

Comparisons of in-orbit radiometric calibration results between the field measurement and the onboard blackbody methods of FY-3A VIRR split-window channels

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Abstract: On May 27th, 2008, FY-3A meteorological satellite was launched successfully at Taiyuan Satellite Launch Center of China. FY-3 (Feng Yun 3) is the second generation of Chinese polar orbiting meteorological satellites, which are the follow-on to the FY-1 series. The three-axis stabilized satellites feature on solar panel and carried on 12 payloads: VIRR (Visible and Infrared Radiometer), IRAS (Infrared Atmospheric Sounder), MWTS (Microwave Temperature Sounder), MWHS (Microwave Humidity Sounder), MERSI (Medium Resolution Spectral Imager), SBUS (Solar Backscattering UV Sounder), TOU (Total Ozone Unit), MWRI (Microwave Radiation Imager), ASI (Atmospheric Sounding Interferometer), ERM (Earth Radiation Measurement), SEM (Space Environment Monitor) and SIM (Solar Irradiation Monitor). VIRR is an instrument heritage from Multi-channel Visible and Infrared Scanning Radiometer (MVISR, 10 channels) onboard FY-1C/D satellites. Actually this 10-channel radiometer will make operational observations from FY-3A. For risk reduction purpose, this instrument will remain the same as the MVISR during the FY-3A. There are two thermal infrared channels on VIRR, 10.3~11.3 μm and 11.5~12.5 μm .

In the autumn of 2008, series field experimentations were carried out at Qinghai Lake Calibration Site of China toward the in-orbit test of FY-3A and the radiometric calibration of FY-1D, FY-2C, FY-3A, CBERS-02, NOAA-16/17 and TERRA/AQUA MODIS thermal infrared channels. There are 7 times water surface observations carried out synchronized with satellite observation, on day and night at Sep. 3^d and 8th, day at Sep. 5th, 7th and 12th. BOMEM MR154 FT-Spectroradiometer was used to measure the water surface radiate spectrum. With this measured radiance, real time sounding balloon data, channel response curves and other ancillary data, the at-pupil channel radiance was simulated by MODTRAN 4.0. On the other way, high accuracy onboard blackbodies can be used to calibrate the VIRR data per scan.

This paper was compared in-orbit absolute radiometric calibration results between the field measurement and the onboard blackbody methods of FY-3A VIRR split-window channels. The results showed that some uncertainties were existed in the onboard blackbody calibration method and influenced the TOA temperatures difference between split-window channels. The difference value was 0.1756K at Qinghai Lake surface. It is too small for the later satellite productions processing. However, using the field measurement data to calibrate the VIRR thermal channels, this difference value can be reached 2.4265K at Qinghai Lake surface.

Key words: FY-3A VIRR, radiometric calibration, split-window channels, thermal infrared