CGMS

CGMS-39, CMA-WP-12
Prepared by CMA
Agenda Item: G.II/8
Discussed in WGII

Inter-calibration and Validation of FY-3B ERM Scanner

Summary of the Working Paper.

This working paper describes the validation result of FY-3B /ERM scanner comparing with the Aqua/CERES FM3 data. The radiative response of ERM showed remarkable change shortly after launch of FY-3B and became stable since January 2011. The ERM shortwave channel suddenly degraded in mid July 2011 and without response to earth targets. Comparison with CERES shows an average bias about 2.67 and 5.72w/m^{2}str for ERM total channel at night time and daytime, and -2.46 w/m^{2}str for ERM SW channel at daytime.

Inter-calibration and Validation of FY-3B ERM Scanner

1. Introduction

The Earth Radiation Measurement (ERM) on FY-3B, which was launched Nov. 5th, 2010, started observation on Nov.12th 2010. To validate the calibration of ERM instrument we have done two things, (1) monitoring the radiative response of two ERM boardband channels with the data from the internal calibration source (ICS), and (2) comparing the measurements of same earth target between Aqua/CERES FM3 instrument and the FY-3B/ERM.

2. Internal Calibration and Validation of ERM

2.1 Stability of ERM internal calibration

The internal calibration module (ICM) was used to transfer the ground radiation reference to ERM and monitor the variations of the ERM sensors' radiative response. The ERM internal calibration module (ICM) includes a lamp, which is used to calibrate the short wave (SW) channel, and a blackbody for the total (TOT) channel. The internal calibration of ERM is made once a day. We compare the internal calibration data with those obtained from ground calibration, and to check the variation of ERM sensor's response. Fig. 1 and 2 shows the change in ERM SW and TOT channels from November 2010 to July 2011. We find that response of the two channels have remarkable change after the launch, and become stable from January 2011. The radiative response of TOT channel changes 0.9% according to the ground calibration, and the SW channel changes about 3.5%. A noticeable jump in the internal calibration data the middle of June 2011 caused 1.5% change in TOT channel and 5% in SW channel. The TOT channel is more sensitive to the thermal change of blackbody and has larger variation than the SW channel. The SW channel has a sudden degradation since mid July 2011 and has no response to earth targets since 10 Aug, 2011.

2.2 Comparison with Aqua CERES

With the Simltaneous Nadir Overpass (SNO) method, the filtered radiance of FY-3B/ERM scanner from the earth targets was spectrally corrected to the unfiltered radiance based on radiative transfer simulation, in order to reduce the impact of spectral response difference between FY-3B/ERM and Aqua/CERES. The unfiltered radiance data from TOT channel at night and SW channel at day time are compared

with those from Aqua/CERES FM3. In fig.3 and 4 we see that the radiance of TOT channel at night, the earth emitted long-wave radiance from ERM is larger than the CERES; the SW radiance at daytime from ERM, the earth reflected radiance, was lower than the CERES. The average bias between ERM and CERES is about 2.67 and 5.72w/m^{2}str for TOT channel day and night, -2.46 w/m^{2}str for SW channel at daytime. The time lapse and space gap in observations of the two instruments may contribute to the differences; Further validation work shall be implemented next.

3. Conclusion

The FY-3B earth radiation budget instrument, ERM, is validated with the internal calibration and comparison with CERES. The radiative response of FY-3B/ERM had a large change shortly after launch and became stable from January 2011. The SW channel suddenly degraded to zero after an anomaly jump in mid June 2011. Comparison with Aqua/CERES FM3 data showed 2.67 and 5.72w/m^{2}str difference for TOT channel at night time and daytime, and -2.46 w/m^{2}str for SW channel at daytime.

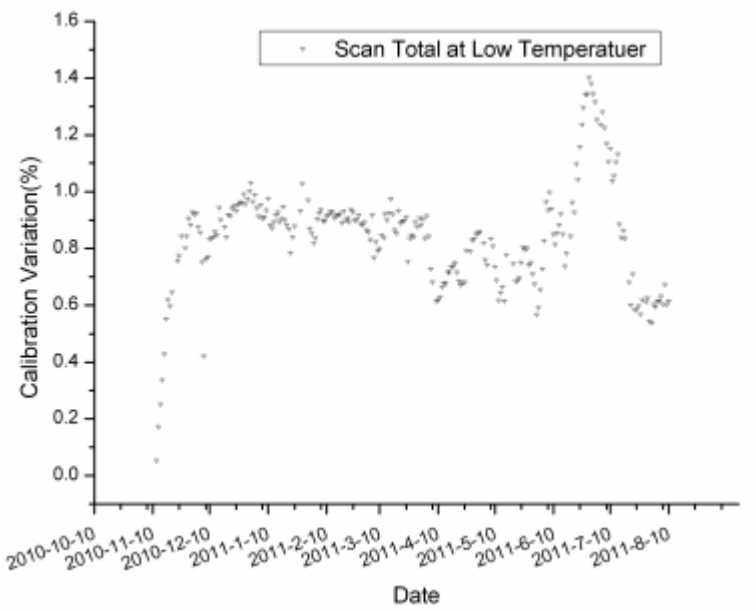

Fig.1 The Radiometric Stabilityof FY-3B ERM TOT channel
(Determined with the internal calibration data normalized to ground calibration)

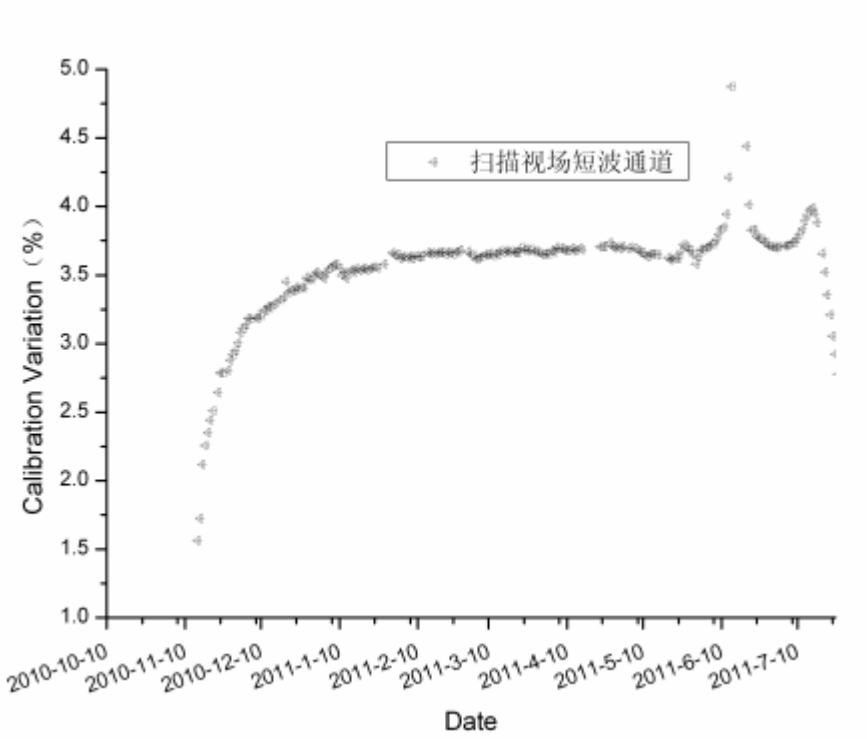

Fig.2 The Radiometric Stabilityof FY-3B ERM SW channel

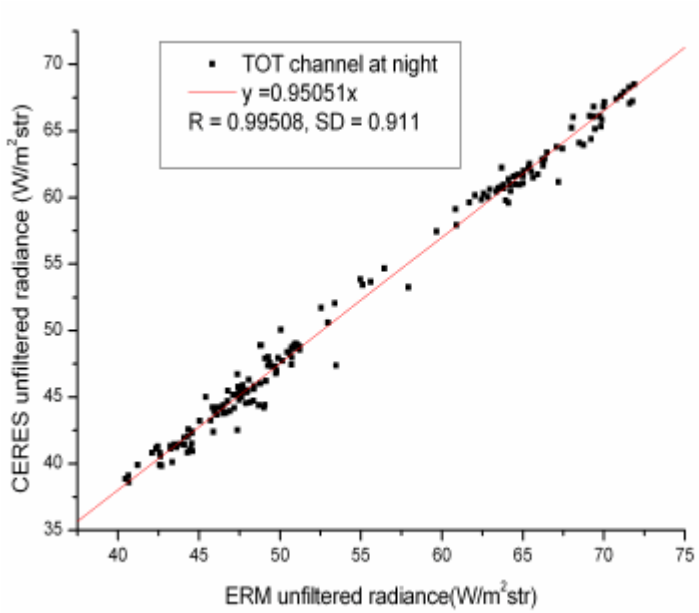

Fig.3 The comparison between FY-3B/ERM and Aqua/CERES FM3 for TOT channel at night time

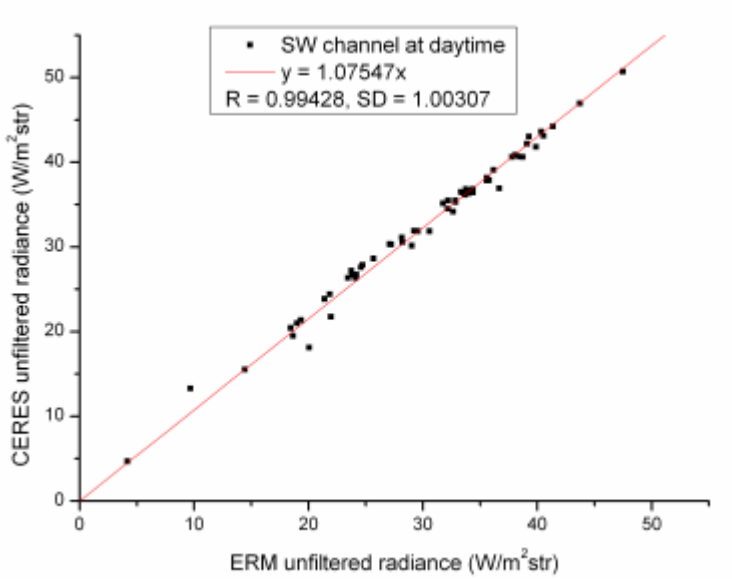

Fig.4 The comparison between FY-3B/ERM and Aqua/CERES FM3 for SW channel at daytime