



## **Comparing Observation Impact's using Adjoint- and Ensemble-based Methods in the NASA GMAO GEOS-5 Hybrid Data Assimilation System.**

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Observation impact at the National Aeronautics and Space Administration (NASA) Global Modeling and Assimilation Office (GMAO) is routinely calculated using the fifth-generation of the Goddard Earth Observing System (GEOS-5) general circulation model, together with its adjoint and an adjoint of the Grid-point Statistical Interpolation (GSI) data analysis system (DAS). Recently, efforts have been made to implement a hybrid data assimilation system incorporating an ensemble Kalman filter in the existing GSI DAS. An ensemble approach to computing the observation impact is implemented that eliminates the need of the GEOS-5 adjoint.

This presentation will illustrate the theoretical equivalence between the two methods using a 40 variable Lorenz model and discuss the relative advantages of each method. A comparison of the observation impacts on reduction in the 24 hour forecast error in the GEOS-5 hybrid DAS as measured by the two methods will be shown. Insights on ensemble size and relative weights of static and flow-dependent error covariance's in a hybrid DAS as gained from observation impact experiments will be presented.