Assimilation of Precipitation-Affected Microwave Radiances in NCEP FV3DA and Its Transition to JEDI

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The operational FV3-GFS hybrid data assimilation system assimilates microwave radiances, including those affected by non-precipitating clouds. The cloudy scenes are assumed to be overcast. In recent years efforts have been made to improve the observation operator (CRTM), quality control procedures, and the analysis to make the assimilation of precipitation-affected radiance feasible.

The capability of the observation operator (CRTM) was validated and improved for its accuracy under scattering conditions. In addition, a two-column radiance calculation approach to handle partial cloud coverage with four types of cloud overlapping schemes were also developed. The cloud optical table for solid hydrometeors used in the assimilation was parameterized according to MODIS Collection 6 - a single habit ice model. The precipitation screening was removed from both data thinning and quality control to maximize the use of radiances affected by precipitation. The field-of-views containing highly scattering conditions were screened out due to large uncertainties in both the forecast model and observation operator. The radiances affected by cold-air-outbreak areas at the winter pole where the model forecast suffers from predicting the correct hydrometeor phase were also removed from the assimilation.   The analysis variables, as well as the ensembles, were augmented to include precipitating hydrometeors such that the ensemble perturbations can effectively facilitate the use of observations.

The preliminary assessments of the impact on forecast were positive from the Microwave radiances, which includes precipitation-affected ones.   The on-going work includes: (1) investigating the linearity of the observation operator under scattering condition; (2) enhancing cloud optical property table to take into account the temperature dependency for solid hydrometeors; (3) testing 4DIAU with hydrometeor increments for forecast initialization; and (4) transitioning the current work to JEDI.