

Comparison of CO₂ column concentrations calculated from GOSAT SWIR and balloon-borne CO₂ instrument measurements

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The Greenhouse gases observing satellite (GOSAT), launched on January 23, 2009, has monitored atmospheric carbon dioxide (CO₂) and methane (CH₄) globally from space. The objectives are to understand the global distribution of CO₂ and CH₄, and the causes of their variability with seasons, years and locations. The Thermal And Near infrared Sensor for carbon Observation-Fourier Transform Spectrometer (TANSO-FTS) onboard GOSAT has two detectable regions; Short-Wavelength Infrared (SWIR) and Thermal Infrared (TIR). TANSO-FTS observe sunlight reflected from the earth's surface in SWIR region and radiation emitted from the ground and atmosphere in TIR region. The global distribution of column-averaged dry air mole fractions of CO₂ (XCO₂) and CO₂ profile, called as GOSAT products, are retrieved from SWIR spectra and TIR spectra, respectively. It is essential to validate GOSAT in order to clarify the uncertainty of GOSAT products intended to get higher precision for use to find out the CO₂ sources and sinks and to assess its impact on climate change.

In this study, we compared the XCO₂ derived from GOSAT and calculated from an originally developed balloon-borne CO₂ instrument (CO₂ sonde) which can measure CO₂ vertical profile up to the altitude of 10 km. XCO₂ calculated from the CO₂ sonde were extrapolated CO₂ mixing ratio provided from Nakazawa et al, Tohoku University.

Four CO₂ sonde data observed in 13:00-14:00 at three sites synchronized with GOSAT overpass were used for comparison; January 7, 2011 at Ichihara, January 31, 2011 at Moriya, June 30, 2012 at Moriya, and July 30, 2012 at Shirako.

As a result, in the comparison to the observations of CO₂ sonde in 2011 at Ichihara and Moriya, we report that there is roughly agreement taking account to the bias of GOSAT L2 product (V.2.XX) -1.20 ± 1.97 ppm which is temporary value reported by Morino et al¹⁾. In the comparison of XCO₂ from GOSAT and the observations of CO₂ sonde in 2012 at Moriya and Shirako, it was found that the distance between the site of CO₂ sonde launched and the point observed by GOSAT made difference 0.3-4.1 ppm. In the Future, we plan to observe the CO₂ at various locations to contribute validation of GOSAT products by using the CO₂ sonde.

¹⁾ Morino et al, 2012: GOSAT TANSO-FTS SWIR products retrieved from improved algorithm and its validation analysis, The 18th Symposium on Atmospheric Chemistry, A-2-13 (in Japanese abstract).

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