

# Supplementals for “Update on the GOSAT TANSO-FTS SWIR Level 2 retrieval algorithm”

## 1 Comparison results for the individual TCCON sites

The validation results of V02.90/91 and V03.00 against the individual TCCON measurements are shown below. The version of TCCON data is GGG2020. The match-up condition is  $\pm 2^\circ$  horizontally and  $\pm 30$  min temporally. The sum of N for the individual sites and N for total can be inconsistent because the total results contain only the nearest TCCON site data for each GOSAT observation.

**Table S1** Validation results for V02.90/91 over land with gain H

V02.90/91 (Land/H)	CO2			CH4		
Site	N	Bias (ppm)	SD (ppm)	N	Bias (ppb)	SD (ppb)
Bremen (br)	45	0.21	2.16	45	11.38	9.93
Brugos (bu)	33	0.85	2.71	33	13.57	10.97
Caltech (Pasadena) (ci)	2240	-0.90	1.83	2240	2.02	10.65
East Trout Lake (et)	4	-2.78	2.24	4	-1.53	10.13
Fourcorners (fc)	17	-0.45	1.76	17	2.04	13.62
Indianapolis (if)	34	-0.03	1.91	34	5.78	10.82
Izana (iz)	0			0		
JPL01 (jc)	0			0		
JPL02 (jf)	753	-0.39	1.92	753	3.02	11.65
Saga (js)	332	1.38	2.30	332	12.22	10.93
Karlsruhe (ka)	222	0.03	2.41	222	3.71	12.26
Lauder01 (lh)	5	-0.82	1.91	5	12.93	3.49
Lauder02 (ll)	221	-1.46	2.00	226	-0.57	11.24
Lauder03 (lr)	147	-2.18	1.67	149	-5.07	10.28
Manaus (ma)	0			0		
Nicosia (ni)	0			0		
Ny-Alesund (ny)	0			0		
Lamont (oc)	1397	-1.22	1.70	1397	0.93	12.17
Park Falls (pa)	230	-0.77	2.16	230	8.83	10.80
Paris (pr)	241	-0.95	2.12	241	-0.01	11.30
Reunion (ra)	0			0		
Rikubetsu (rj)	119	-0.02	2.07	119	8.79	10.59
Sodankyla (so)	51	-0.21	1.91	52	5.75	10.80
Tsukuba (tk)	859	0.57	2.11	859	4.30	10.91
Xianghe (xh)	598	0.02	2.50	598	4.76	14.33
Total	7357	-0.56	2.13	7365	2.97	11.94



**Table 2** Validation results for V02.90/91 over land with gain M

V02.90/91 (Land/M)	CO2			CH4		
	N	Bias (ppm)	SD (ppm)	N	Bias (ppb)	SD (ppb)
Bremen (br)	0			0		
Brugos (bu)	0			0		
Caltech (Pasadena) (ci)	1256	-0.78	1.88	1256	8.51	19.09
East Trout Lake (et)	0			0		
Fourcorners (fc)	0			0		
Indianapolis (if)	0			0		
Izana (iz)	0			0		
JPL01 (jc)	0			0		
JPL02 (jf)	195	-1.16	1.92	195	5.68	18.56
Saga (js)	0			0		
Karlsruhe (ka)	0			0		
Lauder01 (lh)	0			0		
Lauder02 (ll)	0			0		
Lauder03 (lr)	0			0		
Manaus (ma)	0			0		
Nicosia (ni)	0			0		
Ny-Alesund (ny)	0			0		
Lamont (oc)	0			0		
Park Falls (pa)	0			0		
Paris (pr)	0			0		
Reunion (ra)	0			0		
Rikubetsu (rj)	0			0		
Sodankyla (so)	0			0		
Tsukuba (tk)	0			0		
Xianghe (xh)	0			0		
Total	1385	-0.79	1.89	1385	8.13	19.17

**Table 3** Validation results for V02.90/91 over ocean with gain H

V02.90/91 (Ocean/H)	CO2			CH4		
Site	N	Bias (ppm)	SD (ppm)	N	Bias (ppb)	SD (ppb)
Bremen (br)	1	-0.19	0.00	1	-1.87	0.00
Brugos (bu)	39	-1.52	2.56	39	3.99	15.07
Caltech (Pasadena) (ci)	0			0		
East Trout Lake (et)	0			0		
Fourcorners (fc)	0			0		
Indianapolis (if)	0			0		
Izana (iz)	0			0		
JPL01 (jc)	0			0		
JPL02 (jf)	0			0		
Saga (js)	14	-0.05	2.31	14	16.91	11.59
Karlsruhe (ka)	0			0		
Lauder01 (lh)	0			0		
Lauder02 (ll)	0			0		
Lauder03 (lr)	0			0		
Manaus (ma)	0			0		
Nicosia (ni)	9	-2.74	2.62	9	5.78	18.26
Ny-Alesund (ny)	0			0		
Lamont (oc)	0			0		
Park Falls (pa)	0			0		
Paris (pr)	0			0		
Reunion (ra)	9	-3.62	1.34	9	-4.40	7.91
Rikubetsu (rj)	0			0		
Sodankyla (so)	0			0		
Tsukuba (tk)	0			0		
Xianghe( xh)	0			0		
Total	72	-1.63	2.62	72	5.60	15.43

**Table 4** Validation results for V03.00 over land with gain H

V03.00 (Land/H)	CO2			CH4		
Site	N	Bias (ppm)	SD (ppm)	N	Bias (ppb)	SD (ppb)
Bremen (br)	54	0.33	2.37	54	2.60	11.55
Brugos (bu)	77	1.27	2.36	77	2.02	7.89
Caltech (Pasadena) (ci)	2691	-1.24	1.83	2691	-7.09	10.49
East Trout Lake (et)	4	-1.38	1.74	4	1.52	8.67
Fourcorners (fc)	12	-0.97	1.24	12	-4.63	8.78
Indianapolis (if)	41	-0.39	1.99	41	-3.22	10.10
Izana (iz)	0			0		
JPL01 (jc)	0			0		
JPL02 (jf)	907	-0.81	1.93	907	-6.46	11.71
Saga (js)	398	1.12	2.50	398	3.60	12.17
Karlsruhe (ka)	295	0.03	2.44	295	-5.02	11.78
Lauder01 (lh)	5	-0.54	1.25	5	11.94	4.05
Lauder02 (ll)	226	-0.96	1.95	234	-6.49	10.54
Lauder03 (lr)	179	-1.53	1.58	181	-9.94	9.52
Manaus (ma)	3	1.36	0.69	3	-4.95	4.74
Nicosia (ni)	0			0		
Ny-Alesund (ny)	0			0		
Lamont (oc)	1618	-1.06	1.82	1618	-4.51	11.68
Park Falls (pa)	288	-0.89	2.25	288	0.61	11.61
Paris (pr)	321	-0.86	2.10	321	-7.23	11.47
Reunion (ra)	0			0		
Rikubetsu (rj)	152	-0.20	2.24	152	2.44	10.94
Sodankyla (so)	59	-0.17	2.01	59	-2.75	9.99
Tsukuba (tk)	1017	0.74	2.24	1017	-0.83	11.15
Xianghe (xh)	670	0.10	2.67	670	0.10	14.86
Total	8780	-0.61	2.20	8790	-4.23	11.97

**Table 5** Validation results for V03.00 over land with gain M

V03.00 (Land/M)	CO2			CH4		
Site	N	Bias (ppm)	SD (ppm)	N	Bias (ppb)	SD (ppb)
Bremen (br)	0			0		
Brugos (bu)	0			0		
Caltech (Pasadena) (ci)	1229	-0.90	1.94	1229	-0.11	19.01
East Trout Lake (et)	0			0		
Fourcorners (fc)	0			0		
Indianapolis (if)	0			0		
Izana (iz)	0			0		
JPL01 (jc)	0			0		
JPL02 (jf)	166	-0.94	2.18	166	-1.90	21.23
Saga (js)	0			0		
Karlsruhe (ka)	0			0		
Lauder01 (lh)	0			0		
Lauder02 (ll)	0			0		
Lauder03 (lr)	0			0		
Manaus (ma)	0			0		
Nicosia (ni)	0			0		
Ny-Alesund (ny)	0			0		
Lamont (oc)	0			0		
Park Falls (pa)	0			0		
Paris (pr)	0			0		
Reunion (ra)	0			0		
Rikubetsu (rj)	0			0		
Sodankyla (so)	0			0		
Tsukuba (tk)	0			0		
Xianghe (xh)	0			0		
Total	1360	-0.88	1.97	1360	-0.19	19.29

**Table 6** Validation results for V03.00 over ocean with gain H

V03.00 (Ocean/H)	CO2			CH4		
Site	N	Bias (ppm)	SD (ppm)	N	Bias (ppb)	SD (ppb)
Bremen (br)	1	-7.68	0.00	1	-16.87	0.00
Brugos (bu)	33	-7.80	3.00	33	-9.03	13.04
Caltech (Pasadena) (ci)	0			0		
East Trout Lake (et)	0			0		
Fourcorners (fc)	0			0		
Indianapolis (if)	0			0		
Izana (iz)	0			0		
JPL01 (jc)	0			0		
JPL02 (jf)	0			0		
Saga (js)	10	-7.72	2.05	10	-14.12	18.19
Karlsruhe (ka)	0			0		
Lauder01 (lh)	0			0		
Lauder02 (ll)	0			0		
Lauder03 (lr)	0			0		
Manaus (ma)	0			0		
Nicosia (ni)	10	-8.05	2.89	10	-3.72	16.25
Ny-Alesund (ny)	0			0		
Lamont (oc)	0			0		
Park Falls (pa)	0			0		
Paris (pr)	0			0		
Reunion (ra)	7	-10.36	1.69	7	-14.14	9.83
Rikubetsu (rj)	0			0		
Sodankyla (so)	0			0		
Tsukuba (tk)	0			0		
Xianghe (xh)	0			0		
Total	61	-8.12	2.81	61	-9.71	14.60