

1 **Supporting Information for**

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3 **Regional CO₂ Fluxes during 2010-2015 Inferred from GOSAT XCO₂**
4 **retrievals using a new version of Global Carbon Assimilation System**

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Table S1. The 28 layers for 3-D meteorological variables selected from ERA-Interim data set

Layers in MOZART	Layers in ERA-Interim	a [Pa]	b	pf [hPa]	Geopotential Altitude [m]
1	8	298.495789	0.000000	2.6664	40294.73
2	14	1094.834717	0.000000	9.8925	31127.02
3	17	2082.273926	0.000000	18.8146	26880.84
4	19	3196.421631	0.000000	28.8816	24094.12
5	21	4906.708496	0.000000	44.3350	21342.15
6	23	7306.631348	0.000000	66.6233	18755.37
7	24	8765.053711	0.000076	80.3968	17563.62
8	25	10376.126953	0.000461	95.9781	16440.20
9	27	13775.325195	0.005081	132.7577	14382.89
10	29	16819.474609	0.020678	177.1176	12554.62
11	31	19027.695313	0.051690	228.8387	10930.02
12	32	19755.109375	0.073534	257.3558	10175.26
13	34	20429.863281	0.130023	319.6307	8737.51
14	36	20097.402344	0.202476	388.2700	7395.38
15	38	18864.750000	0.288323	461.8996	6154.67
16	39	17961.357422	0.335155	500.0000	5574.58
17	41	15706.447266	0.433963	577.3754	4498.91
18	43	13043.218750	0.535710	654.2732	3539.96
19	44	11632.758789	0.586168	691.7515	3105.35
20	46	8802.356445	0.683269	763.2045	2327.04
21	48	6144.314941	0.771597	828.0468	1670.26
22	49	4941.778320	0.811253	857.3419	1387.12
23	50	3850.913330	0.847375	884.2660	1133.73
24	52	2063.779785	0.907884	930.3702	713.97
25	53	1385.912598	0.931940	949.3494	546.06
26	55	467.333588	0.967645	979.0633	288.55
27	57	65.889244	0.988270	998.3854	124.48
28	60	0.000000	1.000000	1012.0494	10.00

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Table S2. The meteorological variables selected from ERA-Interim data set

Variable	Full Name	Unit	Dimension
t	air temperature	K	3-D
q	specific humidity	kg/kg	3-D
u	U component of wind	m/s	3-D
v	V component of wind	m/s	3-D
CI	Sea ice cover		2-D
SP	Surface pressure	Pa	2-D
SD	Snow depth	m	2-D
SSHF	Surface sensible heat flux	W/m ² /s	2-D
U10M	10 metre U wind component	m/s	2-D
V10M	10 metre V wind component	m/s	2-D
T2M	2 metre temperature	K	2-D
D2M	2 metre dewpoint temperature	K	2-D
SSRD	Surface solar radiation downwards	W/m ² /s	2-D
STRD	Surface thermal radiation downwards	W/m ² /s	2-D
EWSS	East/West surface stress	N/m ² /s	2-D
NSSS	North/South surface stress	N/m ² /s	2-D
IE	Instantaneous moisture flux	kg/m ² /s	2-D

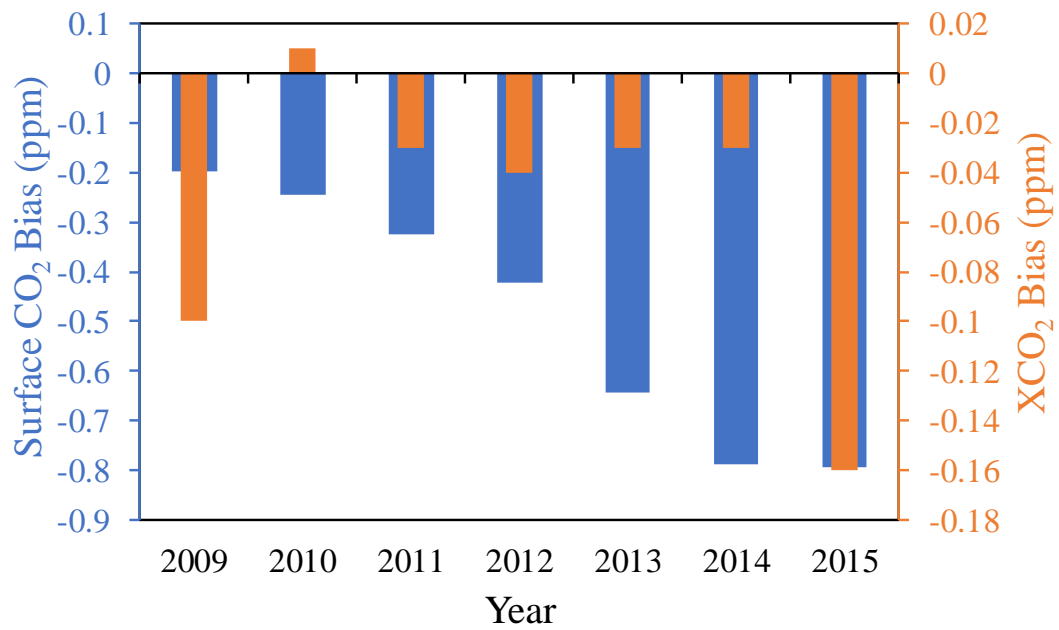
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36 **Table S3.** Statistical results for the prior and posterior CO₂ mixing ratios at the 52 flask sites

Site Code	Lat	Lon	BIAS (ppm)		RMSE (ppm)		CORR	
			Prior	Posterior	Prior	Posterior	Prior	Posterior
alt	82.45	297.49	2.01	-0.28	2.73	1.54	0.96	0.98
asc	-7.97	345.6	1.68	-0.35	1.86	0.72	0.98	0.99
ask	23.26	5.63	1.47	-0.88	1.8	1.13	0.98	0.99
azr	38.77	332.62	1.39	-1	2.46	1.94	0.91	0.94
bhd	-41.41	174.87	0.94	-0.93	1.53	1.45	0.96	0.97
bkt	-0.2	100.32	2.79	0.77	3.56	2.41	0.92	0.92
bmw	32.26	295.12	2.87	0.4	3.21	1.47	0.95	0.95
brw	71.32	203.39	1.78	-0.84	3.26	3.93	0.95	0.93
cba	55.21	197.28	0.84	-1.35	2.41	2.6	0.94	0.95
cgo	-40.68	144.69	1.25	-0.64	1.4	0.82	0.99	0.99
chr	1.7	202.85	1.75	-0.38	2.03	1.04	0.95	0.95
cib	41.81	355.07	0.72	-1.83	2.89	3.16	0.87	0.9
crz	-46.43	51.85	1.29	-0.52	1.41	0.71	0.99	1
dsi	20.7	116.73	2.97	1.17	3.67	2.4	0.93	0.94
eic	-27.16	250.57	1.66	-0.35	1.91	1.07	0.98	0.98

gmi	13.39	144.66	1.77	-0.3	2.13	1.25	0.96	0.96
hba	-75.61	333.79	1.54	-0.35	1.64	0.59	0.99	1
hpb	47.8	11.02	1.92	0.06	3.42	3.27	0.93	0.91
hsu	41.02	235.45	1.19	0.51	3.6	3.13	0.9	0.87
hun	46.95	16.65	1.89	0.33	3.58	4.34	0.96	0.91
izo	28.31	343.5	1.82	-0.52	2.18	1.05	0.96	0.98
key	25.67	279.84	1.93	-0.45	2.44	1.29	0.94	0.96
kum	19.52	205.18	1.28	-0.93	2.05	1.66	0.94	0.96
lln	23.47	120.87	2.36	0.28	3.13	2.04	0.91	0.92
lmp	35.52	12.62	2.45	-0.03	3.28	1.85	0.92	0.94
mex	18.98	262.69	2.43	0.16	2.84	1.25	0.94	0.96
mhd	53.33	350.1	1.84	-0.62	2.63	1.54	0.95	0.98
mid	28.21	182.62	1.93	-0.26	2.55	1.34	0.94	0.96
mlo	19.54	204.42	1.52	-0.69	1.83	1.08	0.97	0.98
nat	-5.8	324.81	1.49	-0.73	1.85	1.28	0.95	0.96
nmb	-23.58	15.03	0.67	-1.14	1.22	1.44	0.96	0.98
nwr	40.05	254.41	1.27	-0.89	2.16	1.77	0.93	0.95
oxk	50.03	11.81	0.88	-1.21	3.06	3.2	0.9	0.9
pal	67.97	24.12	1.38	-0.85	2.76	2.96	0.96	0.95
psa	-64.92	296	1.41	-0.45	1.56	0.74	0.99	0.99
rpb	13.16	300.57	1.63	-0.7	1.92	0.97	0.97	0.99
sey	-4.68	55.53	1.62	-0.31	1.82	0.75	0.98	0.99
sgp	36.61	262.51	1.18	-1.5	2.97	4.09	0.87	0.82
shm	52.71	174.13	1.1	-0.96	2.75	2.43	0.94	0.96
smo	-14.25	189.44	1.7	-0.44	1.81	0.73	0.99	0.99
spo	-89.98	335.2	1.52	-0.34	1.61	0.53	0.99	1
sum	72.6	321.58	2.03	-0.28	2.71	1.47	0.96	0.98
syo	-69.01	39.59	1.51	-0.37	1.6	0.57	0.99	1
tap	36.74	126.13	2.11	0.61	3.42	3.47	0.92	0.87
thd	41.05	235.85	-0.39	-1.43	2.48	2.73	0.91	0.9
tik	71.6	128.89	1.85	-0.65	3.1	2.69	0.95	0.96
ush	-54.85	291.69	0.97	-0.17	1.19	0.81	0.93	0.86
uta	39.9	246.28	2.06	-0.01	2.81	1.9	0.92	0.92
uum	44.45	111.1	0.98	-1.09	3.03	3.44	0.91	0.9
wis	29.97	35.06	1.51	-0.83	2.82	2.19	0.91	0.93
wlg	36.29	100.9	1.24	-0.96	2.39	2.33	0.93	0.93
zep	78.91	11.89	2.33	-0.05	3	1.78	0.96	0.97



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40 **Figure S1.** Interannual variations of the global mean biases of simulated surface CO₂ and

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XCO₂ concentrations

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