4-P03 Comparison of GOSAT-2 XCO2 and an independent inversion analysis

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Abstract

GOSAT-2, designed to monitor the carbon budget, was launched in 2018 and has been accumulating observation data continuously. Compared to the previous satellite GOSAT, this satellite increases the number of observation data by expanding the observable area using intelligent pointing, etc. We compared the latest XCO2 version 1.07 observed by GOSAT-2 with the JMA CO2 distribution, which is an independent inversion analysis using only in-situ observations. The satellite observation data and the JMA CO2 distribution were compared after taking monthly averages at 5-degree horizontal grid points. The comparison period is 2019-2020. The GOSAT-2 observable area has expanded compared to GOSAT, and the number of observation data per unit area has also increased. On the other hand, the differences from the independent analysis results, which were small in GOSAT (NIES SWIRL2Ver. 2.9X), became larger overall, and in many areas, there was a tendency toward overestimation compared to the analysis .

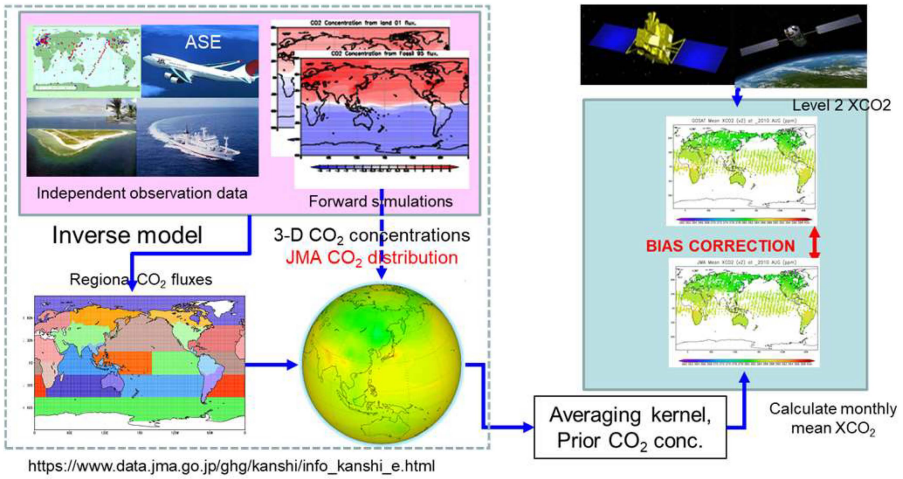

Figure1: Basic concept of our satellite bias correction system

Satellite Data bias estimation

We estimated the bias of GOSAT-2 SWIR L2 NIES Ver. 1.07 and GOSAT SWIR L2 Ver. 2.9. If there is no trend of bias, we could obtain spatial bias by averaging the difference between satellite data and JMA CO2 in the same month. We compare satellite monthly mean XCO2 and XCO2 by JMA-CO2 using averaging kernel etc., of each retrieval.

Inversion Settings (JMA CO2 distribution)

Table 1: Outline of our inversion settings.

Analysis Target	Monthly CO2 flux (1985 – 2020)
Inverse model	Bayesian Synthesis
Region Number	22 (TransCom 3)
Transport model	GSAM-TM (TL159L60)
Meteorology	JRA-55
Prior Flux	CDIAC, CASA, JMA Ocean
In-situ observation	WDCGG (-150 sites)

Summary and conclusion

- We constructed satellite bias estimation system making use of independent inversion analysis (JMA CO_2 distribution).
- GOSAT-2 has more observations than GOSAT in all seasons except for central South America.
- GOSAT-2 XCO2 has a larger difference from the independent inversion analysis near the terrestrial and observable limit area compared to GOSAT.
- The global mean (2019/4-2020/12) of the difference from the independent inversion analysis of GOSAT-2 (Ver. 1.07) is 2.48 ppm. The difference of GOSAT (Ver. 2.9; 2009/4-2020/12) is 0.25ppm.

Observation Number

The number of observations was evaluated based on the assumption that satellite observation data would be introduced into the inverse analysis. Figure 2 shows how many time-averaged values exist within a 5° grid of latitude and longitude during a month. The data are shown every three months to see the trend in each season. GOSAT-2 has more observed data than GOSAT in all seasons except for central South America. This is an advantage in carbon budget analysis, where observational constraints are important.

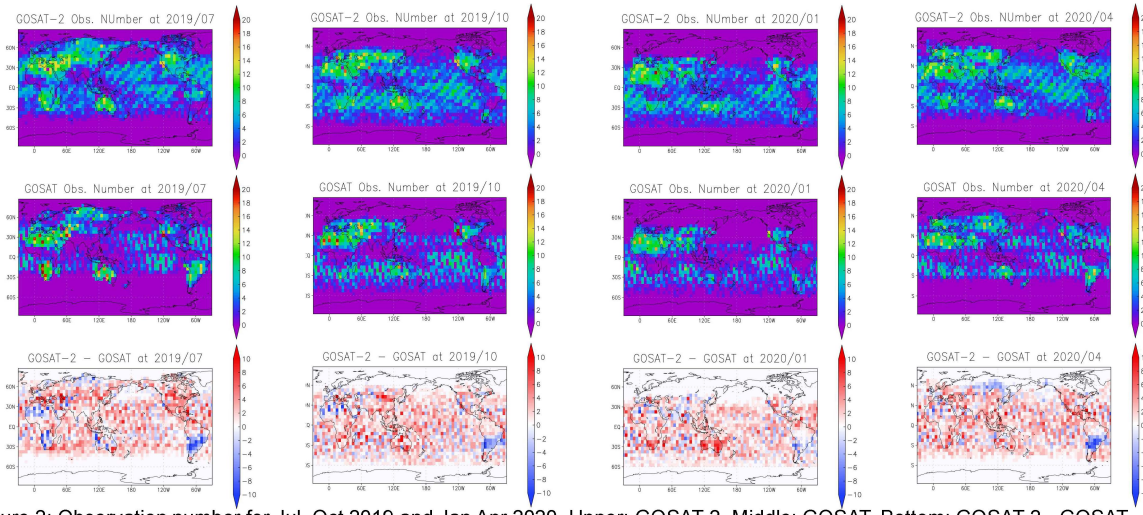

Figure 2: Observation number for Jul, Oct 2019 and Jan Apr 2020. Upper: GOSAT-2, Middle: GOSAT, Bottom: GOSAT-2 - GOSAT

Difference from independent inversion analysis

Figure 3 shows the differences between the independent analyses of the two satellites for each season. GOSAT-2 tends to show a larger difference compared to GOSAT. In particular, there are scattered grid points with high concentrations analyzed on land. In the oceans, a high area of about 5 ppm is spread around the southern limit of the observation limit. On the other hand, in the tropical land area, some grid points are lower than the independent analysis value by more than 5ppm.

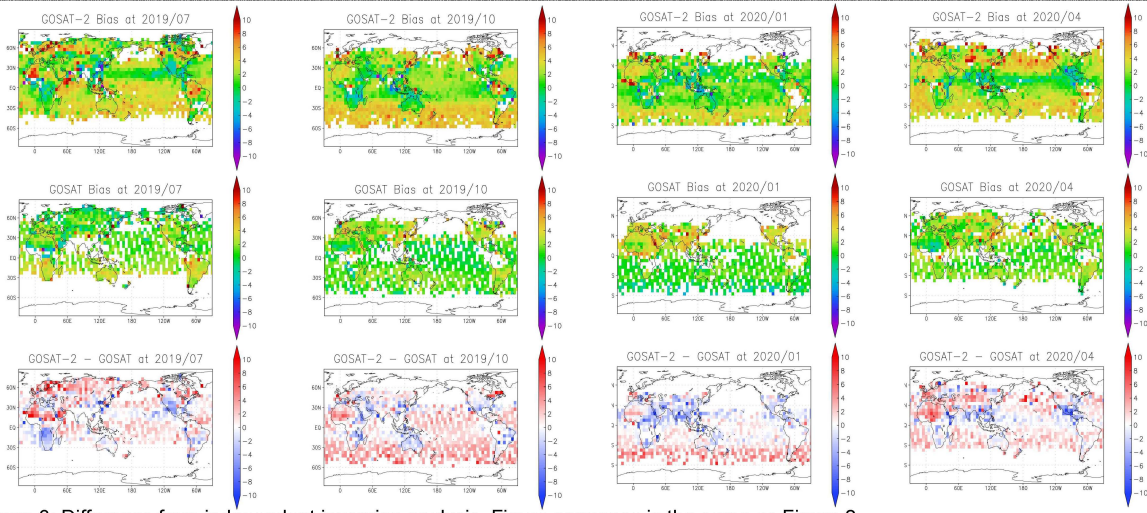

Figure 3: Difference from independent inversion analysis. Figure sequence is the same as Figure 2.

Acknowledgement

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