

# The Assimilation of Cloud-Affected Infrared Radiances at the Global Modeling and Assimilation Office

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This effort is built upon expanding the handling of infrared measurements within the Gridpoint Statistical Interpolation (GSI) data assimilation system to include measurements affected by clouds. The GSI is the atmospheric assimilation component of The Goddard Earth Observing System Model, Version 5 (GEOS-5) system of models. Infrared measurements that are sensitive to clouds are screened out via quality control. These methods can discard ~85% of infrared channels within the window region. It is desirable to further incorporate these observations into the assimilation system, but there are difficulties including, but not limited to, the nonlinear nature of clouds on the observations, the difficulty of detecting multilayer clouds within a single field-of-view, spectral variations in cloud emissivity, and the separation of atmospheric and cloud signatures.

This effort is currently focused on the incorporation of a graybody assumption into the observation operator and allowing the cloud top pressure to vary in the minimization as part of the control vector, similar to the approach presented in McNally (2009) [1]. This study presents a system that adds the adjusted observation operator and Jacobians, via the Community Radiative Transfer Model (CRTM) and variational cloud top pressure to the GSI. Furthermore, initial results beyond the McNally (2009) methodology will be included, including expanding towards observations affected by thin cirrus.

## References

[1] McNally, A. P., 2009: “The direct assimilation of cloud-affected satellite infrared radiances in the ECMWF 4D-Var,” *Quart. J. Roy. Meteor. Soc.*, **135**, 1214-1229