Validation of GOSAT SWIR XCO_2 and XCH_4 retrieved by PPDF-S method

*Chisa Iwasaki[1], Sachiko Hayashida[2], Ryoichi Imasu[1], Tatsuya Yokota[3], Isamu Morino[3], Yukio Yoshida[3]

1.Atmosphere and Ocean Research Institute, The University of Tokyo, 2.Nara Women's University, 3.National Institute for Environmental Studies

We focused on column averaged dry air mole fraction of atmospheric CO_2 and CH_4 (XCO_2 and XCH_4, respectively) retrievals from Greenhouse gases Observing Satellite (GOSAT) measurements through the photon path length probability density function (PPDF-S) based retrieval method that simultaneously retrieves target gas abundance and PPDF parameters. This method is used for an effective retrieval algorithm even under high concentration of clouds and aerosols. First, we validated PPDF-S XCO_2 and XCH_4 retrievals by comparing them with ground-based observations provided by the Total Carbon Column Observing Network (TCCON) from June 2009 to May 2014. For comparison, we also validate retrievals through another algorithm using full physics (FP)-based retrieval method. PPDF-S and FP retrieval methods are different in way to account for light scattering effect. All these XCO_2 and XCH_4 retrievals are provided by the National Institute for Environmental Studies (NIES). PPDF-S retrievals have positive biases (0.47 ±2.11 ppm for XCO_2 and 0.76 ±15.49 ppb for XCH_4), on the other hand, FP retrievals have negative biases (-0.28 ±2.34 ppm for XCO_2 and -2.16 ±13.26 ppb for XCH_4). Next, we compare global maps of XCO_2 and XCH_4 mean value, standard deviation and number of data between PPDF-S and FP retrievals. Over the ocean, PPDF-S method can retrieve large number of data whose standard deviation is larger than FP method. These PPDF-S retrievals over the ocean include data which are eliminated in post-screening process for FP method to exclude data that are strongly affected by clouds and aerosol.

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