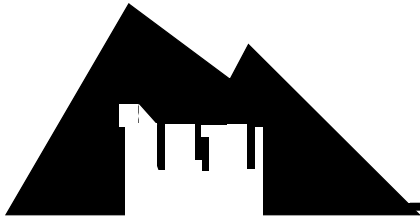


The RAL Seminar Series



NCAR

Automatic Parameter Estimation in Data Assimilation Without Ensembles

by

Greg Duane
NCAR Visiting Scientist

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Foothills Lab Building 2, Room 1001
3:30 p.m.

In many numerical forecasting scenarios, the use of ensembles is prohibitively expensive and/or impracticable because of the inability to properly account for model error in the initialization scheme. If one is seeking to estimate model parameters as well as state variables in data assimilation, it is possible to take advantage of the assumed relative constancy of such parameters over large regions of time and space to derive an estimate from a single realization. The approach follows from a general result on synchronously coupled dynamical systems, where one system here represents "truth" and the other "model": If two such systems can be made to synchronize when their corresponding parameters are identical, for any coupling scheme (such as might be used in conventional data assimilation) a parameter estimation law can generally be added that will dynamically reduce a total cost function including parameter mismatch terms as well as state mismatch terms. The approach is used to estimate a parameter that quantifies the effect of soil moisture in a single-column version of the WRF model.

The parameter estimation quality is only as good as the convergence of model state variables to their true values. For the "nudging" scheme currently used to assimilate data in the ATEC model (single-column WRF), parameter convergence is highly unstable, but true parameter values are still readily inferred from the time series. It is proposed to extend the scheme to infer a 2D map of soil parameter values for a 3D model, using the fact that the parameter is slowly varying almost everywhere. The constrained optimization approach that is proposed should be useful for a variety of NWP parameter estimation problems, and may extend the power of ensemble methods.