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Assimilation of radiances and geophysical retrievals from NASA's AIRS sensor

L. P. Riishojgaard (1), G. Brin (2), H.-C. Liu(1)
(1) Global Modeling and Assimilation Office, GSFC, (2) Laboratory for Atmospheres, GSFC

For several years the consensus in the data assimilation community has been that the optimal way of incorporating satellite mass observations in the operational analyses consists of assimilating radiances (or brightness temperatures) as measured by the sensors rather than profiles of temperature inferred from these data by way of an offline retrieval process. The advantage of the radiance assimilation approach was first convincingly demonstrated in a series of impact experiments involving measurements obtained with the AMSU-A and HIRS sensors flying on the operational NOAA satellite series. However, the optimal assimilation strategy for modern hyper-spectral infrared sounders such as AIRS remains largely unexplored. Issues such as the optimal number of channels as well as the actual channel selection, the merit of off-line retrieval of temperature and humidity profiles, the role of cloud-clearing all remain unresolved. In an attempt to shed further light on some of these problems, several AIRS impact have been run using the GEOS-5 assimilation system at the Goddard Space Flight Center. Here we present experiments in which a variable number of AIRS channels is assimilated and we compare these with results of assimilating off-line temperature retrievals that are performed independently of the forecast background.