

Supporting Information to:

Factors affecting the atmospheric occurrence and deposition of polychlorinated biphenyls in the Southern Ocean

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28 pages

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ANNEX I

Table S1. Ancillary data for samples taken during the ICEPOS, ESSASI and ATOS II surveys around the Antarctic Peninsula and South Scotia Sea, and for samples taken at Polish Beach (Livingston Island). Long: longitude, Lat: latitude, Vol: total volume sampled, TA: air temperature (20 m height) during sampling.

Matrix	Cruise	CODE	LONG	LAT	DATE	Vol m ³	wind speed m s ⁻¹	wind direction °	TA °C
Gas	ICEPOS	GI1	-68.40	-64.50	02/02/05	469	6.57	-	
		GI2	-70.01	-66.57	03/02/05	362	6.66	-	
		GI3	-70.40	-67.00	04/02/05	422	6.65	-	
		GI4	-67.10	-65.69	06/02/05	590	10.64	-	
		GI5	-60.44	-63.80	09/02/05	432	9.19	-	
		GI6	-56.23	-64.46	10/02/05	909	12.47	-	
		GI7	-56.31	-64.71	12/02/05	872	17.34	-	
		GI8	-58.93	-62.20	13/02/05	814	13.78	-	
		GI9	-60.68	-62.97	16/02/05	541	11.63	-	
		GI10	-60.44	-62.97	20/02/05	928	11.33	-	
		GI11	-60.00	-62.97	21/02/05	676	11.32	-	
	ESSASI	GE1	-54.06	-60.53	04/02/08	975	7.63	203.29	1.29
		GE2	-51.41	-61.45	11/02/08	745	5.25	252.18	0.58
		GE3	-51.31	-61.30	14/01/08	1024	6.69	204.90	0.26
		GE4	-50.65	-60.19	16/01/08	862	7.94	249.20	0.92
		GE5	-47.04	-60.20	18/01/08	1556	6.20	155.56	0.12
		GE6	-52.38	-61.67	20/01/08	865	9.97	307.63	1.04
	ATOS II	GA1	-57.87	-62.43	29/01/09	1006	8.25	245.03	1.19
		GA2	-51.78	-63.84	01/02/09	890	6.36	144.73	-1.44
		GA3	-55.85	-64.20	04/02/09	1414	7.60	207.31	1.47
		GA4	-71.36	-67.62	08/02/09	1691	6.56	101.84	2.19
		GA5	-71.40	-67.64	13/02/09	1145	4.36	138.76	-2.01
		GA6	-74.41	-69.54	15/02/09	1414	8.73	104.41	1.38
		GA7	-57.38	-63.05	19/02/09	1940	7.90	118.78	-1.50
		GA8	-63.62	-64.83	21/02/09	1990	4.70	204.49	1.60
		GA9	-55.81	-64.53	24/02/09	1500	5.00	172.54	-2.79
	LIVING ISLAND	GJC1	-60.39	-62.66	11/02/09	816			4.4
		GJC2	-60.39	-62.66	12/02/09	833			3.1
		GJC3	-60.39	-62.66	13/02/09	897			3
	ATOS II CRUISE	A1	-51.51	-62.76	04/02/09	2724	7.49	196.06	0.07
		A2	-58.40	-62.20	06/02/09	1899	7.08	247.26	2.81
		A3	-72.34	-67.98	12/02/09	1043	7.05	134.64	0.54
		A4	-66.38	-65.50	19/02/09	1114	8.84	130.22	1.10
LIVINGSTON ISLAND	ALI1	-60.4	-62.67	22/01/09	1129			3.3	
	ALI2	-60.4	-62.67	23/01/09	1651			1.9	
	ALI3	-60.4	-62.67	27/01/09	2608			2.9	
	ALI4	-60.4	-62.67	30/01/09	2612			3.6	
	ALI5	-60.4	-62.67	02/02/09	2786			2.4	
	ALI6	-60.4	-62.67	05/02/09	2426			0.4	
	ALI7	-60.4	-62.67	09/02/09	2815			2.6	
	ALI8	-60.4	-62.67	12/02/09	2515			3.0	
	ALI9 ¹	-60.39	-62.66	24/01/09	2204			3.4	
	ALI10 ¹	-60.39	-62.66	13/02/09	2596			4.0	

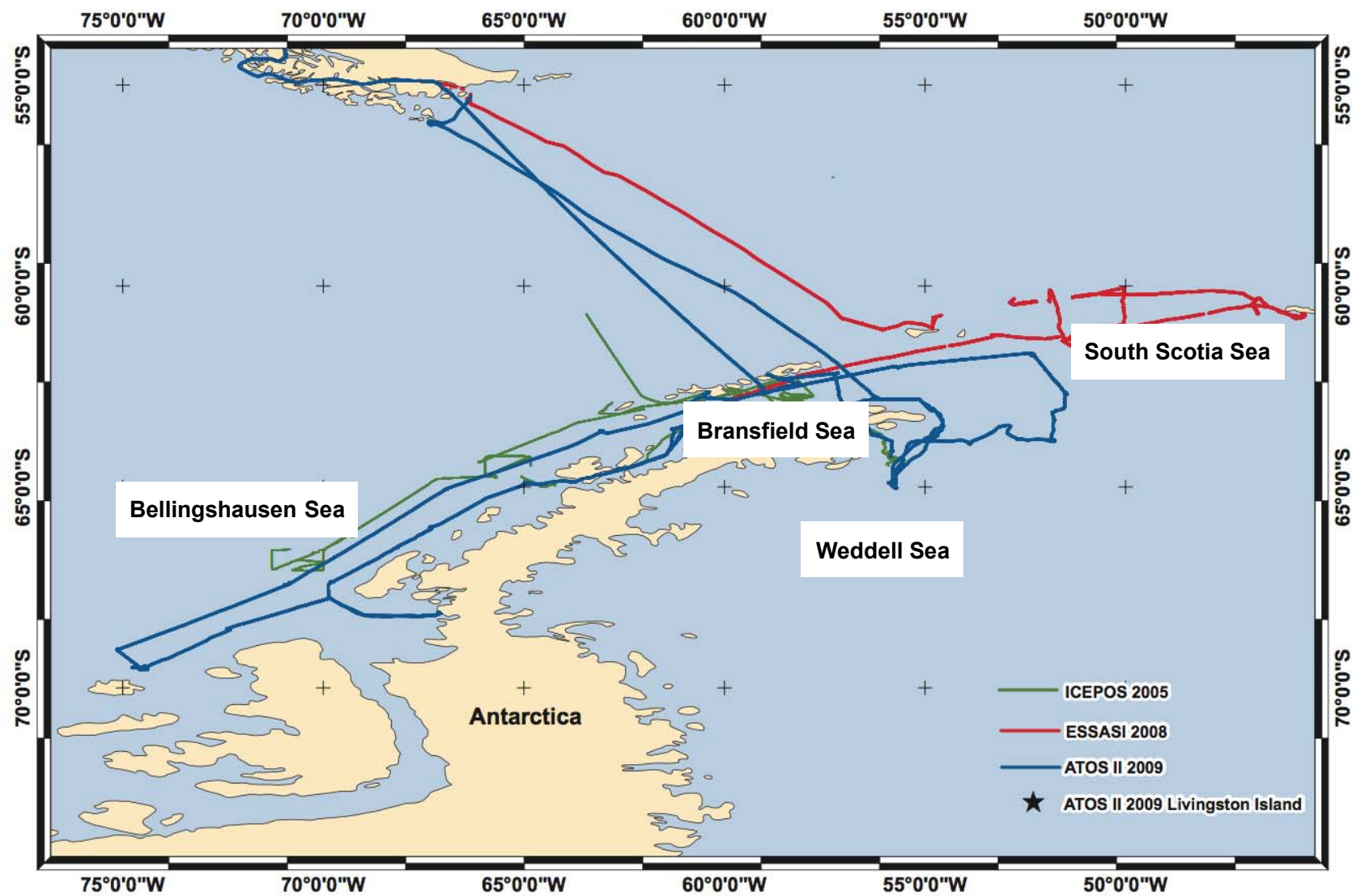


Figure S1. Map of cruises' trajectory during summer 2005 (ICEPOS), 2008 (ESSASI) and 2009 (ATOS II) around the Antarctic Peninsula and South Scotia Sea.

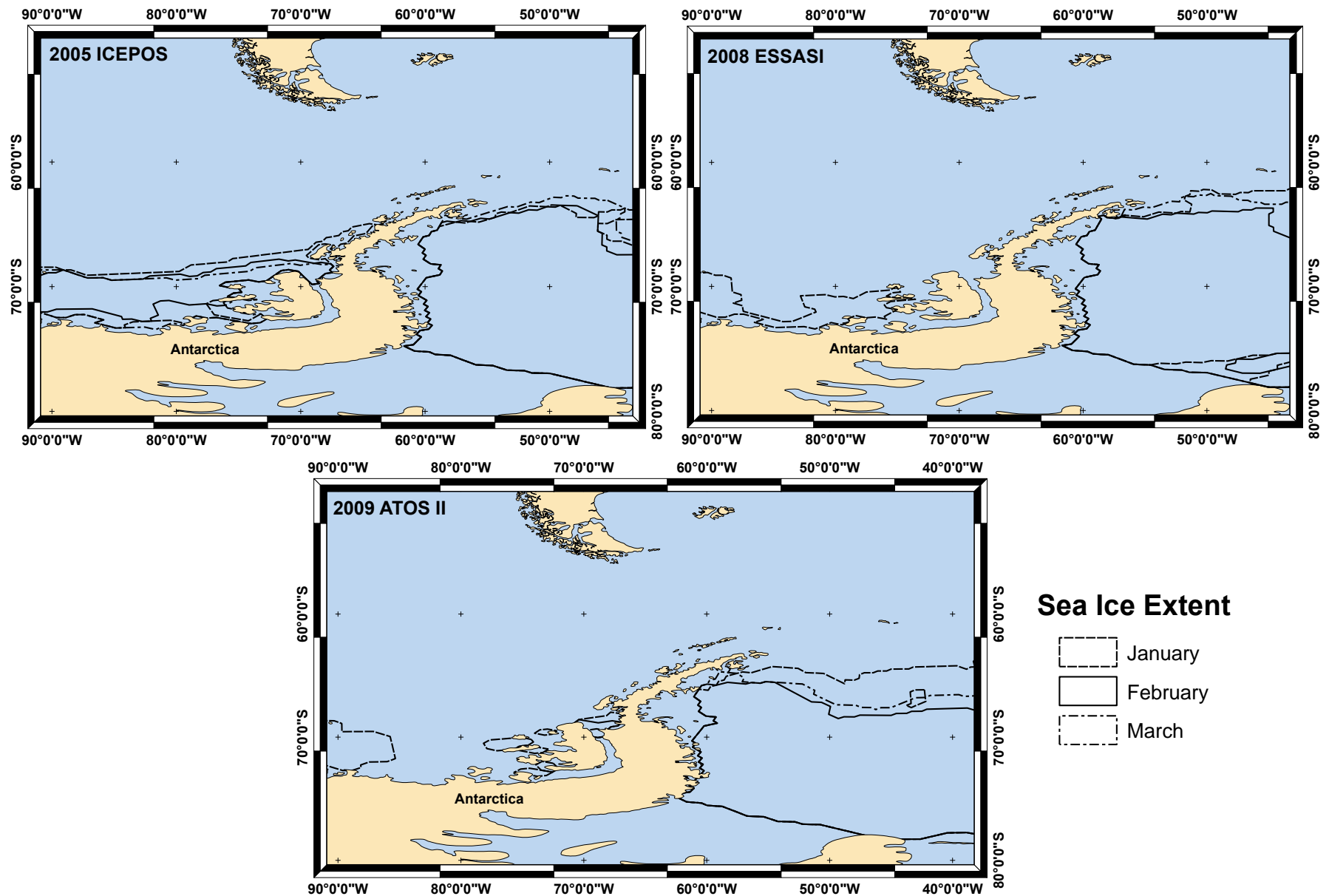


Figure S2. Map of sea ice extent during sampling in ICEPOS, ESSASI and ATOS II cruises taken during austral summer around the Antarctic Peninsula and South Scotia Sea. Data were retrieved from the NSIDC online dataset (www.nsidc.org)

ANNEX II

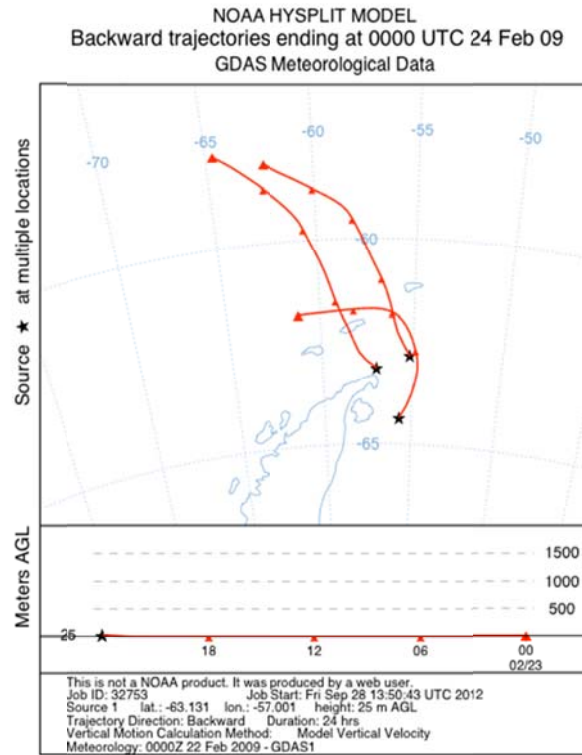
Table S2. Recovery percentages for surrogates PCBs 65 and 200.

		% Recovery					
		PCB65			PCB200		
		Mean	Min	Max	Mean	Min	Max
ATOS II	Gas	70.6	66.9	76.2	76.8	67.1	84.8
	Aerosol	70.6	61.8	77.7	78.4	69.2	85.1
ESSASI	Gas	67.2	53.3	77.9	71.0	57.2	87.3
ICEPOS	Gas	59.0	51.0	75.0	59.0	51.0	81.0

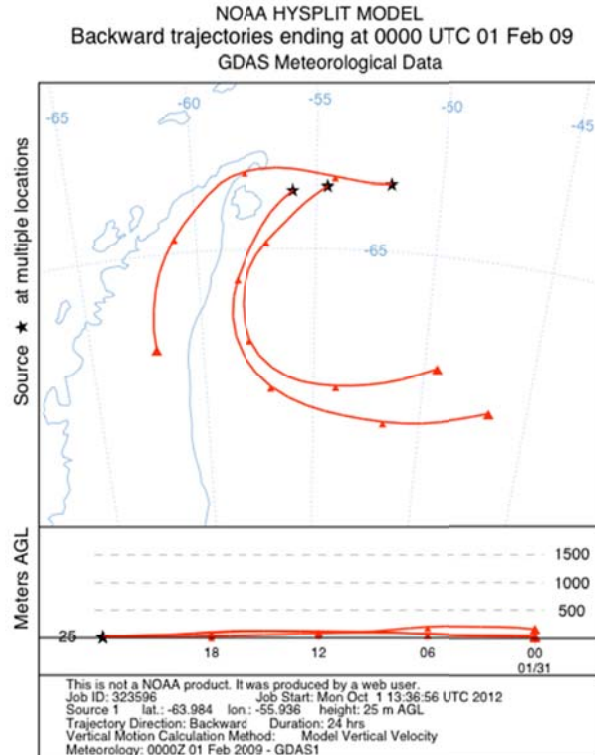
Table S3. Instrumental detection limits (IDLs), limits of detection (LODs) and limits of quantification (LOQs). x: blank averaged, SD: blank standard deviation.

pg on column	IDLs	x	SD	LODs	LOQs
PCB18	0.004	0.015	0.024	0.089	0.260
PCB17	0.02	0.021	0.090	0.291	0.921
PCB31	0.003	0.032	0.043	0.162	0.465
PCB28	0.004	0.131	0.090	0.401	1.031
PCB33	0.004	0.037	0.088	0.302	0.920
PCB52	0.004	0.021	0.056	0.190	0.584
PCB49	0.004	0.012	0.031	0.106	0.326
PCB99/101	0.008	0.153	0.200	0.753	2.153
PCB110	0.004	0.018	0.141	0.440	1.425
PCB151	0.004	0.005	0.283	0.855	2.838
PCB149	0.004	0.128	0.178	0.663	1.910
PCB118	0.004	0.038	0.078	0.273	0.821
PCB153	0.004	0.025	0.229	0.713	2.317
PCB132/105	0.001	0.006	0.036	0.114	0.365
PCB138	0.004	0.028	0.151	0.481	1.537
PCB158	0.001	0.009	0.013	0.049	0.141
PCB187	0.004	0.003	0.160	0.482	1.601
PCB183	0.004	0.011	0.015	0.054	0.157
PCB128	0.004	0.000	0.002	0.006	0.019
PCB177	0.004	0.001	0.005	0.017	0.056
PCB171/156	0.004	0.008	0.026	0.085	0.267
PCB180	0.004	0.006	0.073	0.224	0.734

ACC



WS



Ant C

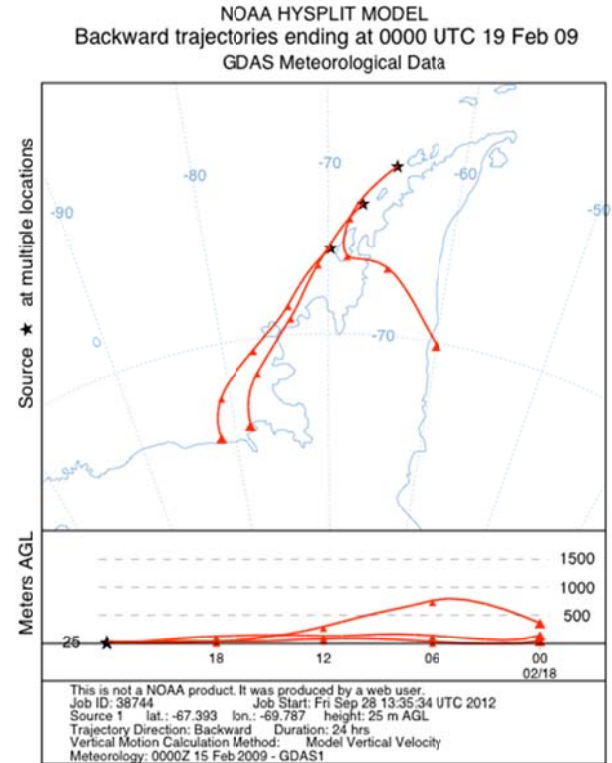


Figure S3. Characteristic atmospheric backtrajectories for samples taken during ICEPOS, ESSASI and ATOS II Antarctic cruises. ACC: Antarctic circumpolar current, WS: Weddell sea, Ant C: Antarctic Continent

ANNEX III

Table S4. Gas phase concentrations of PCBs ($\mu\text{g m}^{-3}$) for samples taken during the ICEPOS cruise in 2005.

	ICEPOS 2005										
	GI1	GI2	GI3	GI4	GI5	GI6	GI7	GI8	GI9	GI10	GI11
PCB18			0.43	2.36	0.62	0.39	1.97	0.13	0.70	0.80	1.64
PCB17											
PCB31	0.41	1.15	0.48	0.91	0.40	0.20	1.75	0.19	0.73	0.93	1.32
PCB28	1.41	1.07	2.62	2.02	0.88	0.53	2.59	0.60	1.56	2.71	1.82
PCB33	0.62	3.17	1.08	1.08		0.40	3.39		0.85	2.53	1.46
PCB52	3.86		4.84	5.01	3.73	1.53		2.38	5.10	5.35	
PCB49	1.42	3.90	1.60	1.49	1.25	0.58	2.68	0.57	1.83	2.11	2.18
PCB99/101											
PCB110											
PCB151	0.90	3.02	0.90	0.70	0.42	0.36	0.85	0.47	0.41	0.75	0.47
PCB149	1.97		1.73	1.46	1.09	0.80	1.87	0.96	1.00	1.58	1.01
PCB118	0.68	1.97	0.51	0.62	0.57	0.25	1.39	0.38	0.51	0.79	0.58
PCB153	1.02	2.38	2.80	1.06	0.71	0.49	2.28	0.69	0.93	1.08	0.56
PCB132/105	0.24	1.34	1.76	0.96	0.56	0.26	1.73	0.37	0.48	0.54	0.41
PCB138	0.88	1.91	2.59	0.94	0.59	0.42	1.92	0.65	1.01	1.10	0.56
PCB158	0.08				0.09	0.04	0.13			0.11	0.07
PCB187		0.56	0.73	0.34	0.16	0.12	0.50	0.18	0.23	0.29	0.14
PCB183						0.03	0.23			0.12	0.05
PCB128	1.08		2.26	1.01	0.94	0.54	1.43		1.04	1.20	0.79
PCB177						0.04	0.23		0.06	0.10	0.01
PCB171/156							0.19				
PCB180			0.51	0.35	0.18	0.13	0.52	0.20	0.30	0.34	0.17
Σ_{25}PCBs	14.56	20.47	24.83	20.29	12.17	7.12	25.65	7.78	16.73	22.43	13.23
Σ_{ICES}PCBs	7.84	7.33	13.87	10.00	6.65	3.35	8.70	4.90	9.42	11.37	3.69

Table S5. Gas phase concentrations of PCBs (pg m^{-3}) for samples taken during the ESSASI cruise in 2008.

	ESSASI 2008					
	GE1	GE2	GE3	GE4	GE5	GE6
PCB18	5.90	0.38	0.06	0.05	2.72	4.75
PCB17		2.48	0.12	0.13	7.78	2.53
PCB31	7.19	0.32	0.10	0.12	17.34	2.55
PCB28	3.89	5.11	0.39	0.58	12.96	2.93
PCB33	9.38	3.40	0.14	0.25	1.96	4.91
PCB52	6.10	0.56	0.09	0.09	1.77	4.56
PCB49	2.62	0.44	0.24	0.05	1.43	
PCB99/101	7.56	7.90	9.95	2.02	9.10	
PCB110	1.23	1.40	0.17	0.18	0.66	0.73
PCB151	1.25	1.10	0.24	0.26	2.86	1.57
PCB149	6.02	3.05	0.75	0.77	7.19	5.33
PCB118	2.27	4.07	0.59	0.26	1.80	0.89
PCB153	2.87	2.68	0.22	0.48	1.75	11.21
PCB132/105	5.52	0.86	0.26	0.13	2.15	1.59
PCB138	4.39	2.75	0.17	0.37	1.94	2.17
PCB158	0.83	0.86		0.07	0.75	0.63
PCB187	1.31	4.29	0.21	0.14	0.96	0.62
PCB183	1.14	2.76		0.04	0.90	0.60
PCB128	0.82	0.66	0.01		0.41	0.85
PCB177	0.92	0.92		0.03	0.53	0.98
PCB171/156	1.28	1.02	0.05	0.08	0.59	0.39
PCB180		1.90	0.03	0.12	0.75	1.41
$\Sigma_{28}\text{PCBs}$	72.48	48.90	13.77	6.18	78.29	51.18
$\Sigma_{\text{ICES}}\text{PCBs}$	27.08	24.97	11.44	3.91	30.05	23.16

Table S6. Gas phase concentrations of PCBs (pg m^{-3}) for samples taken during the ATOS II cruise and concurrent sampling at Polish Beach in Livingston Island during 2009.

	ATOS II Cruise									ATOS II Polish Beach		
	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9	GLI1	GLI2	GLI3
PCB18	0.67	0.73	2.55	1.24	0.37	1.21	1.07	0.28	0.26	0.27		0.07
PCB17	0.94	0.50	1.48	0.62	0.24	0.72	0.50	0.45	0.24	0.24	0.97	0.52
PCB31	1.18	0.59	1.46	0.88	1.17	1.03	0.74	0.60	0.29	0.35	0.15	0.12
PCB28	1.05	1.97	5.10	2.00	1.18	1.50	3.14	1.58	0.89	0.16	0.21	0.20
PCB33		0.89	1.17	0.89	0.36	1.22	0.76	0.29	0.15	0.08	0.14	
PCB52	1.29	0.78	2.92	0.29		0.10	1.15	0.36	0.23	0.43	1.30	0.60
PCB49	0.80	0.45	1.59	0.53	0.06	0.89	0.34		0.36	0.07		
PCB99/101	2.99	1.56	5.43	2.07	2.42	4.90	2.16	1.03	0.66	0.03		
PCB110	0.32		0.91	0.34	0.30	0.63		0.18	0.14	0.02	0.07	
PCB151	1.99	0.39	1.27	0.45	0.21	0.61	0.28	0.25	0.79	0.01	0.04	0.04
PCB149	2.57	1.09	3.58	0.40	0.69	1.70	0.80	1.03	0.44	0.10	0.03	0.04
PCB118	0.43	0.14	1.19	0.33	0.38	1.00	0.33	0.15	0.17	0.02	0.02	0.02
PCB153	1.55	0.71	2.57	0.91	0.55	0.71	0.75	0.87	0.45	0.12	0.07	0.08
PCB132/105	0.68	0.25	0.95	0.33	0.04	0.40	0.39	0.37	0.04			
PCB138	1.22	0.53	2.01	0.74	0.21	0.72	0.70	0.41	0.23	0.05	0.01	0.02
PCB158	0.10	0.03	0.63	0.06	0.04	0.09	0.06	0.07	0.06		0.00	
PCB187	0.64	0.32	1.20	0.43	0.20	0.33	0.35	0.43	0.39	0.10	0.07	0.08
PCB183	0.23	0.09	0.51	0.15	0.06	0.11	0.14	0.11	0.09	0.00	0.01	0.01
PCB128	0.09	0.02	0.16	0.04		0.07	0.07	0.01				
PCB177	0.22	0.07	0.50	0.14	0.01	0.10	0.12	0.15	0.02			
PCB171/156	0.21	0.11		0.09	0.06	0.14	0.12	0.06	0.04			
PCB180	0.39	0.13	0.89	0.26	0.18	0.23	0.27	0.32	0.17	0.04	0.01	0.02
$\Sigma_{25}\text{PCBs}$	19.56	11.34	38.09	13.18	8.73	18.38	14.22	8.99	6.07	2.09	3.11	1.80
$\Sigma_{10}\text{ICES PCBs}$	38.45	5.83	20.12	6.60	4.90	9.16	8.50	4.71	2.78	0.85	1.62	0.93

Table S7. Gas phase concentrations of PCBs (pg m⁻³) for samples taken during the landbase sampling at Pico Radio Hill (Livingston Island) during 2009.
Data taken from Cabrerizo et al., 2013.

	220109	230109	240109	250109	260109	270109	280109	290109	300109	310109	10209	20209	30209	40209	50209
	GLI4	GLI5	GLI6	GLI7	GLI8	GLI9	GLI10	GLI11	GLI12	GLI13	GLI14	GLI15	GLI16	GLI17	GLI18
PCB18	0.463	0.29	0.178	0.163	0.62	0.503	0.822	0.3	0.725	0.22	0.356	0.268	0.484	0.223	0.276
PCB17	0.557	0.71	0.695	0.46	0.311	0.217	0.302	0.254	0.39	0.384	0.343	0.663	0.442	0.309	0.376
PCB31	0.873	0.522	0.402	0.535	0.73	0.347	1.079	0.371	0.999	0.288	0.298	0.343	0.351	0.202	0.276
PCB28	0.576	0.29	0.216	0.238	0.633	0.315	0.781	0.281	0.6	0.133	0.186	0.224	0.259	0.144	0.247
PCB33	0.127					0.11	0.693	0.364			0.083				
PCB52		1.775		1.325	0.863	0.672	1.977	0.494	2.133	1.29	1.296	0.88	0.505	0.534	0.691
PCB49	0.423	0.113			0.257	0.116	0.327		0.455				0.055		
PCB99/101	0.063	0.016		0.013	0.021	0.02			0.022	0.037			0.026		0.037
PCB110		0.038	0.031	0.025	0.077	0.061	0.446	0.026	0.26	0.05	0.045	0.06	0.045	0.008	0.063
PCB151	2.399	2.194	2.117	1.722	0.92	0.827	0.615	0.538	0.659	0.828	0.562	0.514	0.414	0.318	0.386
PCB149	1.206	1.004	0.541	0.716	1.612	1.164	1.837	0.824	1.191	0.478	0.549	0.424	0.861	0.522	0.561
PCB118	0.082	0.048	0.02	0.048	0.124	0.108	0.405	0.064	0.339	0.022	0.034	0.02	0.058	0.035	0.036
PCB153	1.359	1.38	1.119	1.175	1.27	1.139	1.211	0.819	1.107	0.854	0.729	0.718	0.783	0.565	0.628
PCB132/105		0.015			0.107	0.011	0.516		0.042				0.084		
PCB138	0.281	0.227	0.126	0.174	0.609	0.454	0.881	0.34	0.581	0.144	0.212	0.159	0.359	0.231	0.262
PCB158	0.024	0.019	0.014	0.014	0.036	0.03	0.079	0.03	0.048	0.012	0.019	0.008	0.024	0.026	0.019
PCB187	0.462	0.481	0.373	0.436	0.478	0.455	0.428	0.316	0.412	0.351	0.305	0.302	0.362	0.245	0.34
PCB183	0.164	0.171	0.121	0.152	0.158	0.155	0.14	0.108	0.144	0.11	0.096	0.085	0.089	0.066	0.088
PCB128	0.003				0.004		0.069								
PCB177	0.004	0.008		0.011	0.064	0.045	0.117	0.034	0.058		0.02	0.01	0.022	0.005	0.029
PCB171/156							0.025	0.046							
PCB180	0.187	0.196	0.153	0.185	0.215	0.2	0.188	0.13	0.221	0.144	0.143	0.108	0.142	0.108	0.129
Σ25PCBs	9.253	9.497	6.106	7.392	9.109	6.949	12.938	5.339	10.386	5.345	5.276	4.786	5.365	3.541	4.444

Table S8. Aerosol phase concentrations of PCBs (pg m^{-3}) for samples taken during the ATOS II cruise and concurrent sampling at Radio Peak and Polish Beach in Livingston Island during 2009.

	ATOS II Cruise				ATOS II Landbase									
					Pico Radio Hill								Polish Beach	
	A1	A2	A3	A4	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	AB9	AB10
PCB18	0.048	0.135	0.214	0.048									0.034	
PCB17	0.005		0.060										0.007	
PCB31	0.008	0.002		0.004	0.005	0.004	0.002	0.002			0.002	0.002	0.002	0.004
PCB28	0.019		0.013	0.022	0.044	0.011	0.035	0.015	0.036	0.031	0.008	0.008	0.002	<0.001
PCB33					0.001	0.001	<0.001	0.001		0.001			0.005	
PCB52	0.014							0.005	0.007		0.007		0.005	
PCB49	0.005							0.001			0.007	0.001		
PCB99 /101	0.057	0.014	0.023	0.070	0.010	0.009	0.008			0.011		0.006		
PCB110	0.033	0.021		0.031	0.002	0.001	0.003	<0.001	0.002	0.000	0.001	0.001	0.001	0.002
PCB151	0.014				0.004	0.002	0.002			0.001	0.001			0.003
PCB149	0.034				0.041	0.001	0.003	0.001	0.001	0.001	0.002	0.001		
PCB118					0.002	0.001		<0.001	0.001	<0.001				
PCB153	0.062		0.003	0.015	0.090	0.024	0.025	0.011	0.027	0.030	0.011	0.008	0.004	0.003
PCB132 /105	0.020	0.001		0.015	0.043	0.028		0.016	0.006	0.009		0.012		0.004
PCB158	0.049				0.033	0.004	0.003	0.002	0.001	0.002	0.002		0.001	0.002
PCB138	0.004				0.011	0.017	0.003	0.008	0.001	0.002	<0.001	0.002	<0.001	0.001
PCB187	0.093				0.070	0.032	0.019	0.018	0.019	0.020	0.018	0.016	0.014	0.017
PCB183	0.004				0.005	0.002	0.001	0.001	0.001	<0.001	0.002	0.001		<0.001
PCB128	0.007						0.002							
PCB177	0.009				0.001	0.001	0.001	<0.001	0.001	<0.001				
PCB171/156	0.019	0.007	0.009	0.019										
PCB180	0.105		0.039	0.049	0.022	0.003	0.002	0.002	0.004	0.005	0.010	0.003	0.001	0.003
Σ_{25}PCBs	0.607	0.181	0.362	0.273	0.384	0.141	0.108	0.084	0.107	0.114	0.072	0.059	0.076	0.039
Σ_{ICES}PCBs	0.261	0.014	0.079	0.156	0.201	0.051	0.073	0.036	0.077	0.080	0.038	0.025	0.013	0.008

Table S9. Summary of gas phase concentrations of PCBs (pg m^{-3}) for samples taken during the ICEPOS (2005), ESSASI (2008) and ATOS II (2009) cruise and sampling at Livingston Island.

pg m^{-3}	ICEPOS			ESSASI		ATOS II Cruise		ATOS II Livingston Island
	Weddell	Bransfield	Bellingshausen	South Scotia Sea	Weddell	Bransfield	Bellingshausen	Polish Beach
	n=3 Mean (Range)	n=3 Mean (Range)	n=6 Mean (Range)	n=6 Mean (Range)	n=3 Mean (Range)	n=3 Mean (Range)	n=3 Mean (Range)	n=3 Mean (Range)
PCB18	0.83 (0.13-1.97)	1.04 (0.70-1.64)	1.96 (0.43-4.44)	2.31 (0.05-5.90)	0.55 (0.26-0.73)	1.36 (0.28-2.55)	0.88 (0.37-1.21)	0.27 (0.27-0.27)
PCB17				2.61 (0.12-7.78)	0.56 (0.24-0.94)	0.85 (0.45-1.48)	0.49 (0.24-0.72)	0.48 (0.24-0.97)
PCB31	0.72 (0.19-1.75)	0.99 (0.73-1.32)	1.10 (0.40-3.27)	4.60 (0.10-17.34)	0.69 (0.29-1.18)	0.98 (0.60-1.46)	0.98 (0.74-1.17)	0.28 (0.15-0.35)
PCB28	1.24 (0.53-2.59)	2.03 (1.56-2.71)	2.36 (0.88-6.18)	4.31 (0.39-12.96)	1.31 (0.89-1.97)	2.89 (1.58-5.10)	1.94 (1.18-3.14)	0.18 (0.16-0.21)
PCB33	1.90 (0.40-3.39)	1.61 (0.84-2.53)	2.42 (0.62-6.15)	3.34 (0.14-9.38)	0.52 (0.15-0.89)	0.78 (0.29-1.17)	0.78 (0.36-1.21)	0.1 (0.08-0.14)
PCB52	4.72 (1.53-10.26)	6.99 (5.10-10.51)	5.83 (3.73-11.71)	2.19 (0.09-6.10)	0.77 (0.23-1.29)	1.19 (0.29-2.92)	0.62 (0.10-1.15)	0.72 (0.43-1.3)
PCB49	1.28 (0.57-2.68)	2.04 (1.83-2.18)	3.13 (1.25-9.11)	0.96 (0.05-2.62)	0.54 (0.36-0.80)	1.06 (0.53-1.59)	0.43 (0.06-0.89)	0.07 (0.07-0.07)
PCB99/101				7.30 (2.01-9.95)	1.74 (0.66-2.99)	2.85 (1.03-5.43)	3.16 (2.16-4.90)	0.03 (0.03-0.03)
PCB110				0.73 (0.17-1.40)	0.23 (0.14-0.32)	0.48 (0.18-0.91)	0.47 (0.30-0.63)	0.03 (0.01-0.07)
PCB151	0.56 (0.36-0.85)	0.54 (0.41-0.75)	1.39 (0.42-3.02)	1.21 (0.24-2.86)	1.06 (0.39-1.99)	0.65 (0.25-1.27)	0.36 (0.21-0.61)	0.02 (0.01-0.04)
PCB149	1.21 (0.80-1.87)	1.19 (1.00-1.58)	2.75 (1.09-5.65)	3.85 (0.74-7.19)	1.37 (0.43-2.57)	1.67 (0.40-3.58)	1.06 (0.69-1.70)	0.08 (0.03-0.1)
PCB118	0.67 (0.25-1.39)	0.63 (0.51-0.79)	1.18 (0.51-2.73)	1.65 (0.26-4.07)	0.25 (0.14-0.43)	0.55 (0.15-1.19)	0.57 (0.33-1.00)	0.02 (0.02-0.02)
PCB153	1.15 (0.49-2.28)	0.86 (0.56-1.08)	1.69 (0.71-2.80)	3.20 (0.22-11.21)	0.90 (0.45-1.54)	1.45 (0.87-2.57)	0.67 (0.54-0.75)	0.1 (0.07-0.12)
PCB132/105	0.78 (0.26-1.72)	0.48 (0.41-0.54)	1.06 (0.24-1.76)	1.75 (0.13-5.52)	0.32 (0.04-0.68)	0.55 (0.33-0.95)	0.27 (0.04-0.40)	
PCB138	1.00 (0.42-1.92)	0.89 (0.56-1.10)	1.53 (0.59-2.59)	1.96 (0.17-4.39)	0.66 (0.23-1.22)	1.05 (0.41-2.01)	0.54 (0.21-0.72)	0.04 (0.01-0.05)
PCB158	0.09 (0.04-0.13)	0.09 (0.07-0.11)	0.09 (0.08-0.09)	0.63 (0.07-0.86)	0.07 (0.03-0.10)	0.25 (0.06-0.63)	0.07 (0.04-0.09)	
PCB187	0.27 (0.12-0.50)	0.22 (0.14-0.29)	0.43 (0.16-0.73)	1.26 (0.14-4.29)	0.45 (0.32-0.64)	0.69 (0.43-1.20)	0.29 (0.20-0.35)	0.09 (0.07-0.1)
PCB183	0.13 (0.03-0.23)	0.08 (0.05-0.12)		1.09 (0.04-2.76)	0.14 (0.09-0.23)	0.26 (0.11-0.51)	0.10 (0.06-0.14)	0 (0-0.01)
PCB128	0.99 (0.54-1.43)	1.01 (0.79-1.20)	1.32 (0.94-2.26)	0.55 (0.01-0.85)	0.05 (0.02-0.09)	0.07 (0.00-0.16)	0.07 (0.07-0.07)	
PCB177	0.14 (0.04-0.23)	0.06 (0.01-0.10)		0.67 (0.03-0.98)	0.11 (0.02-0.22)	0.26 (0.14-0.50)	0.07 (0.01-0.12)	
PCB171/156	0.19 (0.19-0.19)			0.57 (0.04-1.28)	0.12 (0.04-0.21)	0.07 (0.06-0.09)	0.11 (0.06-0.14)	
PCB180	0.28 (0.13-0.52)	0.27 (0.17-0.34)	0.35 (0.18-0.51)	0.84 (0.03-1.90)	0.23 (0.13-0.39)	0.49 (0.26-0.89)	0.23 (0.18-0.27)	0.03 (0.01-0.04)
$\Sigma_{25}\text{PCBs}$	16.93 (7.12-35.91)	20.97 (16.73-23.74)	25.82 (12.17-45.24)	45.84 (6.21-78.99)	12.11 (5.22-19.15)	20.94 (9.38-39.89)	14.72 (9.25-20.28)	2.43 (2.09-3.11)
$\Sigma_{\text{ICES}}\text{PCBs}$	9.07 (3.35-18.96)	11.66 (9.42-14.21)	11.79 (6.65-19.04)	20.10 (3.91-30.05)	5.84 (2.78-8.92)	10.48 (4.71-20.12)	7.52 (4.90-9.15)	1.11 (0.85-1.62)
$\%_{\text{ICES}}\text{PCBs}$	54.26% (47-63%)	55.6% (50.7-59.8%)	48.9% (29.5-55.9%)	51.7% (36.6-77.2%)	48.3% (46.6-53.2%)	50% (50.2-50.4%)	51% (45.1-53%)	45.7% (40.7-52.1%)

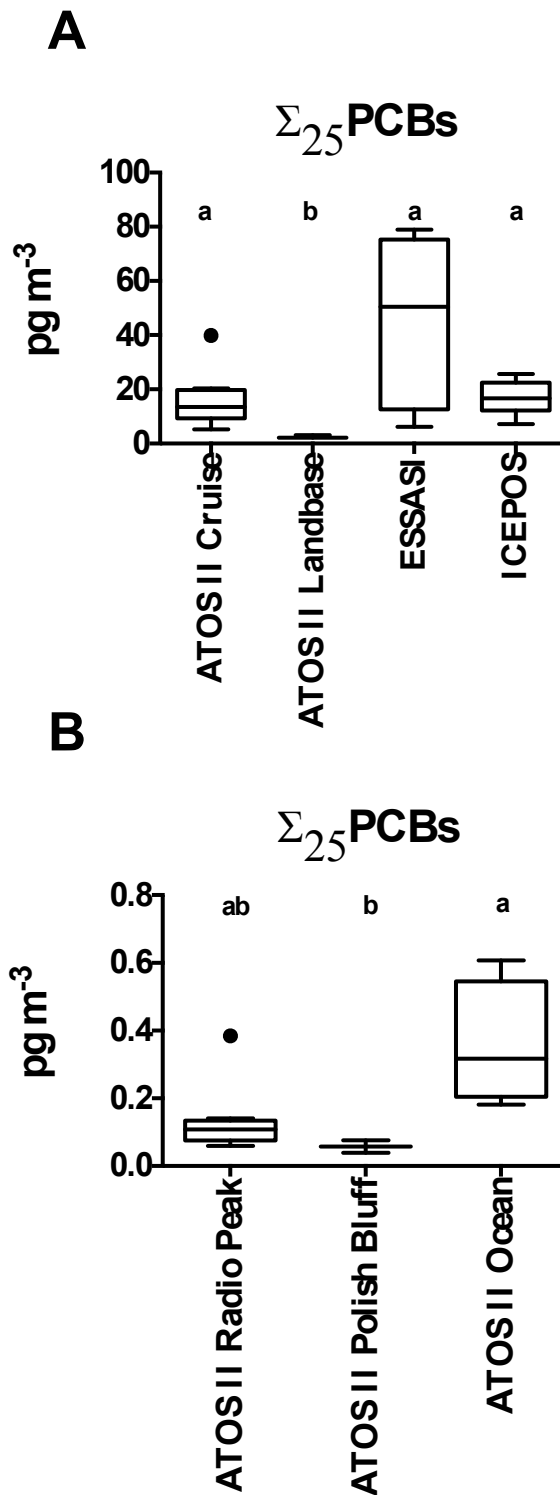


Figure S4. A) BOX-PLOT graph comparing the gas phase atmospheric concentrations from the different sampling campaigns showing that mean levels of samples taken at Polish Beach (a) were different (Kruskall-Wallis $p < 0.05$) and significant lower (post hoc Dunn's test $p < 0.001$) than the rest of the surveys (b) for Σ_{25} PCBs. B) BOX-PLOT graph representing the obtained aerosol phase atmospheric concentrations, comparing the different sampling locations and showing that the median levels of samples taken at Polish Beach during values were different (Kruskall-Wallis $p < 0.05$) and significant lower (post hoc Dunn's test $p < 0.001$) than samples from Radio Peak and over the Ocean (b) for Σ_{25} PCBs.

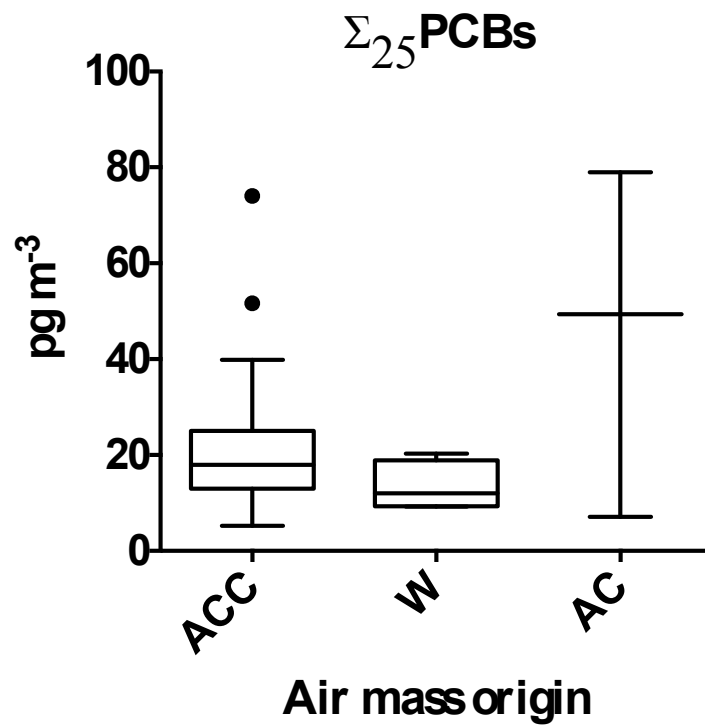


Figure S5. BOX-PLOT graph representing the obtained gas phase concentrations for the three characteristic origins of air masses identified. Obtained results show that samples influenced by the Antarctic Circumpolar water Current (ACC), Weddell Sea (WS) and Antarctic Continent (AC) were not different among them for $\Sigma_{25}\text{PCBs}$.

ANNEX IV

Table S10. physico-chemical properties used for the fugacity ratios, fluxes and gas-particle coefficient estimated in the present work. H: Henry's law constant (Pa m³ mol⁻¹), Log K_{OW}: octanol-water partition coefficient, Log K_{OA}: octanol-air partition coefficient, and Mw: molecular weight (g mol⁻¹), ΔH is the heat of phase change (kJ mol⁻¹).

Compound	H(Pa m ³ mol ⁻¹)	Ref	Log K _{ow} (at 298 K)	Ref	Log K _{oa} (at 298 K)	Ref	Mw	ΔH (KJ mol ⁻¹)	Ref
PCB18	25.3		5.6	Hansch et al., 1995	7.48	Chen et al., 2002	257.54	35	
PCB17	32.1		5.76		7.11		257.54	39	
PCB31	30.7		5.78	Li et al., 2003	7.94	Li et al., 2003	257.54	41	
PCB28	30.2		5.66		7.85		257.54	33	
PCB33	29.2		5.87	Hansch et al., 1995	8.03	Chen et al., 2002	257.54	42	
PCB52	25.12		5.91	Li et al., 2003	8.22	Li et al., 2003	291.99	31	
PCB49	39.9		6.38	Hansch et al., 1995	8.57		291.99	25	
PCB99/101	51.8		6.97	Hardy, 2002	9.07	Harner & Bidleman, 1996	326.43	16	
PCB110	42		6.2	Sangster, 1993	9.19		326.43	38	
PCB151	73.5		6.85	Hansch et al., 1995	9.68	Chen et al., 2002	360.88	37	
PCB149	68.4	Bamford et al. 2002	6.47	Makino, 1998	9.78		368.99	46	Bamford et al., 2002
PCB118	14.45		6.69	Li et al., 2003	9.83		326.43	50	
PCB153	19.95		6.87		9.74		360.88	66	
PCB132/105	59.4		7.04	Hansch et al., 1995	10.02	Harner & Bidleman, 1996	360.88	61	
PCB138	30.2		7.22	Li et al., 2003	9.81		360.88	87	
PCB158	49.9		7.69	Ran et al., 2002	10.28		360.88	80	
PCB187	65.9		7.04	Makino, 1998	10.54		395.32	96	
PCB183	61.5		8.27	Ran et al., 2002	10.83	Chen et al., 2002	395.32	100	
PCB128	32.7		7.32	Hansch et al., 1995	9.93		360.88	118	
PCB177	50.6		6.92	Makino, 1998	10.63		395.32	112	
PCB171/156	37		7.57	Hansch et al., 1995	10.25		360.88	101	
PCB180	37.3		8.51	Li et al., 2003	10.52	Harner & Bidleman, 1996	395.32	144	

Table S11. Truly dissolved water concentration of PCBs (pg L⁻¹) corrected using an average dissolved organic carbon (DOC) concentration for Antarctic region (60 μmol L⁻¹). Data taken from Galbán-Malagón et al., 2013

pg L ⁻¹	ESSASI										ATOS II								
	DE1	DE2	DE3	DE4	DE5	DE6	DE7	DE8	DE9	DE10	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9
PCB18	0.291	0.049	0.101	0.037	0.086	0.068	0.035	0.11	0.109	0.068	0.146	0.049	0.048	0.031	0.034	0.029	0.033	0.059	0.093
PCB17	0.105	0.034	0.077	0.098	0.066	0.058	0.047	0.063	0.156	0.074	0.236	0.093	0.034	0.307	0.048	0.028	0.019	0.083	0.342
PCB31	0.087	0.041	0.04	0.057	0.053	0.034	0.022	0.046	0.078	0.038	0.384	0.071	0.069	0.063	0.049	0.056	0.102	0.06	0.052
PCB28	0.101	0.046	0.042	0.026	0.048			0.025	0.05	0.021	0.173	0.042	0.038	0.032	0.029	0.041	0.065	0.054	0.077
PCB33	0.062		0.021			0.018	0.016		0.014		0.449	0.041	0.057	0.041	0.039	0.043	0.191	0.034	0.027
PCB52	0.115	0.027	0.136	0.106	0.04	0.067	0.033	0.067	0.161	0.207	0.147	0.016	0.063	0.025	0.006	0.066	0.07	0.03	0.015
PCB49	0.221	0.073	0.036	0.072	0.06	0.018	0.015	0.041	0.044	0.04	0.193	0.017	0.035	0.023	0.029	0.008	0.052	0.024	0.052
PCB99/101	0.189	0.078	0.151	0.192	0.150	0.095	0.088	0.101	0.161	0.145	0.059	0.16	0.203	0.154	0.26	0.189	0.479	0.175	0.029
PCB110	0.082	0.039	0.018	0.04	0.022	0.024	0.016	0.026	0.038	0.03	0.029	0.023	0.03	0.02	0.028	0.247	0.03	0.013	0.03
PCB151	0.125	0.038	0.007	0.006	0.013	0.007	0.007	0.005	0.006	0.012	0.142	0.02	0.021	0.027	0.044	0.018	0.098	0.003	0.03
PCB149	0.454	0.212	0.085	0.152	0.094	0.056	0.035	0.038	0.12	0.086		0.041	0.008	0.064	0.123	0.087	0.183	0.057	0.1
PCB118	0.384	0.125	0.048	0.083	0.048	0.028	0.022	0.024	0.079	0.06	0.01	0.056	0.012	0.057	0.11	0.062	0.077	0.049	0.067
PCB153	0.226	0.087	0.034	0.033	0.023	0.023	0.015	0.02	0.026	0.019	0.032	0.030	0.035	0.030	0.062	0.037	0.103	0.033	0.066
PCB132/105	0.032	0.016	0.009	0.017	0.008	0.006	0.007	0.003	0.015	0.007		0.018		0.016	0.037	0.022	0.005		
PCB138	0.104	0.051	0.015	0.022	0.01	0.01	0.008	0.004	0.014	0.011	0.008	0.019	0.02	0.02	0.04	0.026	0.033	0.013	0.018
PCB158	0.008	0.003	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001	0.001	0.002	0.001	0.001	0.001	
PCB187	0.043	0.026	0.019	0.017	0.018	0.03	0.014	0.015	0.02	0.019	0.017	0.016	0.002	0.014	0.028	0.02	0.053	0.012	0.028
PCB183	0.001	0.001	0.001	0.001	0.001	0.001		0.001							0.001	0.001	0.001		0.001
PCB128	0.002	0.001	0.001	0.001	0.001	0.002	0.006	0.001							0.002	0.002			
PCB177	0.015	0.002			0.005			0.002							0.007	0.002	0.006		
PCB171/156	0.01	0.007	0.005	0.005	0.004	0.005	0.004	0.003	0.003	0.004		0.004	0.002	0.004	0.007	0.006	0.007	0.003	0.005
PCB180	0.002	0.001	0.001	0.001	0.001	0.001	0.001		0.001	0.001		0.001		0.001	0.002	0.001	0.003	0.001	0.001

Table S12. Estimated air-water fugacity ratios calculated for samples from the ESSASI and ATOS II cruise. Code refers to the gas phase sample code as in Table S1

	ESSASI						ATOS II								
	GE1	GE2	GE3	GE4	GE5	GE6	GA1	GA2	GA3	GA4	GA5	GA6	GA7	GA8	GA9
PCB18	0.113	0.776	4.326	2.787	0.162	0.030	0.607	0.262	0.110	0.112	0.364	0.113	0.188	0.710	1.323
PCB17		0.102	2.007	1.559	0.036	0.083	0.800	0.804	0.218	1.439	2.630	0.217	0.489	0.543	4.434
PCB31	0.035	0.465	1.194	0.741	0.010	0.034	0.793	0.464	0.246	0.275	0.204	0.294	0.481	0.592	0.842
PCB28	0.092		0.110		0.010		0.549	0.109	0.064	0.083	0.157	0.142	0.107	0.212	0.416
PCB33			0.272	0.233				0.160	0.193	0.177	0.446	0.278	0.606	1.560	
PCB52	0.076	0.420	2.398	1.731	0.174	0.034	0.305	0.095		0.273		1.785	0.219	0.703	0.499
PCB49	0.418	0.685	0.895	2.895	0.258		1.241	0.350	0.319	0.472	3.153		1.106		1.063
PCB99/101	0.317	0.225	0.153	0.721	0.184		0.602		0.938						
PCB110	0.254	0.091	0.689	0.542	0.232	0.130			0.318	0.448	2.030			0.770	1.045
PCB151	0.566	0.076	0.291	0.306	0.018	0.050	0.463		0.306	0.921		0.967	2.224	2.475	0.258
PCB149	0.352	0.129	0.354	0.336	0.038	0.048	0.112	0.266	0.087	1.816	1.027	0.666	1.251	0.961	1.511
PCB118	0.130	0.010	0.051	0.114	0.017	0.033	0.099	0.524	0.045	0.366	0.291	0.155	0.289	0.634	0.540
PCB153	0.052	0.007	0.077	0.032	0.012	0.001	0.021	0.042	0.025	0.057	0.089	0.097	0.112	0.096	0.138
PCB132/105	0.015	0.024	0.079	0.202	0.005	0.016	0.090	0.251		0.324	2.563	0.212			
PCB138	0.012	0.002	0.028	0.016	0.001	0.003	0.008	0.024	0.013	0.034	0.115	0.036	0.030	0.051	
PCB158	0.010	0.001		0.015	0.001	0.002	0.006	0.020	0.010	0.027	0.038	0.027	0.029	0.027	
PCB187	0.033	0.005	0.076	0.115	0.017	0.026	0.027	0.054	0.007	0.066	0.133	0.122	0.138	0.112	0.079
PCB183	0.001	0.000								0.003		0.006			
PCB128	0.001	0.001	0.204							0.011					
PCB177	0.005	0.001								0.027		0.024			
PCB171/156	0.004	0.002	0.046							0.044	0.060	0.030	0.029	0.054	
PCB180							<0.001			0.001	0.001	0.001	0.001	0.001	0.001

Table S13. Estimated net air-water diffusive fluxes for the ESSASI and ATOS II cruises. Code refers to the gas phase sample code as in Table S1

Compound	ESSASI (2008)						ATOS II (2009)								
	South Scotia						Weddell			Bransfield			Bellingshausen		
	GE1	GE2	GE3	GE4	GE5	GE6	GA1	GA2	GA9	GA3	GA4	GA8	GA5	GA6	GA7
PCB18	-0.01	-0.06	-0.42	-0.23	-0.02	-0.04	-0.08	-0.10	0.01	-0.54	-0.20	-0.01	-0.02	-0.31	-0.22
PCB17	-0.13	-0.03	-0.20	-0.04	0.01	0.02	-0.06	-0.02	0.08	-0.26	0.00	-0.02	0.03	-0.16	-0.07
PCB31	-0.22	-0.06	-0.25	-0.17	-0.18	-0.37	-0.08	-0.06	-0.01	-0.28	-0.12	-0.03	-0.09	-0.22	-0.11
PCB28	-0.14	-0.19	-0.79	-0.39	-0.15	-0.33	-0.12	-0.26	-0.05	-0.95	-0.28	-0.11	-0.08	-0.31	-0.59
PCB33		-0.12	-0.23	-0.23				-0.14	0.00	-0.24	-0.14	0.01	-0.02	-0.27	-0.11
PCB52	-0.18	-0.06	-0.43	0.11			-0.22	-0.11	-0.01	-0.56	-0.02	-0.01		0.03	-0.19
PCB49	0.03	-0.01	-0.13	-0.02	0.02	0.05	0.02	-0.03	0.00	-0.17	-0.03		0.01	-0.10	-0.01
PCB99/101	-0.06	0.00	-0.21	0.02	-0.01	-0.03	-0.11	0.05	0.03	-0.19	0.07	0.13	0.02	0.00	0.19
PCB110	-0.01		-0.10	-0.03	-0.02	-0.04	-0.03		0.00	-0.13	-0.02	0.00	0.02	-0.01	
PCB151	-0.14	-0.02	-0.10	-0.04	-0.01	-0.02	-0.14	-0.01	-0.03	-0.11	-0.01	0.01	0.00	0.00	0.02
PCB149	-0.09	-0.06	-0.37	0.04	-0.01	-0.03	-0.39	-0.09	0.01	-0.49	0.01	-0.01	0.00	-0.13	0.00
PCB118	-0.06	-0.02	-0.37	-0.10	-0.09	-0.17	-0.17	-0.02	-0.02	-0.43	-0.08	-0.01	-0.05	-0.40	-0.10
PCB153	-0.58	-0.19	-0.93	-0.40	-0.18	-0.31	-0.70	-0.23	-0.09	-1.05	-0.29	-0.18	-0.10	-0.31	-0.29
PCB132/105	-0.13	-0.03	-0.18	-0.07	0.00	-0.01	-0.16	-0.03		-0.21	-0.04	-0.03	0.00	-0.09	-0.08
PCB138	-0.52	-0.16	-0.79	-0.35	-0.07	-0.12	-0.60	-0.20	-0.06	-0.89	-0.26	-0.10	-0.04	-0.36	-0.31
PCB158	-0.03	-0.01	-0.19	-0.02	-0.01	-0.02	-0.04	-0.01	-0.01	-0.22	-0.02	-0.01	-0.01	-0.03	-0.02
PCB187	-0.23	-0.08	-0.40	-0.17	-0.06	-0.10	-0.27	-0.10	-0.08	-0.45	-0.12	-0.08	-0.03	-0.13	-0.12
PCB183	-0.09	-0.02	-0.18						-0.02		-0.05	-0.02	-0.01	-0.05	-0.06
PCB128	-0.05	-0.01	-0.07								-0.02			-0.04	-0.04
PCB177	-0.10	-0.02	-0.21								-0.06	-0.04	0.00	-0.05	-0.06
PCB171/156	-0.09	-0.03		-0.04	-0.02	-0.04	-0.11	-0.04	-0.01		-0.03	-0.02	-0.01	-0.07	-0.06
PCB180	-0.21	-0.04	-0.45	-0.15	-0.08	-0.13	-0.23	-0.06	-0.06	-0.50	-0.13	-0.11	-0.06	-0.14	-0.15
Σ₂₂PCBs	-3.05	-1.21	-7.01	-2.26	-0.89	-1.68	-3.48	-1.47	-0.32	-7.67	-1.83	-0.63	-0.45	-3.15	-2.39
Σ_{ICES}PCBs	-1.75	-0.66	-3.96	-1.25	-0.59	-1.08	-2.14	-0.84	-0.26	-4.58	-0.99	-0.39	-0.31	-1.49	-1.46

Table S14. Estimated dry deposition fluxes ($\text{ng m}^{-2} \text{d}^{-1}$). Code refers to the gas phase sample code as in Table S1

$\text{ng m}^{-2} \text{d}^{-1}$	ATOS II cruise				Radio Peak							Polish Bluff		
	A1	A2	A3	A4	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	AB9	AB10
PCB18	0.014	0.039	0.061	0.014									0.010	
PCB17	0.001		0.017										0.002	
PCB31	0.002	0.001		0.001	0.002	0.001	<0.001	0.001			0.001	<0.001	0.001	0.001
PCB28	0.005		0.004	0.006	0.013	0.003	0.010	0.004	0.010	0.009	0.002	0.002	0.001	<0.001
PCB33					<0.001	<0.001	<0.001	<0.001		0.000			0.001	
PCB52	0.004							0.002	0.002		0.002		0.002	
PCB49	0.001							<0.001			0.002	<0.001		
PCB99 /101	0.016	0.004	0.007	0.020	0.003	0.003	0.002			0.003		0.002		
PCB110	0.009	0.006		0.009	0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PCB151	0.004				0.001	0.001	<0.001			<0.001	0.000			0.001
PCB149	0.010				0.012	<0.001	0.001	<0.001	<0.001	<0.001	0.001	0.000		
PCB118					0.001	<0.001		<0.001	<0.001	<0.001				
PCB153	0.018		0.001	0.004	0.026	0.007	0.007	0.003	0.008	0.009	0.003	0.002	0.001	0.001
PCB132 /105	0.006	<0.001		0.004	0.012	0.008		0.004	0.002	0.002		0.003		0.001
PCB158	0.014				0.009	0.001	0.001	0.001	<0.001	0.001	0.001		<0.001	<0.001
PCB138	0.001				0.003	0.005	0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
PCB187	0.027				0.020	0.009	0.005	0.005	0.005	0.006	0.005	0.004	0.004	0.005
PCB183	0.001				0.002	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001		<0.001
PCB128	0.002						0.001							
PCB177	0.002				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				
PCB171/156	0.005	0.002	0.003	0.005										
PCB180	0.030		0.011	0.014	0.006	0.001	<0.001	0.001	0.001	0.001	0.003	0.001	<0.001	0.001
Σ25PCBs	0.173	0.052	0.103	0.078	0.110	0.040	0.031	0.024	0.030	0.033	0.021	0.017	0.022	0.011
ΣICESPCBs	0.074	0.004	0.022	0.044	0.057	0.015	0.021	0.010	0.022	0.023	0.011	0.007	0.004	0.002

ATOS II Cruise

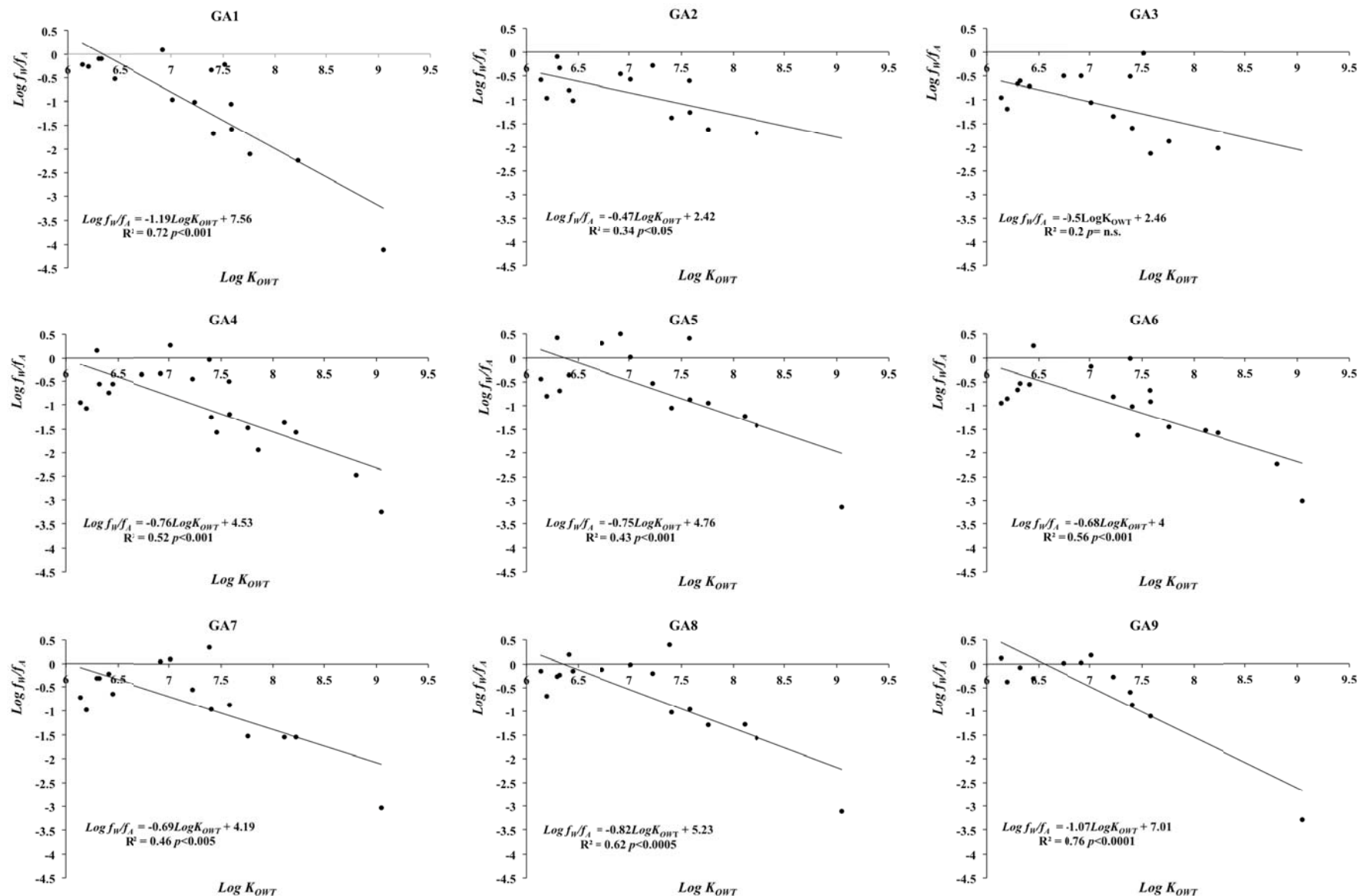


Figure S6: Air-water fugacity ratios ($\text{Log } f_w/f_A$) against the logarithm of temperature corrected octanol-water partition constant ($\text{Log } K_{OWT}$) for samples taken during the ATOS II Cruise. Code refers to the gas phase sample code as in Table S1

ESSASI Cruise

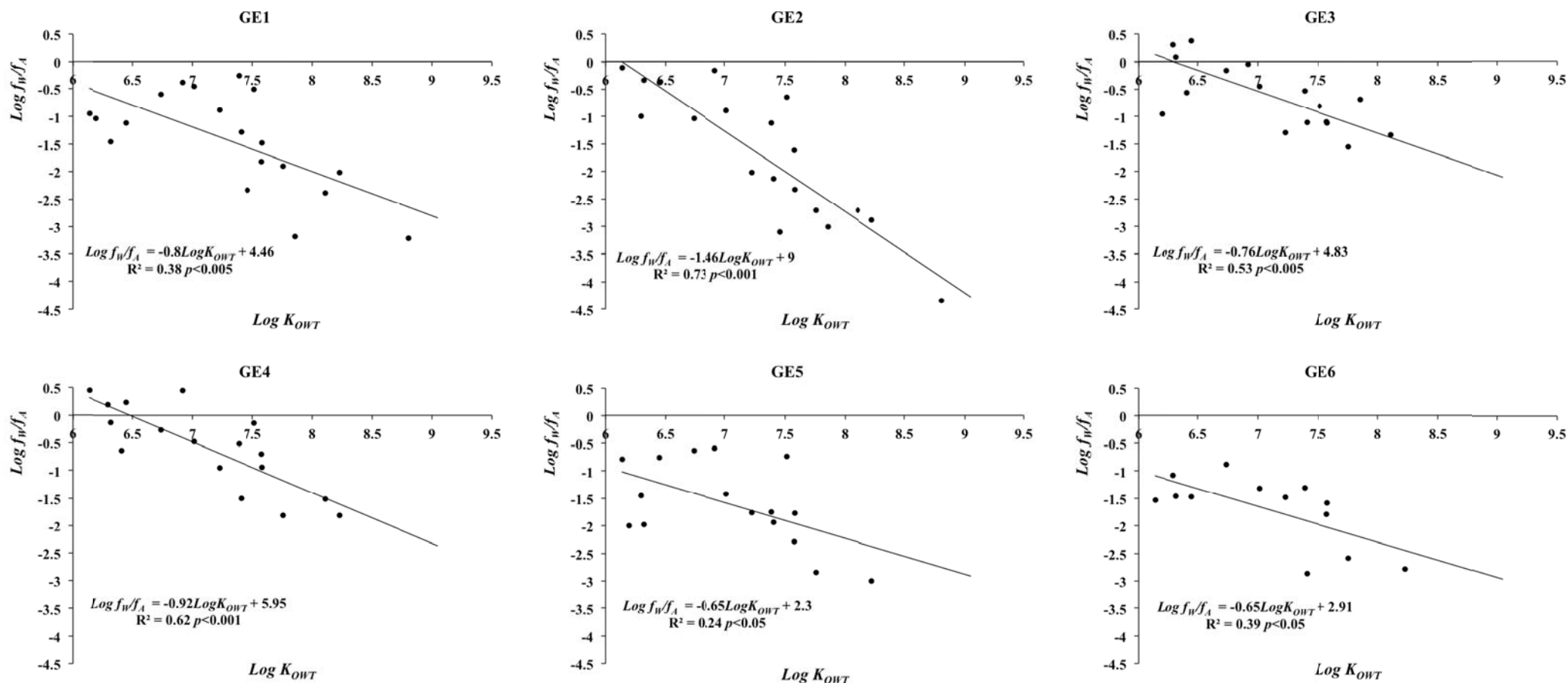


Figure S7: Air-water fugacity ratios ($\text{Log } f_w/f_A$) against the logarithm of temperature corrected octanol-water partition constant ($\text{Log } K_{OWT}$) for samples taken during the ESSASI Cruise. Code refers to the gas phase sample code as in Table S1

ANNEX V

Table S15. Measured $\log K_p$ for samples taken at Livingston Island. Code refers to the gas phase sample code as in Table S1 and TS7.

<i>Log K_p</i> field derived	GLI4 AB1	GLI5 AB2	GLI6 AB2	GLI7 AB3	GLI8 AB3	GLI9 AB3	GLI10 AB4	GLI11 AB4	GLI12 AB4	GLI13 AB5	GLI14 AB5	GLI15 AB5	GLI16 AB6	GLI17 AB6	GLI18 AB6	GLI1 AB9Beach	GLI2 AB9Beach	GLI3 AB9Beach
PCB18																		
PCB17																		
PCB31	-4.613	-4.555	-4.442	-4.941	-5.076	-4.753	-5.070	-4.606	-5.036							-4.543	-4.544	-4.181
PCB28	-3.512	-3.823	-3.695	-3.227	-3.652	-3.349	-4.116	-3.673	-4.002	-2.962	-3.108	-3.189	-3.315	-3.060	-3.295	-3.716	-3.717	-3.827
PCB33	-4.554					-4.856	-5.179	-4.899										
PCB52							-4.965	-4.363	-4.998	-4.675	-4.677	-4.509						
PCB49							-5.028		-5.172									
PCB99/101	-3.209	-2.644		-2.627	-2.835	-2.814							-2.783		-2.936			
PCB110		-4.195	-4.107	-3.367	-3.856	-3.754	-5.464	-4.230	-5.230	-3.843	-3.797	-3.922	-4.436	-3.686	-4.582	-3.716	-3.722	-4.391
PCB151	-5.132	-5.480	-5.464	-5.448	-5.176	-5.130							-5.099	-4.984	-5.068	-3.461	-3.449	-3.983
PCB149	-3.869	-5.316	-5.048	-4.824	-5.177	-5.035	-5.778	-5.430	-5.590	-5.221	-5.281	-5.169	-5.417	-5.199	-5.231			
PCB118	-4.063	-4.297	-3.917				-5.422	-4.621	-5.345	-3.583	-3.772	-3.542	-4.546	-4.327	-4.339			
PCB153	-3.575	-4.165	-4.073	-4.065	-4.099	-4.051	-4.421	-4.251	-4.382	-3.899	-3.831	-3.824	-3.813	-3.672	-3.717	-3.426	-3.428	-3.207
PCB132/105		-2.120					-3.915		-2.825				-3.385					
PCB138	-3.331	-4.194	-3.938	-4.101	-4.645	-4.517	-5.061	-4.647	-4.880	-4.399	-4.567	-4.442	-4.639	-4.447	-4.502	-3.779	-3.777	-3.148
PCB158	-2.752	-2.447	-2.315	-3.057	-3.467	-3.388	-3.412	-2.991	-3.195	-3.621	-3.821	-3.445	-3.464	-3.499	-3.363			-3.325
PCB187	-3.218	-3.574	-3.463	-3.764	-3.803	-3.782	-3.774	-3.643	-3.758	-3.672	-3.611	-3.607	-3.651	-3.482	-3.624	-3.158	-3.157	-2.959
PCB183	-3.887	-4.247	-4.096	-4.695	-4.712	-4.704	-4.660	-4.547	-4.672	-4.583	-4.524	-4.471	-4.732	-4.602	-4.727	-2.426	-2.449	-3.148
PCB128					-2.638													
PCB177	-3.053	-3.218		-3.555	-4.319	-4.166	-4.883	-4.346	-4.578		-3.667	-3.366	-4.125	-3.482	-4.245			
PCB171/156																		
PCB180	-3.325	-4.209	-4.101	-4.479	-4.545	-4.513	-4.311	-4.151	-4.381	-3.922	-3.919	-3.797	-3.856	-3.737	-3.814	-3.021	-3.024	-2.400

Table S16. Predicted $Log K_p$ estimated from the $Log K_{OA}$ corrected for temperature for samples taken in at Livingston Island. Code refers to the gas phase sample code as in Table S1.

<i>Log K_p Modelled</i>	AB1	AB2	AB 2	AB3	AB3	AB3	AB4	AB4	AB4	AB5	AB5	AB5	AB6	AB6	AB6	AB9Beach	AB9Beach	AB9Beach
PCB18	-5.593	-5.575	-5.568	-5.596	-5.629	-5.625	-5.629	-5.596	-5.623	-5.562	-5.564	-5.509	-5.516	-5.440	-5.503	-5.742	-5.672	-5.666
PCB17	-5.963	-5.945	-5.938	-5.966	-5.999	-5.995	-5.999	-5.966	-5.993	-5.932	-5.934	-5.879	-5.886	-5.810	-5.873	-6.112	-6.042	-6.036
PCB31	-5.133	-5.115	-5.108	-5.136	-5.169	-5.165	-5.169	-5.136	-5.163	-5.102	-5.104	-5.049	-5.056	-4.980	-5.043	-5.282	-5.212	-5.206
PCB28	-5.223	-5.205	-5.198	-5.226	-5.259	-5.255	-5.259	-5.226	-5.253	-5.192	-5.194	-5.139	-5.146	-5.070	-5.133	-5.372	-5.302	-5.296
PCB33	-5.043	-5.025	-5.018	-5.046	-5.079	-5.075	-5.079	-5.046	-5.073	-5.012	-5.014	-4.959	-4.966	-4.890	-4.953	-5.192	-5.122	-5.116
PCB52	-4.762	-4.742	-4.735	-4.765	-4.801	-4.797	-4.801	-4.765	-4.795	-4.728	-4.731	-4.671	-4.679	-4.597	-4.665	-4.920	-4.844	-4.839
PCB49	-4.412	-4.392	-4.385	-4.415	-4.451	-4.447	-4.451	-4.415	-4.445	-4.378	-4.381	-4.321	-4.329	-4.247	-4.315	-4.570	-4.494	-4.489
PCB99/101	-3.887	-3.867	-3.859	-3.890	-3.927	-3.923	-3.927	-3.890	-3.921	-3.853	-3.855	-3.794	-3.802	-3.718	-3.788	-4.048	-3.971	-3.965
PCB110	-3.766	-3.746	-3.738	-3.769	-3.807	-3.802	-3.806	-3.769	-3.800	-3.732	-3.734	-3.673	-3.681	-3.598	-3.667	-3.927	-3.850	-3.844
PCB151	-3.264	-3.244	-3.236	-3.268	-3.305	-3.301	-3.305	-3.268	-3.299	-3.230	-3.232	-3.171	-3.179	-3.094	-3.165	-3.427	-3.349	-3.343
PCB149	-3.176	-3.156	-3.148	-3.179	-3.217	-3.212	-3.216	-3.179	-3.210	-3.142	-3.144	-3.083	-3.091	-3.008	-3.077	-3.337	-3.260	-3.254
PCB118	-3.128	-3.108	-3.100	-3.131	-3.168	-3.163	-3.168	-3.131	-3.162	-3.094	-3.096	-3.035	-3.043	-2.959	-3.029	-3.289	-3.212	-3.206
PCB153	-3.221	-3.201	-3.193	-3.224	-3.262	-3.257	-3.261	-3.224	-3.255	-3.187	-3.189	-3.128	-3.136	-3.053	-3.122	-3.382	-3.305	-3.299
PCB132/105	-2.926	-2.906	-2.898	-2.930	-2.967	-2.963	-2.967	-2.930	-2.961	-2.892	-2.894	-2.833	-2.841	-2.756	-2.827	-3.089	-3.011	-3.005
PCB138	-3.132	-3.112	-3.104	-3.135	-3.173	-3.168	-3.172	-3.135	-3.166	-3.097	-3.100	-3.038	-3.046	-2.962	-3.032	-3.294	-3.216	-3.210
PCB158	-2.664	-2.644	-2.636	-2.668	-2.705	-2.701	-2.705	-2.668	-2.699	-2.630	-2.632	-2.571	-2.579	-2.494	-2.565	-2.827	-2.749	-2.743
PCB187	-2.332	-2.311	-2.303	-2.337	-2.376	-2.371	-2.376	-2.337	-2.369	-2.296	-2.299	-2.234	-2.242	-2.153	-2.227	-2.502	-2.420	-2.414
PCB183	-2.042	-2.021	-2.013	-2.047	-2.086	-2.081	-2.086	-2.047	-2.079	-2.006	-2.009	-1.944	-1.952	-1.863	-1.937	-2.212	-2.130	-2.124
PCB128	-3.014	-2.994	-2.986	-3.018	-3.055	-3.051	-3.055	-3.018	-3.049	-2.980	-2.982	-2.921	-2.929	-2.844	-2.915	-3.177	-3.099	-3.093
PCB177	-2.242	-2.221	-2.213	-2.247	-2.286	-2.281	-2.286	-2.247	-2.279	-2.206	-2.209	-2.144	-2.152	-2.063	-2.137	-2.412	-2.330	-2.324
PCB171/156	-2.691	-2.671	-2.663	-2.695	-2.732	-2.727	-2.732	-2.695	-2.726	-2.657	-2.659	-2.598	-2.606	-2.521	-2.592	-2.854	-2.776	-2.770
PCB180	-2.354	-2.333	-2.324	-2.358	-2.398	-2.393	-2.397	-2.358	-2.391	-2.318	-2.321	-2.256	-2.264	-2.175	-2.249	-2.524	-2.442	-2.436

Table S17. Measured Log K_P and predicted Log K_P estimated using the Log K_{OA} corrected temperature for samples taken during the ATOS II cruise. Code refers to the gas phase sample code as in Table S1

Measured Log K_P	GA3 A1	GA4 A2	GA5 A3	GA6 A3	GA8 A4	Predicted Log K_P	A1	A2	A3a and b	A4
PCB18	-3.143	-2.826	-3.597	-4.112	-3.351	PCB18	-5.514	-5.664	-5.540	-5.571
PCB17	-3.922					PCB17	-5.884	-6.034	-5.910	-5.941
PCB31	-3.694	-4.494	-5.139	-5.081	-4.719	PCB31	-5.054	-5.204	-5.080	-5.111
PCB28	-3.857		-4.442	-4.547	-4.442	PCB28	-5.144	-5.294	-5.170	-5.201
PCB33						PCB33	-4.964	-5.114	-4.990	-5.021
PCB52	-3.739					PCB52	-4.673	-4.836	-4.702	-4.735
PCB49	-3.953					PCB49	-4.323	-4.486	-4.352	-4.385
PCB99 /101	-3.395	-4.023	-4.249	-4.556	-3.754	PCB99 /101	-3.796	-3.961	-3.825	-3.859
PCB110	-2.866	-3.082	-3.707	-4.024	-3.360	PCB110	-3.675	-3.841	-3.704	-3.738
PCB151	-3.171					PCB151	-3.705	-3.871	-3.734	-3.768
PCB149	-2.989					PCB149	-3.172	-3.339	-3.201	-3.236
PCB118						PCB118	-3.085	-3.251	-3.114	-3.148
PCB153	-2.701		-4.114	-4.537	-3.590	PCB153	-3.037	-3.202	-3.066	-3.100
PCB132 /105	-3.525	-4.651	-4.274	-4.388		PCB132 /105	-3.130	-3.296	-3.159	-3.193
PCB158	-2.709					PCB158	-2.834	-3.001	-2.863	-2.898
PCB138	-4.087					PCB138	-3.040	-3.207	-3.069	-3.103
PCB187	-2.246					PCB187	-2.572	-2.739	-2.601	-2.636
PCB183	-3.864					PCB183	-2.233	-2.410	-2.264	-2.300
PCB128	-3.270					PCB128	-1.943	-2.120	-1.974	-2.010
PCB177	-2.678					PCB177	-2.922	-3.089	-2.951	-2.986
PCB171/156	-2.843	-3.135	-2.186	-3.437	-3.494	PCB171/156	-2.143	-2.320	-2.174	-2.210
PCB180			-2.812	-3.162	-2.706	PCB180	-2.599	-2.766	-2.628	-2.663

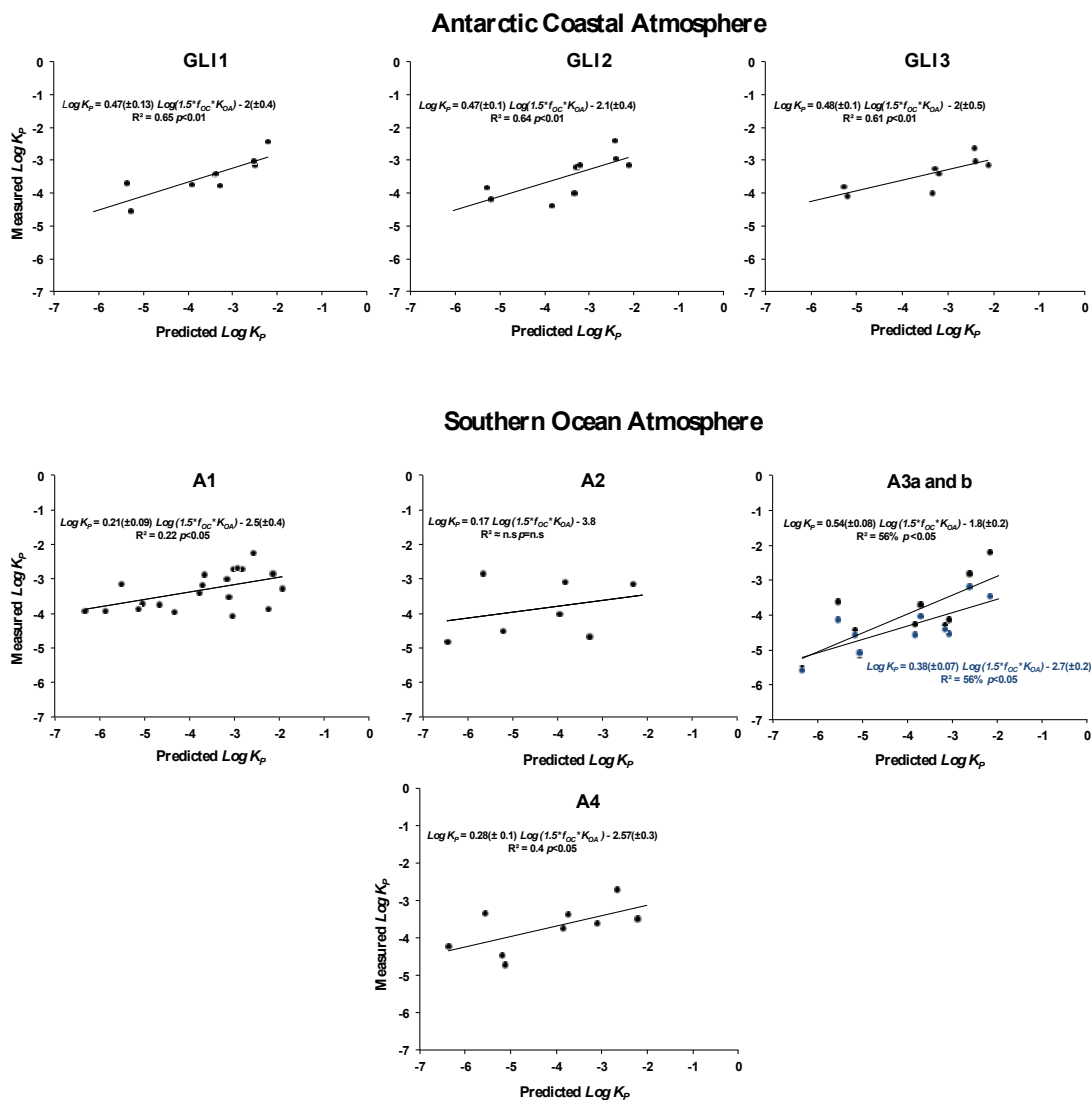


Figure S8. Measured versus predicted gas-particle partition constant ($\text{Log } K_p$) from gas and aerosol phase samples from the Antarctic coastal atmosphere (Livingston Island) and from Southern Ocean atmosphere taken during 2009. Code refers to the gas phase sample code as in Table S1

Antarctic Atmosphere

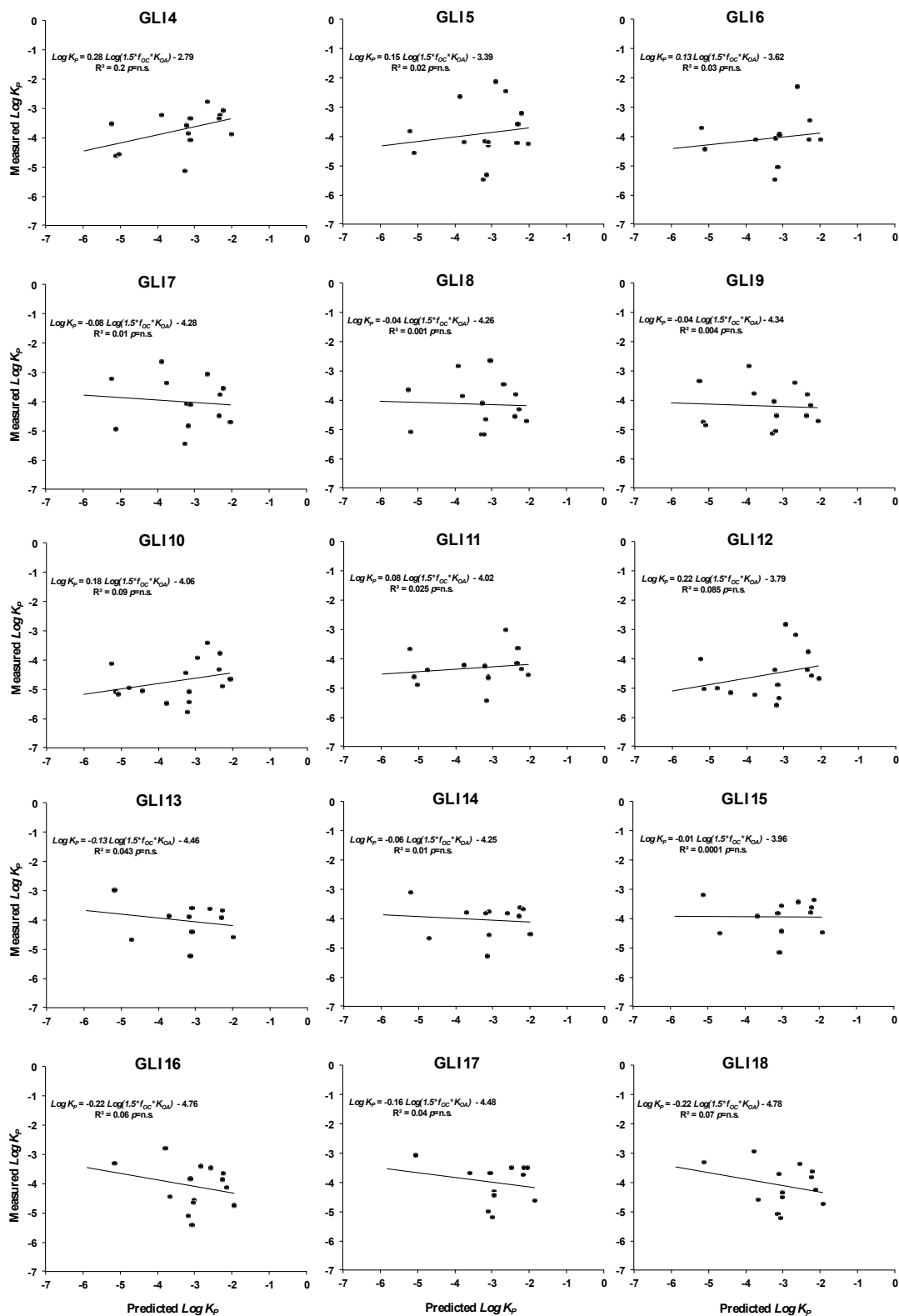


Figure S9. Measured versus predicted gas-particle partition constant ($\text{Log } K_p$) for gas and aerosol phase samples taken at Radio Peak in Livingston Island in 2009 austral summer (Cabrerizo et al., 2013) and aerosols samples reported in the present work. Code refers to the gas phase sample code as in Table S1 and TS7

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