Evaluation of the impact of different observations on forecasting a cold-airdamming event using the NCAR-DART system

panels) at 24 hour forecasts with different observations

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Motivation

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The NCAR DART (Data Assimilation Research Testbed) modeling system contains a suite of Ensemble Kalman Filter (EnKF) approaches and interfaces to several research and operational models (Anderson et al, 2009, BAMS). In this study, DART is employed for a cold air damming (CAD) event to

 study the capability of DART for realtime data assimilation and forecast,
investigate the impact of assimilation of observations of different platforms and different variables with DART, and
test the impact of inflation factors.

Case, model and data

A CAD event occurred in the northeastern states during 11 – 14 February 2008 was simulated at 6 hour cycle intervals and 24 hour forecasts in each cycle. DART EaKF (Ensemble Adjustment Kalman Filter) and WRF V3 were employed. The datasets evaluated include surface data, radiosondes, satellite winds, wind profiler data, and ACARS. All verification statistics were computed against radiosonde observations by interpolated the model to the observation locations.





Fig.2 Bias (upper two panels) and root mean squared difference (lower two panels) of DART analysis with different observations.

Temperature vs. wind

Further tests with assimilation of temperature only or wind only show that the results from assimilating temperature only are better than those of using wind only (Figs. 4-5). Impacts of assimilation of different observations for domain and time average are given in Fig. 6. The

results using radiosondes are the best.

Fig. 4 Simulation bias (upper two panels) and root mean squared difference (lower two panels) with temperature observations only (left) and wind observations only (right of the two panels) with temperature observations on the two panels) with temperature observations on the tw



Adaptive inflation factor



Sensitivity of inflation factors



Fig. 8 Bias (left three panels) and root mean squared difference (right three panels) of temperature, and wind speed of DART analysis with inflation factors of 1.02 and 2, and adaptive inflation factors.



Fig. 9 Bias (left three panels) and root mean squared error (right three panels) of temperature, and wind speed of 24h forecasts with inflation factors of 1.02 and 2, and adaptive inflation factors.

Conclusions

- DART assimilates different observations reasonably well and the result indicates that the radiosonde and ACARS data are most effective. Using wind profiler and satellite winds are less effective, especially at the upper layers.
- 2) Using temperatures only performs better than winds only.
- 3) The results were unexpectedly insensitive to a large change in the inflation factors.

On-going work: Conducting more experiments and analysis to validate the above findings and understand whether they are CAD-case dependent or a DART-EnKF property.