Use of Hyperspectral IR Data in 4D Assimilation at NRL

Benjamin Ruston, Nancy Baker, William Campbell, Tim Hogan, Xu Liu

A newly developed weak-constraint 4D-Var system is in parallel pre-operational testing at the Naval Research Laboratory. The NRL Atmospheric Variational Data Assimilation System – Accelerated Representer (NAVDAS-AR) is targeted to be the next generation assimilation system for the US Navy replacing the 3D-Var NAVDAS system within the next year. In particular, NAVDAS-AR scales much better to the high data volumes encountered working with hyperspectral instruments such as AIRS and IASI. The NAVDAS-AR system has been configured to use both the JCSDA Community Radiative Transfer Model (CRTM) and RTTOV-8.7 and a brief comparison of the two will be presented. The adjoints of NAVDAS-AR and the Navy Operational Global Atmospheric Prediction System (NOGAPS) are used to produce observation sensitivities for all simulated channels allowing for additional guidance in channel selection for assimilation. Primary channel selection begins by identifying the spectral region of interest for assimilation. The assimilation has focused initially on the longwave CO2 channels in the 13-15 micron range. Further channel selection is done by leveraging advice from other modeling centers (UK-Met Office and ECMWF), examining Jacobians for sensitivity above the model top, and the use of the NAVDAS-AR and NOGAPS adjoint sensitivities. Quality control is being done primarily by the NWP-SAF released cloud detection package for high resolution infrared sounders. Results of the assimilation runs will present standard diagnostics including the 500hPa anomaly correlations from the Northern and Southern hemispheres, vector wind RMS from 850 hPa, and tropical cyclone tracks from the 2007 season for AIRS assimilation only. Lastly, Xu Liu, a visitor from NASA Langley has incorporated the principle component version of the CRTM (pCRTM) to be used with NAVDAS-AR and IASI data. This allows direct assimilation of principle components rather than individual channels. These results are contrasted with the results from the conventional channel style assimilation runs in both computational efficiency and most importantly in NWP performance.