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CO2 and CH4 profiles retrieved 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 former is a Fourier transform spectrometer that measures near infrared and thermal infrared radiances. The latter is an imager to detect clouds and aerosols in the instantaneous field of view (IFOV) of the TANSO-FTS. 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 adopt maximum a posteriori (MAP) method based on the Bayesian theory [Rodgers, 2000] to retrieve $CO_2$and CH_4vertical profiles from 15-um band (700-800 cm^{-1}) [Saitoh et al., 2009] and 7.6-um band (1250-1300 cm^{-1}), respectively.

We have tested several methods to calibrate a Band 4 spectrum, and will show $CO_2$and CH_4 concentrations retrieved from the best-calibrated spectra. Our preliminary retrieval results suggest that the structure of retrieved CO_2profiles highly depends on the calibration methods. We will also discuss how meaningful CH_4profiles can be retrieved, on the basis of signal-to-noise ratios at around 7.6-um.

Keywords: greenhouse gas, satellite remote sensing, retrieval algorithm