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Introduction of FY-4B instruments and Results of post-launch calibration and Testing

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FY-4B satellite was launched successfully on June 3, 2021, which is the second one of China's second-generation geostationary satellites titled FengYun-4. It was designed to be the first operational satellite of the FY-4 series, and was successfully located at 123.5°E on June 10, 2021, and then located at 133°E on April 11, 2022. The primary payloads onboard FY-4B are Advanced Geostationary Radiation Imager (AGRI), Geostationary Interferometric Infrared Sounder (GIIRS), and Geosynchronous High-speed Imager (GHI).

Compared with FY-4A, a new water vapor channel is added, four channels' band settings are optimized, and the resolution of the short wave and the medium wave is improved to 2km in FY-4B/AGRI. Based on post-launch Calibration and Validation, the SNR of the reflection channel and the sensitivity of the IR channel have met the specification. The radiometric calibration bias has met the specification of 0.7K in IR bands, while 5% in VIS/NIR bands.

FY-4B/GIIRS is an infrared Fourier transform spectrometer based on a Michelson interferometer. It measures the hyperspectral atmospheric upwelling infrared radiance in the two spectral bands: the long-wave IR (LWIR) band from 680 to 1130 cm-1, and the mid-wave IR (MWIR) band from 1650 to 2250 cm-1. With low instrument noise, high spectral resolution, and thousands of spectral channels, the radiance spectra provide critical high vertical resolution information to retrieve the atmosphere's structure of temperature and water vapor in retrieval algorithms and numerical weather prediction (NWP) models and also supply extensive information about trace gases, surface and cloud properties for climate research. Based on post-launch Calibration and Validation, The noise performance specifications have been met with LWIR NEdR<0.5 and MWIR NEdR<0.1 mW/m2/sr/cm-1. The spectral calibration accuracy has met the specification of 7 ppm in both bands. The radiometric calibration bias is about 1K in both bands.

The Geosynchronous High-speed Imager(GHI) is the experimental instrument imaging the Earth with 7 different spectral bands covering 6 visible/near-infrared (VNIR) bands and 1 infrared (IR) band. The results from the post-launch test show that the GHI IR images mean brightness temperature (Tb) bias with respect to Metop-B/IASI of less than 0.7K. The GHI VNIR radiometric calibration has a mean reflectance difference to SNPP/VIIRS of less than 5% for all the 6 VNIR bands except for B01 (the panchromatic band), which has a large spectral mismatch with respect to all VNIR bands of VIIRS. Also, the GHI VNIR radiometric calibration has a mean reflectance difference to FY-4B/AGRI of less than 5% for all 6 VNIR bands. Validations and investigations are still ongoing to improve the GHI imagery and data quality.

On June 1, 2022, FY-4B as well as its ground application system officially started pre-operation. From this day on, it will provide observation data and services to the global community.

Keywords: Fengyun-4B; AGRI; GIIRS; GHI; calibration; post-launch testing