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Real data assimilation experiments using filtering methods

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ICM runs few NWP models in quasi operational regime, using the multivariate optimal interpolation (MVOI) method for data assimilation. Recently we are working on implementation of more advanced methods. The goal of this work is to demonstrate that the assimilation of radiosondes and amdar observations using the ensemble Kalman filter gives an estimation of the initial state of the atmosphere with a quality and performance comparable to another methods. Upper air conventional radiosonde data taken at land stations and from ocean observing systems include information on geopotential height, temperature, humidity and wind on mandatory and significant levels. This information is of primary importance to NWP models. To present mesoscale models this information is to coarse, as the average distance between radiosondes is about 100 km. Automated weather reports from commercial aircraft are also an important data source for numerical weather prediction (NWP) models, and have improved the forecasts from these models. Commercial aircraft now provide over 130,000 meteorological observations per day, including temperature, winds, and in some cases humidity, vertical wind gust, or eddy dissipation rate (turbulence). The temperature and wind data are used in most operational numerical weather prediction models at meteorological centers worldwide. At non-synoptic times, these data are often the primary source of upper air information over the U.S. Even at synoptic times, these data are critical in depicting the atmosphere along oceanic air routes. In Europe, for example in U. K. Meteorological Office models, ACARS/AMDAR are most important data source for winds over the Atlantic Ocean, and the second most important data source after radiosondes over North America.
All our experiments with assimilation of radiosondes and commercial aircraft observations are performed using ensemble Kalman filter (ENKF) technique in version proposed by Data Assimilation Research Testbed (DART) of NCAR. In this environment the different types of filters (EAKF, ENKF, Kernel filter) are available. Additionally to the assimilation, the filter adds a quality control flag to observations used. The forecast model used to generate ensemble of forecasts at times of observations is the US Navy COAMPS system. The atmospheric portion of COAMPS represents a complete three-dimensional data assimilation system comprised of data quality control, analysis, initialization, and forecast model components. Features include a globally relocatable grid, user-defined grid resolutions and dimensions, nested grids, an option for idealized or real-time simulations, and code that allows for portability between mainframes and workstations. The nonhydrostatic atmospheric model includes predictive equations for the momentum, the non-dimensional pressure perturbation, the potential temperature, the turbulent kinetic energy, and the mixing ratios of water vapor, clouds, rain, ice, graupel, and snow, and contains advanced parameterizations for boundary layer processes, precipitation, and radiation. Our data assimilation experiments will be performed with real data for selected cases. Some part of the work is devoted to the examination of the feasibility and impact of assimilating radiosondes and commercial aircraft observations on the quality of the forecast.