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Colloquium

On Ensemble and Particle Filters for Large-Scale Data Assimilation and Inverse Problems

Professor Roland Potthast
Deutscher Wetterdienst (DWD)

Date:	October 25, 2016 (Tuesday)
Time:	3:00pm ~ 4:00pm
Venue:	Room 219, Lady Shaw Building, The Chinese University of Hong Kong, Shatin

(Abstract is attached)

All are Welcome

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Abstract

In almost all operational centres for numerical weather prediction around the world ensemble data assimilation techniques are of rapidly growing importance. Ensemble techniques allow to describe and forecast uncertainty of the analysis, but they also improve the assimilation result itself, by allowing estimates of the covariance or, more general, the prior and posterior probability distribution of atmospheric states.

In our talk, we will first give a survey about recent activities of the German Meteorological Service DWD, who is using an Ensemble Kalman Filter both for its new global ICON model as well as for the convective scale high-resolution model COSMO-DE. To be more precise, for the global model a hybrid variational ensemble Kalman filter EnVAR has been developed. We survey the setup of its Ensemble Kalman Filter component, which is based on the LETKF of Hunt, with a range of further features such as relaxation to prior perturbations or random perturbations. The system is run operational since January 2016 and shows scores comparable to state-of-the-art 4D-VAR systems as run by many international centers today. Ensemble data assimilation also provides initial states for ensemble prediction (EPS). We describe ICON EPS and demostrate the high quality of the system.

Then, for the kilometer scale ensemble data assimilation (KENDA) for the 2.8km/2.2km resolution COSMO-DE model we describe the ensemble Kalman filter which is scheduled for operational use in 2016 and show recent results which demonstrate that it is clearly superior to the current nudging scheme. We will also show very encouraging results on the performance of the COSMO-DE-EPS when initial conditions for its 40-member ensemble are taken from KENDA.

In the third part of the talk, we present recent work on the further development of the ensemble data assimilation towards a particle filter for large-scale atmospheric systems, which keeps the advantages of the LETKF, but overcomes some of its limitations. We describe a Localized Markov Chain Particle Filter (LMCPF), present its mathematical foundation. A localized particle filter has been implemented for the global ICON model of DWD. We show results of a case study of one week global assimilation for a hybrid particle filter variational assimilation in a quasi-operational setup, showing the huge potential of the method which already in its first simple implementation can achieve better or comparable scores to the operational EnVAR system.

All are Welcome