Supporting Information

Neutral poly/per-fluoroalkyl substances in air from the Atlantic to the Southern Ocean and in Antarctic snow

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Table S1. Detailed information on sampling

Sample	Start date	Start latitude	Start longitude	End date	End latitude	End longitude	Volume (m^3)	Temp. (°C)
A1	26.10.2010	52.413	2.807	27.10.2010	49.982	-3.182	378	10.0
A2	27.10.2010	49.774	-3.587	28.10.2010	46.606	-4.782	351	12.0
A3	28.10.2010	46.537	-4.666	29.10.2010	45.833	-4.812	392	15.7
A4	29.10.2010	45.839	-4.898	01.11.2010	43.254	-10.107	349	14.8
A5	01.11.2010	42.878	-10.107	03.11.2010	36.031	-12.550	788	15.9
A6	03.11.2010	36.031	-12.550	04.11.2010	33.929	-13.469	474	19.2
A7	04.11.2010	33.913	-13.476	06.11.2010	28.142	-15.408	391	20.6
A8	06.11.2010	28.007	-15.425	07.11.2010	24.290	-20.564	431	22.5
A9	07.11.2010	24.290	-20.564	09.11.2010	14.448	-21.000	825	23.5
A10	09.11.2010	14.428	-21.000	11.11.2010	5.240	-20.168	693	26.7
A11	11.11.2010	5.240	-20.168	13.11.2010	-0.480	-20.168	564	28.3
A12	13.11.2010	-0.486	-17.659	15.11.2010	-6.728	-11.236	810	26.8
A13	15.11.2010	-6.816	-11.145	17.11.2010	-13.301	-4.381	785	24.4
A14	17.11.2010	-13.390	-4.287	19.11.2010	-18.985	3.023	789	20.5
A15	19.11.2010	-19.985	3.022	21.11.2010	-23.999	8.747	782	20.0
A16	21.11.2010	-24.061	8.805	23.11.2010	-28.412	12.912	780	18.8
A17	23.11.2010	-28.412	12.879	24.11.2010	-31.522	15.952	394	17.7
A18	24.11.2010	-31.522	15.952	28.11.2010	-33.915	18.433	1666	17.5
A19	29.11.2010	-35.783	15.114	02.12.2010	-41.473	9.689	907	15.5
A20	02.12.2010	-41.652	9.550	05.12.2010	-47.661	4.256	930	10.5
A21	05.12.2010	-47.771	4.141	09.12.2010	-55.502	0.003	1390	7.3
A22	09.12.2010	-55.708	0.000	11.12.2010	-59.066	0.007	516	0.4
A23	11.12.2010	-59.082	0.001	15.12.2010	-64.009	-0.047	1598	-1.1
A24	15.12.2010	-63.995	-0.050	19.12.2010	-60.198	-1.085	1546	-0.1

A25	22.12.2010	-70.375	-7.982	25.12.2010	-70.305	-13.860	1169	-0.5
A26	25.12.2010	-70.303	-13.845	29.12.2010	-66.626	27.093	1260	-1.1
A27	29.12.2010	-66.584	-27.475	02.01.2011	-65.537	-37.233	1483	-0.8
A28	02.01.2011	-65.442	-37.778	05.01.2011	-64.039	-48.369	879	-0.9
A29	05.01.2011	-63.899	-49.079	08.01.2011	-63.698	-55.573	1317	-1.1
A30	08.01.2011	-62.910	-57.429	11.01.2011	-62.170	-65.434	964	0.4
A31	17.01.2011	-64.744	-66.910	20.01.2011	-66.111	-67.948	1310	1.0
A32	23.01.2011	-67.435	-73.227	26.01.2011	-67.235	-70.556	972	0.8
A33	26.01.2011	-67.272	-70.482	29.01.2011	-65.615	-69.987	1208	-1.1

Table S2. Full names, acronyms, Chemical Abstract System (CAS) numbers and the method detection limits (MDL) of the 12 PFASs in air and snow

Full name	CAS number	Abbr.	MDL in air (pg m^{-3})	MDL in snow (pg L^{-1})
8:2 Fluorotelomer alcohol	678-39-7	8:2 FTOH	0.10	5.90
6:2 Fluorotelomer alcohol	647-42-7	6:2 FTOH	0.05	1.80
10:2 Fluorotelomer alcohol	865-86-1	10:2 FTOH	0.10	4.80
12:2 Fluorotelomer alcohol	39239-77-5	12:2 FTOH	0.10	5.60
N-methyl perfluorooctane sulfonamide	31506-32-8	MeFOSA	0.01	0.41
N-ethyl perfluorooctane sulfonamide	4151-50-2	EtFOSA	0.04	0.80
N-methyl perfluorobutane sulfonamide	68298-12-4	MeFBSA	0.02	0.10
N-methyl perfluorooctane sulfonamidoethanol	24448-09-7	MeFOSE	0.01	1.42
N-ethyl perfluorooctane sulfonamidoethanol	1691-99-2	EtFOSE	0.04	2.10
N-methyl perfluorobutane sulfonamidoethanol	34454-97-2	MeFBSE	0.01	0.20
6:2 Fluorotelomer acrylate	17527-29-6	6:2 FTA	0.01	0.69
8:2 Fluorotelomer acrylate	27905-45-9	8:2 FTA	0.01	0.26

Table S3. Atmospheric concentrations of the 12 PFASs (pg m^{-3})

samples	8:2 FTOH	6:2 FTOH	10:2 FTOH	12:2 FTOH	MeFBSA	MeFOSA	EtFOSA	MeFBSE	MeFOSE	EtFOSE	6:2 FTA	8:2 FTA	Sum
A1	17.11	6.37	3.1	2.82	0.37	0.49	0.23	0.16	1.75	0.25	0.12	0.27	33.03
A2	12.42	3.17	4.82	1.11	0.47	0.28	0.15	0.11	0.91	0.21	0.11	0.12	23.88
A3	50.67	3.94	7.99	4.52	0.42	0.27	0.13	0.09	0.35	0.13	0.13	0.16	68.80
A4	30.33	3.32	4.38	5.17	0.57	0.49	0.23	0.11	0.54	0.14	0.27	1.55	47.10
A5	17.04	2.46	4.41	2.79	0.43	0.39	0.17	0.14	0.65	0.04	0.08	0.21	28.82
A6	22.09	4.65	7.73	6.07	0.35	0.67	0.42	0.30	0.81	0.15	0.09	0.24	43.58
A7	20.17	5.15	6.28	3.53	0.39	0.64	0.74	0.44	1.08	0.1	0.13	0.34	38.96
A8	28.15	7.82	8.88	4.70	0.33	0.67	0.39	0.40	1.43	0.13	0.25	0.44	53.59
A9	11.84	2.04	2.76	3.46	0.23	0.40	0.35	0.15	0.82	0.13	0.15	0.28	22.59
A10	13.82	1.08	3.22	1.76	0.15	0.27	0.18	0.13	0.78	0.08	0.12	0.16	21.74
A11	30.07	1.23	11.35	5.28	0.09	0.28	0.14	0.17	1.02	0.13	0.15	0.24	50.14
A12	4.90	0.39	1.42	0.82	0.06	0.10	0.08	0.07	0.31	0.03	0.06	0.03	8.29
A13	4.82	0.67	0.88	0.85	0.04	0.07	0.04	0.05	0.36	0.06	0.05	0.08	7.97
A14	2.24	0.21	0.74	0.53	0.02	0.06	0.02	0.02	0.11	0.05	0.10	0.08	4.18
A15	2.74	0.16	1.11	0.69	0.03	0.06	0.05	0.03	0.17	0.03	0.05	0.02	5.13
A16	1.51	0.18	0.37	0.43	0.02	0.04	0.02	0.02	0.10	0.01	0.05	0.03	2.78
A17	3.54	0.14	1.39	0.77	0.05	0.10	0.03	0.04	0.22	0.02	0.07	0.04	6.41
A18	6.89	1.38	1.82	1.04	0.02	0.19	0.10	0.12	0.21	0.05	0.04	0.07	11.92
A19	4.88	0.39	0.78	0.57	0.07	0.06	0.08	0.05	0.23	0.07	0.07	0.01	7.27
A20	5.66	0.65	1.23	0.71	0.03	0.09	0.11	0.07	0.23	0.04	0.04	0.09	8.94
A21	4.31	0.55	0.94	0.83	0.03	0.06	0.08	0.06	0.36	0.03	0.04	0.12	7.42
A22	6.23	0.39	1.28	1.34	0.05	0.06	0.06	0.04	0.18	0.05	0.14	0.05	9.89
A23	9.19	0.32	1.55	1.44	0.02	0.14	0.05	0.03	0.20	0.02	0.03	0.07	13.04
A24	8.50	0.36	2.14	1.85	0.02	0.13	0.07	0.05	0.18	0.03	0.04	0.07	13.42

samples	8:2 FTOH	6:2 FTOH	10:2 FTOH	12:2 FTOH	MeFBSA	MeFOSA	EtFOSA	MeFBSE	MeFOSE	EtFOSE	6:2 FTA	8:2 FTA	Sum
A25	10.26	0.45	1.90	1.27	0.01	0.13	0.05	0.03	0.14	0.01	0.04	0.06	14.34
A26	8.19	0.55	3.20	1.70		0.20	0.06	0.09	0.10	0.04	0.03	0.05	14.21
A27	19.52	0.52	1.89	2.28	0.03	0.18	0.06	0.02	0.11	0.04	0.04	0.19	24.86
A28	37.60	0.87	4.36	4.12	0.06	0.34	0.07	0.03	0.59	0.05	0.04	0.25	48.39
A29	17.44	0.98	2.67	2.03	0.02	0.09	0.04	0.01	0.10	0.02	0.01	0.04	23.44
A30	30.63	0.65	2.20	4.82	0.02	0.15	0.05	0.04	0.20	0.02	0.08	0.11	38.97
A31	18.58	0.48	9.50	2.21	0.03	0.08	0.02	0.01	0.04	0.01	0.03	0.04	31.04
A32	16.46	0.69	2.94	2.13	0.04	0.14	0.06	0.01	0.28	0.05	0.03	0.11	22.94
A33	14.05	0.35	2.15	2.13	0.02	0.16	0.04	0.02	0.25	0.02	0.01	0.10	19.28

Table S4. Comparison of atmospheric PFAS concentrations (pg m^{-3}) reported by Dreyer et al. (2009), Vento et al. (2012) and obtained in this study at different areas

PFASs	South Atlantic <30°S		South Atlantic (30°S-70°S)		Antarctic Peninsula	
	This study	Dreyer et al. (2009)	This study	Dreyer et al. (2009)	This study	Vento et al., (2012)
6:2 FTOH	0.29	1.87	0.56	1.20	0.65	1.10
8:2 FTOH	3.29	5.44	7.12	6.00	22.04	9.90
10:2 FTOH	0.99	1.69	1.65	2.70	3.67	7.40
12:2 FTOH	0.68	2.78	1.19	1.00	2.82	1.10
6:2 FTA	0.06	3.14	0.05	1.00	0.04	0.90
8:2 FTA	0.05	1.08	0.07	0.20	0.12	-
MeFBSA	0.04	0.85	0.03	0.20	0.03	3.80
MeFOSA	0.07	0.81	0.12	0.60	0.16	0.20
EtFOSA	0.04	0.60	0.07	0.30	0.05	0.10
MeFBSE	0.04	0.58	0.06	0.30	0.02	2.90
MeFOSE	0.21	1.03	0.20	1.60	0.22	0.50
EtFOSE	0.03	0.30	0.04	0.50	0.03	0.10
ΣPFASs	5.79	13.91	11.16	15.60	29.85	28.00

Reference

Dreyer, A.; Weinberg, I.; Temme, C..Ebinghaus, R. Polyfluorinated compounds in the atmosphere of the Atlantic and Southern Oceans: evidence for a global distribution. Environ. Sci. Technol. 2009, 43 (17), 6507-6514.

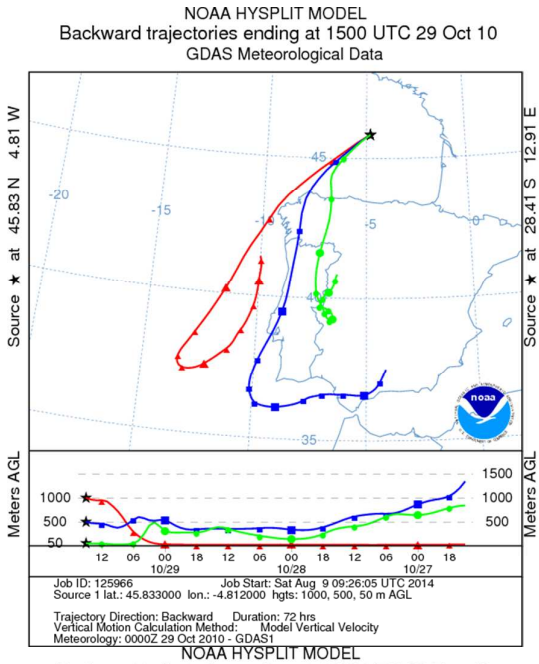
Jahnke, A.; Berger, U.; Ebinghaus, R..Temme, C. Latitudinal gradient of airborne polyfluorinated alkyl substances in the marine atmosphere between Germany and South Africa (53 degrees N-33 degrees S). Environ. Sci. Technol. 2007, 41 (9), 3055-3061.

Table S5. Summarized concentration data of the 12 PFASs and their total concentrations (pg L^{-1}) in snow from the Antarctic Peninsula

Compd.	Ave.	std	min	max
8:2 FTOH	77	25	40	130
6:2 FTOH	26	29	5.0	115
10:2 FTOH	24	8.3	9.3	36
12:2 FTOH	13	4.1	5.6	19
MeFBSA	0.9	0.5	0.2	2.1
MeFOSA	3.0	1.0	1.2	4.8
EtFOSA	1.6	0.7	0	3.0
MeFBSE	2.8	1.2	1.4	5.4
MeFOSE	48	16	24	74
EtFOSE	10	4.6	3.8	20
6:2 FTA	1.4	0.5	0.7	2.1
8:2 FTA	0.9	0.5	0	1.8
Total	209	57	125	303

Table S6. Estimation for air-snow exchange fluxes for the 12 neutral PFASs (average values) (pg m^{-2} d^{-1})

PFASs	*F*gas (pg m^{-2} d^{-1})	volatile flux (pg m^{-2} d^{-1})	deposition flux (pg m^{-2} d^{-1})
8:2 FTOH	2.3	29	27
6:2 FTOH	17	18	1.0
10:2 FTOH	0.43	5.1	4.7
12:2 FTOH	-1.3	1.6	2.9
MeFBSA	0.31	0.38	0.07
MeFOSA	0.02	0.06	0.03
EtFOSA	-0.09	0.07	0.15
MeFBSE	-0.03	0.01	0.04
MeFOSE	-0.02	0.00	0.02
EtFOSE	-0.20	0.00	0.21
6:2 FTA	14.8	14.9	0.05
8:2 FTA	7.5	7.6	0.10
Sum	40	76	36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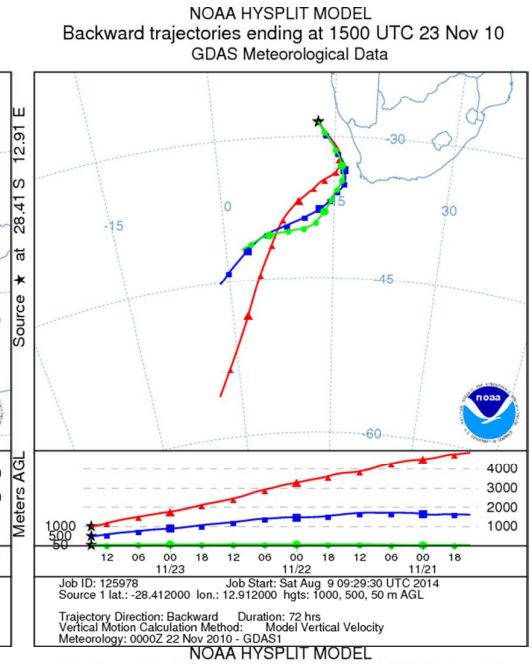
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 29 Oct 2010 - GDAS1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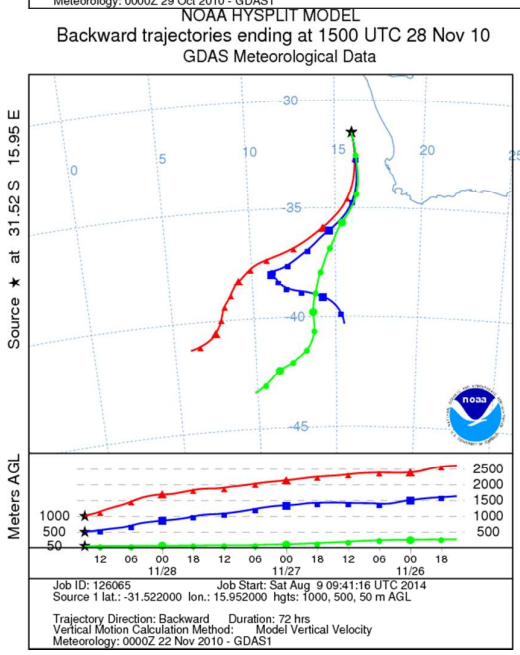
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Meters AGL
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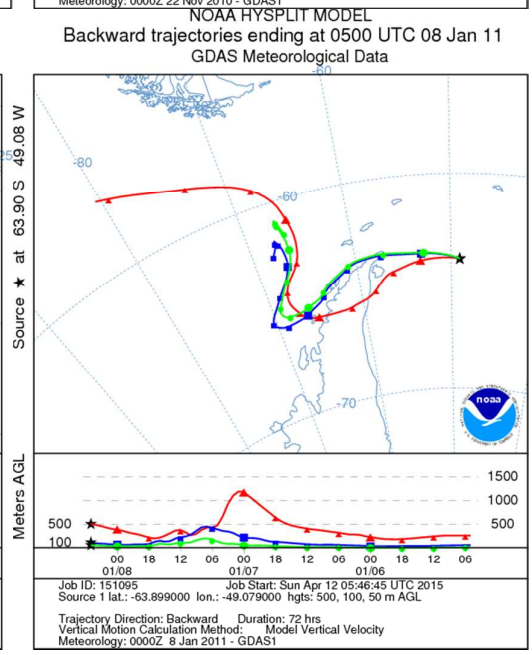
Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 22 Nov 2010 - GDAS1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Meters AGL
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Vertical Motion Calculation Method: Model Vertical Velocity
Meteorology: 0000Z 8 Jan 2011 - GDAS1

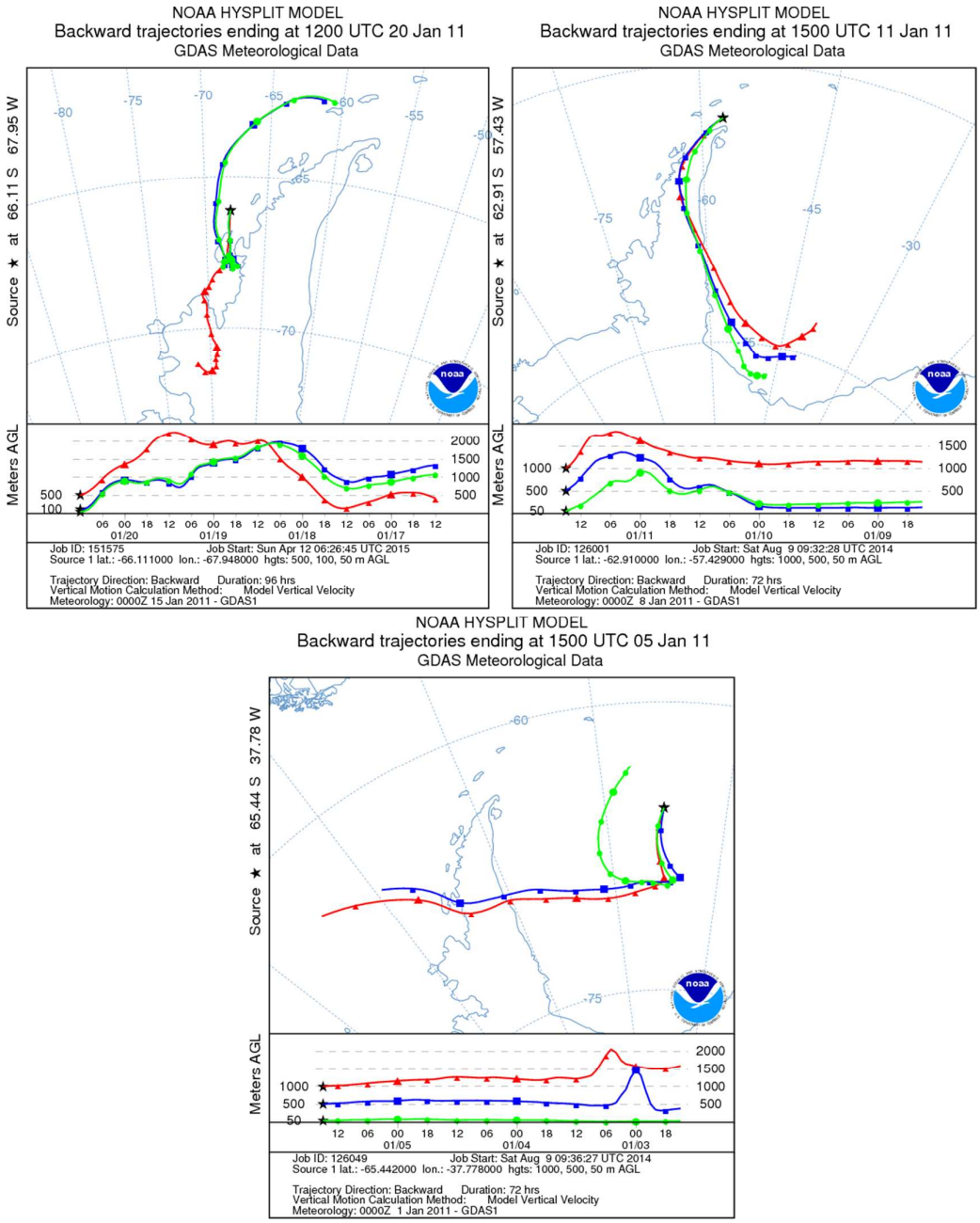

Figure S1. The 72 h backward trajectories analysis of air mass using NOAA's HYSPLIT model with 50 m as arrival height (http://www.arl.noaa.gov/HYSPLIT_info.php). back trajectories were calculated for arrival times in 6-h steps at the position of the ship along the cruise leg.

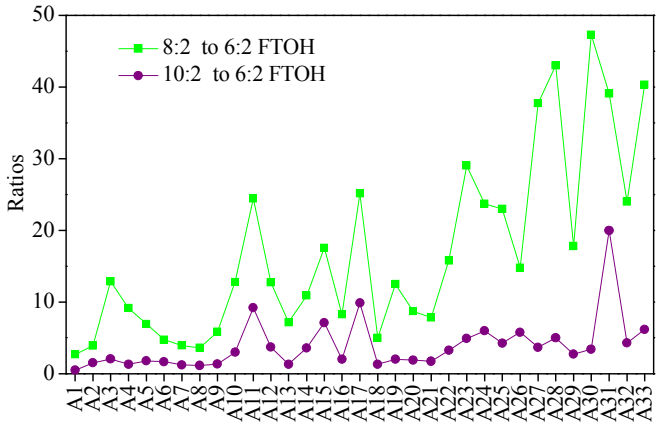

Figure S2. Ratios of 8:2 to 6:2 FTOH and 10:2 to 6:2 FTOH of the 33 air samples along with the cruise.