Characteristics of Version 1.0 CO_2 data retrieved from TIR band of GOSAT/TANSO-FTS

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Greenhouse Gases Observing Satellite (GOSAT) was launched on 23 January 2009, and has continued to make global observations of greenhouse gases, including both nadir and off-nadir measurements, for more than seven years since its launch. Carbon dioxide (CO_2) concentrations in several atmospheric layers can be retrieved from radiance spectra of the thermal infrared (TIR) band of Thermal and Near-infrared Sensor for Carbon Observation Fourier Transform Spectrometer (TANSO-FTS) on board the GOSAT. We have analyzed the latest released version of the TIR Level 2 (L2) CO_2 product (Version 1.0). We compared TANSO-FTS TIR V1.0 CO_2 data and CO_2 data obtained in the Comprehensive Observation Network for TRace gases by AIrLiner (CONTRAIL) project. The comparisons over several airports showed that the TIR V1.0 CO_2 data had a 1-2% negative bias in the middle troposphere; the magnitude of the bias varied seasonally and regionally. The comparisons in the upper troposphere and lower stratosphere (UTLS), where the TIR band of TANSO-FTS is most sensitive to CO_2 concentrations, showed that the averages of the TIR upper atmospheric CO_2 data agreed well with the averages of the data obtained by the CONTRAIL Continuous CO_2 Measuring Experiment (CME) within 0.1% and 0.5% for all of the seasons in the Southern and Northern Hemisphere, respectively. The magnitude of bias in the TIR upper atmospheric CO_2 data did not have a clear longitudinal dependence. The comparison results for flights in northern low and middle latitudes showed that the agreement between TIR and CONTRAIL CO_2 data in the upper troposphere was worse in the spring and summer than in the fall and winter. The negative bias in northern middle latitudes made the maximum of TIR CO_2 concentrations lower than that of CONTRAIL CO_2 concentrations, which leads to underestimate the amplitude of CO_2 seasonal variation. CO_2 growth rate estimated from the TIR UTLS CO_2 data from 2010 to 2012 was slightly lower (-0.6 ppm) than that from the CONTRAIL level flight data during the same period, which increases the differences between TIR and CONTRAIL CO_2 concentrations in UTLS.

Keywords: satellite remote sensing, retrieval algorithm, validation analysis, CO2

