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Using machine learning and data assimilation to learn both dynamics and state

Tuesday, 6 October 2020 12:00 (30 minutes)

The recent introduction of machine learning techniques in the field of numerical geophysical prediction has expanded the scope so far assigned to data assimilation, in particular through efficient automatic differentiation, optimisation and nonlinear functional representations. Data assimilation together with machine learning techniques, can not only help estimate the state vector but also the physical system dynamics or some of the model parametrisations. This addresses a major issue of numerical weather prediction: model error. I will discuss from a theoretical perspective how to combine data assimilation and deep learning techniques to assimilate noisy and sparse observations with the goal to estimate both the state and dynamics, with, when possible, a proper estimation of residual model error. I will review several ways to accomplish this using for instance offline, variational algorithms and online, sequential filters. The skills of these solutions with be illustrated on low-order chaotic dynamical systems. Finally, I will discuss how such techniques can enhance the successful techniques of data assimilation. Examples will be taken from collaborations with J. Brajard, A. Carrassi, L. Bertino, A. Farchi, M. Bonavita, P. Laloyaux, and Q. Malartic.

Thematic area

1. Machine Learning for Data Assimilation - Including Model Error Estimation and Correction, Parameter estimation, Fast linearised models for DA, Hybrid DA

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Session Classification: Session 3: ML for Data Assimilation

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