

**Introduction** The Haiyang-1C (HY-1C) satellite was launched in September 2018, operated by the National Ocean Satellite Application Center (NSOAS) of China. HY-1C satellite is the successor satellite for HY-1A and HY-1B, with the greater measurement accuracy of global ocean color parameters and sea surface temperature (SST). The Chinese Ocean Color and Temperature Scanner (COCTS) on board the HY-C has 2 thermal infrared bands centered near 11  $\mu\text{m}$  and 12  $\mu\text{m}$  used for measuring SST, with a spatial resolution of 1.1 km at nadir. The accurate and stable calibration of satellite is the foundation for deriving geophysical and atmospheric parameters with high quality. The Infrared Atmospheric Sounding Interferometer (IASI) is the main payload on board MetOp series satellites. Owing to its hyperspectral nature and high-quality measurements, IASI has been used as the inter-calibration reference in many studies. To evaluate the calibration accuracy of HY-1C COCTS infrared channels, the inter-calibration of the COCTS with IASI is carried out in this study.

## Inter-calibration method

The IASI spectral radiances with a fixed spectral binning of  $0.25 \text{ cm}^{-1}$  are convolved with COCTS spectral response functions (SRF) of 11  $\mu\text{m}$  and 12  $\mu\text{m}$  channels. COCTS and IASI-convolved radiance are projected to equal-angle maps in the global region with the grid size of  $0.12^\circ$ . All the COCTS pixels located in the same projected grid are averaged and the local standard deviation in one grid are also recorded for the following filtering of matchups. In addition, in order to reduce the uncertainty causing from the atmospheric path difference between COCTS and IASI observation, the difference in the secant of satellite zenith angles between COCTS and IASI are controlled lower than 0.03.

Considering the spatial resolution at nadir of COCTS and IASI observations are 1.1 km and 12 km, respectively. Thus, the homogeneity of COCTS pixels in each matched IASI instantaneous fields of view (IFOV) will affect the uncertainties of matchups. We used the relative standard deviation of COCTS pixels in collocated  $0.12^\circ \times 0.12^\circ$  grid to quantify the uniformity. Figure 1 (a) and (b) show the variations of COCTS 11  $\mu\text{m}$  and 12  $\mu\text{m}$  channels minus IASI BT difference against the relative standard deviation of COCTS radiance in collocated region, respectively. It is obvious that the uncertainties of COCTS minus IASI BT differences increase with the increasing of relative standard deviations. We set the relative standard deviations for COCTS 11  $\mu\text{m}$  and 12  $\mu\text{m}$  channel of 0.01 as the thresholds of uniform region, shown as the black vertical lines in figure 1. The total number of filtered matchups is 44862 in December 2018, which are utilized for the following comparison.

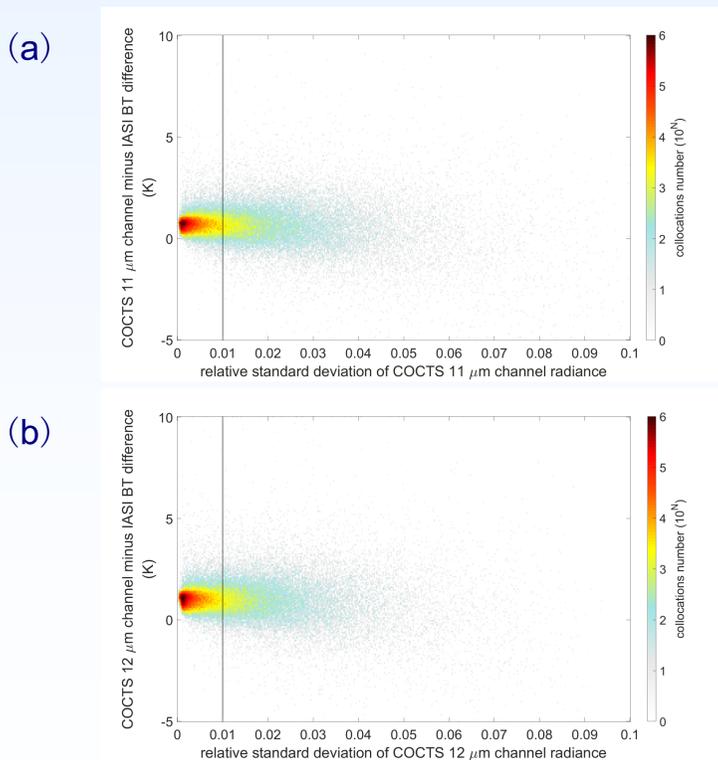


Figure 1. The variations of COCTS 11  $\mu\text{m}$  (a) and 12  $\mu\text{m}$  (b) channel minus IASI BT difference against the relative standard deviation of COCTS pixels in collocated region

## Comparison results

The HY-1C COCTS 11  $\mu\text{m}$  and 12  $\mu\text{m}$  BTs are compared with IASI based on the filtered matchups. The statistic results indicate the mean differences of COCTS 11  $\mu\text{m}$  and 12  $\mu\text{m}$  BTs with IASI are 2.61 K and 3.06 K, with the corresponding standard deviations of 0.59 K and 0.61K, respectively. The dependences of BT differences on IASI BTs and total column water vapor (TCWV) are also analyzed. Figure 2 (a) and (b) are the variations of COCTS 11  $\mu\text{m}$  and 12  $\mu\text{m}$  BTs minus IASI differences against IASI BT. Figure 3 (a) and (b) are the variations of COCTS 11  $\mu\text{m}$  and 12  $\mu\text{m}$  BTs minus IASI differences against TCWV. The TCWV data are provided from ECMWF ERA-interim. There are apparent dependences of BT differences on IASI BTs, indicating that the HY-1C COCTS calibration accuracy need to be improved. But the dependences on TCWV are not significant, only appearing in the lower TCWV regions. Error analysis of COCTS infrared calibration will be investigated using long-time data, and the inter-calibration coefficients will be obtained based on the relationship of COCTS BTs with IASI in the future study.

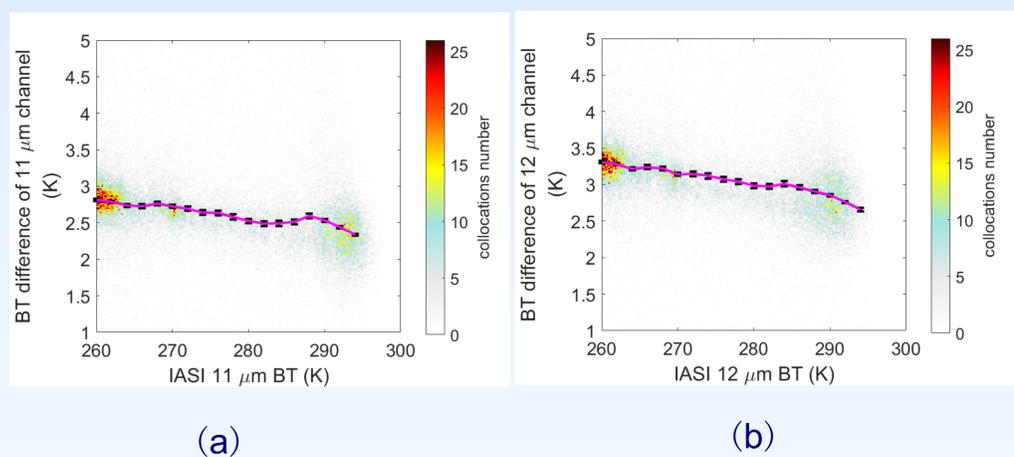


Figure 2. The variations of COCTS 11  $\mu\text{m}$  (a) and 12  $\mu\text{m}$  (b) BTs minus IASI differences against IASI BT

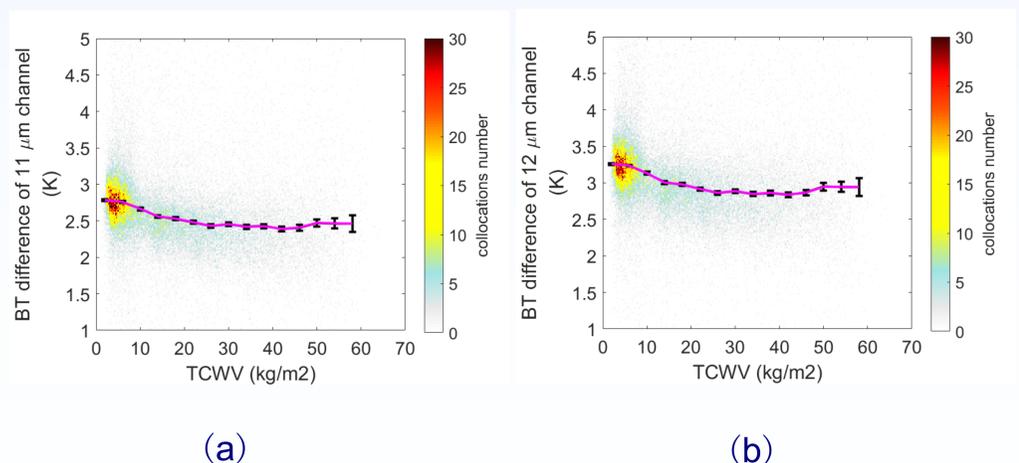


Figure 3. The variations of COCTS 11  $\mu\text{m}$  (a) and 12  $\mu\text{m}$  (b) BTs minus IASI differences against TCWV