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**FY-4A/GIIRS Temperature Validation in Winter and Application in Cold
Wave Monitoring**

Suling REN, Jianying JIANG, Xiang FANG, Hui LIU, and Zhiqiang CAO
National Satellite Meteorological Center (NSMC), China Meteorological Administration(CMA)

In order to improve the operational application ability of the FY-4A new sounding dataset, in this paper, validation of the FY-4A Geosynchronous Interferometric Infrared Sounder (FY-4A /GIIRS) temperature was carried out using the balloon sounding temperature from meteorological sounding stations. More than 350,000 samples were obtained through time–space matching, and the results show that the FY-4A/GIIRS temperature mean bias (MB) is 0.07°C , the mean absolute error (MAE) is 1.80°C , the root-mean-square error (RMSE) is 2.546°C , and the correlation coefficient (RR) is 0.95. The FY-4A/GIIRS temperature error is relatively larger in the upper and lower troposphere, and relatively smaller in the middle troposphere; that is, the temperature at 500 hPa is better than that at 850 hPa. The temporal variation is smaller in the upper and middle troposphere than in the lower troposphere. The reconstruction of missing data of FY-4A/GIIRS temperature in cloudy areas is also carried out and the results are evaluated. The spatial distribution of reconstructed FY-4A/GIIRS temperature and ERA5 reanalysis data is consistent and completely retains the minimum temperature center with high precision of FY-4A/GIIRS. There are more detailed characteristics of intensity and position at the cold center than that of the reanalysis data. Therefore, an operational satellite retrieval temperature product with time–space continuity and high accuracy is formed. The reconstructed FY-4A/GIIRS temperature is used to monitor a strong cold wave event in November 2021. The results show that the product effectively monitors the movement and intensity of cold air activities, and it also has good indication for the phase transition of rain and snow triggered by cold wave.