Comparisons of XCO2 data from SWIR and TIR bands of GOSAT/TANSO−FTS.

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Abstract:

This study has assessed the quality of CO2 data retrieved from the thermal infrared (TIR) band [Saitoh et al., 2016] of Thermal and Near−infrared Sensor for Carbon Observation−Fourier Transform Spectrometer on board Greenhouse Gases Observing Satellite (GOSAT) by comparing the column-averaged dry−air mole fractions (XCO2) calculated based on the TIR CO2 data with aircraft XCO2 data, XCO2 data from Nonhydrostatic Icosahedral Atmospheric Model−based Transport Model (NICAM−TM) [Niwa et al., 2011, 2012, 2017], and XCO2 data retrieved from the short−wave infrared (SWIR) band [Yoshida et al., 2011, 2013] of TANSO−FTS. Overall, TIR XCO2 data agreed with SWIR XCO2 data to within 1% on average over the ocean and the land except the Sahara in the Northern Hemisphere after applying TIR CO2 bias−correction values proposed by Saitoh et al. [2017]. In the Southern Hemisphere, TIR XCO2 data were slightly larger than SWIR and NICAM−TM XCO2 data, which suggests overcorrection of the negative biases in TIR CO2 data. In background regions without any strong CO2 sources like Hawaii, bias−corrected TIR XCO2 data agreed with SWIR XCO2 data to within 0.2% on average and showed much better agreement with NICAM−TM XCO2 data, which demonstrates a certain degree of consistency between CO2 measurements by the two bands. We have evaluated the consistency between the two bands through comparisons of bias−corrected TIR and SWIR XCO2 data with XCO2 data obtained in the Comprehensive Observation Network for TRace gases by AirLiner (CONTRAIL) project [Machida et al., 2008] by applying TIR and SWIR CO2 averaging kernel functions to the aircraft CO2 data over airports. The results showed that there were some disagreements among the three XCO2 data in some seasons and regions, which suggests the seasonal and regional dependence of quality of CO2 data from the two bands of TANSO−FTS.