EVALUATION OF CRIS/ATMS PROXY RADIANCES/RETRIEVALS WITH IASI RETRIEVALS, ECMWF ANALYSIS AND RAOB MEASUREMENTS

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1. ABSTRACT

Temperature and water vapor profiles retrieved from the Northrop Grumman Application System (NGAS) Cross-track Infrared Sounder/Advanced Technology Microwave Sounder Suite (CrIMSS) Environmental Data Record (EDR) algorithm (Version 1.5) were evaluated with matched European Center for Medium-Range Weather Forecasts (ECMWF) data and other correlative data sets. Proxy radiances derived for the CrIS/ATMS instruments were used with the NGAS-CrIMSS EDR algorithm to retrieve temperature and water vapor profiles. Comparison of the CrIS/ATMS proxy radiances with the corresponding channel data from the Infrared Atmospheric Sounding Interferometer (IASI) and the Advanced Microwave Sounding Unit (AMSU) instruments reveals very good agreement both spectrally and spatially, thus indicating robustness of the proxy data algorithms. Preliminary evaluation of the CrIMSS retrieval products with matched ECMWF analysis fields reveals reasonable agreement. Further evaluation of the CrIMSS temperature and water vapor retrievals with IASI retrievals and radiosonde (RAOB) measurements is in progress and will be presented at the conference.

2. VALIDATION DATA

The IASI instrument aboard Meteorological Operational satellite programme (MetOp) series is a Fourier Transform Spectrometer and provides 8461 infrared (IR) spectral radiances covering the IR spectrum from 3.62 µm -15.5 µm [1]. The 15-channel AMSU temperature sounder and the 5-channel Microwave Humidity Sounder (MHS) complement the IASI instrument to retrieve many high quality geophysical products. In addition to the retrieval products, these IR and MW observations can be used to generate proxy radiances for future National Polar Orbiting Environmental Satellite System (NPOESS) CrIS/ATMS instruments to develop and test new retrieval algorithms. The National Oceanic and Atmospheric Administration-National Environmental Satellite Data and Information Service (NOAA/NESDIS) operate a near-real time operational system for IASI/AMSU/MHS retrieval products. The system is being tailored to the CrIS/ATMS processing to derive NOAA Unique CrIS/ATMS products (NUCAPS). The products include Level-1B radiance products and Level-2 profiles of temperature, water vapor and ozone, and many other surface and cloud parameters. In addition to the NUCAPS retrieval system, the NOAA center for Satellite Applications and Research (STAR) has implemented the NGAS CrIMSS EDR algorithm (Version 1.5) to facilitate validation of the NGAS algorithm with matched ECMWF analysis fields, global radiosonde (RAOB) measurements, and other correlative data sets available as a part of the NUCAPS test-bed [2].

3. RESULTS AND DISCUSSION

Using matched IASI/AMSU/MHS observations for the focus day (October 10, 2007), proxy radiances were derived for the CrIS (1315 spectral channels) and the ATMS (22 channels) instruments using the algorithms developed by Xu Liu and Kizer [3], and Jairam *et al*. [4], respectively. Figure 1 shows the brightness temperature spectra observed by the IASI instrument, and the corresponding proxy brightness temperatures for the CrIS instrument. Figure 2 shows the comparison of gridded brightness temperature maps, and the difference map between the IASI and CrIS observations for two channels. Figure 3 shows the comparison of the ATMS 23GHz and 89GHz channel brightness temperatures with the AMSU/MHS channels. An examination of these figures reveals very good agreement between the CrIS and IASI radiances both spectrally and spatially. The ATMS proxy data algorithm provides reasonably good comparisons for most of the globe except for the high latitude regions (>70^{o} latitudes) and over the sea/ice boundaries. These differences at high latitudes and sea/ice boundaries are being resolved in the updated version of the ATMS proxy data algorithm, and will be presented at the conference. The CrIS/ATMS proxy radiances were applied to the CrIMSS EDR algorithm to derive retrieval products. Preliminary evaluation of the CrIMSS retrieval products with matched ECMWF analysis fields reveals reasonable agreement, and has given a high degree of confidence on the performance of the CrIMSS EDR algorithm. We are currently evaluating CrIMSS temperature and water vapor profiles with IASI retrievals and RAOB measurements and the results will be presented at the conference.

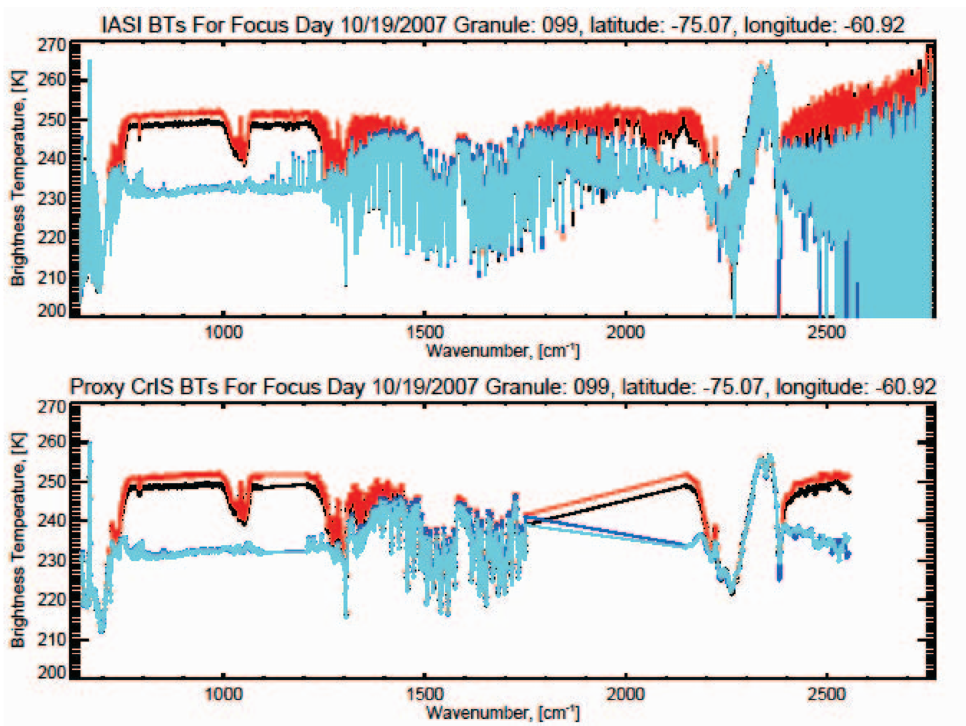

Figure 1. IASI observed brightness temperature spectra (top) and the corresponding CrIS proxy brightness temperature spectra (bottom). The IASI instrument has 8461 IR channels covering the IR spectrum. The instrument has 4 fields of view (FOVs) for each Field of Regard (FOR) and the radiances are Gaussian apodized. The CrIS instrument has a total of 1315 IR channels in 3 bands covering longwave (655-1095 cm^{-1}), midwave (1210-1750 cm^{-1}), and shortwave (2155-2550 cm^{-1}) channels, and has spectral gaps between the bands. The instrument has 9 FOVs for each FOR and the radiances are Hamming apodized. The CrIS 4 FOVs that correspond to the IASI 4 FOVs are plotted in the figure.

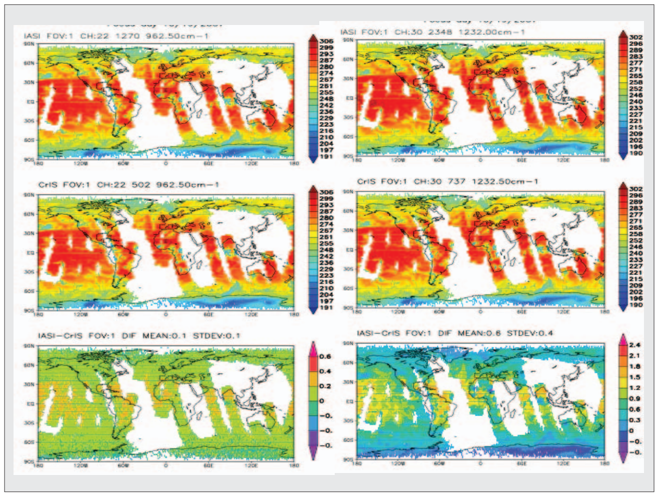

Figure 2. Brightness temperature maps of IASI (top), proxy CrIS (middle) and IASI-CrIS differences (bottom) for 962.5 cm^{-1} (left) and 1232.5 cm^{-1} (right) channels for the focus day October 10, 2007. The differences are mainly due to finer spectral resolution of the IASI instrument to that of CrIS.

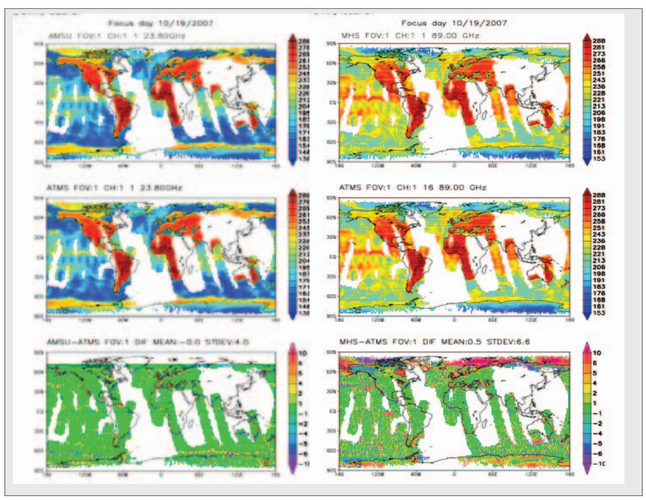

Figure 3. Brightness temperature maps of AMSU/MHS (top), proxy ATMS (middle) and AMSU/MHS-ATMS differences (bottom) for 23GHz (left) and 89GHz (right) channels for the focus day October 10, 2007.

4. REFERENCES

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