

## Supporting Information to:

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

Cristóbal J. Galbán-Malagón, Sabino Del Vento, Ana Cabrerizo and Jordi Dachs

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 <sup>3</sup>	wind speed m s <sup>-1</sup>	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 <sup>1</sup>	-60.39	-62.66	24/01/09	2204			3.4	
	ALI10 <sup>1</sup>	-60.39	-62.66	13/02/09	2596			4.0	

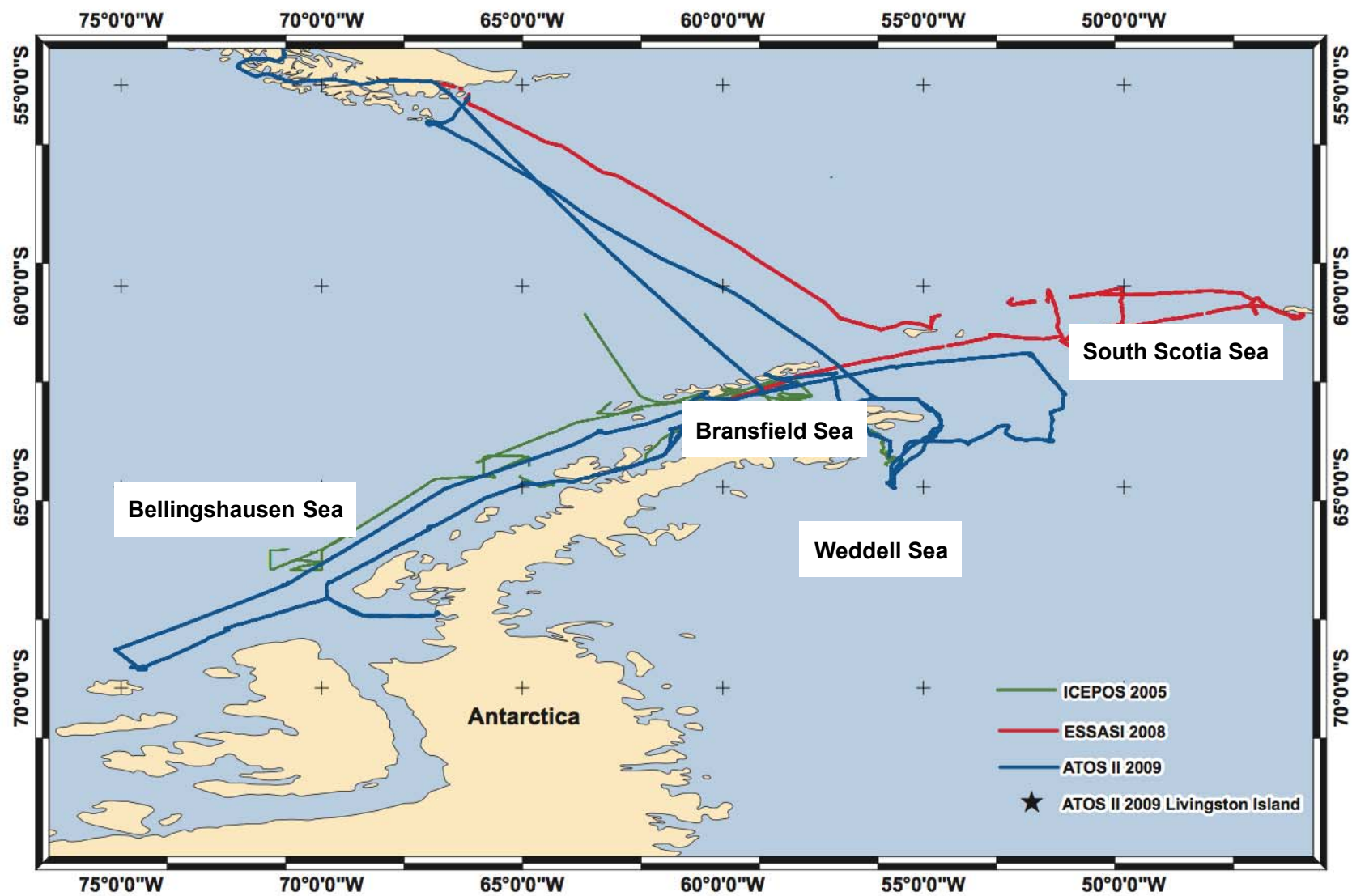


Figure S1. Map of cruises' trajectory during summer 2005 (ICEPOS), 2008 (ESSASI) and 2009 (ATOS II) around the Antarctic Peninsula and South Scotia Sea.

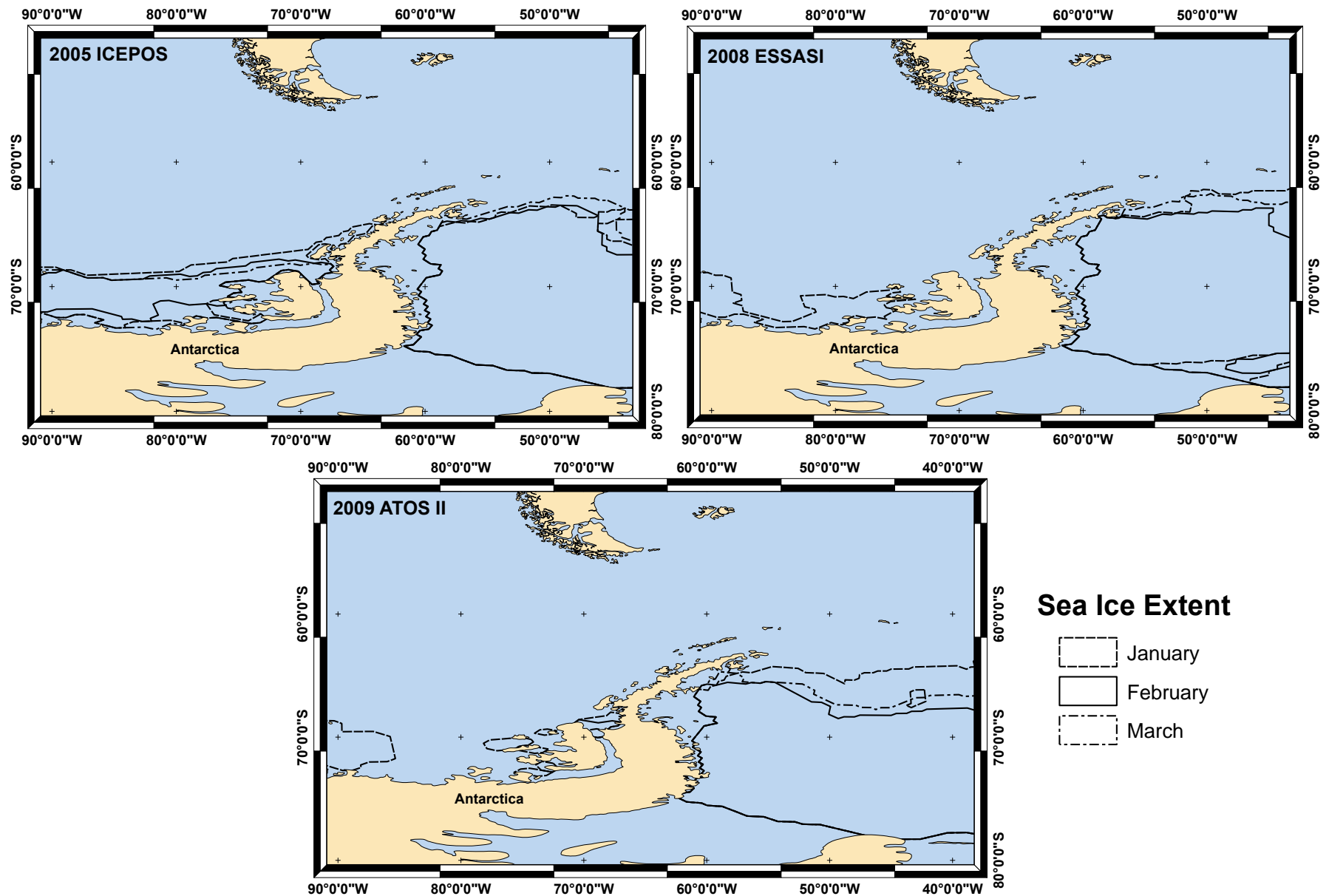


Figure S2. Map of sea ice extent during sampling in ICEPOS, ESSASI and ATOS II cruises taken during austral summer around the Antarctic Peninsula and South Scotia Sea. Data were retrieved from the NSIDC online dataset ([www.nsidc.org](http://www.nsidc.org))

## ANNEX II

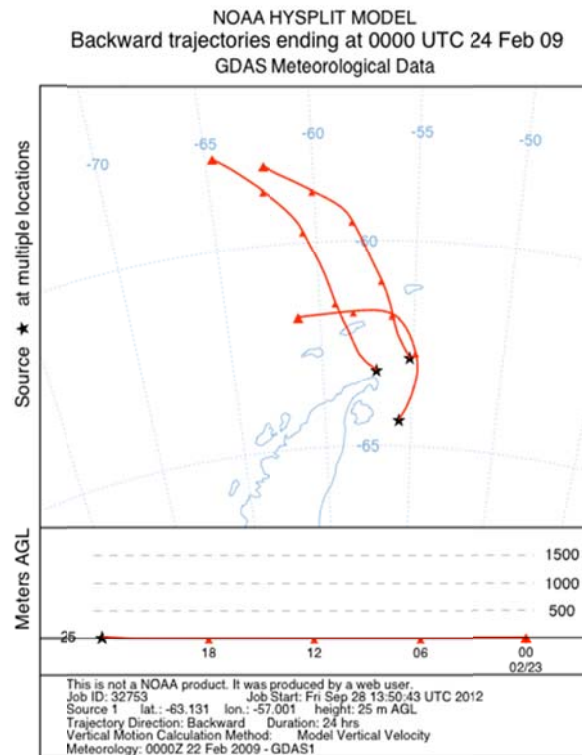
Table S2. Recovery percentages for surrogates PCBs 65 and 200.

		% 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

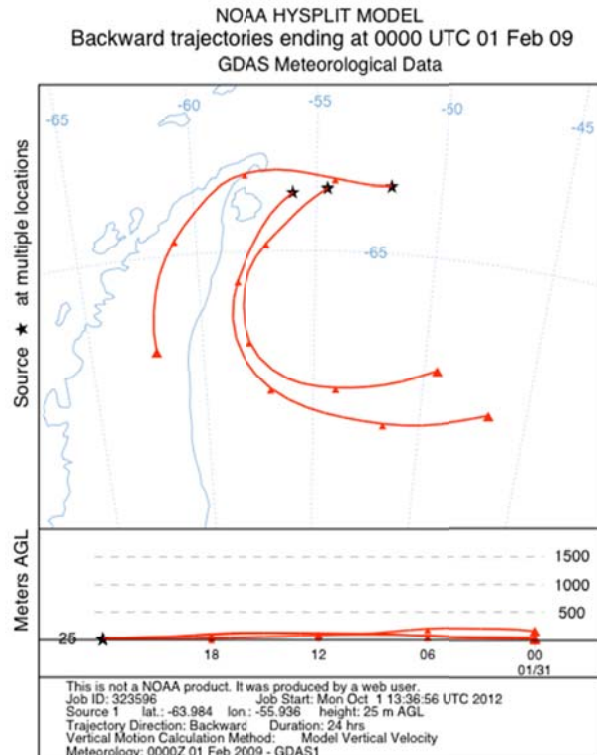
Table S3. Instrumental detection limits (IDLs), limits of detection (LODs) and limits of quantification (LOQs). x: blank averaged, SD: blank standard deviation.

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

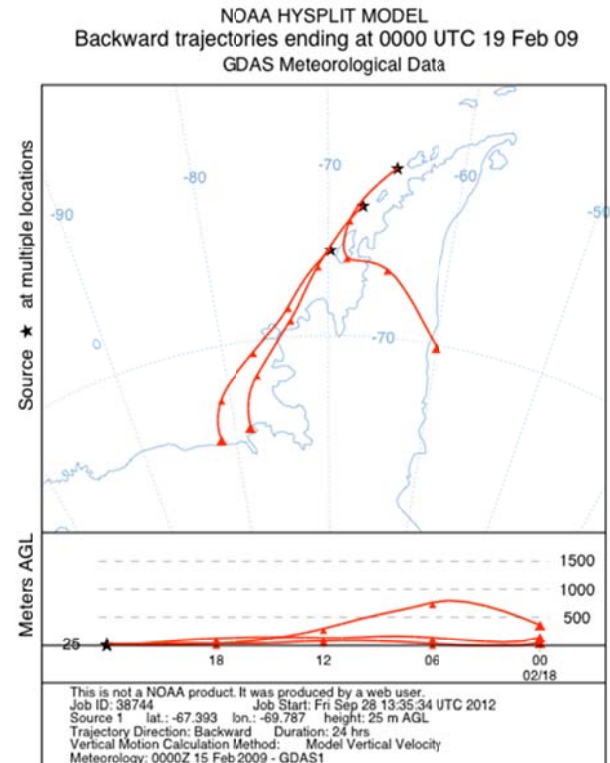


Figure S3. Characteristic atmospheric backtrajectories for samples taken during ICEPOS, ESSASI and ATOS II Antarctic cruises. ACC: Antarctic circumpolar current, WS: Weddell sea, Ant C: Antarctic Continent

## 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
<b>PCB18</b>			0.43	2.36	0.62	0.39	1.97	0.13	0.70	0.80	1.64
<b>PCB17</b>											
<b>PCB31</b>	0.41	1.15	0.48	0.91	0.40	0.20	1.75	0.19	0.73	0.93	1.32
<b>PCB28</b>	1.41	1.07	2.62	2.02	0.88	0.53	2.59	0.60	1.56	2.71	1.82
<b>PCB33</b>	0.62	3.17	1.08	1.08		0.40	3.39		0.85	2.53	1.46
<b>PCB52</b>	3.86		4.84	5.01	3.73	1.53		2.38	5.10	5.35	
<b>PCB49</b>	1.42	3.90	1.60	1.49	1.25	0.58	2.68	0.57	1.83	2.11	2.18
<b>PCB99/101</b>											
<b>PCB110</b>											
<b>PCB151</b>	0.90	3.02	0.90	0.70	0.42	0.36	0.85	0.47	0.41	0.75	0.47
<b>PCB149</b>	1.97		1.73	1.46	1.09	0.80	1.87	0.96	1.00	1.58	1.01
<b>PCB118</b>	0.68	1.97	0.51	0.62	0.57	0.25	1.39	0.38	0.51	0.79	0.58
<b>PCB153</b>	1.02	2.38	2.80	1.06	0.71	0.49	2.28	0.69	0.93	1.08	0.56
<b>PCB132/105</b>	0.24	1.34	1.76	0.96	0.56	0.26	1.73	0.37	0.48	0.54	0.41
<b>PCB138</b>	0.88	1.91	2.59	0.94	0.59	0.42	1.92	0.65	1.01	1.10	0.56
<b>PCB158</b>	0.08				0.09	0.04	0.13			0.11	0.07
<b>PCB187</b>		0.56	0.73	0.34	0.16	0.12	0.50	0.18	0.23	0.29	0.14
<b>PCB183</b>						0.03	0.23			0.12	0.05
<b>PCB128</b>	1.08		2.26	1.01	0.94	0.54	1.43		1.04	1.20	0.79
<b>PCB177</b>						0.04	0.23		0.06	0.10	0.01
<b>PCB171/156</b>							0.19				
<b>PCB180</b>			0.51	0.35	0.18	0.13	0.52	0.20	0.30	0.34	0.17
<b><math>\Sigma_{25}</math>PCBs</b>	14.56	20.47	24.83	20.29	12.17	7.12	25.65	7.78	16.73	22.43	13.23
<b><math>\Sigma_{ICES}</math>PCBs</b>	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 ( $\text{pg m}^{-3}$ ) 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 ( $\text{pg m}^{-3}$ ) 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
$\Sigma_{\text{ICES}}\text{PCBs}$	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 ( $\text{pg m}^{-3}$ ) 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
$\Sigma 25\text{PCBs}$	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 ( $\text{pg m}^{-3}$ ) 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
<b>PCB18</b>	0.048	0.135	0.214	0.048									0.034	
<b>PCB17</b>	0.005		0.060										0.007	
<b>PCB31</b>	0.008	0.002		0.004	0.005	0.004	0.002	0.002			0.002	0.002	0.002	0.004
<b>PCB28</b>	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
<b>PCB33</b>					0.001	0.001	<0.001	0.001		0.001			0.005	
<b>PCB52</b>	0.014							0.005	0.007		0.007		0.005	
<b>PCB49</b>	0.005							0.001			0.007	0.001		
<b>PCB99 /101</b>	0.057	0.014	0.023	0.070	0.010	0.009	0.008			0.011		0.006		
<b>PCB110</b>	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
<b>PCB151</b>	0.014				0.004	0.002	0.002			0.001	0.001			0.003
<b>PCB149</b>	0.034				0.041	0.001	0.003	0.001	0.001	0.001	0.002	0.001		
<b>PCB118</b>					0.002	0.001		<0.001	0.001	<0.001				
<b>PCB153</b>	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
<b>PCB132 /105</b>	0.020	0.001		0.015	0.043	0.028		0.016	0.006	0.009		0.012		0.004
<b>PCB158</b>	0.049				0.033	0.004	0.003	0.002	0.001	0.002	0.002		0.001	0.002
<b>PCB138</b>	0.004				0.011	0.017	0.003	0.008	0.001	0.002	<0.001	0.002	<0.001	0.001
<b>PCB187</b>	0.093				0.070	0.032	0.019	0.018	0.019	0.020	0.018	0.016	0.014	0.017
<b>PCB183</b>	0.004				0.005	0.002	0.001	0.001	0.001	<0.001	0.002	0.001		<0.001
<b>PCB128</b>	0.007						0.002							
<b>PCB177</b>	0.009				0.001	0.001	0.001	<0.001	0.001	<0.001				
<b>PCB171/156</b>	0.019	0.007	0.009	0.019										
<b>PCB180</b>	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
<b><math>\Sigma_{25}</math>PCBs</b>	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
<b><math>\Sigma_{ICES}</math>PCBs</b>	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 ( $\text{pg m}^{-3}$ ) for samples taken during the ICEPOS (2005), ESSASI (2008) and ATOS II (2009) cruise and sampling at Livingston Island.

$\text{pg m}^{-3}$	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)
<b>PCB18</b>	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)
<b>PCB17</b>				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)
<b>PCB31</b>	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)
<b>PCB28</b>	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)
<b>PCB33</b>	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)
<b>PCB52</b>	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)
<b>PCB49</b>	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)
<b>PCB99/101</b>				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)
<b>PCB110</b>				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)
<b>PCB151</b>	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)
<b>PCB149</b>	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)
<b>PCB118</b>	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)
<b>PCB153</b>	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)
<b>PCB132/105</b>	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)	
<b>PCB138</b>	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)
<b>PCB158</b>	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)	
<b>PCB187</b>	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)
<b>PCB183</b>	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)
<b>PCB128</b>	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)	
<b>PCB177</b>	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)	
<b>PCB171/156</b>	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)	
<b>PCB180</b>	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)
<b><math>\Sigma_{25}\text{PCBs}</math></b>	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)
<b><math>\Sigma_{\text{ICES}}\text{PCBs}</math></b>	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)
<b><math>\%_{\text{ICES}}\text{PCBs}</math></b>	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%)

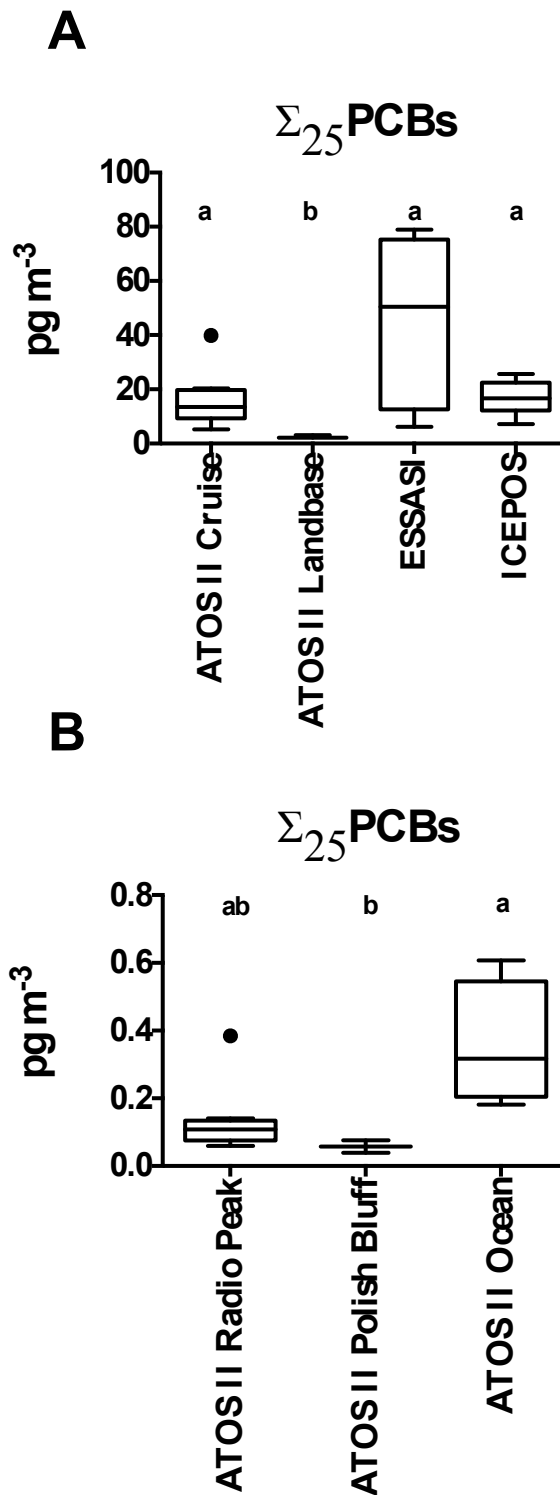


Figure S4. A) BOX-PLOT graph comparing the gas phase atmospheric concentrations from the different sampling campaigns showing that mean levels of samples taken at Polish Beach (a) were different (Kruskall-Wallis  $p < 0.05$ ) and significant lower (post hoc Dunn's test  $p < 0.001$ ) than the rest of the surveys (b) for  $\Sigma_{25}$ 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  $\Sigma_{25}$ PCBs.

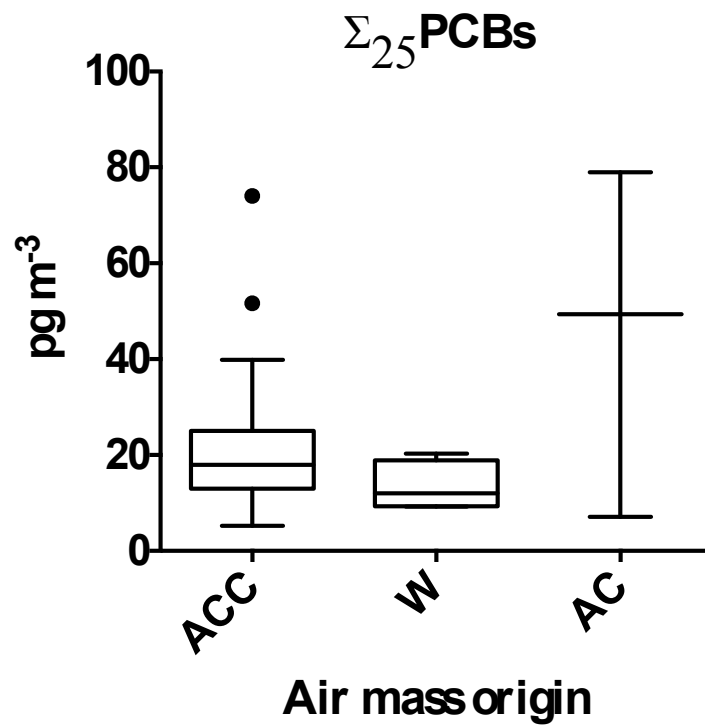


Figure S5. BOX-PLOT graph representing the obtained gas phase concentrations for the three characteristic origins of air masses identified. Obtained results show that samples influenced by the Antarctic Circumpolar water Current (ACC), Weddell Sea (WS) and Antarctic Continent (AC) were not different 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 ( $\text{Pa m}^3 \text{mol}^{-1}$ ),  $\text{Log } K_{\text{OW}}$ : octanol-water partition coefficient,  $\text{Log } K_{\text{OA}}$ : octanol-air partition coefficient, and Mw: molecular weight ( $\text{g mol}^{-1}$ ),  $\Delta H$  is the heat of phase change ( $\text{kJ mol}^{-1}$ ).

Compound	$H(\text{Pa m}^3 \text{mol}^{-1})$	Ref	$\text{Log } K_{\text{ow}}$ (at 298 K)	Ref	$\text{Log } K_{\text{oa}}$ (at 298 K)	Ref	Mw	$\Delta H (\text{KJ mol}^{-1})$	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	Harner & Bidleman, 1996	291.99	25	
PCB99/101	51.8		6.97	Hardy, 2002	9.07		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	Harner & Bidleman, 1996	360.88	66	
PCB132/105	59.4		7.04	Hansch et al., 1995	10.02		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	Harner & Bidleman, 1996	360.88	101	
PCB180	37.3		8.51	Li et al., 2003	10.52		395.32	144	



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

pg L <sup>-1</sup>	ESSASI										ATOS II								
	DE1	DE2	DE3	DE4	DE5	DE6	DE7	DE8	DE9	DE10	DA1	DA2	DA3	DA4	DA5	DA6	DA7	DA8	DA9
<b>PCB18</b>	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
<b>PCB17</b>	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
<b>PCB31</b>	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
<b>PCB28</b>	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
<b>PCB33</b>	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
<b>PCB52</b>	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
<b>PCB49</b>	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
<b>PCB99/101</b>	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
<b>PCB110</b>	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
<b>PCB151</b>	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
<b>PCB149</b>	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
<b>PCB118</b>	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
<b>PCB153</b>	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
<b>PCB132/105</b>	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		
<b>PCB138</b>	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
<b>PCB158</b>	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	
<b>PCB187</b>	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
<b>PCB183</b>	0.001	0.001	0.001	0.001	0.001	0.001		0.001							0.001	0.001	0.001		0.001
<b>PCB128</b>	0.002	0.001	0.001	0.001	0.001	0.002	0.006	0.001							0.002	0.002			
<b>PCB177</b>	0.015	0.002			0.005			0.002							0.007	0.002	0.006		
<b>PCB171/156</b>	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
<b>PCB180</b>	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
<b>PCB18</b>	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
<b>PCB17</b>		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
<b>PCB31</b>	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
<b>PCB28</b>	0.092		0.110		0.010		0.549	0.109	0.064	0.083	0.157	0.142	0.107	0.212	0.416
<b>PCB33</b>			0.272	0.233				0.160	0.193	0.177	0.446	0.278	0.606	1.560	
<b>PCB52</b>	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
<b>PCB49</b>	0.418	0.685	0.895	2.895	0.258		1.241	0.350	0.319	0.472	3.153		1.106		1.063
<b>PCB99/101</b>	0.317	0.225	0.153	0.721	0.184		0.602		0.938						
<b>PCB110</b>	0.254	0.091	0.689	0.542	0.232	0.130			0.318	0.448	2.030			0.770	1.045
<b>PCB151</b>	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
<b>PCB149</b>	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
<b>PCB118</b>	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
<b>PCB153</b>	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
<b>PCB132/105</b>	0.015	0.024	0.079	0.202	0.005	0.016	0.090	0.251		0.324	2.563	0.212			
<b>PCB138</b>	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	
<b>PCB158</b>	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	
<b>PCB187</b>	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
<b>PCB183</b>	0.001	0.000								0.003		0.006			
<b>PCB128</b>	0.001	0.001	0.204							0.011					
<b>PCB177</b>	0.005	0.001								0.027		0.024			
<b>PCB171/156</b>	0.004	0.002	0.046							0.044	0.060	0.030	0.029	0.054	
<b>PCB180</b>							<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
<b>PCB18</b>	-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
<b>PCB17</b>	-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
<b>PCB31</b>	-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
<b>PCB28</b>	-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
<b>PCB33</b>		-0.12	-0.23	-0.23				-0.14	0.00	-0.24	-0.14	0.01	-0.02	-0.27	-0.11
<b>PCB52</b>	-0.18	-0.06	-0.43	0.11			-0.22	-0.11	-0.01	-0.56	-0.02	-0.01		0.03	-0.19
<b>PCB49</b>	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
<b>PCB99/101</b>	-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
<b>PCB110</b>	-0.01		-0.10	-0.03	-0.02	-0.04	-0.03		0.00	-0.13	-0.02	0.00	0.02	-0.01	
<b>PCB151</b>	-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
<b>PCB149</b>	-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
<b>PCB118</b>	-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
<b>PCB153</b>	-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
<b>PCB132/105</b>	-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
<b>PCB138</b>	-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
<b>PCB158</b>	-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
<b>PCB187</b>	-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
<b>PCB183</b>	-0.09	-0.02	-0.18						-0.02		-0.05	-0.02	-0.01	-0.05	-0.06
<b>PCB128</b>	-0.05	-0.01	-0.07								-0.02			-0.04	-0.04
<b>PCB177</b>	-0.10	-0.02	-0.21								-0.06	-0.04	0.00	-0.05	-0.06
<b>PCB171/156</b>	-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
<b>PCB180</b>	-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
<b>Σ<sub>22</sub>PCBs</b>	-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
<b>Σ<sub>ICES</sub>PCBs</b>	-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
<b>PCB18</b>	0.014	0.039	0.061	0.014									0.010	
<b>PCB17</b>	0.001		0.017										0.002	
<b>PCB31</b>	0.002	0.001		0.001	0.002	0.001	<0.001	0.001			0.001	<0.001	0.001	0.001
<b>PCB28</b>	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
<b>PCB33</b>					<0.001	<0.001	<0.001	<0.001		0.000			0.001	
<b>PCB52</b>	0.004							0.002	0.002		0.002		0.002	
<b>PCB49</b>	0.001							<0.001			0.002	<0.001		
<b>PCB99 /101</b>	0.016	0.004	0.007	0.020	0.003	0.003	0.002			0.003		0.002		
<b>PCB110</b>	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
<b>PCB151</b>	0.004				0.001	0.001	<0.001			<0.001	0.000			0.001
<b>PCB149</b>	0.010				0.012	<0.001	0.001	<0.001	<0.001	<0.001	0.001	0.000		
<b>PCB118</b>					0.001	<0.001		<0.001	<0.001	<0.001				
<b>PCB153</b>	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
<b>PCB132 /105</b>	0.006	<0.001		0.004	0.012	0.008		0.004	0.002	0.002		0.003		0.001
<b>PCB158</b>	0.014				0.009	0.001	0.001	0.001	<0.001	0.001	0.001		<0.001	<0.001
<b>PCB138</b>	0.001				0.003	0.005	0.001	0.002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
<b>PCB187</b>	0.027				0.020	0.009	0.005	0.005	0.005	0.006	0.005	0.004	0.004	0.005
<b>PCB183</b>	0.001				0.002	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001		<0.001
<b>PCB128</b>	0.002						0.001							
<b>PCB177</b>	0.002				<0.001	<0.001	<0.001	<0.001	<0.001	<0.001				
<b>PCB171/156</b>	0.005	0.002	0.003	0.005										
<b>PCB180</b>	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
<b><math>\Sigma</math>25PCBs</b>	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
<b><math>\Sigma</math>ICESPCBs</b>	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

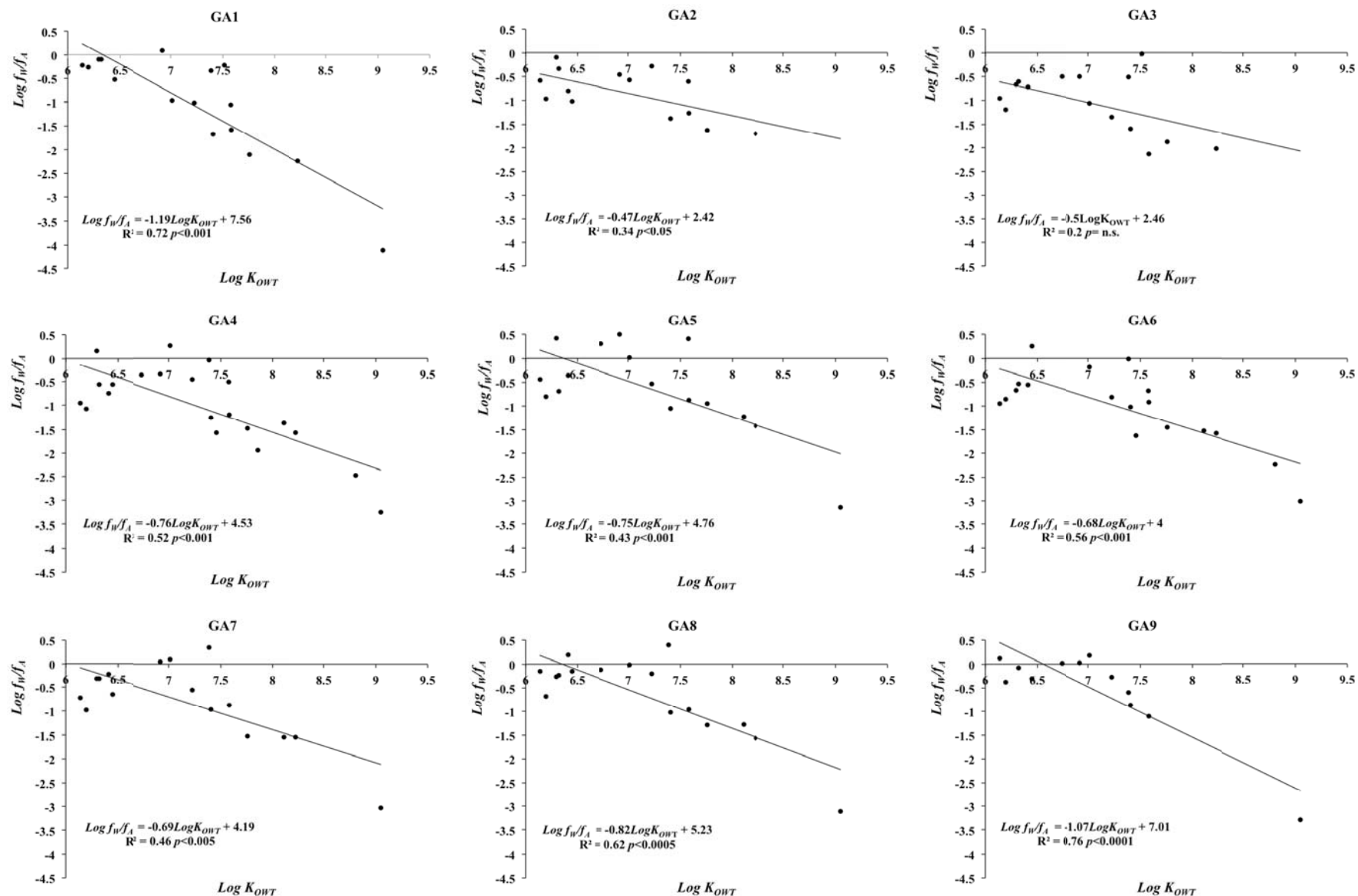


Figure S6: Air-water fugacity ratios ( $\text{Log } f_w/f_A$ ) against the logarithm of temperature corrected octanol-water partition constant ( $\text{Log } K_{OWT}$ ) for samples taken during the ATOS II Cruise. Code refers to the gas phase sample code as in Table S1

# ESSASI Cruise

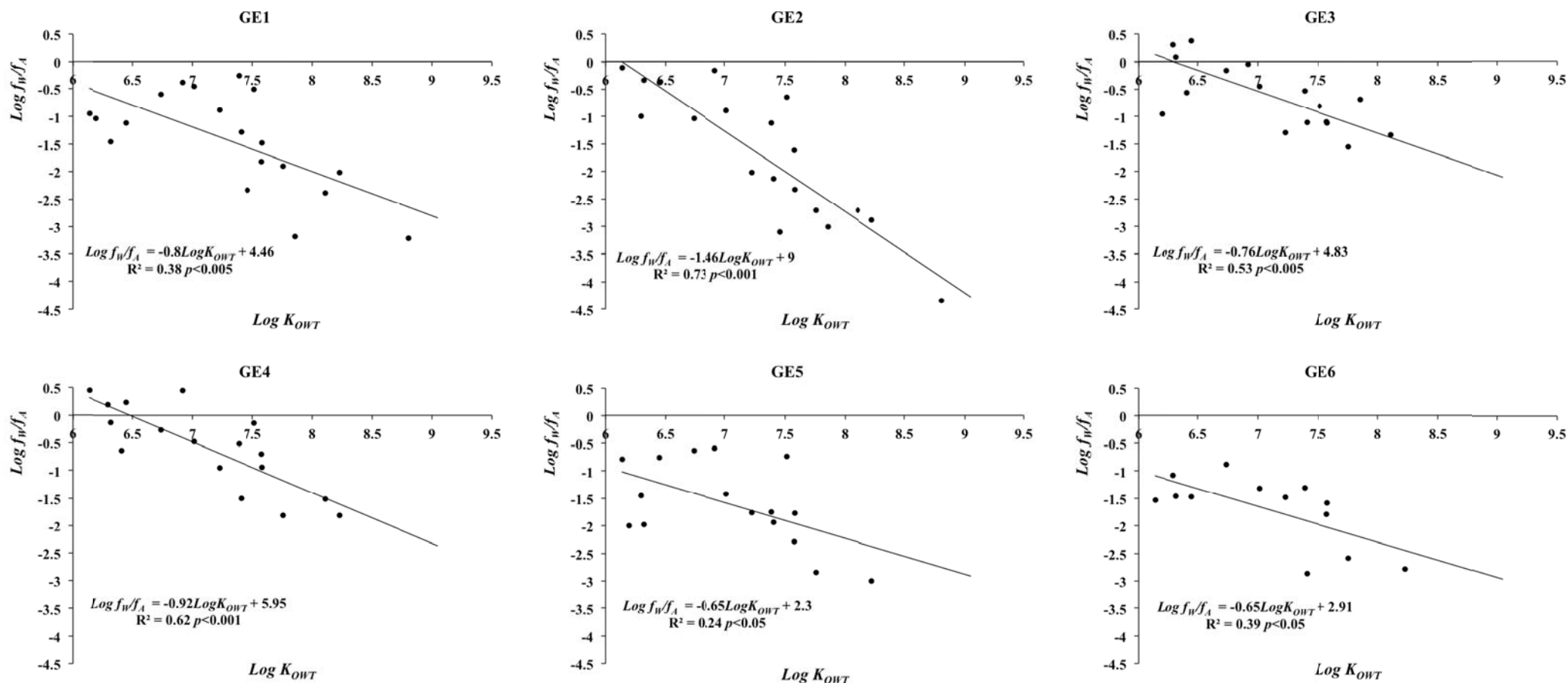


Figure S7: Air-water fugacity ratios ( $\text{Log } f_w/f_A$ ) against the logarithm of temperature corrected octanol-water partition constant ( $\text{Log } K_{OWT}$ ) for samples taken during the ESSASI Cruise. Code refers to the gas phase sample code as in Table S1

## ANNEX V

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

$\text{Log } K_p$ 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
<b>PCB18</b>																		
<b>PCB17</b>																		
<b>PCB31</b>	-4.613	-4.555	-4.442	-4.941	-5.076	-4.753	-5.070	-4.606	-5.036							-4.543	-4.544	-4.181
<b>PCB28</b>	-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
<b>PCB33</b>	-4.554					-4.856	-5.179	-4.899										
<b>PCB52</b>							-4.965	-4.363	-4.998	-4.675	-4.677	-4.509						
<b>PCB49</b>							-5.028		-5.172									
<b>PCB99/101</b>	-3.209	-2.644		-2.627	-2.835	-2.814							-2.783		-2.936			
<b>PCB110</b>		-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
<b>PCB151</b>	-5.132	-5.480	-5.464	-5.448	-5.176	-5.130							-5.099	-4.984	-5.068	-3.461	-3.449	-3.983
<b>PCB149</b>	-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			
<b>PCB118</b>	-4.063	-4.297	-3.917				-5.422	-4.621	-5.345	-3.583	-3.772	-3.542	-4.546	-4.327	-4.339			
<b>PCB153</b>	-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
<b>PCB132/105</b>		-2.120					-3.915		-2.825				-3.385					
<b>PCB138</b>	-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
<b>PCB158</b>	-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
<b>PCB187</b>	-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
<b>PCB183</b>	-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
<b>PCB128</b>					-2.638													
<b>PCB177</b>	-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			
<b>PCB171/156</b>																		
<b>PCB180</b>	-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  $\text{Log } K_p$  estimated from the  $\text{Log } K_{OA}$  corrected for temperature for samples taken in at Livingston Island. Code refers to the gas phase sample code as in Table S1.

<i>Log <math>K_p</math> Modelled</i>	AB1	AB2	AB 2	AB3	AB3	AB3	AB4	AB4	AB4	AB5	AB5	AB5	AB6	AB6	AB6	AB9Beach	AB9Beach	AB9Beach
<b>PCB18</b>	-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
<b>PCB17</b>	-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
<b>PCB31</b>	-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
<b>PCB28</b>	-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
<b>PCB33</b>	-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
<b>PCB52</b>	-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
<b>PCB49</b>	-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
<b>PCB99/101</b>	-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
<b>PCB110</b>	-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
<b>PCB151</b>	-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
<b>PCB149</b>	-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
<b>PCB118</b>	-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
<b>PCB153</b>	-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
<b>PCB132/105</b>	-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
<b>PCB138</b>	-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
<b>PCB158</b>	-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
<b>PCB187</b>	-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
<b>PCB183</b>	-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
<b>PCB128</b>	-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
<b>PCB177</b>	-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
<b>PCB171/156</b>	-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
<b>PCB180</b>	-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
<b>PCB18</b>	-3.143	-2.826	-3.597	-4.112	-3.351	<b>PCB18</b>	-5.514	-5.664	-5.540	-5.571
<b>PCB17</b>	-3.922					<b>PCB17</b>	-5.884	-6.034	-5.910	-5.941
<b>PCB31</b>	-3.694	-4.494	-5.139	-5.081	-4.719	<b>PCB31</b>	-5.054	-5.204	-5.080	-5.111
<b>PCB28</b>	-3.857		-4.442	-4.547	-4.442	<b>PCB28</b>	-5.144	-5.294	-5.170	-5.201
<b>PCB33</b>						<b>PCB33</b>	-4.964	-5.114	-4.990	-5.021
<b>PCB52</b>	-3.739					<b>PCB52</b>	-4.673	-4.836	-4.702	-4.735
<b>PCB49</b>	-3.953					<b>PCB49</b>	-4.323	-4.486	-4.352	-4.385
<b>PCB99 /101</b>	-3.395	-4.023	-4.249	-4.556	-3.754	<b>PCB99 /101</b>	-3.796	-3.961	-3.825	-3.859
<b>PCB110</b>	-2.866	-3.082	-3.707	-4.024	-3.360	<b>PCB110</b>	-3.675	-3.841	-3.704	-3.738
<b>PCB151</b>	-3.171					<b>PCB151</b>	-3.705	-3.871	-3.734	-3.768
<b>PCB149</b>	-2.989					<b>PCB149</b>	-3.172	-3.339	-3.201	-3.236
<b>PCB118</b>						<b>PCB118</b>	-3.085	-3.251	-3.114	-3.148
<b>PCB153</b>	-2.701		-4.114	-4.537	-3.590	<b>PCB153</b>	-3.037	-3.202	-3.066	-3.100
<b>PCB132 /105</b>	-3.525	-4.651	-4.274	-4.388		<b>PCB132 /105</b>	-3.130	-3.296	-3.159	-3.193
<b>PCB158</b>	-2.709					<b>PCB158</b>	-2.834	-3.001	-2.863	-2.898
<b>PCB138</b>	-4.087					<b>PCB138</b>	-3.040	-3.207	-3.069	-3.103
<b>PCB187</b>	-2.246					<b>PCB187</b>	-2.572	-2.739	-2.601	-2.636
<b>PCB183</b>	-3.864					<b>PCB183</b>	-2.233	-2.410	-2.264	-2.300
<b>PCB128</b>	-3.270					<b>PCB128</b>	-1.943	-2.120	-1.974	-2.010
<b>PCB177</b>	-2.678					<b>PCB177</b>	-2.922	-3.089	-2.951	-2.986
<b>PCB171/156</b>	-2.843	-3.135	-2.186	-3.437	-3.494	<b>PCB171/156</b>	-2.143	-2.320	-2.174	-2.210
<b>PCB180</b>			-2.812	-3.162	-2.706	<b>PCB180</b>	-2.599	-2.766	-2.628	-2.663

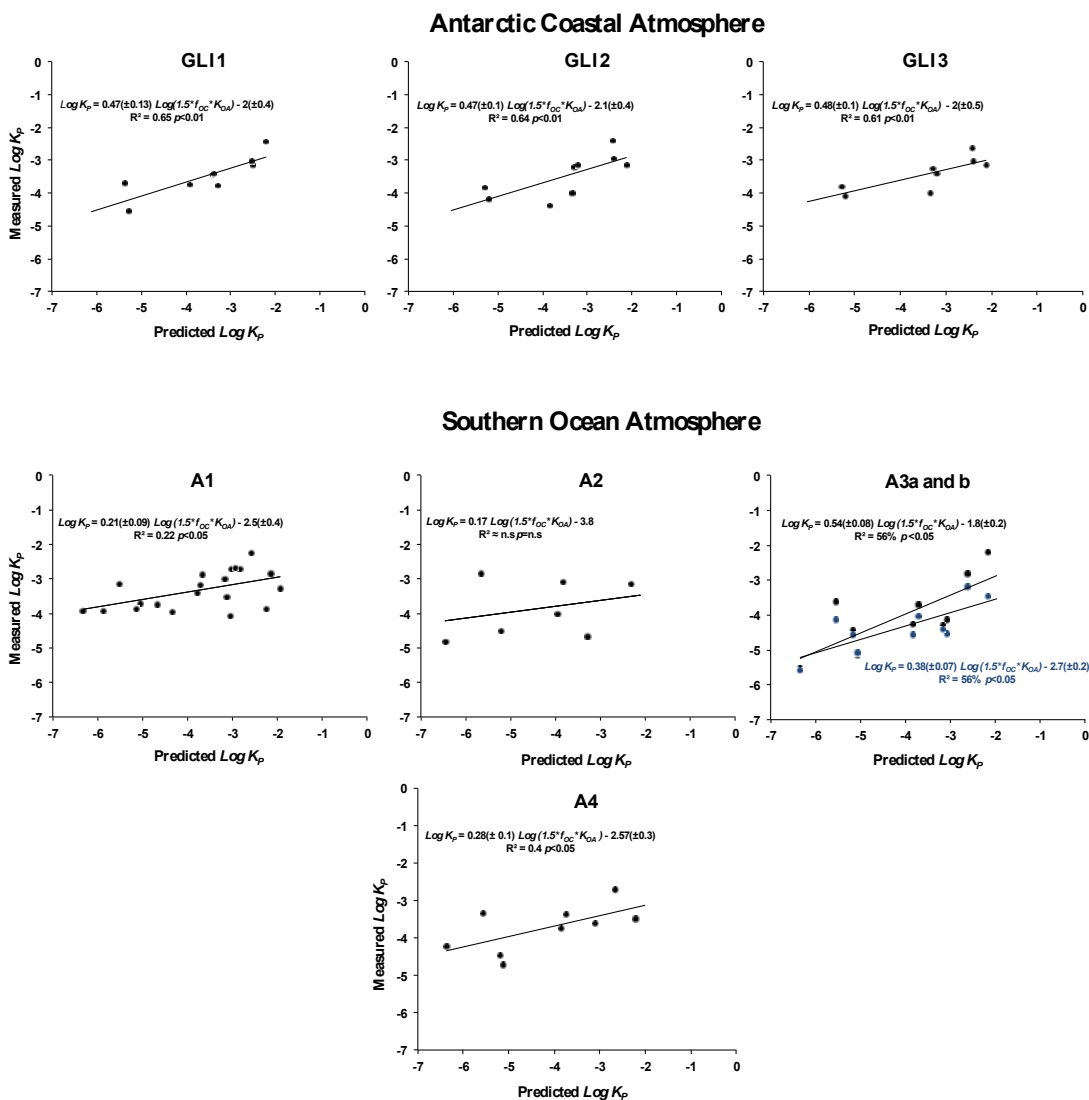


Figure S8. Measured versus predicted gas-particle partition constant ( $\text{Log } K_p$ ) from gas and aerosol phase samples from the Antarctic coastal atmosphere (Livingston Island) and from Southern Ocean atmosphere taken during 2009. Code refers to the gas phase sample code as in Table S1

## Antarctic Atmosphere

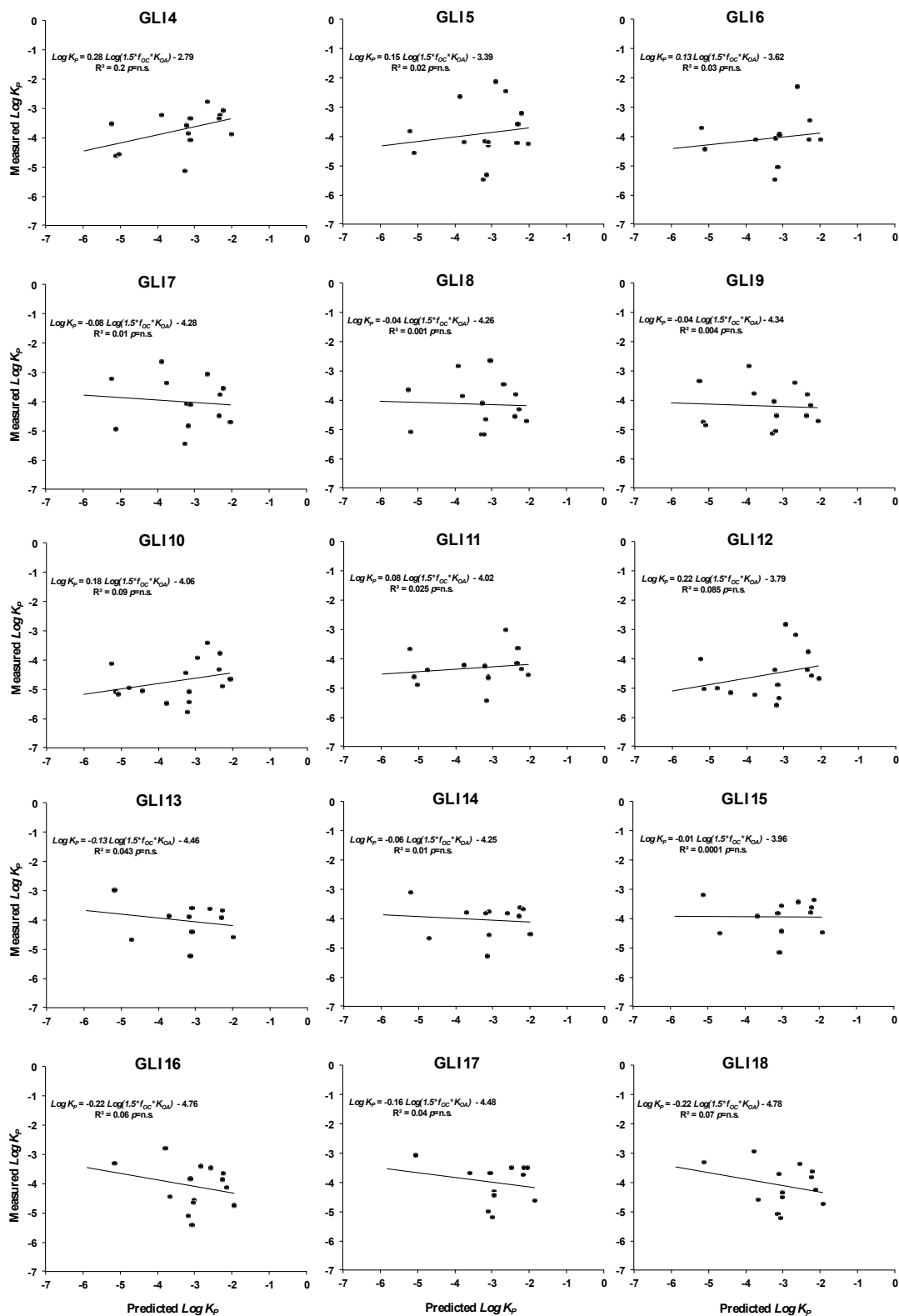


Figure S9. Measured versus predicted gas-particle partition constant ( $\text{Log } K_p$ ) for gas and aerosol phase samples taken at Radio Peak in Livingston Island in 2009 austral summer (Cabrerizo et al., 2013) and aerosols samples reported in the present work. Code refers to the gas phase sample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

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