



ATMOS 2021

THE FUSION ALGORITHM OF XCO₂ PRODUCT

APPLIED TO GOSAT

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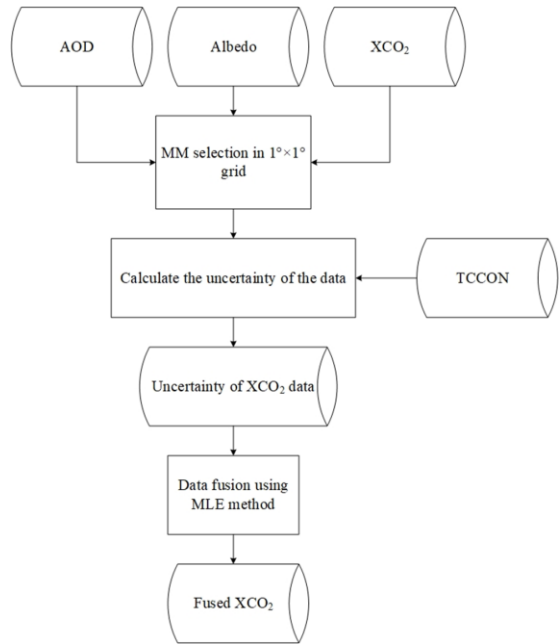
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25/11/2021

The Fusion Algorithm of XCO₂ Product Applied to GOSAT

In this study, we use the maximum likelihood estimation (MLE) method to fuse four GOSAT XCO₂ products. They are ACOS v9r, NIES v02.75, OCFP v7.0 and SRFP v2.3.8 from April 2009 to December 2015. The flowchart in Figure 1 shows the main steps for fusing GOSAT XCO₂ products using the MLE method.



$$XCO_{2i,j}^{fused} = \sum_{k=1}^N \left(\frac{UN_{i,j,k}^{-2}}{\sum_{k=1}^N UN_{i,j,k}^{-2}} * XCO_2 \right) \quad (1)$$

$$RMSE = \sqrt{\frac{\sum_{i=1}^N (x_i - x'_i)^2}{N}} \quad (2)$$

Uncertainty calculation and Fusion of XCO₂

Figure 1. Flowchart of GOSAT XCO₂ products' fusion by the MLE method. "MM" means mean method.



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With MLE method, the fusion data set of GOSAT XCO₂ was obtained from April 2009 to December 2015. Compared to the four individual GOSAT XCO₂ products, the fusion data set has the best coverage and a nice precision.

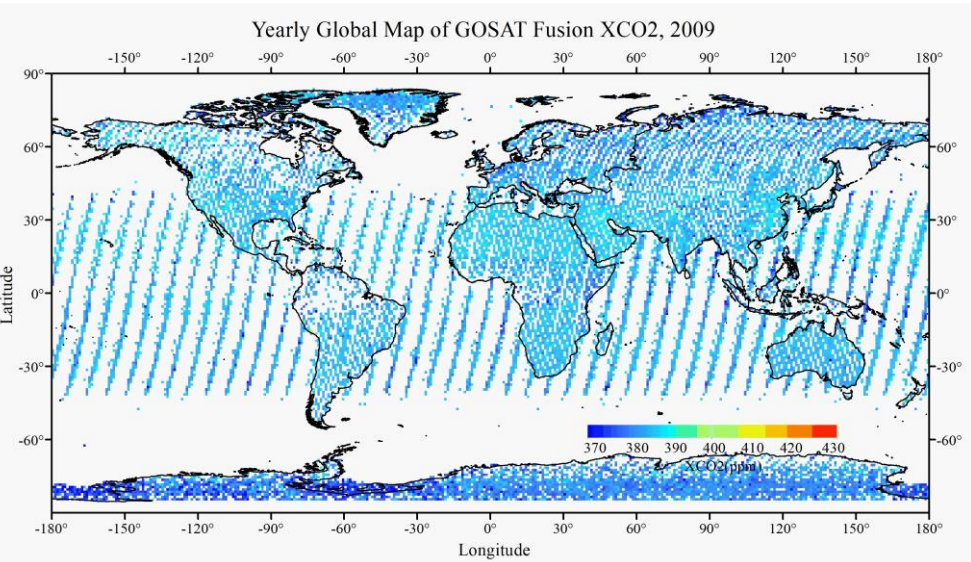


Figure 2. The yearly averaged GOSAT Fusion XCO₂ from 2009 to 2015.

Table 1. Validation results between four GOSAT products and TCCON

Product	N	R	RMSE	MAE	Coverage (Grids/day)
ACOS	2412	0.819	3.374	1.961	462.0
NIES	1395	0.933	1.641	1.271	126.5
OCFP	2153	0.841	2.915	1.973	339.5
SRFP	2140	0.703	4.367	2.77	332.3

Fusion XCO₂ coverage: **547.7**

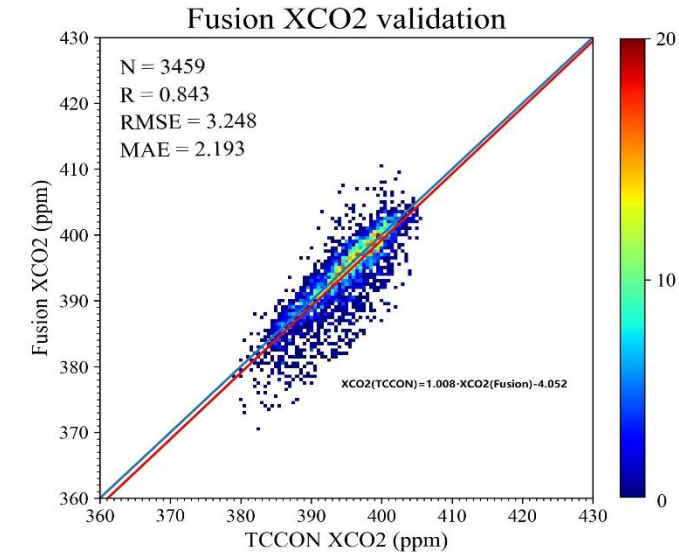


Figure 3. Scatterplot of fusion data set against TCCON data during the study period .