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Optimal control perspective on 4D-Var data assimilation: error estimates and reduced order modeling

In this talk, we formulate a four-dimensional variational (4D-Var) data assimilation problem as an optimal control problem in which the initial condition itself serves as the control variable to be estimated. A reformulation of the associated optimality system as an all-at-once system leads to a coupled problem in space-time for which we derive a-posteriori error estimates in regards to time.

Within the data assimilation framework, we investigate the impact of temporal adaptivity on both the discretization scheme and the timing of observations. Since the involved high-fidelity problem can be costly to solve, we study the application of suitable model reduction approaches and analyze the efficiency and accuracy. Numerical examples illustrate the methods.

This is joint work with Jannis Marquardt.