CGMSXXX USA-WP-26
Agenda Item: II.4
Discussed in WG-2

Report on Monitoring Procedures and Practices for Satellite Data

Summary and Purpose of Document

A summary of monitoring procedures and practices in response to Action 29.31

Action Requested: None

CGMSXXX USA-WP-26

REPORT ON MONITORING PROCEDURES AND PRACTICES FOR SATELLITE DATA

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The monitoring of instrument performance and calibration takes place in the three main phases of instrument life: pre-launch testing, performed primarily by the instrument manufacturer; post-launch checkout, carried out cooperatively by NOAA and NASA; continuing on-orbit operations, carried out by NOAA.

Pre-launch testing

1. Test the instrument to verify that it meets specifications, e.g., noise, relative (line-to-line, detector-to-detector) accuracy, spectral response functions, pointing accuracy, etc. Determine the quadratic coefficients of the radiometric calibration equations. Transfer the calibration of the laboratory blackbody (secondary calibration standard) to the instruments' internal calibration targets. This work is done by the instrument manufacturer and verified by NASA and NOAA.
2. Determine the calibration coefficients of all channels.
3. At NOAA, generate and validate calibration databases. Also, validate the compatibility between the data stream from the new instrument and the ground-system processing by playing taped thermal/vacuum test data through the system.
4. At NOAA, examine and validate the instruments' spectral response functions obtained from the instrument manufacturer, derive coefficients/tables for computing radiance from temperature and vice versa, and put this information on the calibration web site.

Post-Launch Checkout

1. Determine the noise levels in visible and infrared channels, and for the GOES instruments only, evaluate related properties such as coherent noise, 1/f noise in Imager channels, and impulsive noise events in the visible channel and infrared channel 2 (3.8□m) of the Imager.
2. Determine that the calibration slopes and intercepts are realistic and consistent with pre-launch values.
3. Evaluate the relative accuracy (e.g. line-to-line, detector-to-detector) in the infrared channels using uniform targets like space and ocean.
4. For the GOES instruments, evaluate image striping and banding in infrared channels and decide if additional processing algorithms available in the ground system (such as filtering of the calibration coefficients) need to be implemented.
5. For the GOES instruments, evaluate the visible-channel image striping and compute normalization look-up tables (NLUTs). (The visible-channels are not calibrated in orbit. Artificial stripes in the images are removed in the normalized process.)
6. For the GOES instruments, determine the east-west variation of scan-mirror emissivity as a function of time from measurements on space above the north pole and below the south pole. (Both the Imager and the Sounder exhibit a variation in scan-mirror emissivity along the east-west scan direction. To account for this effect during normal operations, the calibration equation is formulated to include the radiative transfer at the scan mirror. This requires knowledge of the scan mirror emissivity as a function of east-west position, which is derived from the measurements of space.)

On-Orbit Operations

1. Monitor instrument performance such as noise level, space-count level, blackbody count level, electronic calibration parameters, and calibration coefficients. Time trends of these quantities have been compiled and archived ever since launch.

2. Monitor the diurnal/seasonal variation of instrument temperatures of components that affect calibration, such as the blackbody, scan mirror, telescope mirrors and baffles. Time trends of these temperatures have been compiled and archived ever since launch.
3. Monitor the diurnal/seasonal variation of the responsivity in the infrared channels. If there is a loss of responsivity (or increase in noise), decide what measures (such as outgassing) may be required to regain optimal radiometric performance. Time trends of the responsivities have been compiled and archived ever since launch. The figure below shows an example of such monitoring for the responsivity of one of the detectors of channel 8 of the GOES-8 sounder. Time trends are displayed for periods of four different durations.
4. Determine the long-term degradation of the responsivities in visible channels with observations of desert targets. For GOES instruments, also use observations of stars for this purpose.
5. For the GOES instruments, determine the variation in time of the east-west difference of the scan-mirror emissivity. To do this, NOAA uses measurements on space above the north pole and below the south pole obtained during the periodic east-west station-keeping maneuvers.