AMS ABSTRACT

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A Module for Assimilating Hyperspectral Infrared Retrieved Profiles into the Gridpoint Statistical Interpolation System for Unique Forecasting Applications

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Hyperspectral infrared sounder radiance data are assimilated into operational modeling systems however the process is computationally expensive and only approximately 1% of available data are assimilated due to data thinning as well as the fact that radiances are restricted to cloud-free fields of view. In contrast, the number of hyperspectral infrared profiles assimilated is much higher since the retrieved profiles can be assimilated in some partly cloudy scenes due to profile coupling other data, such as microwave or neural networks, as first guesses to the retrieval process. As the operational data assimilation community attempts to assimilate cloud-affected radiances, it is possible that the use of retrieved profiles might offer an alternative methodology that is less complex and more computationally efficient to solve this problem.

The NASA Short-term Prediction Research and Transition (SPoRT) Center has assimilated hyperspectral infrared retrieved profiles into Weather Research and Forecasting Model (WRF) simulations using the Gridpoint Statistical Interpolation (GSI) System. Early research at SPoRT demonstrated improved initial conditions when assimilating Atmospheric Infrared Sounder (AIRS) thermodynamic profiles into WRF (using WRF-Var and assigning more appropriate error weighting to the profiles) to improve regional analysis and heavy precipitation forecasts. Successful early work has led to more recent research utilizing WRF and GSI for applications including the assimilation of AIRS profiles to improve WRF forecasts of atmospheric rivers and assimilation of AIRS, Cross-track Infrared and Microwave Sounding Suite (CrIMSS), and Infrared Atmospheric Sounding Interferometer (IASI) profiles to improve model representation of tropopause folds and associated non-convective wind events.

Although more hyperspectral infrared retrieved profiles can be assimilated into model forecasts, one disadvantage is the retrieved profiles have traditionally been assigned the same error values as the rawinsonde observations when assimilated with GSI. Typically, satellite-derived profile errors are larger and more difficult to quantify than traditional rawinsonde observations (especially in the boundary layer), so it is important to appropriately assign

observation errors within GSI to eliminate potential spurious innovations and analysis increments that can sometimes arise when using retrieved profiles. The goal of this study is to describe modifications to the GSI source code to more appropriately assimilate hyperspectral infrared retrieved profiles and outline preliminary results that show the differences between a model simulation that assimilated the profiles as rawinsonde observations and one that assimilated the profiles in a module with the appropriate error values.