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MMM SEMINAR *NCAR*

Linear Filtering of Sample Covariances for Ensemble Data Assimilation: Theory and Applications of Optimality Criteria

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The estimation of forecast error covariances estimation is a key-point to data assimilation (DA) schemes in numerical weather prediction (NWP) systems. For several years, it has been shown that ensemble methods are the most accurate at capturing flow-dependence information. However, their huge computational cost raises a strong limitation to the ensemble size. Consequently, covariances estimated with a small ensemble are contaminated with random sampling error, especially at convective scales. A theory of covariance filtering has been developed in order to remove most of the sampling noise while keeping the signal of interest. It arises from the merging of linear filtering theory and the theory of sample centered moments estimation. Its strength comes from the definition of a criterion for optimal filtering that relies on known quantities, that are the raw and the filtered sample covariances.

This criterion paves the way for new algorithms and interesting applications for NWP. Two of them are detailed: spatial filtering of variances and covariance localization. The theory is tested with real background error covariances computed using a large Ensemble Data Assimilation (EDA) at convective scale coupled with a corresponding EDA at global scale, based respectively on the AROME and ARPEGE NWP systems operational at METEO-FRANCE. Variance filtering algorithms, both homogeneous and heterogeneous, show very good and consistent results. Localization functions are successfully diagnosed from the ensemble, providing relevant localization length-scales that strongly depend on the number of members, on the meteorological variables and on the vertical levels.

This seminar will be recorded and available via webcast at:
http://www.fin.ucar.edu/it/mms/fl-live.htm

Thursday, 28 August 2014, 3:30 PM
Refreshments 3:15 PM
NCAR-Foothills Laboratory
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