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Assimilation data from diverse sources for mesoscale NWP: TAMDAR-data impact

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Mesoscale (10-2000 km length scales) meteorological data assimilation and prediction are challenging due to the sparseness of observations, especially above the surface. A new source of data, called TAMDAR (Tropospheric Airborne Meteorological Data Reporting), has been introduced, that can potentially fill the data gaps. TAMDAR sensors, developed by AirDat LLC in collaboration with NASA, FAA and NOAA, are specially designed for smaller commercial aircraft that fly in the lower troposphere over the United States and other parts of the world. These sensors provide a full suite of meteorological measurements, including temperature, winds, humidity, icing, turbulence, etc., with high space-time density.By 15 July 2005, AirDat had completed sensor installations on 63 Saab340 aircraft operated by Mesaba Airline, which executes ˜400 flights a day, providing ˜800 soundings. At present, AirDat is working with other airlines to field more TAMDAR sensors, and is targeting to complete the North American coverage within the next one to two years. NCAR has been working with AirDat on evaluation and optimization of the impacts of the existing and future CONUS TAMDAR data on the NCAR 4DWX real-time, multi-scale, rapid-cycling, four-dimensional data assimilation and forecast (RTFDDA) system.

The RTFDDA system assimilates weather observations from diverse sources, including standard wmo radiosondes and surface observations, mesonets, wind profilers, satellite cloud-drift wind, Doppler-radar wind, ACARS/AMDAR aircraft report, QuikSCAT sea surface winds and many other data. Its 4-D continuous data-assimilation scheme is capable of weighting each observation according to its observation time and location, and thus it is able to assimilate the aircraft data measured along a flight leg, whichcan be very irregular in time and space. In this paper, the impact of TAMDAR data on mesoscale NWP isevaluated through real-time

data-denial forecasting practices, case studies, observing-system experiments (OSE) and observing-system-simulation experiments (OSSE). The value of the current TAMDAR data relative to the other currently available upper-air measurement platforms is evaluated. OSSE experimentswere conducted to evaluate the potential value of future CONUS-wide TAMDAR observing systems, based on 12 airlines which make 8951 flights a day. The result shows a very encouraging positive impact of the TAMDAR observing system on mesoscale NWP.