

Validation of BESD-SCIAMACHY and SWIR-GOSAT satellite data of XCO₂ using TCCON data

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So far, long-term datasets of greenhouse gases have been obtained by multiple satellite observations. However, data acquired with different satellite sensors may have a difference in both spatial and time resolution as well as in its data quality. In this research, we validated two different satellite observation data of XCO₂ by using the same ground observation data of Total Carbon Column Observing Network (TCCON). Here, the missing values in the satellite observations was interpolated by multi-B spline interpolation method.

One dataset used in this study was the level 2 data of XCO₂ from March 2003 to March 2012, which was acquired based on the monthly Bremen Optimal Estimation DOAS (BESD) algorithm by the Scanning Imaging Absorption spectrometer for Atmospheric Chartography (SCIAMACHY) sensor, a spectrometer for atmospheric measurement of the ENVISAT (Environmental Satellite) satellite by the European Space Agency (ESA). The other dataset was the level 2 of XCO₂ from April 2009 to February 2016 acquired by the FTS / Short Wave Infrared (SWIR) sensor of the Greenhouse gases Observing Satellite (GOSAT) satellite by Japan Aerospace Exploration Agency (JAXA). The validation data was the ground observations at 27 sites of TCCON.

As a result, we found that the ground observation data of TCCON has a good consistency with XCO₂ trends observed by both SCIAMACHY and GOSAT. The comparison result at 16 sites showed that the average value of the correlation coefficient (R^2) between TCCON data and SCIAMACHY data was 0.71. On the other hand, the comparison result at 27 sites showed that the average value of R^2 between TCCON data and GOSAT data was 0.74. From these results, we come to a conclusion that the XCO₂ data observed by the two satellites showed a good correlation with the ground observations of TCCON. Additionally, we found that the annual fluctuation of the XCO₂ concentration at each site has a remarkable increase trend, namely, the annual increase of the XCO₂ concentration was between 1.479 and 2.045 (ppm / yr.), and the mean value of the annual increase at 27 observation sites of TCCON was 1.888 (ppm / yr.).

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