B5.7

Satellite Bias estimation by independent CO2 inversion Analysis

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Introduction

The satellite observation has advantages such as its wide observable area and spatial representation close to the model horizontal resolution. On the other hand, satellite observation has a critical issue of bias. This bias varies spatiotemporally. We need to properly evaluate and correct this bias in carbon cycle analysis.

Basic concept

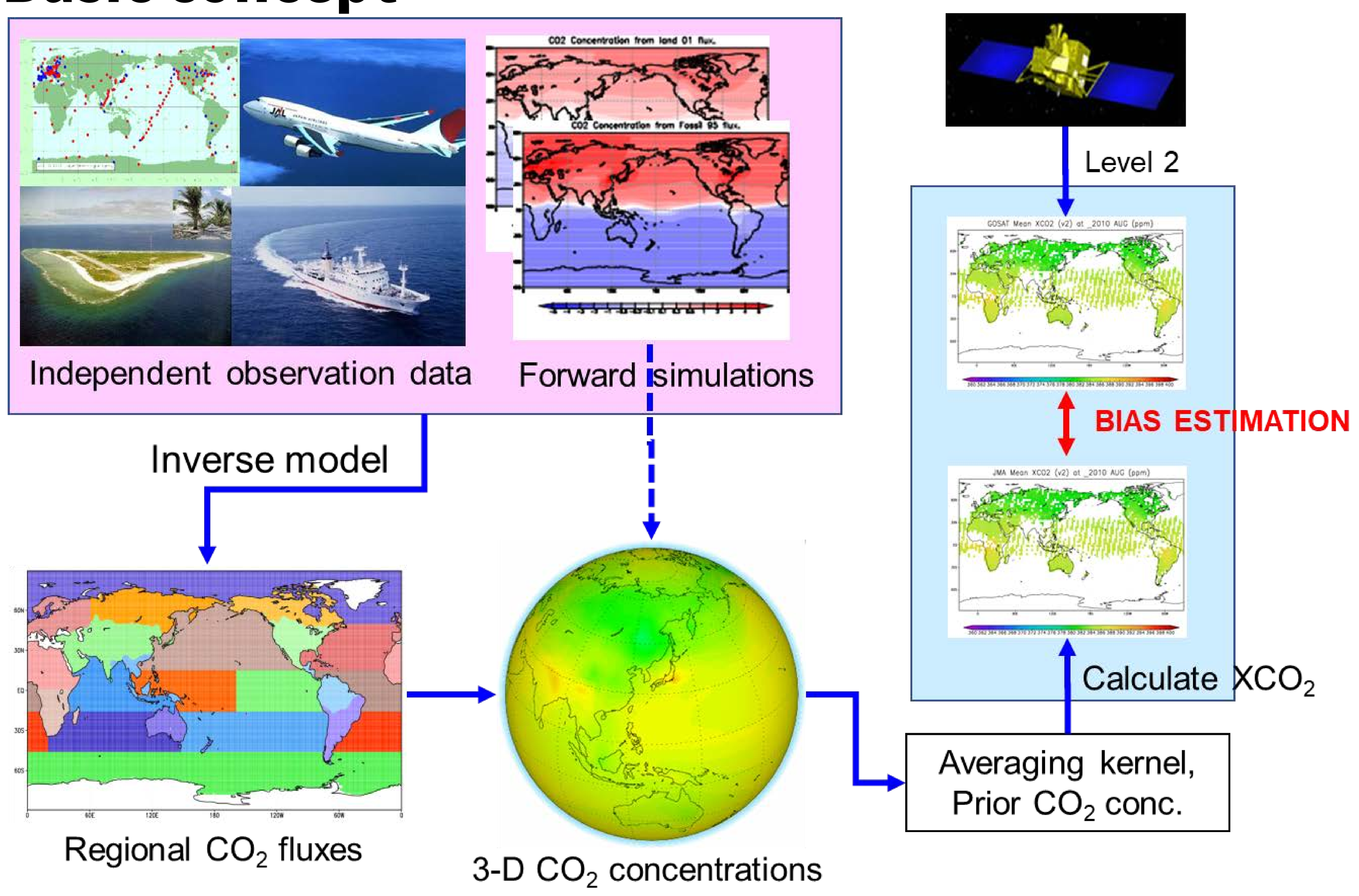


Figure 1: Concept of our satellite bias estimation

JMA CO2 distribution

	Description
Analysis Period	1985 - 2016
Temporal resolution	Monthly
Transport Model	GSAM-TM (on-line)
Meteorological Data	JRA-55
Horizontal resolution	TL96 (1.875 deg.)
Vertical resolution	60
Inverse model	Bayesian Synthesis (TransCom 3)
Number of regions	22 (TransCom 3)
Fossil fuel burning	CDIAC
Land Biosphere	CASA neutral
Ocean exchange	JMA analysis
Observation data	WDCGG (surface, ship, aircraft)

Table 1: Features of JMA CO2 distribution

Satellite BIAS estimation methods

We have developed satellite bias correction method by making use of JMA CO_2 distribution analysis (Maki et al. 2010). We compare satellite monthly mean XCO_2 and XCO_2 by JMA analysis using averaging kernel of each satellite. We have calculated averaged difference for each month in order to remove noise and extract the signal of satellite systematic bias for 8 years (2009 – 2016).

GOSAT BIAS distribution (NIES SWIR L2 Ver. 2.72)

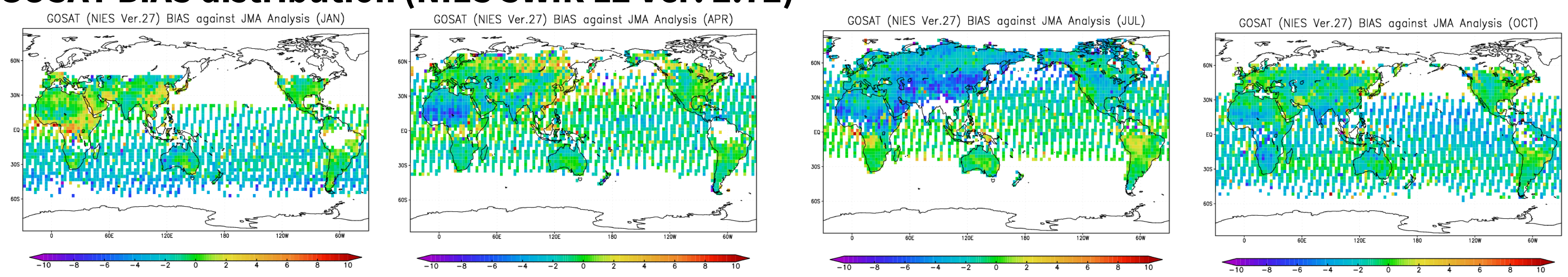
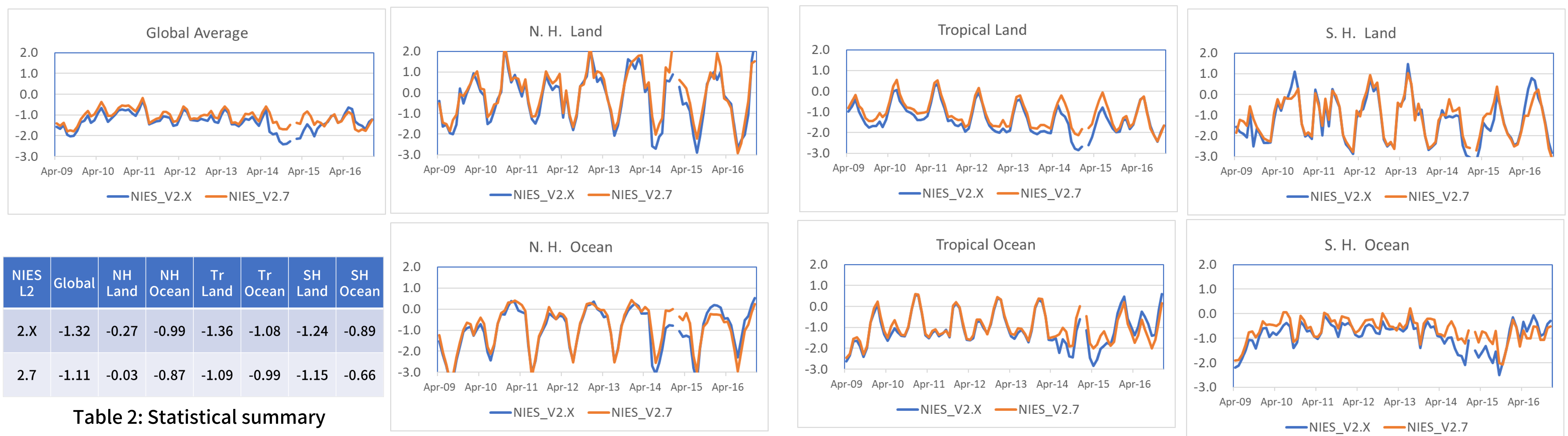


Figure 2: 8 years (2009 - 2016) averaged GOSAT SWIR L2 BIAS against JMA CO2 distribution (Jan. Apr. Jul. Oct.).



NIES L2	Global	NH Land	NH Ocean	Tr Land	Tr Ocean	SH Land	SH Ocean
2.X	-1.32	-0.27	-0.99	-1.36	-1.08	-1.24	-0.89
2.7	-1.11	-0.03	-0.87	-1.09	-0.99	-1.15	-0.66

Table 2: Statistical summary

Figure 3: The difference between GOSAT XCO2 and JMA CO2 distribution at each area.

Summary and conclusion

- We construct satellite (GOSAT, OCO-2) bias correction scheme making use of independent analysis (making use of JMA CO_2 distribution).
- The averaged GOSAT SWIR L2 XCO2 difference is -1.3ppm (Ver. 2.X) and -1.1ppm (Ver. 2.72) against JMA CO2 distribution.
- The difference of NIES Ver. 2.72 is significantly reduced from Jun. 2014 to Jul. 2015 comparing with that of NIES Ver. 2.X globally.
- The difference changes spatiotemporally. We should take care of these features when we try to use satellite observation data in carbon cycle analysis.

Future plans

- We compare our results with other analysis results and validate with independent observation.
- We make use of this satellite bias correction method to our inverse model system (JMA CO2 distribution).
- We make use of this bias corrected satellite data in our data assimilation system (LETKF).
- We estimate regional CO_2 flux with multiple satellite observation data (GOSAT, OCO-2, TanSat, etc.) by this bias correction method.

Acknowledgement

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