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Reduced order POD/DEIM 4-D Var data assimilation

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The computational cost of realistic ensemble and hybrid variational/ensemble data assimilation is typically dominated by the cost of ensemble forecasting. The high computational cost of ensemble forecasting limits the number of ensembles, eventually creating a severe rank reduction. Consequently, the efficiency and quality of ensemble-based data assimilation are greatly reduced. With the ever-increasing spatiotemporal resolution and complexity of numerical weather prediction (NWP) models, the room for ensemble forecasting is getting even smaller, creating a paradox: Although the NWP generally benefits from increased resolution and complexity of the models, the quality of their data assimilation is getting worse due to additional computational restrictions. We propose POD model order reduction substantially improving computational efficiency of NWP models. We present recent advances in this domain and the state-of the art of hyper reduction addressing issues of turbulence closure and nonlinearities allowing CPU speed –ups of orders of magnitude, reduced order 4-D VAR and future prospects of implementation to operational NMP models.