

Supplement of

Global carbon budgets estimated from atmospheric O₂/N₂ and CO₂ observations in the western Pacific region over a 15-year period

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Supplementary materials

Table S1: Annual averages of the atmospheric CO₂, O₂/N₂, and APO for HAT.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
1998	366.27	0.10	22	-23.5	0.9	21	50.7	1.0	21
1999	370.15	0.21	25	-61.5	1.4	24	31.7	0.9	25
2000	370.32	0.17	79	-65.4	1.7	78	30.0	1.3	78
2001	371.98	0.17	107	-89.2	1.2	102	13.7	0.9	103
2002	373.55	0.13	100	-112.6	1.2	92	-0.3	0.9	92
2003	376.49	0.17	105	-133.4	1.2	105	-5.7	0.7	105
2004	378.86	0.15	113	-154.5	1.0	112	-14.7	0.7	112
2005	380.44	0.15	111	-165.9	1.3	112	-17.1	0.7	111
2006	382.84	0.16	108	-189.7	1.2	108	-28.6	0.8	108
2007	385.15	0.16	107	-210.0	1.1	107	-36.9	0.6	108
2008	387.45	0.20	108	-232.2	1.2	107	-46.4	0.6	108
2009	388.34	0.21	109	-248.5	1.2	106	-58.3	0.8	109
2010	390.68	0.18	105	-269.3	1.4	104	-66.6	0.7	106
2011	393.43	0.18	112	-296.2	1.1	111	-80.0	0.6	112
2012	395.12	0.22	111	-314.6	1.3	108	-87.4	0.7	112
2013	398.02	0.17	105	-342.7	1.1	105	-101.8	0.6	106
2014	400.43	0.20	108	-365.6	1.4	108	-112.1	0.7	109
2015	402.51	0.23	105	-383.6	1.4	104	-119.7	0.7	106
2016	405.49	0.23	104	-409.6	1.4	106	-129.7	0.6	105
2017	407.92	0.20	110	-438.7	1.4	111	-146.4	0.7	113

Table S2: Same as Table S1 but for COI.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
2000	370.52	0.26	103	-58.3	1.9	97	36.0	1.4	102
2001	372.83	0.22	108	-87.0	1.5	105	22.2	1.3	105
2002	373.49	0.18	112	-107.7	1.3	113	3.7	1.1	113
2003	376.49	0.19	114	-126.9	1.3	114	0.8	1.2	114
2004	379.14	0.16	111	-148.0	1.2	109	-6.2	0.9	110
2005	380.50	0.25	100	-157.9	1.5	99	-8.7	1.1	97
2006	382.81	0.19	99	-188.4	1.6	99	-26.0	1.1	100
2007	384.98	0.25	98	-203.3	1.4	96	-32.5	1.1	98
2008	386.72	0.21	101	-225.0	1.4	98	-42.5	1.1	102
2009	388.55	0.21	101	-244.8	1.4	101	-53.7	0.9	101
2010	389.62	0.19	99	-257.7	1.3	97	-60.5	1.0	101
2011	393.45	0.25	99	-288.3	1.8	95	-69.6	1.3	98
2012	395.06	0.22	97	-306.0	1.4	94	-79.3	1.0	99
2013	397.95	0.20	103	-332.3	1.5	102	-91.7	1.0	102
2014	399.80	0.27	99	-352.8	1.6	97	-103.1	1.2	100
2015	401.97	0.24	98	-374.7	1.7	98	-112.9	1.3	101
2016	404.20	0.22	99	-397.2	1.2	95	-123.6	0.9	99
2017	408.18	0.22	99	-430.0	1.6	94	-136.8	1.2	100

Table S3: Same as Table S1 but for shipboard data of 20-30°N.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
2003	376.15	0.32	14	-127.2	2.5	14	-1.2	1.6	14
2004	378.64	0.36	16	-142.1	2.8	16	-3.1	1.4	16
2005	380.32	0.42	13	-154.4	3.4	13	-6.6	1.9	13
2006	382.87	0.23	16	-180.6	2.7	16	-19.4	1.6	16
2007	384.58	0.20	7	-205.5	2.4	7	-35.0	1.4	7
2008	386.52	0.36	14	-221.9	2.4	14	-41.5	1.6	14
2009	387.28	0.30	14	-234.7	1.3	14	-50.2	0.8	14
2010	390.21	0.18	17	-258.5	1.4	17	-58.7	1.1	17
2011	393.26	0.29	13	-286.5	1.9	13	-70.7	0.8	13
2012	394.64	0.21	13	-304.7	1.0	13	-81.6	1.2	13
2013	397.69	0.38	19	-328.0	2.3	19	-89.0	1.1	19
2014	399.92	0.28	15	-355.5	2.6	15	-104.7	1.3	15
2015	401.42	0.37	20	-372.1	2.0	20	-113.4	1.0	20
2016	404.76	0.29	19	-400.1	3.0	19	-123.8	1.9	19
2017	407.90	0.34	29	-430.0	2.4	28	-141.0	1.4	29

Table S4: Same as Table S1 but for shipboard data of 10 -20°N.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
2003	375.53	0.14	21	-123.0	2.7	21	-0.3	2.4	21
2004	377.65	0.09	30	-132.6	1.3	30	1.3	1.2	30
2005	379.18	0.09	27	-146.2	1.2	27	-4.3	1.0	27
2006	381.86	0.12	23	-175.5	1.3	23	-19.6	1.0	23
2007	383.59	0.16	13	-203.4	1.9	13	-38.3	1.2	13
2008	385.08	0.11	33	-209.0	1.4	33	-36.1	0.9	33
2009	386.67	0.06	30	-228.5	1.0	30	-47.3	1.0	30
2010	389.28	0.08	30	-253.4	1.0	30	-58.5	0.9	30
2011	391.04	0.10	33	-272.6	1.4	33	-68.4	1.0	33
2012	393.51	0.15	30	-301.5	1.5	30	-84.3	0.9	30
2013	395.77	0.08	28	-321.9	1.4	28	-92.8	1.2	28
2014	398.40	0.14	37	-346.7	1.5	37	-103.9	1.0	37
2015	400.39	0.09	34	-367.6	0.9	34	-114.3	0.6	34
2016	402.96	0.13	32	-390.6	1.0	32	-123.8	0.9	32
2017	406.36	0.13	47	-422.7	1.7	46	-138.9	1.4	47

Table S5: Same as Table S1 but for shipboard data of 0-10°N.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
2003	375.22	0.25	21	-117.7	1.9	21	3.3	1.5	21
2004	377.36	0.13	26	-130.3	1.1	26	2.0	0.7	26
2005	378.84	0.08	27	-141.3	0.8	27	-1.2	0.9	27
2006	381.14	0.12	22	-168.7	1.4	22	-16.6	1.0	22
2007	382.90	0.10	13	-190.1	1.7	13	-28.5	1.4	13
2008	384.60	0.06	27	-203.8	0.9	27	-33.4	0.7	27
2009	386.47	0.08	26	-226.2	1.7	26	-46.0	1.4	26
2010	388.76	0.10	33	-249.6	1.2	33	-57.4	0.9	33
2011	390.29	0.06	32	-265.5	1.3	32	-65.2	1.1	32
2012	392.62	0.11	27	-288.9	1.1	27	-76.4	0.8	27
2013	394.99	0.12	31	-310.5	1.9	31	-85.5	1.5	31
2014	397.48	0.08	39	-338.0	1.4	39	-100.0	1.2	39
2015	399.48	0.09	31	-358.9	1.1	31	-110.3	1.0	31
2016	402.26	0.11	33	-387.0	1.2	33	-123.8	1.1	33
2017	405.24	0.07	41	-413.0	1.2	41	-134.2	1.1	41

Table S6: Same as Table S1 but for shipboard data of 10-0°S.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
2003	374.62	0.16	20	-113.5	1.2	20	4.4	1.2	20
2004	376.75	0.25	30	-121.9	1.3	29	5.6	1.3	29
2005	378.65	0.16	29	-135.6	1.3	29	3.5	1.2	29
2006	380.04	0.12	23	-159.8	1.6	23	-13.4	1.1	23
2007	381.43	0.12	13	-175.4	1.7	13	-21.8	1.5	13
2008	384.07	0.10	29	-198.5	0.7	29	-31.0	0.6	29
2009	386.03	0.15	29	-220.2	1.7	29	-42.3	1.2	29
2010	387.92	0.11	28	-242.6	1.0	28	-54.8	0.8	28
2011	390.19	0.14	31	-261.5	1.2	31	-61.7	1.0	31
2012	392.07	0.23	29	-284.2	1.6	29	-74.6	1.1	29
2013	394.12	0.13	27	-304.2	1.0	27	-83.9	0.8	27
2014	396.34	0.16	36	-328.0	1.2	36	-96.0	0.7	36
2015	398.26	0.22	32	-350.8	2.2	32	-108.7	1.5	32
2016	401.67	0.19	27	-384.2	2.0	27	-124.2	1.4	27
2017	404.19	0.10	39	-407.4	1.4	39	-134.2	1.3	39

Table S7: Same as Table S1 but for shipboard data of 20-10°S.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
2003	373.26	0.17	20	-105.6	1.8	21	7.0	0.9	21
2004	375.11	0.05	23	-121.9	1.1	23	-1.4	1.1	23
2005	377.02	0.06	23	-132.8	0.7	23	-2.3	0.7	23
2006	378.63	0.07	18	-151.6	1.4	19	-11.2	0.9	18
2007	380.60	0.02	11	-178.2	1.0	11	-28.7	1.0	11
2008	382.86	0.14	26	-197.3	1.0	26	-36.1	0.9	26
2009	384.79	0.09	24	-218.1	1.5	24	-46.9	1.2	24
2010	386.00	0.04	20	-233.3	2.0	21	-54.1	0.9	22
2011	388.55	0.05	24	-257.3	0.8	24	-66.1	0.6	24
2012	390.29	0.08	21	-277.3	1.1	21	-77.0	0.8	21
2013	392.78	0.19	23	-299.5	0.8	23	-86.2	0.7	23
2014	395.29	0.06	27	-326.8	1.3	27	-100.3	1.0	27
2015	396.99	0.05	26	-345.1	1.0	26	-109.7	0.9	26
2016	399.87	0.13	24	-374.0	1.2	24	-124.5	1.5	25
2017	403.01	0.13	40	-402.0	1.2	40	-134.9	1.1	40

Table S8: Same as Table S1 but for shipboard data of 30-20°S.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
2003	372.65	0.10	13	-99.0	2.2	13	8.4	2.2	13
2004	374.57	0.09	16	-115.1	0.9	16	2.5	0.7	16
2005	376.81	0.21	14	-128.9	0.9	14	0.6	0.9	14
2006	378.63	0.16	11	-158.5	2.2	12	-17.6	1.1	12
2007	380.23	0.06	6	-180.0	2.2	6	-32.8	2.4	6
2008	382.32	0.19	16	-191.6	1.8	16	-33.3	1.3	16
2009	384.11	0.07	15	-217.1	1.5	15	-49.4	1.1	15
2010	385.38	0.08	15	-226.9	0.7	15	-52.5	0.8	15
2011	387.37	0.08	16	-252.0	1.7	16	-67.2	1.5	16
2012	389.45	0.12	16	-276.2	0.9	16	-80.4	1.2	16
2013	392.11	0.22	12	-294.5	1.7	12	-84.7	1.7	12
2014	394.62	0.09	14	-321.0	0.8	14	-98.7	0.9	16
2015	396.57	0.10	19	-342.1	1.4	19	-108.9	1.1	19
2016	399.53	0.03	13	-369.4	0.8	13	-120.6	0.7	13
2017	402.07	0.11	29	-394.1	0.8	29	-132.0	0.8	29

Table S9: Same as Table S1 but for shipboard data of 40-30°S.

Year	CO ₂ (ppm)	Error (ppm)	N	O ₂ /N ₂ (per meg)	Error (per meg)	N	APO (per meg)	Error (per meg)	N
2003	372.22	0.35	5	-101.4	2.8	5	3.6	1.6	5
2004	374.39	0.06	12	-120.2	0.5	12	-3.5	0.4	12
2005	376.33	0.08	14	-125.3	2.1	14	1.6	2.0	14
2006	378.57	0.09	13	-157.2	1.5	13	-18.7	1.1	13
2007	380.08	0.03	6	-176.2	2.3	6	-29.6	2.4	6
2008	382.20	0.18	17	-193.9	1.1	17	-36.2	0.8	17
2009	383.55	0.11	15	-211.3	1.0	15	-46.5	0.8	15
2010	385.09	0.05	13	-226.8	0.7	13	-53.9	0.7	13
2011	387.18	0.07	11	-251.6	1.2	11	-67.8	1.0	11
2012	389.04	0.10	13	-268.4	1.7	13	-74.7	1.3	13
2013	392.00	0.23	15	-296.9	1.5	15	-87.7	0.9	15
2014	394.20	0.07	17	-317.7	1.2	17	-97.0	1.1	17
2015	396.18	0.06	20	-342.7	1.4	20	-111.6	1.4	20
2016	399.42	0.15	18	-369.7	1.2	18	-121.5	0.5	18
2017	401.89	0.16	25	-396.6	1.0	25	-135.6	1.0	26