Enhanced Radiance Bias Correction in the NCEP's Gridpoint Statistical Interpolation Data Assimilation System

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The enhancements to the operational radiance bias correction in the NCEP's Gridpoint Statistical Interpolation (GSI) Data Assimilation System have been developed and tested on the development versions of the parallel Global Forecast System (GFS). Enhancement efforts have focused on several aspects of radiance bias correction. First, a modified pre-conditioning is applied to the bias correction coefficients and the analysis variables to speed up the convergence of the minimization process. Second, the capabilities of detecting any new/missing/recovery radiance data and initializing the bias correction for new radiance data are implemented. The background error variances for the bias correction coefficients are automatically adjusted using an approximation of the analysis error variances from the previous cycle, and the pre-specified predictor parameters are removed. Third, the capability to perform bias correction for passive channels within the GSI is developed. Finally, another major endeavor is that the two-step bias correction procedure currently used is replaced with a one-step variational bias correction scheme within the GSI. The scan angle and the air-mass bias corrections are now obtained consistently along with other analysis variables inside the GSI in the one-step procedure, and it is expected that they could respond quickly to any changes in data quality or algorithm accordingly.

Although experiments conducted with the latest GSI-based hybrid ensemble-variational system show that the one-step enhanced scheme of radiance bias correction is working properly, further tuning over a longer time period may be necessary, and there is still room to improve. One of the issues we will discuss is the larger land/sea difference as the new Community Radiative Transfer Model (CRTM) development improves the microwave sea surface emissivity model. An emissivity sensitivity predictor term is constructed to account for the land/sea difference. Preliminary results are promising, and more experiment results will be shown at the conference.