Boulder Fluid and Thermal Sciences Seminar Series

Tuesday, December 1, 2015
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado, Boulder

Building State-of-the-Art Forecast Systems with the Ensemble Kalman Filter

Jeffrey Anderson, *National Center for Atmospheric Research*

The development of numerical weather prediction was one of the great scientific and computational achievements of the last century. Computer models that approximate solutions of the partial differential equations that govern fluid flow and a comprehensive global observing network are two components of this prediction enterprise. An essential third component is data assimilation, the computational method that combines observations with predictions from previous times to produce initial conditions for subsequent predictions. The best present-day numerical weather prediction systems have evolved over decades and feature model-specific assimilation systems built with nearly a person century of effort.

This talk describes the design of a community software facility for ensemble Kalman filter data assimilation, the Data Assimilation Research Testbed (DART). DART can produce high-quality weather predictions but can also be used to build a comprehensive forecast system for any prediction model and observations. DART forecast systems must be inexpensive to implement and must run efficiently on computing platforms ranging from laptops to the largest available supercomputing. A description of the basic ensemble Kalman filter algorithm is followed by a discussion of algorithmic enhancements, in particular localization of observation impacts and inflation of prior ensembles, that are essential for efficient implementations for large prediction models.

Examples of Research Tools Enabled by CESM Atmospheric Models and DART

Kevin Raeder, *National Center for Atmospheric Research*

Ensemble Kalman data assimilation has proven to be a versatile tool in geophysical sciences. Besides the traditional use of combining observations with a model state to create improved initial conditions for a forecast, researchers are using EnKF to gain clearer pictures of physical phenomena, conduct sensitivity studies of the time evolution of modeled phenomena, and assisting with forecast model development by identifying model biases, helping to reveal coding and algorithm errors, and providing insight into model variability and error characteristics. This talk will illustrate as many of these uses as time allows, using NCAR's Community Earth System Model (CESM) and the Data Assimilation Research Testbed (DART) for illustration.