS Weather).* 



Figure 8. Surface Analysis done by the Hydro-meteorological Prediction Center (HPC) for 0000 UTC July 14<sup>th</sup>, 2010.



Figure 9. 1200 UTC Skew-T Log-P for July 14<sup>th</sup>, 2010 from Aberdeen, South Dakota (University of Wyoming).





Figure 10. Base reflectivity images from KMVX WSR-88D radar in 2 hour intervels starting at (a) 02 UTC on April 14th, 2010

(Generated using Gibson Ridge Software).



Figure 11. 500mb absolute vorticity (fill) at  $3*10^{-5}$  s<sup>-1</sup> intervals and 1000-500mb thickness at 6mb intervals for the 27 km

parent grid starting at (a) 0000 UTC July 14<sup>th</sup> and progressing in 6-hour intervals (b-e).



Figure 12. 850mb heights (black contours) at 20m intervals, temperature (red contours) at 2°C intervals, and relative humidity (green fill) at 10% intervals from 60°%, for the 27 km parent grid starting at (a) 0000 UTC July 14<sup>th</sup> and progressing in 6-hour intervals (b-e).



Figure 13. Sea level pressure (black contours) at 2mb intervals, temperature (fill) at 2 °F intervals, and wind vectors for the

27 km parent grid starting at (a) 0000 UTC July 14<sup>th</sup> and progressing in 6-hour intervals (b-e).



Figure 14. Most Unstable Convective Available Potential Energy (MUCAPE) at 250 J kg<sup>-1</sup> intervals for the 27 km parent grid

starting at (a) 0000 UTC July 14<sup>th</sup> and progressing in 6-hour intervals (b-e).



Figure 15. Simulated reflectivity at 1 km heights displayed from the 27 km parent grid with CP for July 14<sup>th</sup>, 2010 for (a)

0600 UTC, (b) 1200 UTC, (c) 1800 UTC, and (d) 2400 UTC.



Figure 16. Number of all forecasted (red) and all observed (yellow) cells greater than (a) 5 dBZ, (b) 30 dBZ and (c) 50 dBZ for the entire POLCAST3 time period (June  $22^{nd}$  – July  $23^{rd}$ ). Valid forecasts were compared to the closest radar observation within 30 minutes. All cells are within UND radar's 150 km range.



Figure 17. Showing the number of cases that were hits, misses, and false alarms across the POLCAST3 campaign (June 22<sup>nd</sup> – July  $23^{rd}$ ) out of a total of 275 cases, where 'F' and 'O' imply the forecast and observation domains respectively, while 'Y' signifies convection was present and 'N' signifies that no convection was present in that domain.



Figure 18. Number of cases and their corresponding differences between forecast and observed convective areal coverage when convection existed in both domains across the entire POLCAST3 field campaign (June  $22^{nd}$  – July  $23^{rd}$ ).





Figure 19. 3-km simulated reflectivity at a height of 1 km is displayed at 2-hour intervals starting at (a) 0200 UTC on July

14<sup>th</sup>, 2010 until (I) 0000 UTC July 15<sup>th</sup>, 2010.





Figure 20. 1-km simulated reflectivity at a height of 1 km is displayed at 2-hour intervals starting at (a) 0200 UTC on July

14th, 2010 until (I) 0000 UTC July 15th, 2010.



Figure 21. The following figure displays the forecasted 3-km (left column) and 1-km (right column) cross sections valid at 10

UTC on July 14th 2010. The first row is simulated horizontal reflectivity at 1 km (purple line indicates cross sectional cut),

the second row is the simulated reflecitivty cross section, and the thrid row is equivalent potential temperature.