



Assessing observation impact using the adjoint of the GEOS-5 data assimilation system

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The NASA Global Modeling and Assimilation Office (GMAO) has developed the adjoint of its GEOS-5 data assimilation and forecasting system, consisting of the GEOS-5 finite volume atmospheric model and Gridpoint Statistical Interpolation (GSI) analysis scheme developed at the National Centers for Environmental Prediction (NCEP). By combining sensitivity information from the forecast model and analysis adjoints, the contributions of any or all assimilated observations to the reduction (or increase) of forecast error can be estimated accurately and efficiently. This allows aggregation of the impacts of different observing systems by, for example, data type, channel or location, as well as examination of the interactions between them.

The impacts of various conventional and satellite observing systems, including Atmospheric Infrared Sounder (AIRS) radiances, on short-range forecast errors in the GEOS-5 system are examined for July 2005 and January 2006. It is found that both conventional and satellite observations contribute significantly to the reduction of forecast errors, with asymmetries in the magnitudes of their impacts depending on the season and hemisphere. Redundancies and inter-dependencies between observing systems are also evident, providing major challenges for optimizing the use of the current observational network and for defining the requirements for future observing systems.