

An Overview of NASA EOS MODIS Instrument On-orbit Operation, Calibration, and Performance

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Moderate Resolution Imaging Spectroradiometer (MODIS) is a key instrument for NASA's Earth Observing System (EOS), currently operated onboard the Terra spacecraft launched in December 1999 and Aqua spacecraft launched in May 2002. MODIS was developed based on the desire of a broad science community to extend and enhance a number of heritage sensors' long-term data records with improved spectral, spatial, and temporal resolutions, and, in particular, with more stringent on-orbit calibration requirements. It makes observations in 36 spectral bands covering wavelengths from visible (VIS) to long-wave infrared (LWIR) at three spatial nadir resolutions (250m, 500m, and 1000m) and a complete global coverage in less than two days. Terra and Aqua MODIS together have produced more than 10 years of global data sets that have been extensively used by scientists worldwide for their studies of the Earth system of land, oceans, and atmosphere. In order to maintain on-orbit calibration and science data product quality, MODIS was built and operated with one of the most comprehensive on-board calibrators (OBCs) even flown on a remote sensing instrument, including a solar diffuser (SD), a solar diffuser stability monitor (SDSM), a blackbody (BB), a deep space view (SV) port, and a spectro-radiometric calibration assembly (SRCA). In this paper we provide a brief description of MODIS on-orbit calibration activities, including monthly lunar observations implemented to track sensors' radiometric stability for the VIS and near infrared (NIR) spectral bands. We present both Terra and Aqua MODIS on-orbit performance in radiometric, spatial, and spectral calibration and characterization using multi-year observations made by their on-board calibrators. We illustrate sensors' short-term stability and long-term response trending and compare sensors' pre-launch design characteristics, initial at-launch and current on-orbit performance.