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Possibility of retrieving atmospheric minor constituents from GOSAT/ TANSO-FTS TIR spectra

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The Greenhouse Gases Observing Satellite (GOSAT), which was developed by the National Institute for Environmental Studies (NIES), the Ministry of the Environment (MOE), and the Japan Aerospace Exploration Agency (JAXA) for global observations of greenhouse gases, was successfully launched from the Tanegashima Space Center in Japan on 23 January 2009. The satellite makes global observations, including both nadir and off-nadir measurements, of approximately 56,000 ground points every three days. It carries two sensors: the TANSO-FTS and the TANSO-Cloud and Aerosol Imager (CAI). The TANSO-FTS consists of four spectral bands: Band 1 (0.75-0.78 um), Band 2 (1.56-1.72 um), Band 3 (1.92-2.08 um), and Band 4 (5.5-14. 3 um). This study focuses on the Band 4. It is rather difficult to calibrate a Band 4 spectrum (L1B data) due to polarization effects, opacity of the dichroic mirrors of the Band 1-3, emissions from the inside of the optics, and so on. Therefore, an earlier version of Band 4 L1B data has an obvious bias judging from comparisons of Band 4 spectra with AIRS, IASI, and TES spectra.

We perform feasibility analysis for developing an optimal algorithm for retrieving atmospheric minor constituents such as O_3, N_2O, SO_2, HNO_3, and CFCs (HCFCs) from radiance spectra of the Band 4. We use absorption bands of 9.6-um for O_3, 7.8-um for N_2O, 11.1-11.8-um for HNO_3, 8.6-um for SO_2, and 10.8-12.0 um for CFCs (HCFCs). Our theoretical calculations for GOSAT measurements show that much information on stratospheric $O_3$is included in radiance spectra, but several channels have some information on tropospheric O_3; thus, using these channels can separate tropospheric column $O_3$from stratospheric O_3. Our simulations also suggest that it can be possible to retrieve N_2O below 200 hPa on relatively fine vertical grids judging from averaging kernel functions calculated at 7.8-um.

Keywords: atmospheric minor constituents, satellite remote sensing, retrieval algorithm