

Bias values used to calculate whole-atmosphere monthly mean CO₂ and CH₄ concentrations
derived from GOSAT observational data (January, 2023)

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The whole-atmosphere monthly mean CO₂ and CH₄ concentrations based on GOSAT observations are calculated from GOSAT FTS Level 2 products, that are column-averaged dry air mole fractions of CO₂ (XCO₂) and CH₄ (XCH₄). In the calculation, the biases found in these products need to be corrected.

Bias values of GOSAT FTS SWIR Level 2 Product (V02.90/V02.91) released in July / August 2020, which are used to calculate whole-atmosphere monthly mean CO₂ and CH₄ concentrations, are determined comparing with TCCON (Total Carbon Column Observing Network) data obtained at the corresponding sites around the world, and the bias values for XCO₂ and XCH₄ are listed in the Table 1 and 2 respectively. GOSAT H-gain data measured over land, within a ± 2 degree longitude/latitude grid around each TCCON site are matched up with TCCON data measured within ± 30 minutes of the GOSAT overpass time. The data obtained at TCCON and GOSAT observation points whose elevation differences are larger than 500 m are omitted. The latest version (GGG2020) of TCCON data processing software were used this time. The biases based on GGG2014 are also shown in Table 1 and 2 for your reference.

As sufficient TCCON data have not been collected to compare with GOSAT data in 2022 or later, the bias values defined for GOSAT data in 2021 will be applied to GOSAT data in 2022 or later tentatively. After sufficient TCCON data in 2022 or later are obtained and the necessary data processing is completed, the bias values will be reevaluated.

Table 1 Bias and Standard Deviation (SD) of XCO₂ in GOSAT FTS SWIR Level 2 Product (V02.90/V02.91)

GGG2014 Results as of June 2021														
Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Matchups	165	196	420	730	796	689	923	1000	955	1007	1104	746	-	-
SD (ppm)	1.65	1.65	2.14	1.99	2.29	2.30	2.04	1.98	2.10	2.08	2.11	2.04	-	-
Bias (ppm)	-0.89	-0.19	-0.31	-0.04	0.42	0.03	-0.22	-0.50	-0.63	-0.53	-0.82	-1.14	-	-
GGG2020 Results as of January 2023														
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Matchups	30	34	249	485	540	454	808	929	816	1026	1263	1382	1148	403
SD (ppm)	1.73	1.67	1.93	1.85	1.89	2.29	2.02	1.95	2.01	2.07	2.15	2.12	2.49	2.21
Bias (ppm)	-0.66	-0.36	-0.81	-0.31	-0.09	-0.34	-0.14	-0.58	-0.55	-0.61	-0.67	-0.58	-0.50	-1.14

Table 2 Bias and Standard Deviation (SD) of XCH₄ in GOSAT FTS SWIR Level 2 Product (V02.90/V02.91)

GGG2014 Results as of June 2021														
Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Matchups	167	198	421	730	796	692	926	1003	956	1008	1106	747	-	-
SD (ppb)	11.00	11.20	12.66	11.70	12.63	13.05	12.33	11.51	11.24	11.77	12.24	12.20	-	-
Bias (ppb)	-0.13	3.55	-2.39	-0.10	1.04	-1.69	-0.68	-2.44	-3.58	-4.30	-4.84	-3.31	-	-
GGG2020 Results as of January 2023														
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of Matchups	30	34	249	485	540	456	812	932	817	1027	1265	1383	1151	403
SD (ppb)	9.13	10.82	12.62	10.87	11.34	13.20	11.86	11.11	10.80	11.61	12.44	12.81	13.27	12.99
Bias (ppb)	5.25	4.20	0.18	4.52	5.24	4.15	5.97	3.47	2.44	1.85	2.23	4.53	2.99	3.00

Note: A negative bias indicates that the GOSAT concentration is lower than the corresponding TCCON concentration.