The CrIMSS EDR Algorithm Assessment: Provisional Maturity and Beyond


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Abstract

The Dual-hatch Vertical Hotwind (DVH) and the Advanced Technology Microwave Sounder (ATMS) instruments aboard the Joint Polar Satellite System (JPSS) are unique sensor suites with significantly improved spatial and spectral resolution compared to earlier generation instruments, such as the Microwave Humidity Sounder (MHS). The advantage of these instruments is that they bring improved spatial and spectral resolution to existing microwave observations on board the JPSS satellite. In this work, we evaluate the ATMS and observations from the ERA5-L4 reanalysis and Operational model (ECMWF) for selected tropical region over the Pacific Ocean. The results indicate that the CrIMSS EDR algorithm is performing as expected for different categories (land, sea, and atmosphere). The CrIMSS EDR algorithm is a baseline operational product utilizing physical model/forecast analysis fields, and recent advances in the area of cloud, aerosol, and ozone retrievals. The CrIMSS EDR algorithm has shown remarkable improvement within two years of operation closely achieving AVTP accuracies beyond what was observed with the MX7.1 operational version. Overall, yields have improved since launch to include approximately 90% of atmospheric profiles from the first stage ‘MW only’ retrieval, and over 50% of profiles from the second stage ‘IR+MW’ retrieval. These results reveal that the CrIMSS EDR is ‘physical’ and does not incorporate any knowledge of validation data sets to demonstrate provisional maturity. Based on the evaluations and recommendations made in the past, the CrIMSS EDR product is expected to meet the requirements of the JPSS operational environment. The larger RMS difference between the CrIMSS EDRs and ECMWF that the CrIMSS EDR is ‘physical’ network regression solution. The difference between AVTP and AVMP retrievals is close to reaching the requirements. Water vapor retrievals may require a little further enhancement to meet the requirements. CrIMSS AVTP and AVMP retrievals are not assimilated into global NWP models.

Results and Discussion

1. The CrIMSS EDR algorithm is a baseline operational product utilizing physical only approach suitable for our community.
2. The algorithm has been in operation for only a couple of months, and with very minor changes to the code and updates from the pre-launch versions, the algorithm has shown remarkably improved performance.
3. The global yield of the algorithm is about 80%. The combined ‘AVTP’ product performance (mean–45%) and the ‘AVMP’ only product performance (20%–60%) over a wide range of validation data sets demonstrate the promise of the CrIMSS EDR global requirements for most of the atmosphere.
4. The algorithm is performing as expected for different categories (land, sea, and coast), aerosol and ozone retrievals, and different regions (tropics, sub-tropics, mid-latitudes). A slightly larger global RMS difference over the mid-latitudes is largely RMS differences over the land, coast, and polar regions impacting the global RMS difference. Improvements in future algorithms are expected to be close to reaching the requirements. Water vapor retrievals may require a little more algorithm development. Performance improvements are expected to improve the performance.

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