NPP CLOUDS AND THE EARTH'S RADIANT ENERGY SYSTEM (CERES) PREDICTED SENSOR PERFORMANCE CALIBRATION AND PRELIMINARY DATA PRODUCT PERFORMANCE

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Abstract
Continuation of the Earth Radiation Budget (ERB) Climate Data Record (CDR) has been identified as critical in the 2007 NRC Decadal Survey, the Global Climate Observing System WCRP report, and in an assessment titled 'Impacts of NPOESS Nunn-McCurdy Certification on Joint NASA-NOAA Climate Goals'. In response, NASA, NOAA and NPOESS agreed in early 2008 to fly the final existing CERES Flight Model (FM-5) on the NPP spacecraft for launch in 2010. Future opportunities for ERB CDR continuity consist of procuring an additional CERES Sensor with modest performance upgrades for flight on the NPOESS C1 spacecraft in 2013, followed by a new CERES follow-on sensor for flight in 2018 on the NPOESS C3 spacecraft.

While science goals remain unchanged for the long-term ERB Climate Data Record, it is now understood that the task of achieving these goals is more difficult for two reasons. The first is an increased understanding of the dynamics of the Earth/atmosphere system which demonstrates that rigorous separation of natural variability from anthropogenic change on decadal time scales requires higher accuracy and stability than originally envisioned. Secondly, future implementation scenarios involve less redundancy in flight hardware (1 vs. 2 orbits and operational sensors) resulting in higher risk of loss of continuity and reduced number of independent observations to characterize performance of individual sensors. Although EOS CERES CDR's realize a factor of 2 to 4 improvement in accuracy and stability over previous ERBE CDR's, future sensors will require an additional factor of 2 improvement to answer rigorously the science questions moving forward. Modest investments, defined through the CERES Science Team's 30-year operational history of the EOS CERES sensors, in onboard calibration hardware and pre-flight calibration and test program will ensure meeting these goals while reducing costs in re-processing scientific datasets.

The CERES FM-5 pre-flight radiometric characterization program benefited from the 30-year operational experience of the CERES EOS sensors, as well as a stronger emphasis of radiometric characterization in the Statement of Work with the sensor provider. Improvements to the pre-flight program included increased spectral, spatial, and temporal sampling under vacuum conditions as well as additional tests to characterize the primary and transfer standards in the

calibration facility. Future work will include collaboration with NIST to further enhance the understanding of the radiometric performance of this equipment prior to flight. The current effort summarizes these improvements to the CERES FM-5 pre-flight sensor characterization program , as well as modifications to inflight calibration procedures and operational tasking. In addition, an estimate of the impacts to the system level accuracy and traceability is presented.