Data Assimilation for Chaotic Geophysical Dynamics - An Overview

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We refer to state estimation theory in geosciences as data assimilation (DA). DA is standard practice in numerical weather prediction, and its application is becoming widespread in many other areas of climate, atmosphere, ocean, and environment modelling; in all circumstances where one intends to estimate the state of a large dynamical system based on limited information.

Atmosphere and ocean, are examples of chaotic dissipative dynamics: error dynamics is extremely sensitive to the initial condition and highly state-dependent.

Dealing with such a flow-dependent error growth is a challenge for DA: one must in fact be able to properly track and incorporate this dependency in the DA process. A situation that is made even worse by the large size of the geophysical models.

This talk will recall the unique challenges that chaotic environmental systems have posed to the development of adequate DA and predictability tools and will provide an outlook on one of such approach, the assimilation in the unstable subspace and on its applications in atmospheric and ocean systems.

References:
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