Scientific findings from observations of GOSAT/TANSO–FTS TIR band

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Greenhouse Gases Observing Satellite (GOSAT) has continued its observations of greenhouse gases for more than 10 years since its launch on 23 January 2009. The thermal infrared (TIR) band of the Thermal and Near Infrared Sensor for Carbon Observation (TANSO)–Fourier Transform Spectrometer (FTS) on board GOSAT has observed concentrations of CO_2, CH_4 and other greenhouse gases in several atmospheric layers. In the latest TANSO–FTS TIR Level 2 retrieval algorithm, Version 1 (V1), ozone, water vapor, and temperature have been retrieved as by-products of the CO_2 and CH_4 products (Saitoh et al., 2016). We have already evaluated the data quality of the TANSO–FTS TIR V1 CO_2 and CH_4 products (Saitoh et al., 2016, 2017; Holl et al., 2016; Zou et al., 2016; Olsen et al., 2017). We applied the evaluated bias-correction values to the TANSO–FTS TIR V1 CO_2 data and compared variations in concentrations of the TIR CO_2 data with those of Measurement Of Pollution In The Troposphere (MOPITT) CO data [Deeter et al., 2014] in upper troposphere over the northern Africa. The comparison result showed that both TANSO–FTS TIR CO_2 and MOPITT CO concentrations became larger there almost at the same time in March through May, which suggests air mass with high CO and CO_2 emitted due to biomass burning was transported to upper atmosphere. As TANSO–FTS TIR V1 CH_4 profiles generally agreed with aircraft CH_4 profiles to within ~1% in the troposphere in low and middle latitudes, we analyzed seasonal variations in CH_4 concentrations in each altitude layer over India by using the TIR V1 CH_4 data. Our results were similar to the results reported in Chandra et al. (2017), but showed larger impact of CH_4 variations in lower troposphere on seasonal variations in XCH_4 concentrations. We have conducted validation analysis of TANSO–FTS TIR O_3 profiles simultaneously retrieved with the TIR V1 CO_2 product using Atmospheric Chemistry Experiment (ACE)–FTS and ozonesonde data. Although there was slightly high bias in the TANSO–FTS TIR O_3 data in the lower troposphere in summer, they showed better agreements with ACE–FTS and ozonesonde data than their a priori data taken from MacPeters et al. (2007). The TANSO–FTS TIR O_3 data in the lowest retrieval layer (surface–857 hPa) showed clear enhancements in O_3 concentrations over Mainland China compared to eastern Japan, which could demonstrate the detectability of tropospheric pollutants by the TANSO–FTS TIR band.

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