Performance of the NPOESS CrIS Sensor and Environmental Data Records

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ABSTRACT

NPOESS is a tri-agency (DOC, DoD, and NASA) United States program for the next-generation operational, environmental, polar-orbiting satellite system. The Cross-track Infrared Sounder (CrIS) is a key NPOESS sensor providing two environmental mission Key Performance Parameters (KPP) namely, the atmospheric vertical moisture and temperature profiles. The CrIS sensor measures upwelling infrared radiance at very high spectral resolution. The science heritage for CrIS was derived from the Atmospheric Infrared Radiation Sounder (AIRS) on the NASA EOS Aqua satellite. CrIS works in cooperation with another sensor on the NPOESS satellite, the Advanced Technology Microwave Sounder (ATMS). Together, the CrIS and ATMS sensors produce the data to generate three EDRs, the atmospheric vertical moisture profile, the atmospheric vertical temperature profile, and the pressure profile,. This presentation discusses the performance of the first CrIS flight instrument and its data product performance. Together with ATMS, the CrIS sensor is a critical payload for NPOESS and will first fly on the NPOESS Preparatory Project (NPP) mission. NPP is the risk reduction flight for NPOESS. The performance of the sensors and algorithms will be demonstrated on NPP in time for changes to be made for the first operational NPOESS launch in order to reduce risk to the NPOESS operational mission by taking advantage of lessons learned. The presentation describes instrument radiometric performance such as calibrated spectral response shape, error residuals and absolute spectral calibration of the CrIS Flight Model 1 (FM1) sensor including the signal processing algorithms used to radiometrically and spectrally calibrate the CrIS sensor. This includes a

description of the CrIS ground algorithms that convert Raw Data Records (RDR) into calibrated Sensor Data Records (SDR) and then the SDRs into Environmental Data Records (EDR). The radiometric performance is at the heart of the environmental mission performance, since it represents the quality of the calibrated sensor response. Additional important performance parameters will be presented, including: sensor noise, Instrument Line Shape (ILS), short-term repeatability, long-term repeatability, and mapping uncertainty. The SDR algorithm flow is given along with examples of the algorithm's ability for linearity correction to limit radiometric uncertainty and produce accurate spectral response functions in all sensor Fields Of Views (FOV) and spectral channels. The CrIS sensor development has included three engineering unit builds, as well as the design, development, and testing of the flight sensor unit. The run-for-record flight sensor and algorithm performance have been verified against the specification requirements. The testing has included ambient, electrical magnetic interference testing, vibration, as well as thermal vacuum testing to simulate the environmental conditions on-orbit. By the time of the presentation, the sensor sell-off will have been completed and the presentation will summarize the results. The CrIS sensor calibration plan is being developed in order to ensure high quality SDR and EDR environmental products on-orbit. In order to get accurate results, the sensor data must be well calibrated both radiometrically and spectrally. In this presentation, sensor performance testing results will be summarized and both SDR and EDR performance will be discussed for the as-delivered CrIS sensor.

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