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Global ground-based tropospheric ozone measurements: reference data and individual site trends (2000–2022) from the TOAR-II/HEGIFTOM project

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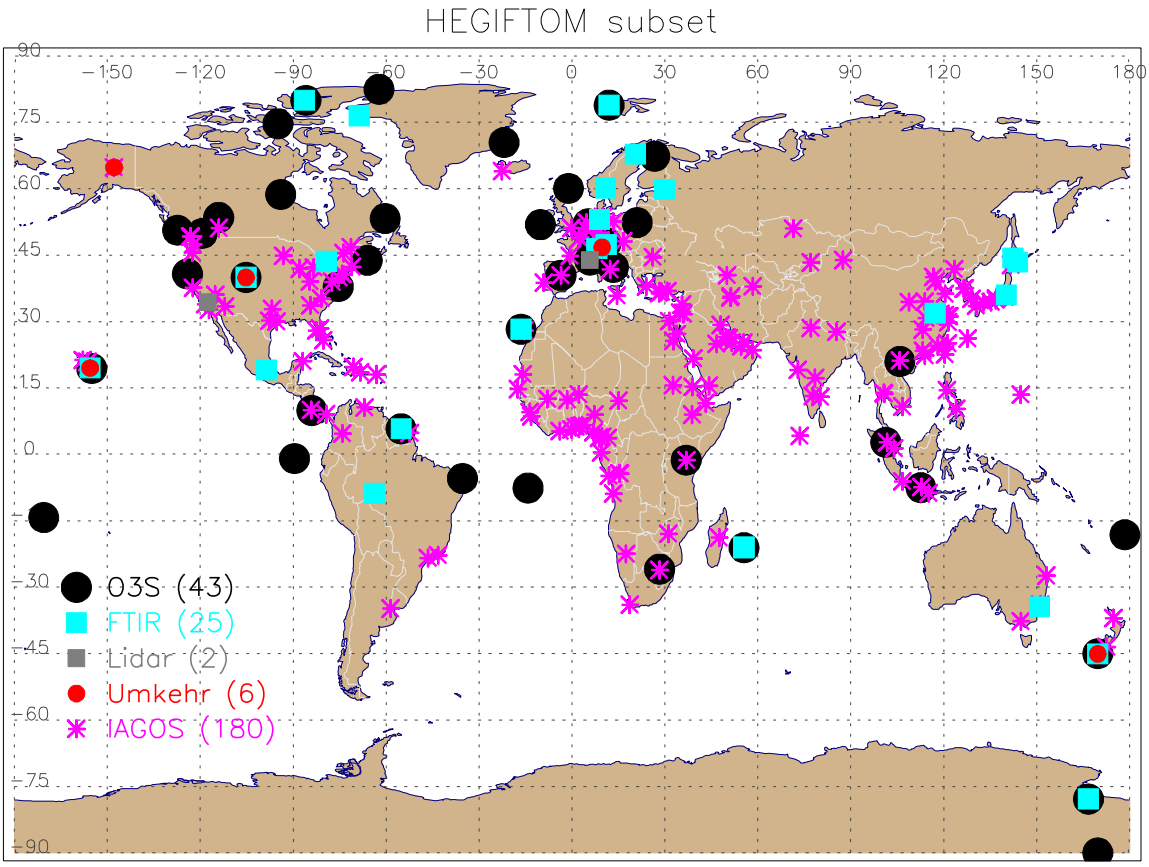

Figure S1. Map showing all HEGIFTOM sites with TrOC data since 2000. A list of those stations, together with latitude, longitude, beginning and end year, and amount of observations in the 2000-2022 period is provided in Table S1.

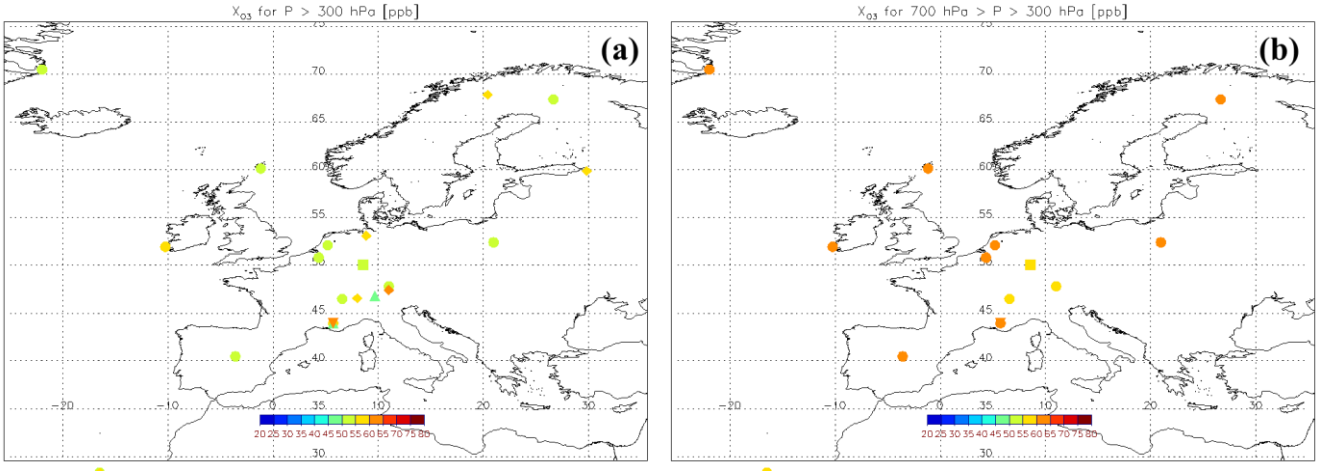

Figure S2. Close-up of Fig. 4: mean (a) TrOC (ppb, surface to 300 hPa), (b) FTOC (ppb, 700 > p > 300 hPa) at European HEGIFTOM sites with at least 120 monthly values in the 2000-2022 period. Circles denote ozonesondes, squares denote IAGOS airports, diamonds denote FTIR, upward triangles denote Umkehr, and downward triangles denote lidar.

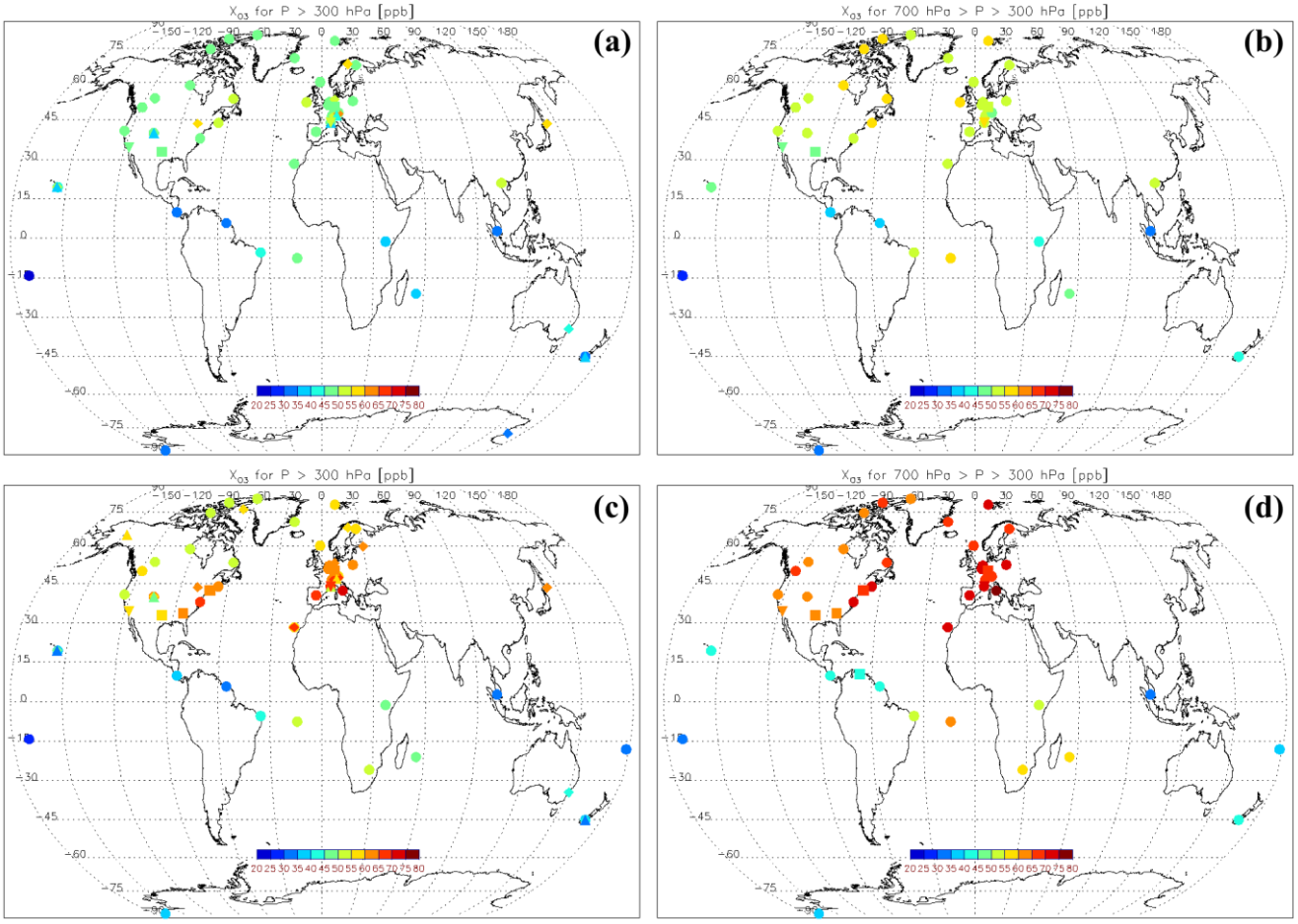

Figure S3. Same as Fig. 4, but now for TrOC DJF (a) and JJA (c), and for FTOC DJF (b) and JJA (d).

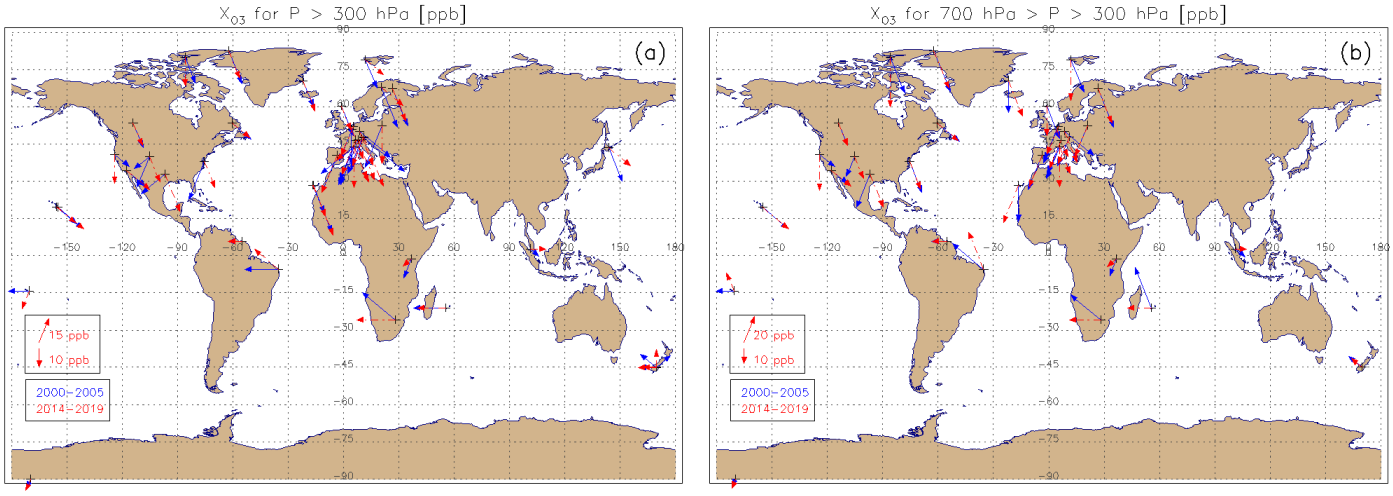

Figure S4. Same as Fig. 6, but now for the 2014-2019 period (red) instead of 2015-2022.

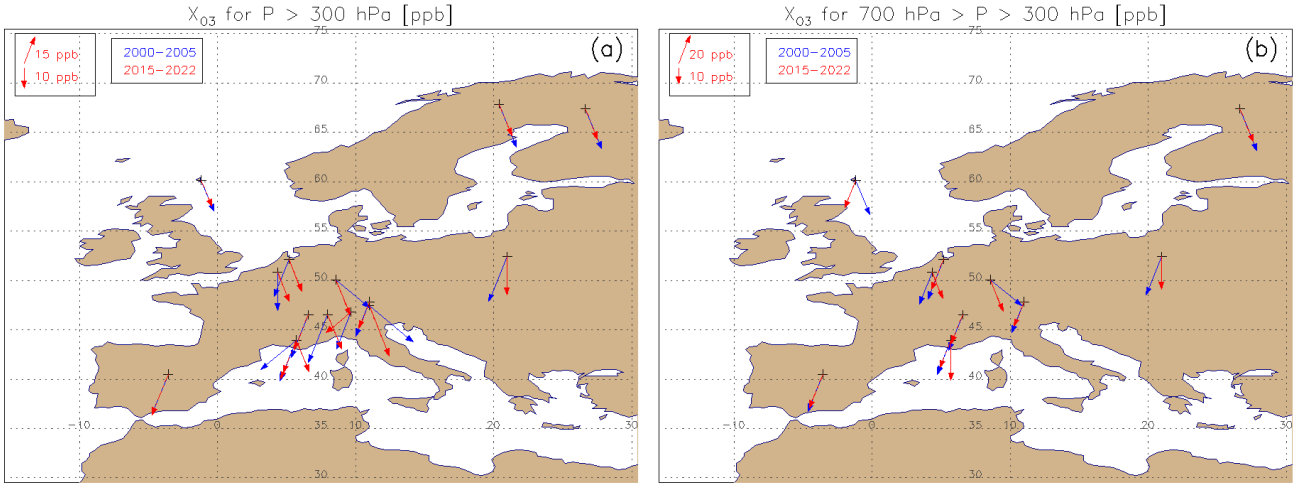

Figure S5. Close-up of Fig. 6 for Europe.

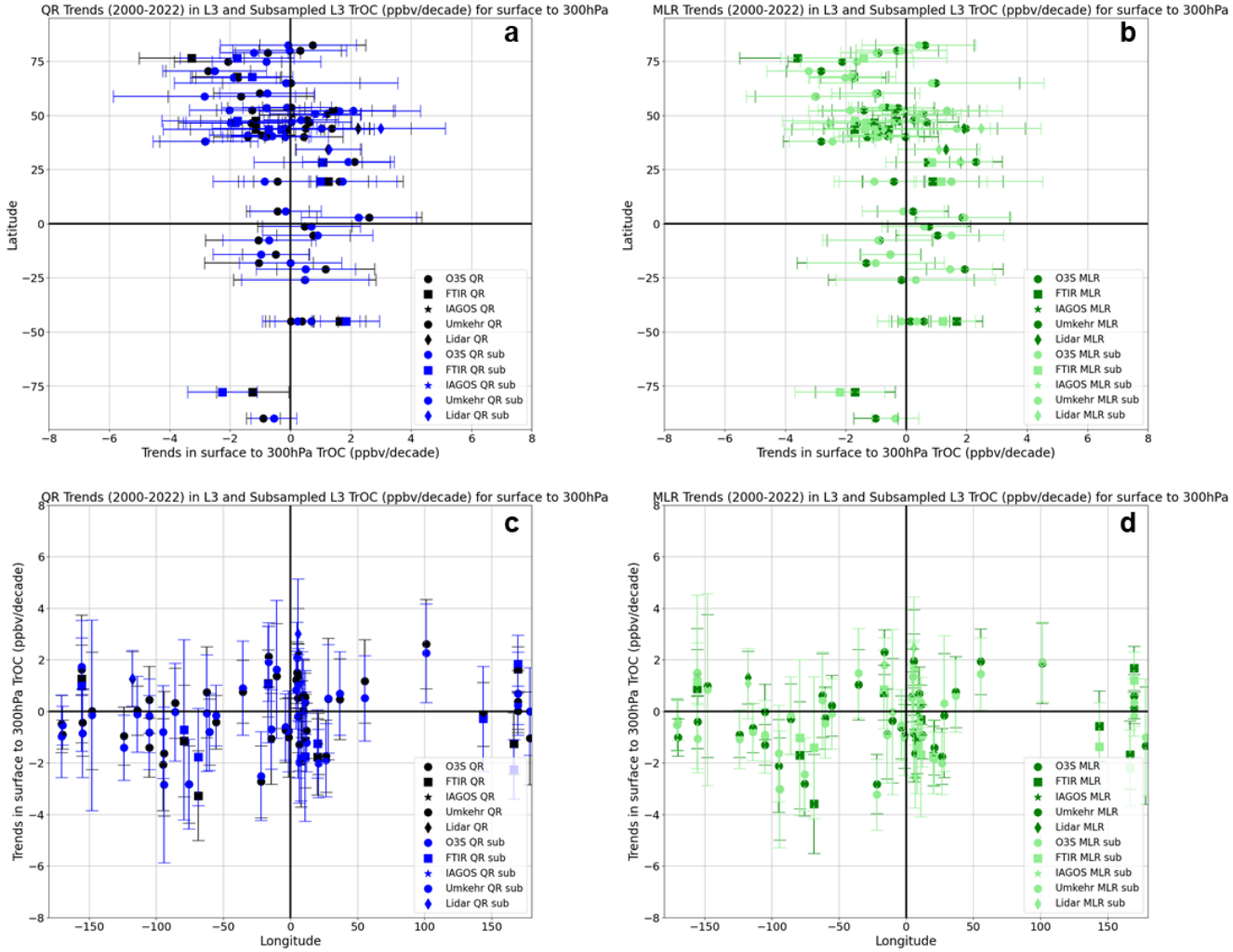

Figure S6. QR (left) and MLR (right) TrOC trend (2000-2022) estimates as a function of latitude (upper panels) and longitude (lower panels) for the original L3 datasets and for the datasets subsampled to exactly two random daily values for each month ("sub" in legend).

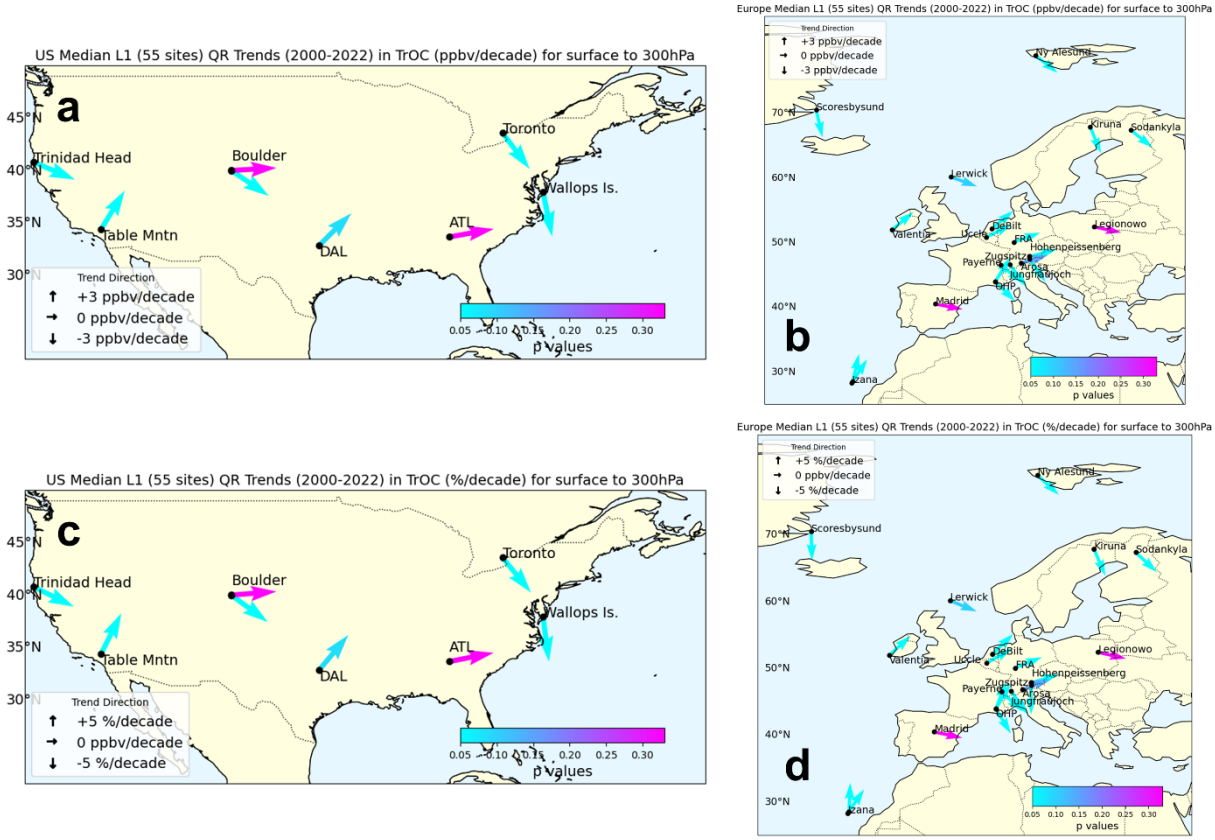

Figure S7. Close-up of Fig. 10 trends at stations within highly-sampled regions: (a) US; (b) Europe. Multiple arrows correspond to multi-instrument sites, Boulder in (a), OHP and Izaña in (b). (c) Trend same as (a) except in % per decade with *p* values; (d) same as (b) except in % per decade with *p* values.

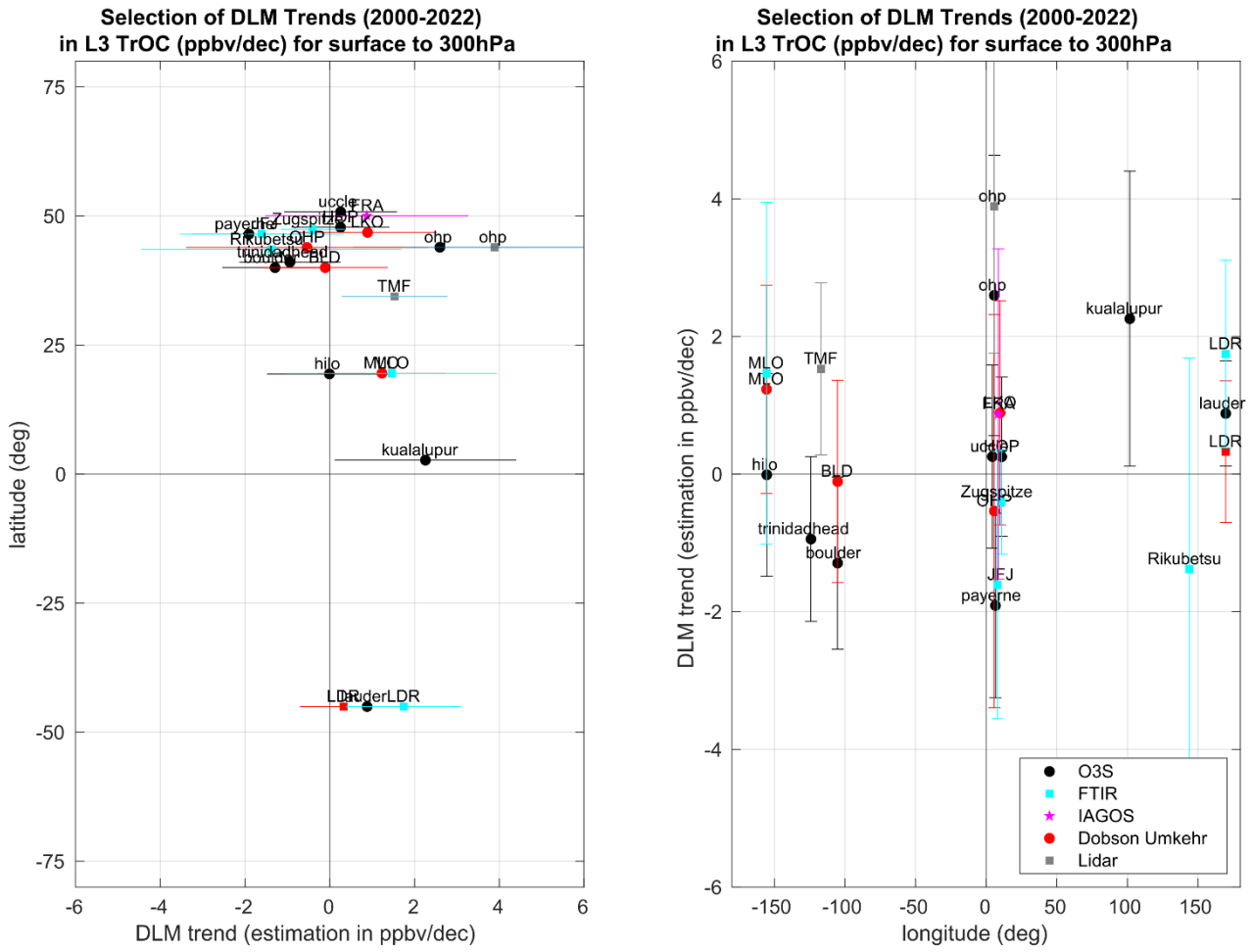

Figure S8. DLM trend estimates (ppbv per decade), based on the monthly mean time series for a subset of sites from our sample. DLM trend values are output in ppbv per year. In order to compare DLM trend values with QR and MLR decadal trend values, we need to give an estimate of the trend in ppbv per decade. DLM outputs a distribution of ozone change between the beginning and the end of the considered time period and the trend values in ppbv per decade are determined in ratio. The uncertainty on these values is determined by Monte-Carlo simulations. Assuming the distribution to be normal, we estimate the standard deviation of the trends values from the FWHM of the distribution.

Table S1. Overview of all HEGIFTOM sites with TrOC data since 2000. The instruments, site names, latitude, longitude, begin and end period of the observations, the total amount of (L1) TrOC observations, and the number of months with (L3) observations are shown.

Instrument	Site/Airport	lat	lon	begin	end	N_{obs}	N_{months}
O3S	Alert	82.49	-62.34	2000	2020	931	227
FTIR	Eureka	80.05	-86.42	2006	2020	6261	97
O3S	Eureka	79.98	-85.94	2000	2021	1345	248
O3S	Ny Alesund	78.92	11.93	2000	2022	1794	276
FTIR	Ny Alesund	78.92	11.92	2000	2022	2052	119
FTIR	Thule	76.53	-68.74	2000	2022	6204	163
O3S	Resolute	74.70	-94.96	2000	2021	771	199
O3S	Scoresbysund	70.48	-21.97	2000	2022	1127	264
FTIR	Kiruna	67.84	20.40	2000	2022	4853	230
O3S	Sodankylä	67.37	26.65	2000	2022	1074	254
Umk	105 (Fairbanks)	64.86	-147.85	2000	2021	1652	148
IAGOS	FAI	64.82	-147.87	2015	2016	7	3
IAGOS	KEF	64.00	-22.62	2003	2013	14	5
FTIR	Harestua	60.20	10.80	2009	2020	2366	112
O3S	Lerwick	60.13	-1.18	2000	2022	1203	243
FTIR	Peterhof	59.88	29.82	2009	2023	5764	133
O3S	Churchill	58.74	-94.07	2000	2021	690	183
IAGOS	HAM	53.63	10.01	2000	2011	5	5
O3S	Edmonton	53.54	-114.10	2000	2021	969	244
O3S	Goose Bay	53.31	-60.36	2000	2021	953	230
FTIR	Bremen	53.10	8.85	2004	2023	1994	164
IAGOS	TXL	52.55	13.29	2001	2021	38	8
O3S	Legionowo	52.40	20.97	2000	2022	1340	276
IAGOS	AMS	52.31	4.76	2014	2016	151	21
O3S	De Bilt	52.10	5.18	2000	2020	1085	252
O3S	Valentia	51.94	-10.25	2000	2022	600	127
IAGOS	DUS	51.28	6.77	2000	2015	716	26
IAGOS	LGW	51.16	-0.16	2005	2009	378	40
IAGOS	YYC	51.13	-114.01	2009	2011	168	17
IAGOS	TSE	51.03	71.46	2006	2022	214	55
IAGOS	BRU	50.90	4.48	2000	2009	866	24
O3S	Uccle	50.80	4.35	2000	2022	3265	276
O3S	Port Hardy	50.68	-127.38	2018	2021	109	29

IAGOS	FRA	50.05	8.57	2000	2022	14358	246
O3S	Kelowna	49.93	-119.40	2003	2017	699	161
IAGOS	CXH	49.27	-123.12	2001	2011	2	2
IAGOS	YVR	49.19	-123.18	2000	2021	556	73
IAGOS	CDG	49.00	2.57	2000	2022	2460	82
IAGOS	ORY	48.73	2.36	2002	2018	149	8
IAGOS	MUC	48.35	11.79	2000	2011	1983	51
IAGOS	VIE	48.12	16.56	2000	2021	2367	91
O3S	Hohenpeissenberg	47.80	11.01	2000	2023	3014	285
IAGOS	SEA	47.44	-122.30	2013	2022	113	28
FTIR	Zugspitze	47.42	10.98	2000	2022	19529	264
IAGOS	YQB	46.79	-71.38	2015	2022	5	2
Umk	35 (Arosa)	46.78	9.68	2000	2022	2936	268
FTIR	Jungfraujoch	46.55	7.98	2000	2023	8649	261
O3S	Payerne	46.49	6.57	2002	2022	3112	244
IAGOS	PDX	45.59	-122.59	2003	2018	380	54
IAGOS	YUL	45.46	-73.75	2000	2021	272	51
IAGOS	MSP	44.88	-93.21	2013	2018	28	11
IAGOS	BOD	44.83	-0.70	2000	2018	11	7
IAGOS	OTP	44.57	26.08	2004	2006	4	2
FTIR	Moshiri	44.40	142.30	2000	2007	1042	83
Lidar	OHPO3T	43.94	5.71	2000	2022	1592	237
O3S	OHP	43.94	5.71	2000	2023	1075	279
Umk	40 (OHP)	43.94	5.71	2000	2022	3596	238
IAGOS	URC	43.90	87.48	2016	2016	2	2
O3S	Yarmouth	43.87	-66.11	2003	2021	793	189
IAGOS	YYZ	43.68	-79.61	2000	2021	774	95
FTIR	Toronto	43.60	-79.36	2002	2023	5497	210
FTIR	Rikubetsu	43.46	143.77	2000	2022	1745	191
IAGOS	ALA	43.35	77.01	2001	2022	257	59
IAGOS	CTS	42.79	141.68	2016	2018	23	8
IAGOS	BOS	42.37	-71.02	2000	2022	632	102
O3S	L'Aquila	42.30	13.31	2000	2023	342	116
IAGOS	DTW	42.21	-83.36	2000	2022	404	86
IAGOS	ORD	41.98	-87.90	2000	2021	1089	91
IAGOS	SHE	41.86	123.43	2012	2021	219	43
IAGOS	FCO	41.79	12.25	2016	2021	7	4
O3S	Trinidad Head	40.80	-124.16	2000	2023	1239	273
IAGOS	EWR	40.69	-74.18	2000	2021	804	70

IAGOS	JFK	40.64	-73.79	2000	2022	761	88
IAGOS	MAD	40.47	-3.57	2014	2014	15	2
O3S	Madrid	40.47	-3.58	2000	2022	935	234
IAGOS	GYD	40.46	50.05	2001	2013	69	14
IAGOS	PEK	40.08	116.59	2000	2021	236	50
FTIR	Boulder	40.04	-105.24	2010	2022	3613	122
O3S	Boulder	40.00	-105.25	2000	2023	1276	283
Umk	67 (Boulder)	39.99	-105.26	2000	2022	4721	272
IAGOS	PHL	39.88	-75.24	2000	2022	686	115
IAGOS	DEN	39.85	-104.67	2001	2022	48	18
IAGOS	TSN	39.12	117.34	2020	2020	2	2
IAGOS	CVG	39.06	-84.66	2000	2004	6	2
IAGOS	IAD	38.95	-77.45	2000	2022	497	81
IAGOS	LIS	38.77	-9.13	2002	2021	5	3
IAGOS	ASB	37.98	58.37	2001	2013	34	14
IAGOS	ATH	37.94	23.95	2003	2017	8	5
O3S	Wallops Island	37.93	-75.48	2000	2020	1143	245
IAGOS	SFO	37.62	-122.39	2000	2018	153	39
IAGOS	GMP	37.56	126.80	2000	2000	28	8
IAGOS	ICN	37.45	126.45	2001	2022	171	35
IAGOS	AYT	36.90	30.80	2000	2006	23	6
IAGOS	DLM	36.72	28.78	2005	2005	10	3
IAGOS	RHO	36.40	28.09	2002	2002	11	4
IAGOS	TAO	36.27	120.38	2012	2022	127	48
IAGOS	LAS	36.09	-115.15	2017	2018	74	12
FTIR	Tsukuba	36.05	140.12	2014	2020	780	74
IAGOS	MLA	35.86	14.48	2011	2019	13	9
IAGOS	NRT	35.77	140.39	2000	2018	855	96
IAGOS	THR	35.69	51.32	2000	2005	202	46
IAGOS	HND	35.55	139.78	2017	2022	66	17
IAGOS	IKA	35.41	51.15	2009	2022	150	35
IAGOS	NKM	35.25	136.92	2000	2004	26	14
IAGOS	CLT	35.22	-80.94	2004	2011	36	9
IAGOS	PUS	35.18	128.95	2016	2018	9	5
IAGOS	NGO	34.86	136.81	2006	2020	413	76
IAGOS	CGO	34.53	113.84	2016	2016	2	2
IAGOS	KIX	34.44	135.24	2000	2018	634	83
IAGOS	HIJ	34.44	132.92	2016	2017	4	2
IAGOS	XIY	34.44	108.76	2016	2017	7	3

Lidar	TMF	34.38	-117.68	2000	2023	2918	276
IAGOS	LAX	33.94	-118.41	2000	2018	255	34
IAGOS	BEY	33.83	35.49	2013	2022	25	8
IAGOS	ATL	33.64	-84.44	2000	2022	1465	139
IAGOS	FUK	33.58	130.44	2015	2018	75	14
IAGOS	PHX	33.44	-112.00	2001	2018	17	6
IAGOS	DAL	32.84	-96.85	2000	2022	734	131
IAGOS	SAN	32.73	-117.20	2017	2020	89	21
IAGOS	TLV	32.00	34.87	2000	2022	305	59
FTIR	Hefei	31.91	117.17	2015	2020	3375	55
IAGOS	NKG	31.74	118.87	2009	2020	69	41
IAGOS	AMM	31.72	35.99	2006	2020	3	2
IAGOS	WUX	31.49	120.42	2016	2018	8	4
IAGOS	SHA	31.20	121.34	2000	2000	11	3
IAGOS	PVG	31.15	121.80	2000	2021	182	41
IAGOS	WUH	30.78	114.21	2017	2018	17	8
IAGOS	AUS	30.20	-97.67	2019	2022	23	9
IAGOS	CAI	30.12	31.41	2000	2019	320	44
IAGOS	IAH	29.98	-95.34	2000	2022	266	62
IAGOS	NGB	29.82	121.46	2012	2018	11	8
IAGOS	KWI	29.24	47.97	2001	2022	417	80
IAGOS	DEL	28.56	77.10	2000	2021	607	77
IAGOS	MCO	28.43	-81.31	2008	2022	27	10
FTIR	Izaña	28.30	-16.48	2000	2022	7665	259
O3S	Izaña	28.30	-16.50	2000	2022	1086	270
IAGOS	CSX	28.19	113.21	2015	2018	6	3
IAGOS	TPA	27.98	-82.54	2018	2022	11	5
IAGOS	LPA	27.94	-15.39	2002	2005	2	2
IAGOS	KTM	27.70	85.36	2003	2006	10	5
IAGOS	HRG	27.19	33.81	2000	2001	13	3
IAGOS	DMM	26.47	49.80	2003	2022	68	31
IAGOS	BAH	26.27	50.63	2010	2021	14	10
IAGOS	OKA	26.20	127.65	2015	2018	31	10
IAGOS	MIA	25.80	-80.28	2001	2021	51	16
IAGOS	LXR	25.67	32.70	2001	2001	4	4
IAGOS	DOH	25.27	51.56	2012	2017	131	28
IAGOS	DXB	25.25	55.35	2000	2022	448	88
IAGOS	TPE	25.08	121.22	2012	2018	1422	40
IAGOS	RUH	24.96	46.70	2000	2022	287	81

IAGOS	XMN	24.54	118.13	2012	2018	31	14
IAGOS	AUH	24.43	54.65	2003	2017	65	20
IAGOS	MCT	23.59	58.29	2003	2015	38	12
IAGOS	CAN	23.39	113.30	2009	2018	88	17
IAGOS	KHH	22.57	120.35	2018	2018	6	2
IAGOS	HKG	22.32	113.94	2000	2021	719	68
IAGOS	JED	21.67	39.15	2001	2019	238	50
IAGOS	HNL	21.33	-157.92	2016	2018	239	24
IAGOS	HAN	21.21	105.80	2016	2018	20	8
IAGOS	CUN	21.04	-86.87	2001	2021	31	10
O3S	Hanoi	21.01	105.80	2004	2021	350	121
IAGOS	OGG	20.89	-156.44	2017	2018	23	8
IAGOS	POP	19.75	-70.56	2001	2002	2	2
IAGOS	KOA	19.74	-156.04	2017	2018	4	3
FTIR	Mauna Loa	19.54	-155.57	2000	2022	9025	165
Umk	31 (Mauna Loa)	19.54	-155.58	2000	2022	7822	266
O3S	Hilo	19.43	-155.04	2000	2023	1174	284
FTIR	Altzomoni	19.12	-98.68	2012	2022	4307	100
IAGOS	BOM	19.10	72.87	2000	2022	95	34
IAGOS	PUJ	18.56	-68.36	2021	2021	23	4
IAGOS	NKC	18.10	-15.95	2003	2022	64	15
IAGOS	SXM	18.04	-63.11	2013	2022	44	17
IAGOS	HYD	17.24	78.43	2005	2018	485	62
IAGOS	KRT	15.59	32.55	2000	2014	260	31
IAGOS	SAH	15.47	44.23	2000	2004	10	4
IAGOS	ASM	15.29	38.91	2002	2012	18	5
IAGOS	DKR	14.74	-17.49	2000	2009	50	12
IAGOS	MNL	14.51	121.01	2005	2018	73	19
IAGOS	DMK	13.91	100.61	2005	2006	211	13
IAGOS	BKK	13.69	100.75	2006	2022	272	43
IAGOS	GUM	13.49	144.80	2016	2016	2	2
IAGOS	NIM	13.48	2.18	2002	2022	73	22
IAGOS	BLR	13.20	77.71	2017	2022	50	10
IAGOS	MAA	12.98	80.16	2000	2018	315	59
IAGOS	BKO	12.54	-7.95	2013	2017	29	15
IAGOS	OUA	12.36	-1.51	2002	2022	61	27
IAGOS	NDJ	12.13	15.03	2013	2022	26	10
IAGOS	JIB	11.55	43.15	2013	2018	9	6
IAGOS	SGN	10.81	106.66	2005	2018	130	26

IAGOS	CCS	10.60	-67.01	2000	2018	722	104
IAGOS	CEB	10.31	123.98	2018	2018	10	2
IAGOS	SJO	10.00	-84.20	2014	2022	42	20
O3S	Costa Rica	9.94	-84.04	2005	2023	638	176
IAGOS	CKY	9.58	-13.62	2003	2022	58	25
IAGOS	PTY	9.07	-79.39	2017	2020	24	8
IAGOS	ABV	9.00	7.27	2003	2022	247	54
IAGOS	ADD	8.98	38.80	2001	2019	242	58
IAGOS	FNA	8.62	-13.20	2009	2022	9	5
IAGOS	LOS	6.58	3.32	2000	2022	476	93
IAGOS	COO	6.35	2.39	2001	2022	68	32
IAGOS	LFW	6.17	1.25	2003	2022	60	26
FTIR	Paramaribo	5.81	-55.20	2004	2016	234	17
O3S	Paramaribo	5.80	-55.21	2000	2022	855	247
IAGOS	ACC	5.61	-0.17	2003	2022	45	19
IAGOS	ABJ	5.25	-3.93	2000	2022	118	26
IAGOS	PHC	5.01	6.95	2002	2022	79	39
IAGOS	CAY	4.82	-52.37	2002	2022	112	8
IAGOS	BOG	4.70	-74.14	2000	2021	292	30
IAGOS	MLE	4.20	73.52	2000	2022	27	12
IAGOS	DLA	4.01	9.72	2000	2022	125	30
IAGOS	SSG	3.76	8.72	2014	2022	126	41
IAGOS	NSI	3.70	11.55	2017	2022	18	5
IAGOS	KUL	2.76	101.71	2005	2016	72	15
O3S	Kuala Lumpur	2.73	101.27	2000	2022	456	203
IAGOS	SIN	1.36	103.99	2000	2022	78	19
IAGOS	LBV	0.46	9.41	2000	2022	12	7
O3S	San Cristobal	-0.92	-89.62	2000	2022	350	82
O3S	Nairobi	-1.27	36.80	2000	2022	872	223
IAGOS	NBO	-1.32	36.93	2018	2022	89	28
IAGOS	BZV	-4.26	15.25	2002	2022	31	9
IAGOS	FIH	-4.39	15.45	2000	2022	73	21
IAGOS	PNR	-4.81	11.88	2014	2022	29	11
O3S	Natal	-5.42	-35.38	2000	2022	676	175
IAGOS	CGK	-6.13	106.66	2005	2018	54	11
IAGOS	SUB	-7.38	112.78	2016	2018	14	5
O3S	Watukosek	-7.50	112.60	2000	2022	326	75
O3S	Ascension Island	-7.58	-14.24	2000	2022	676	174
IAGOS	DPS	-8.74	115.16	2016	2018	20	7

FTIR	Porto Velho	-8.77	-63.87	2019	2019	491	5
IAGOS	LAD	-8.85	13.23	2000	2022	175	68
O3S	Samoa	-14.23	-170.56	2000	2023	821	241
IAGOS	HRE	-17.92	31.10	2000	2000	20	8
O3S	Fiji	-18.13	178.40	2000	2023	397	125
IAGOS	TNR	-18.80	47.48	2016	2017	9	3
FTIR	St Denis	-20.90	55.48	2004	2011	1778	37
O3S	Reunion Island	-21.06	55.48	2000	2022	735	215
FTIR	Maido	-21.08	55.38	2013	2023	4460	76
IAGOS	WDH	-22.49	17.46	2000	2013	1618	69
IAGOS	GIG	-22.81	-43.25	2000	2014	58	25
IAGOS	GRU	-23.43	-46.48	2000	2021	23	11
O3S	Irene	-25.90	28.22	2000	2023	391	140
IAGOS	JNB	-26.13	28.23	2000	2021	77	19
IAGOS	BNE	-27.40	153.11	2016	2018	61	11
IAGOS	SYD	-33.93	151.18	2013	2018	85	18
IAGOS	CPT	-33.97	18.60	2005	2021	103	34
FTIR	Wollongong	-34.41	150.88	2007	2023	8481	150
IAGOS	EZE	-34.81	-58.54	2014	2014	4	2
IAGOS	AKL	-37.00	174.78	2016	2018	59	13
IAGOS	MEL	-37.67	144.85	2016	2018	25	8
IAGOS	CHC	-43.49	172.54	2016	2018	20	6
O3S	Lauder	-45.00	169.68	2000	2021	923	237
FTIR	Lauder	-45.04	169.68	2001	2023	10389	252
Umk	256 (Lauder)	-45.04	169.68	2000	2022	2957	262
FTIR	Arrival Heights	-77.82	166.65	2000	2022	2563	176
O3S	Mc Murdo	-77.85	166.67	2000	2010	295	36
O3S	South Pole	-90.00	169.68	2000	2023	1371	279

Table S2. Results of the intercomparison analysis between all coincident and collocated measurements (L1) for column-averaged tropospheric ozone column amounts (in ppbv, from surface to 300 hPa). The different columns show the sites (filenames of the time series at the HEGIFTOM ftp-server have been used), the number of coincident observations, the mean bias, the standard deviation of differences, the linear Pearson correlation coefficient, the slope and offset of the linear regression line. The rows are ordered in blocks according to the instruments compared with each other. The intercomparison selection criteria are sites within ±4° in latitude and longitude, observations coincident within 12h (closest measurements) and requiring at least 15 coincident measurements.

site1	site2	N	bias (2 - 1)	stdev	r	slope	offset
mcmurdo_O3S	Ahts_FTIR	39	3.80	3.42	0.56	0.57	18.42
lauder_O3S	Lauder_FTIR	309	2.54	5.47	0.61	0.76	11.22
hilo_O3S	Mauna_Loa_FTIR	389	10.57	8.32	0.80	1.16	4.31
izana_O3S	Izana_FTIR	431	5.37	7.68	0.82	1.07	1.80
boulder_O3S	Boulder_FTIR	211	1.36	6.41	0.79	0.90	7.25
payerne_O3S	Jungfraujoch_FTIR	825	2.70	9.53	0.70	0.89	8.99
hohenpeissenberg_O3S	Zugspitze_FTIR	1324	11.41	14.25	0.49	0.88	17.83
sodankyla_O3S	Kiruna_FTIR	344	6.07	9.92	0.53	0.73	20.95
nyalesund_O3S	Ny_Alesund_FTIR	118	3.80	9.81	0.53	0.51	33.57
eureka_O3S	Eureka_FTIR	239	9.90	6.82	0.73	0.75	23.12
yarmouth_O3S	BOS_IAGOS	20	-1.84	7.17	0.72	0.95	1.33
kelowna_O3S	PDX_IAGOS	37	0.06	9.29	0.75	0.86	7.89
kelowna_O3S	YVR_IAGOS	19	1.81	9.28	0.66	1.43	-19.51
payerne_O3S	FRA_IAGOS	2115	-0.69	8.85	0.66	0.68	16.90
hohenpeissenberg_O3S	MUC_IAGOS	303	2.85	7.45	0.74	0.80	12.84
uccle_O3S	ORY_IAGOS	35	-2.82	8.94	0.29	0.28	37.02
uccle_O3S	CDG_IAGOS	1028	-2.83	9.40	0.61	0.62	17.83
uccle_O3S	BRU_IAGOS	481	0.40	10.00	0.64	0.77	13.40
debilt_O3S	DUS_IAGOS	84	-1.36	6.61	0.84	0.79	10.94
legionowo_O3S	VIE_IAGOS	458	-1.95	10.01	0.66	0.70	15.62
lauder_O3S	256_Umk	445	-2.07	9.57	0.04	0.04	33.33
hilo_O3S	031_Umk	43	-9.26	7.72	0.57	0.51	9.15
boulder_O3S	067_Umk	24	-10.36	10.93	0.13	0.14	37.39
ohp_O3S	040_Umk	456	-10.05	12.72	0.44	0.60	13.00
payerne_O3S	035_Umk	760	-5.30	10.24	0.59	0.67	12.97
sodankyla_O3S	105_Umk	224	0.97	12.36	0.29	0.46	31.91
Mauna_Loa_FTIR	HNL_IAGOS	55	-6.12	8.54	0.76	0.61	13.91
Tsukuba_FTIR	KIX_IAGOS	17	-5.17	6.62	0.12	0.07	45.55
Tsukuba_FTIR	NRT_IAGOS	17	-3.81	8.88	0.35	0.26	38.52
Toronto_FTIR	DTW_IAGOS	54	-5.54	11.44	0.54	0.47	27.74
Toronto_FTIR	YYZ_IAGOS	63	-5.38	16.41	0.58	0.32	38.04

Jungfraujoch_FTIR	FRA_IAGOS	2330	-5.92	11.24	0.57	0.46	26.94
Zugspitze_FTIR	MUC_IAGOS	363	-9.83	13.56	0.55	0.33	33.26
Lauder_FTIR	256_Umk	950	-5.09	8.12	0.29	0.31	21.67
Jungfraujoch_FTIR	035_Umk	1080	-7.76	9.92	0.66	0.64	13.01
Kiruna_FTIR	105_Umk	373	-6.50	14.90	0.30	0.32	36.88
031_Umk	HNL_IAGOS	46	8.46	7.46	0.59	0.80	15.83
035_Umk	FRA_IAGOS	2209	2.46	11.18	0.52	0.44	30.00
KIX_IAGOS	NKM_IAGOS	15	0.68	5.64	0.94	1.17	-10.00
KIX_IAGOS	NRT_IAGOS	44	0.76	11.66	0.57	0.46	29.19
CDG_IAGOS	BRU_IAGOS	743	1.55	10.57	0.58	0.67	19.60
DUS_IAGOS	AMS_IAGOS	22	2.13	7.63	0.58	0.53	27.49
TMF_Lidar	LAX_IAGOS	33	-2.80	6.55	0.84	0.93	1.10
TMF_Lidar	LAS_IAGOS	17	-4.97	8.67	0.74	0.57	20.64
OHPO3T_Lidar	ohp_O3S	205	-5.43	11.90	0.52	0.41	31.03

Table S3. Same as Table S2, but now for the column-averaged tropospheric ozone column monthly means (in ppbv). The coincidence criterion is now that monthly means from the same month are compared.

site1	site2	N	Bias (2 - 1)	stdev	r	slope	offset
mcmurdo_O3S	Ahts_FTIR	26	3.50	2.13	0.54	0.58	18.08
lauder_O3S	Lauder_FTIR	210	2.31	3.55	0.76	0.94	4.33
paramaribo_O3S	Paramaribo_FTIR	16	2.70	6.79	0.44	0.45	21.19
hilo_O3S	Mauna_Loa_FTIR	200	10.49	6.05	0.78	0.99	10.97
izana_O3S	Izana_FTIR	257	4.96	5.83	0.84	1.13	-2.03
boulder_O3S	Boulder_FTIR	120	2.27	6.38	0.67	0.83	11.51
payerne_O3S	Jungfraujoch_FTIR	226	4.51	6.12	0.78	0.88	10.86
hohenpeissenberg_O3S	Zugspitze_FTIR	305	11.10	10.39	0.51	0.85	19.02
sodankyla_O3S	Kiruna_FTIR	252	5.05	6.84	0.70	0.90	10.78
nyalesund_O3S	Ny_Alesund_FTIR	146	3.45	7.20	0.61	0.87	11.17
eureka_O3S	Eureka_FTIR	94	10.18	6.02	0.76	0.96	12.53
irene_O3S	JNB_IAGOS	19	-6.68	8.42	0.66	0.58	16.63
nairobi_O3S	NBO_IAGOS	20	-1.46	6.50	0.63	0.62	13.82
kualalumpur_O3S	SIN_IAGOS	22	-2.36	8.70	0.66	1.15	-7.09
hilo_O3S	HNL_IAGOS	23	5.63	6.27	0.50	0.62	20.09
boulder_O3S	DEN_IAGOS	17	-0.85	6.60	0.66	0.91	4.40
yarmouth_O3S	BOS_IAGOS	53	-3.02	6.20	0.63	0.73	13.19
kelowna_O3S	PDX_IAGOS	43	-1.38	7.75	0.43	0.59	20.16
kelowna_O3S	YVR_IAGOS	56	0.07	6.01	0.63	0.82	9.07
payerne_O3S	FRA_IAGOS	214	-0.11	4.36	0.86	0.84	8.35
hohenpeissenberg_O3S	MUC_IAGOS	55	2.55	4.06	0.88	0.94	5.71
uccle_O3S	CDG_IAGOS	119	-1.85	4.70	0.83	0.86	5.94
uccle_O3S	BRU_IAGOS	54	0.01	3.26	0.93	1.07	-3.76
debilt_O3S	DUS_IAGOS	61	2.63	5.85	0.84	1.01	2.35
debilt_O3S	AMS_IAGOS	22	1.03	4.84	0.83	0.92	5.44
edmonton_O3S	YYC_IAGOS	16	-0.17	5.29	0.64	0.71	14.90
legionowo_O3S	VIE_IAGOS	146	-1.78	5.22	0.86	0.84	7.44
lauder_O3S	256_Umk	342	-1.59	6.94	-0.11	-0.10	38.43
hilo_O3S	031_Umk	398	-5.20	5.37	0.73	0.58	11.72
boulder_O3S	067_Umk	400	-12.14	6.43	0.63	0.46	17.95
ohp_O3S	040_Umk	303	-10.14	7.49	0.70	0.81	0.34
payerne_O3S	035_Umk	235	-4.69	4.95	0.83	0.81	5.65
sodankyla_O3S	105_Umk	172	-0.73	7.66	0.46	0.56	24.21
Mauna_Loa_FTIR	HNL_IAGOS	22	-5.65	5.61	0.71	0.63	12.92
Tsukuba_FTIR	KIX_IAGOS	19	-4.88	7.51	0.71	0.53	23.36

Tsukuba_FTIR	NGO_IAGOS	34	-5.00	8.33	0.76	0.72	13.09
Tsukuba_FTIR	NRT_IAGOS	18	-8.09	6.99	0.86	0.51	22.43
Toronto_FTIR	DTW_IAGOS	58	-9.54	8.33	0.55	0.54	19.22
Toronto_FTIR	YYZ_IAGOS	60	-6.31	7.83	0.62	0.52	22.63
Jungfraujoch_FTIR	FRA_IAGOS	230	-5.26	6.23	0.78	0.68	13.76
Zugspitze_FTIR	MUC_IAGOS	50	-11.45	10.36	0.54	0.38	28.77
Lauder_FTIR	256_Umk	235	-4.34	6.65	0.10	0.07	31.48
Boulder_FTIR	067_Umk	121	-12.95	6.37	0.66	0.49	16.45
Jungfraujoch_FTIR	035_Umk	250	-9.90	7.30	0.68	0.57	15.55
Kiruna_FTIR	105_Umk	171	-5.13	8.72	0.51	0.46	27.58
031_Umk	HNL_IAGOS	21	7.58	5.04	0.71	1.09	4.48
067_Umk	DEN_IAGOS	15	10.28	9.35	0.13	0.19	46.08
035_Umk	FRA_IAGOS	303	3.68	6.57	0.69	0.75	16.40
KIX_IAGOS	NGO_IAGOS	16	-0.72	6.53	0.81	0.97	0.85
KIX_IAGOS	NKM_IAGOS	36	0.05	8.30	0.77	1.05	-2.86
KIX_IAGOS	NRT_IAGOS	111	2.59	8.69	0.62	0.62	22.85
NGO_IAGOS	NRT_IAGOS	20	1.30	11.15	0.40	0.29	39.09
NKM_IAGOS	NRT_IAGOS	23	3.26	8.56	0.76	0.58	26.26
DTW_IAGOS	YYZ_IAGOS	36	0.22	7.02	0.65	0.58	22.21
PDX_IAGOS	YVR_IAGOS	18	2.66	11.28	0.04	0.06	46.50
CDG_IAGOS	BRU_IAGOS	45	0.89	3.14	0.93	1.10	-4.30
TMF_Lidar	SAN_IAGOS	20	-4.81	6.56	0.70	0.59	18.77
TMF_Lidar	LAX_IAGOS	33	-3.13	5.38	0.80	0.83	6.53
OHPO3T_Lidar	ohp_O3S	235	-5.98	7.83	0.64	0.57	20.65
OHPO3T_Lidar	040_Umk	206	-16.41	9.86	0.46	0.45	17.63

Table S4. Same as Table S2, but now for the tropospheric ozone column amounts from the surface to 300 hPa in Dobson unit (DU).

site1	site2	N	Bias (2 - 1)	stdev	r	slope	offset
mcmurdo_O3S	Ahts_FTIR	39	1.41	1.83	0.59	0.55	9.77
lauder_O3S	Lauder_FTIR	309	1.31	2.85	0.62	0.75	6.11
hilo_O3S	Mauna_Loa_FTIR	389	-7.44	3.34	0.79	0.59	1.91
izana_O3S	Izana_FTIR	431	-6.57	3.29	0.82	0.77	0.56
boulder_O3S	Boulder_FTIR	211	1.19	2.73	0.79	0.90	3.53
payerne_O3S	Jungfraujoch_FTIR	825	-12.01	3.66	0.73	0.53	1.97
hohenpeissenberg_O3S	Zugspitze_FTIR	1324	-4.40	4.73	0.51	0.59	5.80
sodankyla_O3S	Kiruna_FTIR	344	3.97	5.47	0.52	0.71	12.56
nyalesund_O3S	Ny_Alesund_FTIR	118	2.32	5.60	0.52	0.50	19.34
eureka_O3S	Eureka_FTIR	239	1.79	4.28	0.69	0.57	14.91
yarmouth_O3S	BOS_IAGOS	20	-2.93	2.99	0.81	0.92	-0.18
kelowna_O3S	PDX_IAGOS	37	0.76	5.44	0.68	0.56	13.27
kelowna_O3S	YVR_IAGOS	19	0.89	3.97	0.65	1.23	-4.98
payerne_O3S	FRA_IAGOS	2115	-0.14	4.19	0.70	0.68	8.96
hohenpeissenberg_O3S	MUC_IAGOS	303	2.53	3.40	0.76	0.82	6.97
uccle_O3S	ORY_IAGOS	35	-3.27	4.24	0.40	0.30	18.08
uccle_O3S	CDG_IAGOS	1028	-2.98	4.73	0.64	0.59	9.52
uccle_O3S	BRU_IAGOS	481	-1.28	4.38	0.72	0.73	7.09
debilt_O3S	DUS_IAGOS	84	-2.52	3.59	0.85	0.77	4.88
legionowo_O3S	VIE_IAGOS	458	-2.65	5.13	0.69	0.65	8.46
lauder_O3S	256_Umk	445	-1.23	5.10	0.02	0.02	17.94
hilo_O3S	031_Umk	43	-9.94	3.93	0.46	0.32	4.15
boulder_O3S	067_Umk	24	-4.03	4.52	0.14	0.16	15.29
ohp_O3S	040_Umk	456	-5.09	6.65	0.41	0.52	8.73
payerne_O3S	035_Umk	760	-8.72	4.72	0.59	0.51	5.21
sodankyla_O3S	105_Umk	224	0.49	6.68	0.30	0.47	16.98
Mauna_Loa_FTIR	HNL_IAGOS	55	9.18	3.46	0.76	1.04	8.59
Tsukuba_FTIR	KIX_IAGOS	17	-3.61	3.51	0.23	0.17	22.08
Tsukuba_FTIR	NRT_IAGOS	17	-3.70	4.47	0.48	0.28	19.52
Toronto_FTIR	DTW_IAGOS	54	-4.58	6.44	0.46	0.32	18.67
Toronto_FTIR	YYZ_IAGOS	63	-4.57	9.52	0.51	0.24	22.01
Jungfraujoch_FTIR	FRA_IAGOS	2330	10.90	4.34	0.59	0.80	14.55
Zugspitze_FTIR	MUC_IAGOS	363	6.68	4.64	0.56	0.53	16.39
Lauder_FTIR	256_Umk	950	-2.80	4.30	0.28	0.30	11.66
Jungfraujoch_FTIR	035_Umk	1080	2.92	3.61	0.66	0.87	5.19

Kiruna_FTIR	105_Umk	373	-4.44	8.07	0.30	0.33	19.59
031_Umk	HNL_IAGOS	46	10.60	3.84	0.60	1.13	8.75
035_Umk	FRA_IAGOS	2209	7.57	5.04	0.51	0.54	16.57
KIX_IAGOS	NKM_IAGOS	15	-0.05	2.11	0.96	1.07	-2.52
KIX_IAGOS	NRT_IAGOS	44	0.12	5.99	0.59	0.45	15.69
CDG_IAGOS	BRU_IAGOS	743	0.98	4.51	0.66	0.76	7.83
DUS_IAGOS	AMS_IAGOS	22	1.21	3.63	0.68	0.53	14.68
TMF_Lidar	LAX_IAGOS	33	8.57	3.70	0.81	1.33	1.60
TMF_Lidar	LAS_IAGOS	17	4.76	3.24	0.76	0.82	8.71
OHPO3T_Lidar	ohp_O3S	205	5.51	4.79	0.53	0.66	13.25

Table S5. Same as Table S3, but now for the tropospheric ozone column amounts from the surface to 300 hPa in Dobson unit (DU).

site1	site2	N	Bias (2 - 1)	stdev	r	slope	offset
mcmurdo_O3S	Ahts_FTIR	26	1.27	1.20	0.57	0.55	9.55
lauder_O3S	Lauder_FTIR	210	1.20	1.86	0.76	0.94	2.43
paramaribo_O3S	Paramaribo_FTIR	16	1.51	3.78	0.45	0.46	11.79
hilo_O3S	Mauna_Loa_FTIR	200	-7.44	2.86	0.77	0.50	3.88
izana_O3S	Izana_FTIR	257	-6.50	2.41	0.84	0.82	-1.21
boulder_O3S	Boulder_FTIR	120	1.57	2.72	0.66	0.80	6.12
payerne_O3S	Jungfraujoch_FTIR	226	-10.89	2.65	0.82	0.53	2.33
hohenpeissenberg_O3S	Zugspitze_FTIR	305	-4.43	3.48	0.54	0.59	5.74
sodankyla_O3S	Kiruna_FTIR	252	3.59	3.78	0.71	0.90	6.57
nyalesund_O3S	Ny_Alesund_FTIR	146	2.34	4.29	0.57	0.79	9.31
eureka_O3S	Eureka_FTIR	94	2.03	3.03	0.77	0.86	6.17
irene_O3S	JNB_IAGOS	19	-4.48	3.74	0.66	0.52	6.92
nairobi_O3S	NBO_IAGOS	20	-1.01	2.53	0.66	0.62	5.22
kualalumpur_O3S	SIN_IAGOS	22	-1.47	4.59	0.67	1.11	-3.36
hilo_O3S	HNL_IAGOS	23	2.29	3.38	0.53	0.60	10.82
boulder_O3S	DEN_IAGOS	17	-0.47	2.28	0.71	0.88	2.42
yarmouth_O3S	BOS_IAGOS	53	-3.31	3.36	0.65	0.63	9.39
kelowna_O3S	PDX_IAGOS	43	-0.10	3.64	0.46	0.51	13.31
kelowna_O3S	YVR_IAGOS	56	0.34	2.77	0.63	0.68	8.65
payerne_O3S	FRA_IAGOS	214	0.11	2.09	0.88	0.85	4.27
hohenpeissenberg_O3S	MUC_IAGOS	55	2.31	2.00	0.89	1.00	2.38
uccle_O3S	CDG_IAGOS	119	-2.53	2.54	0.83	0.79	3.93
uccle_O3S	BRU_IAGOS	54	-1.44	1.57	0.93	1.00	-1.36
debilt_O3S	DUS_IAGOS	61	-0.18	3.23	0.84	0.96	1.13
debilt_O3S	AMS_IAGOS	22	-1.30	2.58	0.83	0.83	4.16
edmonton_O3S	YYC_IAGOS	16	-2.33	2.59	0.58	0.51	10.36
legionowo_O3S	VIE_IAGOS	146	-2.71	2.69	0.88	0.81	3.21
lauder_O3S	256_Umk	342	-0.88	3.68	-0.12	-0.12	20.62
hilo_O3S	031_Umk	398	-9.22	3.15	0.73	0.39	4.59
boulder_O3S	067_Umk	400	-4.65	2.64	0.64	0.48	7.44
ohp_O3S	040_Umk	303	-4.98	4.00	0.66	0.76	1.78
payerne_O3S	035_Umk	235	-8.27	2.52	0.82	0.63	2.30
sodankyla_O3S	105_Umk	172	-0.46	4.22	0.46	0.54	13.86
Mauna_Loa_FTIR	HNL_IAGOS	22	8.95	2.54	0.72	1.15	6.78
Tsukuba_FTIR	KIX_IAGOS	19	-4.03	4.35	0.68	0.47	13.91
Tsukuba_FTIR	NGO_IAGOS	34	-4.29	4.42	0.77	0.68	7.20

Tsukuba_FTIR	NRT_IAGOS	18	-5.88	3.88	0.85	0.52	11.01
Toronto_FTIR	DTW_IAGOS	58	-6.77	4.46	0.54	0.51	10.19
Toronto_FTIR	YYZ_IAGOS	60	-5.51	4.40	0.57	0.45	13.01
Jungfraujoch_FTIR	FRA_IAGOS	230	10.78	2.63	0.81	1.20	7.22
Zugspitze_FTIR	MUC_IAGOS	50	5.53	3.74	0.59	0.65	12.79
Lauder_FTIR	256_Umk	235	-2.34	3.49	0.10	0.07	16.65
Boulder_FTIR	067_Umk	121	-5.72	2.66	0.67	0.49	6.68
Jungfraujoch_FTIR	035_Umk	250	2.37	2.34	0.72	0.82	5.56
Kiruna_FTIR	105_Umk	171	-3.71	4.75	0.53	0.46	14.58
031_Umk	HNL_IAGOS	21	9.95	2.84	0.73	1.58	2.02
067_Umk	DEN_IAGOS	15	3.86	3.55	0.15	0.19	18.79
035_Umk	FRA_IAGOS	303	7.92	3.16	0.70	0.97	8.62
KIX_IAGOS	NGO_IAGOS	16	-0.30	3.65	0.78	0.94	1.50
KIX_IAGOS	NKM_IAGOS	36	-0.38	4.15	0.78	1.01	-0.67
KIX_IAGOS	NRT_IAGOS	111	1.18	4.18	0.69	0.64	11.56
NGO_IAGOS	NRT_IAGOS	20	0.27	5.60	0.38	0.26	21.36
NKM_IAGOS	NRT_IAGOS	23	1.52	4.03	0.83	0.58	13.68
DTW_IAGOS	YYZ_IAGOS	36	-0.31	3.45	0.70	0.63	9.88
PDX_IAGOS	YVR_IAGOS	18	0.80	4.58	0.12	0.18	21.42
CDG_IAGOS	BRU_IAGOS	45	0.54	1.53	0.94	1.11	-2.46
TMF_Lidar	SAN_IAGOS	20	7.23	2.89	0.69	0.81	11.28
TMF_Lidar	LAX_IAGOS	33	7.97	2.80	0.79	1.19	4.09
OHPO3T_Lidar	ohp_O3S	235	5.20	3.17	0.69	0.90	7.37
OHPO3T_Lidar	040_Umk	206	0.02	4.19	0.49	0.71	6.61

Table S6. TrOC QR and MLR L3 trend calculations for the original and subsampled (2 randomly chosen daily measurements a month, denoted by "Sub" in the column headers) monthly mean time series. Trends are estimated in ppb per decade, and trend uncertainties (2 standard deviations) and *p* values (QR) are given. Bold trends have $p < 0.05$. Left columns display the station name, instrument type, and mean monthly sampling frequency of the original time series.

Station	Instrument	Monthly Sampling	QR L3 Trend ± 2σ (ppbv/dec)	QR L3 *p* value	QR L3 Sub Trend ± 2σ (ppbv/dec)	QR L3 Sub *p* value	MLR L3 Trend ± 2σ (ppbv/dec)	MLR L3 Sub Trend ± 2σ (ppbv/dec)
Northern Hemisphere (180-20° W) TrOC (surface to 300hPa) trends								
Alert	O3S	4.04	0.74 ± 1.76	0.42	-0.07 ± 2.26	0.95	0.62 ± 1.63	0.42 ± 1.89
ATL	IAGOS	5.51	-0.78 ± 2.22	0.50	N/A	N/A	-0.53 ± 2.44	N/A
Boulder	O3S	4.51	**-1.41 ± 1.14**	**0.01**	-0.17 ± 1.43	0.81	**-1.30 ± 0.79**	-0.91 ± 1.02
Boulder (067)	Umkehr	13.47	0.44 ± 1.30	0.52	-0.82 ± 1.43	0.26	-0.02 ± 1.08	-0.99 ± 1.41
Churchill	O3S	3.63	-1.64 ± 2.42	0.17	-2.85 ± 3.02	0.08	**-3.01 ± 1.98**	-3.02 ± 2.27
DAL	IAGOS	3.08	**2.41 ± 1.66**	**0.01**	N/A	N/A	2.16 ± 2.63	N/A
Edmonton	O3S	3.93	0.03 ± 0.96	0.95	-0.11 ± 1.47	0.89	-0.64 ± 0.95	-0.80 ± 1.11
Eureka	O3S	5.40	0.32 ± 1.36	0.65	-0.03 ± 1.89	0.98	-0.30 ± 1.37	-0.16 ± 1.51
Fairbanks (105)	Umkehr	8.72	0.02 ± 2.28	0.99	-0.15 ± 3.70	0.94	0.98 ± 2.77	0.84 ± 3.72
Goose Bay	O3S	4.09	-0.80 ± 1.28	0.21	-0.80 ± 1.49	0.28	-0.26 ± 1.20	-0.47 ± 1.34
Hilo	O3S	4.13	-0.43 ± 1.30	0.50	-0.86 ± 1.71	0.32	-0.41 ± 1.03	-1.06 ± 1.32
Mauna Loa	FTIR	14.37	1.26 ± 2.48	0.30	0.99 ± 2.54	0.44	0.88 ± 2.33	1.15 ± 3.37
Mauna Loa (031)	Umkehr	19.65	**1.62 ± 0.96**	**0.00**	**1.73 ± 1.12**	**0.00**	**1.49 ± 0.91**	**1.50 ± 1.17**
Paramaribo	O3S	3.40	-0.42 ± 1.04	0.45	-0.16 ± 1.18	0.78	0.22 ± 1.17	-0.10 ± 1.36
Resolute	O3S	3.71	**-2.07 ± 1.78**	**0.03**	-0.80 ± 1.80	0.37	**-2.12 ± 1.80**	-1.63 ± 1.87
Scoresbysund	O3S	4.23	**-2.73 ± 1.40**	**0.00**	**-2.51 ± 1.72**	**0.00**	**-2.82 ± 1.15**	**-3.23 ± 1.38**
TMF	Lidar	10.57	**1.24 ± 1.08**	**0.02**	**1.28 ± 1.08**	**0.02**	**1.31 ± 1.02**	1.08 ± 1.36
Thule	FTIR	9.69	**-3.27 ± 1.74**	**0.00**	-1.77 ± 1.89	0.06	**-3.59 ± 1.92**	-1.41 ± 2.75
Toronto	FTIR	8.98	-1.15 ± 2.16	0.27	-0.72 ± 3.50	0.68	-1.70 ± 2.08	-1.02 ± 3.02
Trinidad Head	O3S	4.50	-0.96 ± 1.12	0.07	**-1.41 ± 1.27**	**0.03**	**-0.90 ± 0.89**	-1.08 ± 1.14
Wallops Island	O3S	4.67	**-2.83 ± 1.50**	**0.00**	**-2.82 ± 1.74**	**0.00**	**-2.81 ± 1.25**	**-2.45 ± 1.42**
Northern Hemisphere (19° W-79° E) TrOC (surface to 300hPa) trends								
Arosa (035)	Umkehr	8.09	0.63 ± 1.36	0.34	0.03 ± 2.00	0.98	0.68 ± 1.05	-0.38 ± 1.42
Ascension Island	O3S	3.83	-1.06 ± 1.76	0.22	-0.70 ± 1.54	0.37	-0.88 ± 1.74	-0.93 ± 1.84
De Bilt	O3S	4.31	**1.50 ± 1.20**	**0.01**	**2.08 ± 1.38**	**0.00**	**1.34 ± 1.08**	**1.34 ± 1.34**
FRA	IAGOS	24.64	0.09 ± 1.10	0.87	1.13 ± 1.19	0.06	-0.04 ± 1.08	0.28 ± 1.36
Hohenpeissenberg	O3S	10.58	0.55 ± 0.94	0.23	0.35 ± 1.24	0.63	0.26 ± 0.76	0.35 ± 0.97
Izana	FTIR	8.55	1.08 ± 1.30	0.08	1.05 ± 2.26	0.37	0.73 ± 1.07	0.85 ± 1.53
Izana	O3S	4.00	**2.12 ± 1.18**	**0.00**	**1.92 ± 1.52**	**0.01**	**2.30 ± 0.87**	**1.79 ± 1.06**
Jungfraujoch	FTIR	8.56	**-1.93 ± 1.78**	**0.03**	**-1.83 ± 1.64**	**0.03**	-1.08 ± 1.34	-1.33 ± 1.86

Kiruna	FTIR	7.26	**-1.77 ± 1.48**	**0.02**	-1.26 ± 1.33	0.06	**-1.73 ± 1.15**	**-1.77 ± 1.42**
Legionowo	O3S	4.86	**-1.26 ± 1.18**	**0.04**	**-2.02 ± 1.32**	**0.00**	**-1.40 ± 1.06**	**-1.86 ± 1.05**
Lerwick	O3S	4.93	-1.01 ± 1.54	0.18	-0.77 ± 1.57	0.33	-0.96 ± 1.24	-1.02 ± 1.46
Madrid	O3S	3.96	-0.74 ± 1.24	0.25	-0.61 ± 1.29	0.38	-0.62 ± 1.22	-0.54 ± 1.39
NyAlesund	O3S	6.50	-0.75 ± 1.08	0.15	**-1.21 ± 1.14**	**0.04**	**-0.93 ± 0.91**	-0.98 ± 1.18
OHP (040)	Umkehr	11.29	0.51 ± 2.10	0.62	-0.19 ± 2.40	0.88	-0.86 ± 1.88	-0.76 ± 1.92
OHP	Lidar	6.72	**2.24 ± 1.76**	**0.01**	**3.00 ± 2.13**	**0.00**	1.90 ± 2.04	**2.48 ± 1.97**
OHP	O3S	3.85	**1.37 ± 1.26**	**0.03**	1.04 ± 1.39	0.12	**1.96 ± 1.05**	**1.67 ± 1.10**
Payerne	O3S	12.75	**-1.29 ± 1.02**	**0.01**	**-1.98 ± 1.57**	**0.01**	**-1.63 ± 0.94**	**-2.53 ± 1.22**
Sodankyla	O3S	4.17	**-1.74 ± 1.40**	**0.01**	**-1.89 ± 1.42**	**0.01**	**-1.75 ± 1.08**	**-2.02 ± 1.20**
Uccle	O3S	11.80	**1.23 ± 1.10**	**0.03**	0.83 ± 1.51	0.27	0.57 ± 0.97	0.51 ± 1.31
Valentia	O3S	4.06	1.37 ± 2.04	0.18	1.63 ± 2.68	0.23	-0.36 ± 2.41	-0.02 ± 3.20
Zugspitze	FTIR	9.68	-1.15 ± 1.82	0.22	-1.75 ± 2.51	0.16	-0.32 ± 0.60	-1.69 ± 2.40
Northern Hemisphere (80-180° E) TrOC (surface to 300hPa) trends								
Kuala Lumpur	O3S	2.07	**2.61 ± 1.74**	**0.00**	**2.26 ± 1.91**	**0.02**	**1.86 ± 1.56**	**1.92 ± 1.55**
Rikubetsu	FTIR	3.73	-0.12 ± 1.24	0.85	-0.29 ± 2.03	0.78	-0.58 ± 1.37	-1.37 ± 1.72
Southern Hemisphere TrOC (surface to 300hPa) trends								
Arrival Heights	FTIR	6.24	**-1.25 ± 1.20**	**0.04**		**0.00**	**-1.69 ± 1.32**	**-2.20 ± 1.48**
Fiji	O3S	2.58	-1.04 ± 1.80	0.29	0.0 ± 1.70	1.00	-1.33 ± 2.28	-1.01 ± 2.27
Irene	O3S	2.48	0.48 ± 2.36	0.68	0.49 ± 2.11	0.66	-0.16 ± 2.41	0.31 ± 2.63
Lauder	O3S	3.84	0.01 ± 0.70	0.98	0.24 ± 0.75	0.52	0.13 ± 0.61	-0.16 ± 0.79
Lauder	FTIR	10.90	**1.64 ± 0.86**	**0.00**	**1.85 ± 1.10**	**0.00**	**1.67 ± 0.86**	**1.21 ± 1.08**
Lauder (256)	Umkehr	8.97	0.38 ± 1.20	0.55	0.69 ± 1.61	0.41	0.58 ± 0.86	0.35 ± 0.92
Nairobi	O3S	3.90	0.47 ± 1.56	0.54	0.69 ± 1.62	0.40	0.75 ± 1.37	0.60 ± 1.41
Natal	O3S	3.67	0.76 ± 1.22	0.21	0.90 ± 1.83	0.33	1.04 ± 1.37	1.49 ± 1.73
Reunion	O3S	3.27	1.17 ± 1.62	0.15	0.51 ± 1.65	0.54	**1.93 ± 1.27**	**1.45 ± 1.40**
Samoa	O3S	3.31	-0.49 ± 1.10	0.35	-0.97 ± 1.60	0.23	-0.52 ± 0.99	-0.52 ± 1.03
South Pole	O3S	4.89	**-0.90 ± 0.56**	**0.00**	-0.55 ± 0.76	0.15	**-1.01 ± 0.73**	-0.36 ± 0.77

In Table S6, we compare the original L3 trends values with the L3 trends from a single realization of the datasets subsampled to exactly two random daily values a month. It should be mentioned that our single "subsampled" dataset contains fewer sites, as the IAGOS airports DAL and ATL have too many months with only one measurement a month, so that any time series sampled to exactly two daily values a month contain too much gaps for a reliable trend estimation. From Table S6, we can conclude that, for this specific subsampling strategy, the differences between the trend values estimated from both samples are not large (mean absolute trend difference of 0.46±0.37 and 0.37±0.38 ppb per decade for QR and MLR, respectively). For both methods, only at around five sites, there is a trend sign reversal, but the estimated trends have large uncertainties. The most striking and consistent feature of the comparison is the higher trend uncertainties (2σ) for the subsampled dataset (i.e. for

46/49 sites, or 87/92%, for QR/MLR). Also the QR *p* values of the "subsampled" trend estimations are higher for the majority of the sites (32 sites, 60%). As a consequence, the number of sites with trends significantly different from zero (taking a *p* value lower than 0.05 as criterion) decreases, although moderately, from 22/21 (40/38%) to 16/15 (30/28%) for QR/MLR when subsampling the data to exactly two monthly measurements for calculating the monthly mean. This is not unexpected because, based on the sampling theory (Thompson, 2012), if the samples are chosen randomly and have no structural bias, the results are not expected to be biased, but smaller samples lead to larger uncertainty. As a matter of fact, the differences in trend values and trend uncertainties between the two L3 datasets are comparable with those between QR L1 and QR L3: a similar amount of sites with larger than smaller trend estimates, a mean absolute trend differences of 0.46±0.40 ppb per decade, 7 (out of 55 sites) switching trend sign, all but one sites having larger trend uncertainties (2 sigma values) for QR L3 compared to QR L1, 40 sites having larger QR L3 trend *p* values, the number of sites with trends significantly different from zero (taking a *p* value lower than 0.05 as criterion) being 32 for QR L1 (and 22 for QR L3). On top of that, the trend (uncertainty) differences between the original and subsampled datasets lie also in the same order of magnitude than those between the two trends estimation methods (QR and MLR) used, with a mean absolute trend difference of 0.38±0.37 ppb per decade, and exactly the same number of sites having trends significantly different from zero.

We can therefore conclude that the trend uncertainty due to a monthly sampling frequency of around 2 is comparable to the trend uncertainty that is associated with the choice of the trend estimation method and with the one due to the sampling frequency (all measurements vs. monthly means) for the QR trend estimation.

Table S7. Summary of trend differences, drifts, and their causes between the time series at collocated sites. The sampling is described by percentage of months with data and by the average number of observations for each month with data.

station	technique	sampling	QR trend [ppbv/dec]	drift [ppbv/dec]	site comments	general comment
Izaña	O3S	97.8% 4.0/month	**+2.59±0.68**		launch at coast (36 m a.s.l.)	despite drift between series, no significant trend difference
	FTIR	96.3% 8.6/month	**+1.88±0.88**	-1.53±0.88	FTIR located at mountain top (2373m)	
Boulder	O3S	99.7% 4.5	**-1.14±0.86**		DLM trends always negative over the years	interannual variability not always similar, no significant DLM trend differences over the years
	Umkehr	98.6% 13.5/month	+0.11±0.72	+1.24±0.84	DLM trends close to zero over the years	
Lauder	O3S	91.9% 3.8/month	+0.13±0.50		ends in mid 2022, while other two continue until 2023	Umkehr different seasonal cycle than the other two techniques? Very low correlation coefficients between Umkehr and O3S/FTIR time series. Less positive trends compared to Bjorklund et al. (2024)
	FTIR	98.1% 10.9/month	**+1.54±0.44**	+1.97±0.80 (vs. O3S) +0.97±0.81 (vs. Umkehr)	positive drift of FTIR vs. other two	
	Umkehr	95.3% 9.0/month	+0.36±0.70		Umkehr turns from negative to positive trends in 2014 (DLM)	
OHP	O3S	97.9% 3.9/month	**+1.95±1.08**			especially large differences in beginning of time series
	Umkehr	88.5% 11.3/month	**-1.49±1.00**	-2.74±1.44 (vs. O3S)	DLM negative trends over the entire period	
	Lidar	85.9% 6.7/month	**+1.93±1.02**		significantly positive trend by DLM during the entire period	

Hawaii	O3S	100% 4.1/month	-0.28±0.98		launch at coast (11 m a.s.l.), drop in TCO since 2014	due to TCO drop in ozonesonde time series, positive drifts of other techniques vs. O3S. Umkehr and FTIR trends, located at same spot, are consistent
	Umkehr	96.7% 19.7/month	**+1.83±0.44**	+1.97±0.88 (vs. O3S)	located at mountain top (3397 m), significant positive trends since 2004 (DLM).	
	FTIR	60% 14.4/month	**+2.03±1.30**	+1.71±1.45 (vs. O3S)	located at mountain top (3397 m), sparse data coverage in beginning of time period, constant trend of 0.2 ppbv/yr by DLM	

Table S8. Same as Table S7, but now for different techniques at nearby sites.

station	technique	sampling	Trend [ppb/dec]	drift [ppb/dec]	site comments	general comment
Sodankylä	O3S	92.0% 4.2/month	**-1.28±0.78**			in agreement
Kiruna	FTIR	85.2% 7.3/month	**-2.26±0.88**			
Uccle	O3S	100% 11.8/month	**+0.90±0.48**			overall very good agreement between the 3 time series, De Bilt most deviant from other 2 due to lower sampling frequency?
De Bilt	O3S	100% 4.3/month	**+1.34±0.86**		higher variability in monthly anomalies due to lower launch rate	
Frankfurt	IAGOS	90.8% 24.6/month	**+0.65±0.36**		outliers associated with large statistical uncertainty or single monthly value (2005)	
Payerne	O3S	100% 12.8/month	**-1.30±0.62**		altitude: 491m, homogenized time series starts in 2002, other 2 start in 2000, "smoother" anomaly time series (higher monthly sampling?), DLM negative trends during entire period (but only significant until 2009)	especially large differences in beginning of time series
Arosa	Umkehr	97.1% 8.1/month	+0.56±0.78	+1.93±0.96 (vs. O3S) +1.88±1.18 (vs. FTIR)	altitude: 1840 m	
Jungfraujoch	FTIR	93.9% 8.6/month	**-1.78±0.66**		altitude: 3580 m, free troposphere	

Hohen-peissenberg	O3S	100% 10.6/month	**+0.50±0.46**		altitude: 975 m Brewer-Mast type	although different trend sign, no significant drift between both time series. Is altitude differences driving the trend difference?
Zugspitze	FTIR	95.7% 9.7/month	**-1.82±0.88**		altitude: 2960 m, low values at beginning of time period, higher variability	