Supplement of

Observational ozone data over the global oceans and polar regions: The TOAR-II Oceans data set version 2024

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Table S1. Methods and uncertainties of CO, NOx, and CN observations associated with O_3 observations from ship cruises.

Label	Cruise	CO, NOx, CN	Uncertainty
S1	MR12: MR12-02	Thermo, 48C	3% for CO
S2	MR13: MR13-04, 05, 06, 14-01, 02	Thermo, 48C	3% for CO
S3	MR14: MR14-04, 05, 06	Thermo, 48C	3% for CO
S4	MR15: MR15-03, 04, 05	Thermo, 48C	3% for CO
S5	MR16: MR16-06, 08, 09	Thermo, 48C	3% for CO
S6	MR17: MR17-05C, 08	Thermo, 48C	3% for CO
S7	MR18: MR18-04, 05C, 06	Thermo, 48C	3% for CO
S8	MR19: MR19-03C, 04	Thermo, 48C	3% for CO
S9	MR20: MR20-E01, 05C, E02, 01	Thermo, 48iTLE	3% for CO
S10	MR21: MR21-01, 03, 05C, 06	Thermo, 48iTLE	3% for CO
S11	KH-18-6	Thermo, 48iTLE	3% for CO
S12	NAAMES1	TSI 3010	CO: ±(10 +5%) ppb
S13	NAAMES2	TSI 3010	
S14	NAAMES3	TSI 3010	
S15	NAAMES4	TSI 3010	
S16	ATOMIC	TSI 3010	
S17	DYNAMO	TSI 3010	
S18	WACS	TSI 3010	
S19	VOCALS	TSI 3010	± 2% n/cm3
S20	MAGE92	N/A	
S21	RITS93	TSI 3076	
S22	RITS94	TSI 3076	

S24	ACEASIA	TSI 3760	
S25	NEAQS 2002	NO by NO_2 chemiluminescence (custom instrument) Conversion of NO2 to NO by broadband UV light from 500W Xe lamp	NO ±(4%+0.006 ppb); NO2 ±(7%+0.024 ppb)
S26	NEAQS 2004	CO AeroLaser AL-5002;NO Chemiluminescence instrument; NO_2 Photolysis of NO_2 and NO detection	CO ±(3% + 1 ppbv); NO ±(4.4%); NO2 The total estimated accuracy for NO2 when NO_2/NO = 3 is ±(6.5% + 93 pptv), increasing to ±11% when NO_2/NO = 1 and ±23% when NO_2/NO = 0.33.
S27	TEXAQS 2006	CO AL 5002, NO by ozone-induced Chemiluminescence, NO2 by photolysis, followed by ozone-induced chemiluminescence	CO: ±3%, NO 3.8% + 0.010 ppbv, see NO2_ppbv_var
S28	ICEALOT	CO AL5002, NO is measured directly by ozone-induced chemiluminescence. NO_2 is partially photoyzed and measured as the difference in signal between a photoyzed and unphotolyzed sample., CNC	CO ± 4.1%, see NO_ppbv_unc and NO2_ppbv_unc
S29	CalNex 2010	CO N/A, NO, NO_2: N/A	CO N/A, NO, NO_2 N/A
S60	MOSAiC	CO: Cavity ring-down spectrometer (Picarro model G2401)	manufacturer-specified precisions of 1.0 ppb for 20-s averages, CO 1.5 ppb (5 min)
S62	AEROSOLS99-INDOEX	TSI 3010	NA

Table S2. Methods and uncertainties of CO, NOx, and CN observations associated with O_3 observations from aircraft campaigns.

Label	Campaign	CO, NOx	Uncertainty
A5	PEM-West A	TDL, Chemiluminescence, PF/LIF	CO 1%, NO ±18%. NO_2 ±20%
A6	PEM-West B	TDL, LIF	CO 1%, NO ±18%
A8	PEM-Tropics A	TDL, TP-LIF, PF/TP-LIF	CO 1%, NO 63 ppt, NO_2 12 ppt
A9	PEM-Tropics B P3B	differential absorption IR, chemiluminescence	CO ±2%, NO, NO_2: 1.5 ppt
A10	PEM-Tropics B DC8	TDL, TP-LIF, PF/TP-LIF	CO ±2%, NO, NO_2: see original data files
A11	TRACE-P P3B	TDLAS, chemiluminescence	±2% (CO), ±8%(NO), ±20% (NO_2)
A12	TRACE-P DC8	TDLAS, TP-LIF	±2% (CO), ±20-30% (NO, NO_2)
A13	INTEX-NA	TDLAS, LIF	CO (5% or 1 ppb), NO, NO_2 (5 ppt, 10%)
A14	INTEX-B DC8	DACOM, LIF	CO: 5% or 1 ppb, NO, NO_2 5%, 15%
A15	INTEX-B C-130	VUV-fluorescence, chemiluminescence	CO: ± 10%, ±(15+7% of the mixing ratio) pptv for NO, ±(15+10% of the mixing ratio) pptv for NO_2
A16	ARCTAS	TDLAS, chemiluminescence	CO: 2% or 2 ppb, NO: 7%, NO_2: 10%
A17	SEAC4RS DC8	CO: Diode laser spectrometer, NO: chemiluminescence, NO_2:UV-LED photolysis/chemiluminescence	CO: 5% or 5 ppb, NO:0.010 ppbv + 4%, NO_2: 0.030 ppbv + 7%
A18	SEAC4RS ER2	CO: Picarro Cavity Ringdown Spectrometer	CO: 2.5 ppb
A19	DISCOVER-AQ	4ch chemiluminescence	10 pptv + 10% for NO, 20 pptv + 10% for NO_2
A20	KORUS-AQ	4ch chemiluminescence, CO: Diode laser spectrometer	(30 pptv + 20%) for NO, (50 pptv + 30%) for NO_2, 2% or 2 ppbv for CO
A21	ATOM1-4	4ch chemiluminescence, PICARRO cavity ringdown spectrometer	NO, NO_2: 5-10 ppt, 3.6 ppb CO (10 s)
A22	HIPPO	VUV fluorescence	CO: 5 ppb
A23	ACSIS FAAM	CO: AERO AL5002 instrument	N/A
A24	ACCACIA FAAM	CO: AERO AL5002 instrument	N/A
A25	CAST FAAM	CO: AERO AL5002 instrument	N/A
A26	CLARIFY FAAM	CO: AERO AL5002 instrument	N/A

A27	ITOP FAAM	CO: AERO AL5002 instrument	N/A
A28	VOCALS FAAM	CO: AERO AL5002 instrument	N/A
A31	TEXAQS2000	CO vacuum ultraviolet fluorescence; NO/O_3 Chemiluminescence; NO_2 via UV photolysis	CO random uncertainty: 2.5%. NO: ±(20 pptv+5%); NO_2: ±(40 pptv+8%);
A32	ITCT2002	CO vacuum ultraviolet fluorescence; NO/O_3 Chemiluminescence; NO_2 via UV photolysis	CO random uncertainty: 2.5%. NO: ±(10 pptv+5%); NO_2: ±(30 pptv+10%)
A33	ITCT2004	CO VUV resonance fluorescence; NO, NO_2: Photolysis & NO/O_3 Chemiluminescence	CO 5%, NO_ppbv ±(0.010 + 5%); NO_2_ppbv ±(0.025 + 8%)
A35	TEXAQS2006	CO VUV resonance fluorescence; NO, NO_2: Photolysis & NO/O_3 Chemiluminescence	CO 5% ±1 ppbv, NO (0.015 ppbv + 5%), NO_2 (0.040 ppbv + 9%)
A36	ARCPAC2008	CO VUV Resonance Fluorescence, NO, NO_2: Photolysis and NO/O_3 Chemiluminescence	CO 3%, NO (0.02 + 8%), NO_2 (0.04 + 10%)
A37	CalNex2010	CO VUV Resonance Fluorescence, NO, NO_2: Photolysis and NO/O_3 Chemiluminescence	CO 5%, NO (0.01 ppbv + 3%), NO_2 (0.03 ppbv + 4%)
A45	ACTIVATE	CO: Picarro Cavity Ringdown Spectrometer	CO ±5 ppb or ±2%
A46	CONTRAST	2-ch chemiluminescence instrument for NO-NO2, CO: Aero-laser AL5002 VUV fluorescence	CO: 3 ppbv ±3%, See error columns in this original file
A47	TORERO	CO: Aero-laser AL5002 VUV fluorescence	CO: 3 ppbv ±3%

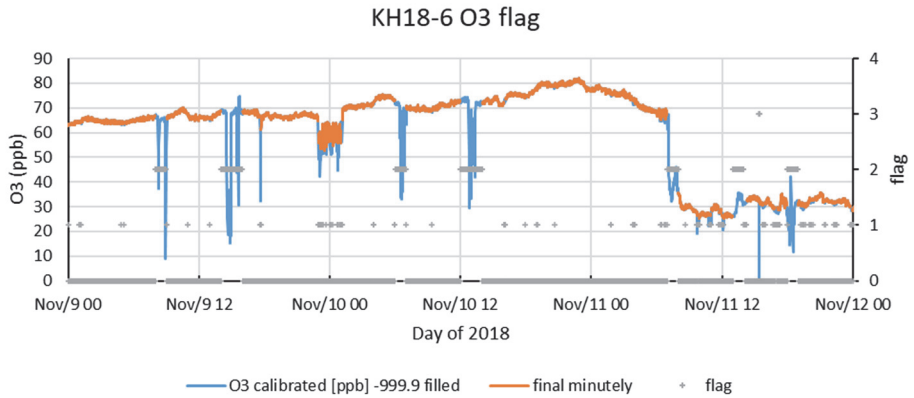

Figure S1. Removal of ozone data affected by ship exhaust and instability (blue). Flags (grey, in the right axis) 1: 1-minute based data removed (as lower than hourly average - 1σ), 2: hours with large variability, and 3: no data. The data after removal (orange) are used to calculate the hourly averages.

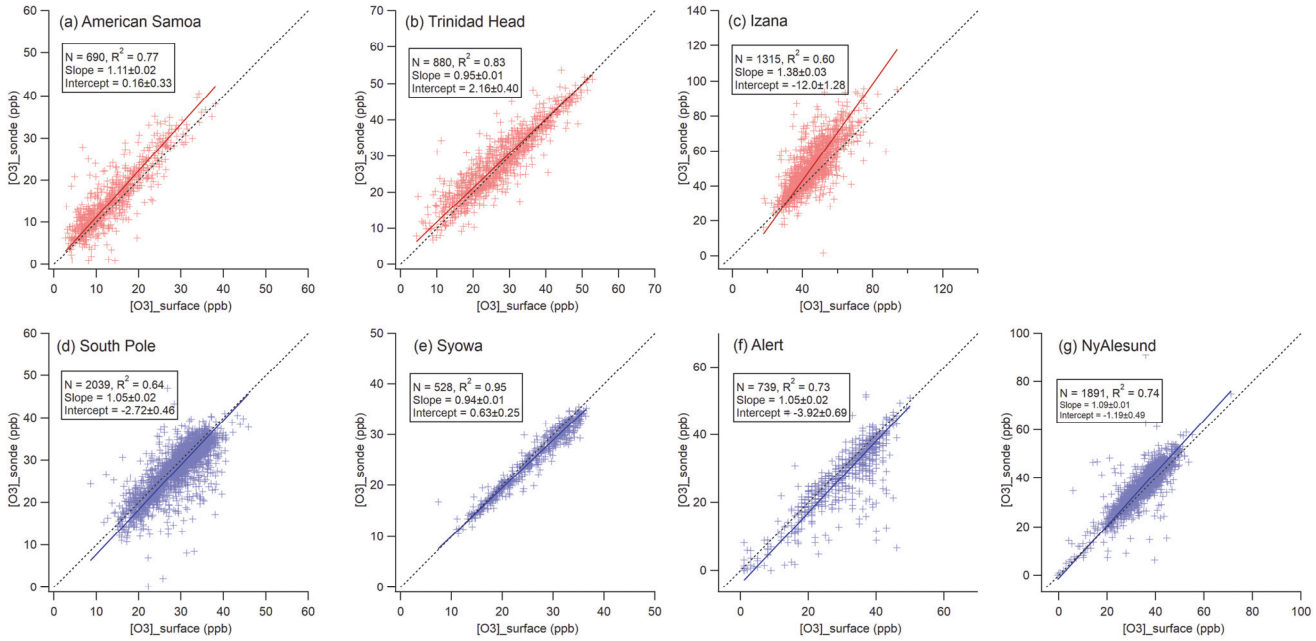

Figure S2. Scatterplots between ozonesonde data at the lowest level (~200 m) and surface data at 7 sites with co-located observations. For Izana, the ozonesonde data in the altitude layer of 2200–2400 m were used. The colored lines are the bivariate linear fits. The dashed black lines represent y = x.