GOSAT series product validation with TCCON, Sky radiometer and lidar data

*TRIEU THI NGOC TRAN[1], Isamu Morino[1], Osamu Uchino[1], Yukitomo Tsutsumi[1], Tetsu Sakai[2], Tomohiro Nagai[2], Akihiro Yamazaki[2], Hiroshi Okumura[3], Kouhei Arai[3], Ben Liley[4]

1. National Institute for Environmental Studies (NIES), Tsukuba, Japan, 2. Meteorological Research Institute, Japan Meteorological Agency, Tsukuba, Japan, 3. Graduate school of Science and Engineering, Saga University, Saga, Japan, 4. National Institute of Water and Atmospheric Research, Lauder, New Zealand

Data from the Total Carbon Column Observing Network (TCCON) are the primary validation source for the column averaged dry air mole fraction XCO_2 and XCH_4 deduced from GOSAT. In addition, aerosol optical thickness, Angstrom exponent, and single scattering albedo, all obtained from sky radiometer measurements, and vertical profiles of aerosols and thin cirrus clouds from lidar observations are important for fully validating XCO_2 and XCH_4 retrievals.

In this presentation, we investigate influences of aerosols and clouds on GOSAT XCO_2 and XCH_4 data at three TCCON sites: Tsukuba, Saga, and Lauder. At these sites, both sky radiometer and lidar have been also operating. The match up was performed with a ±0.1˚ latitude/longitude rectangular area of each TCCON site and within 30 minutes of the GOSAT overpass time. The results showed that the bias and standard deviation were largest at Lauder (-0.99 ±1.91 [ppm] and -5.33 ±11.13 [ppb] for XCO_2 and XCH_4 , respectively). The bias and standard deviation at Tsukuba and Saga were 0.25 ±1.73 [ppm] and 0.24 ± 1.83 [ppm] for XCO_2 and -0.79 ±9.44 [ppb] and 7.19 ±8.17 [ppb] for XCH_4, respectively.

Both XCO_2 and XCH_4 differences between GOSAT and TCCON at Lauder were negatively correlated with AOT at 500 nm. In contrast, at Saga and Tsukuba the difference of XCO_2 only negatively correlated with AOT at 500 nm. AOT at 500 nm was largest especially in Spring at Saga (0.87) and Tsukuba (0.54). AOT at 500 nm of Lauder was smallest (0.15) among the three sites. The single scattering albedo at 500 nm at Tsukuba varied from 0.75 to 1.0 and from 0.67 to 1.0 at Saga and Lauder. The differences in XCO_2 and XCH_4 between GOSAT and TCCON had no relationship with the Angstrom exponents, which varied site by site. The causes for these findings will be discussed in the presentation. Preliminary results of vertical profiles of aerosols and/or clouds at Lauder will be also shown.

Keywords: GOSAT data, Validation, Sky radiometer

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