

## SUPPORTING MATERIAL TO:

### Climatic and biogeochemical controls on the remobilization and reservoirs of persistent organic pollutants in Antarctica

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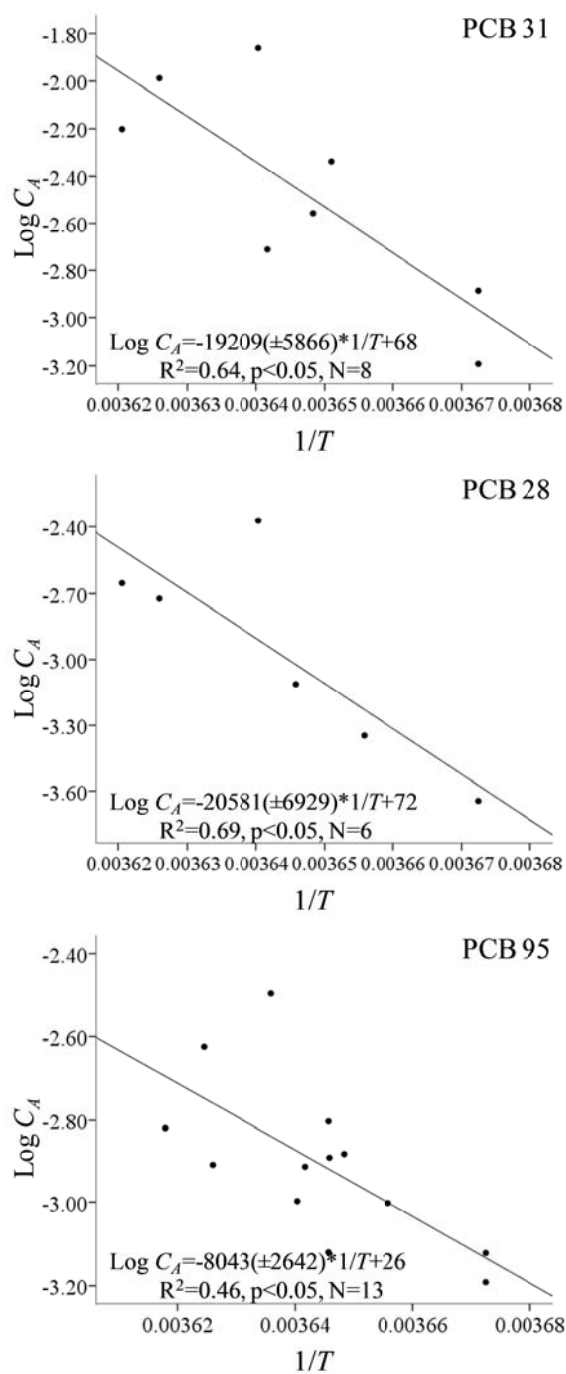
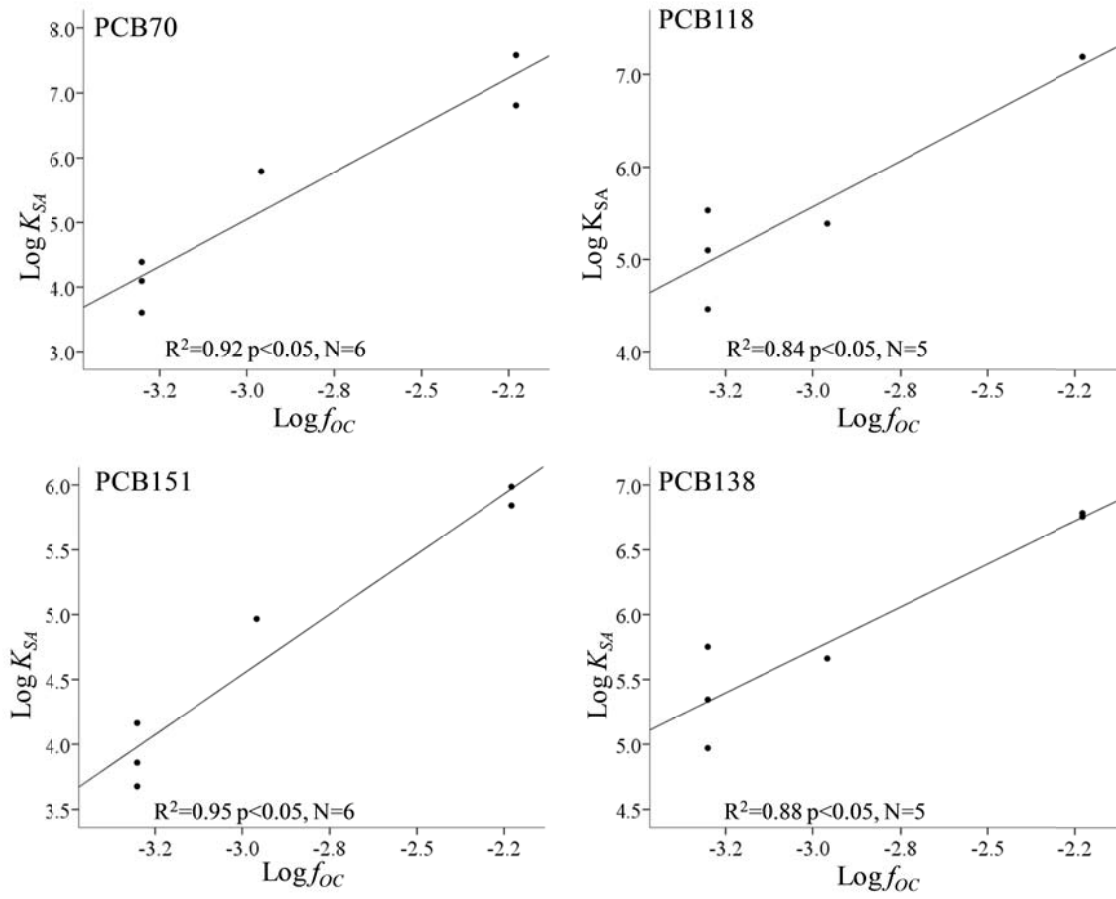
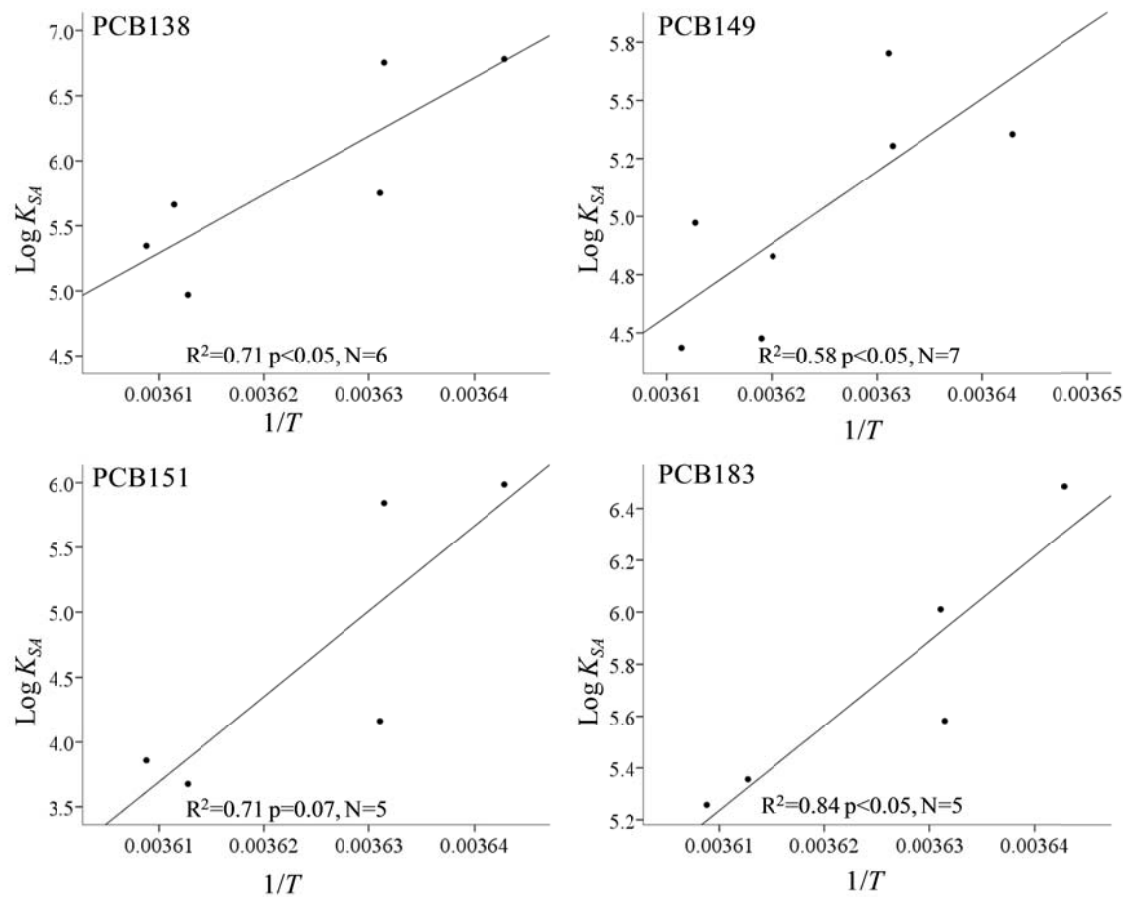


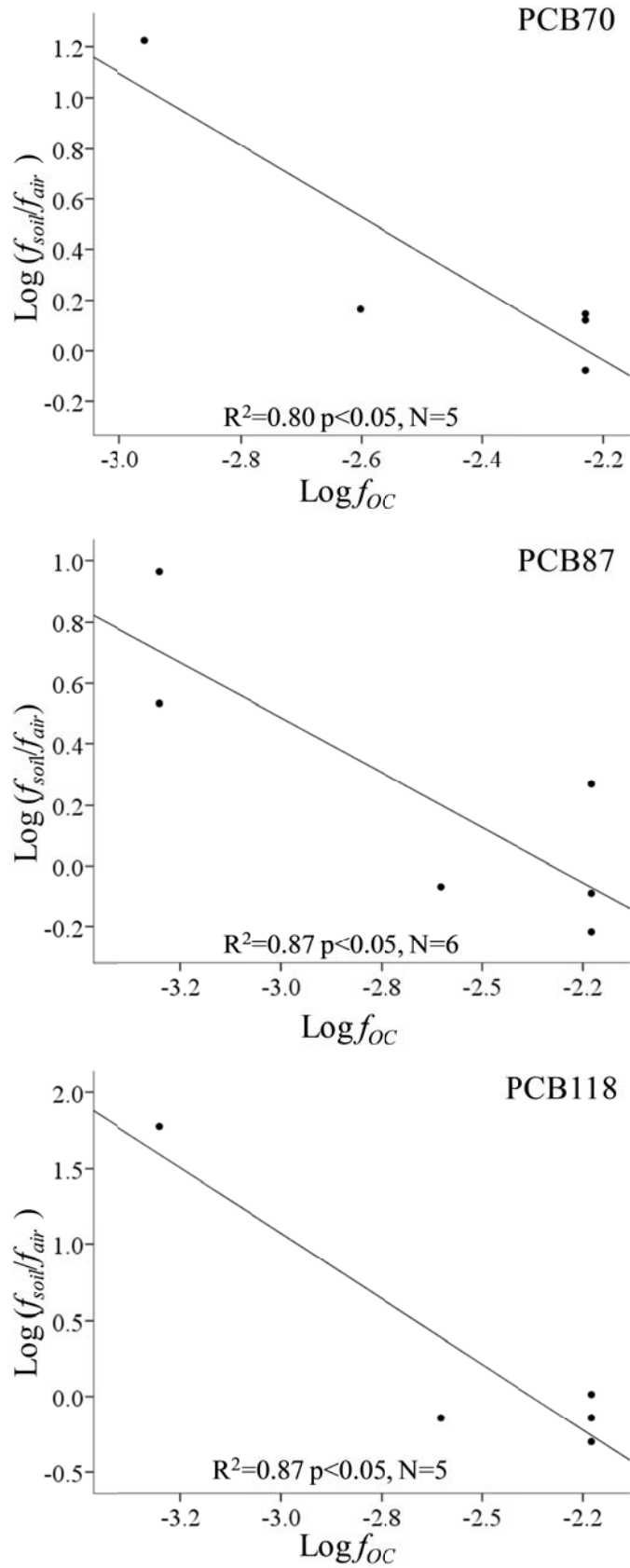
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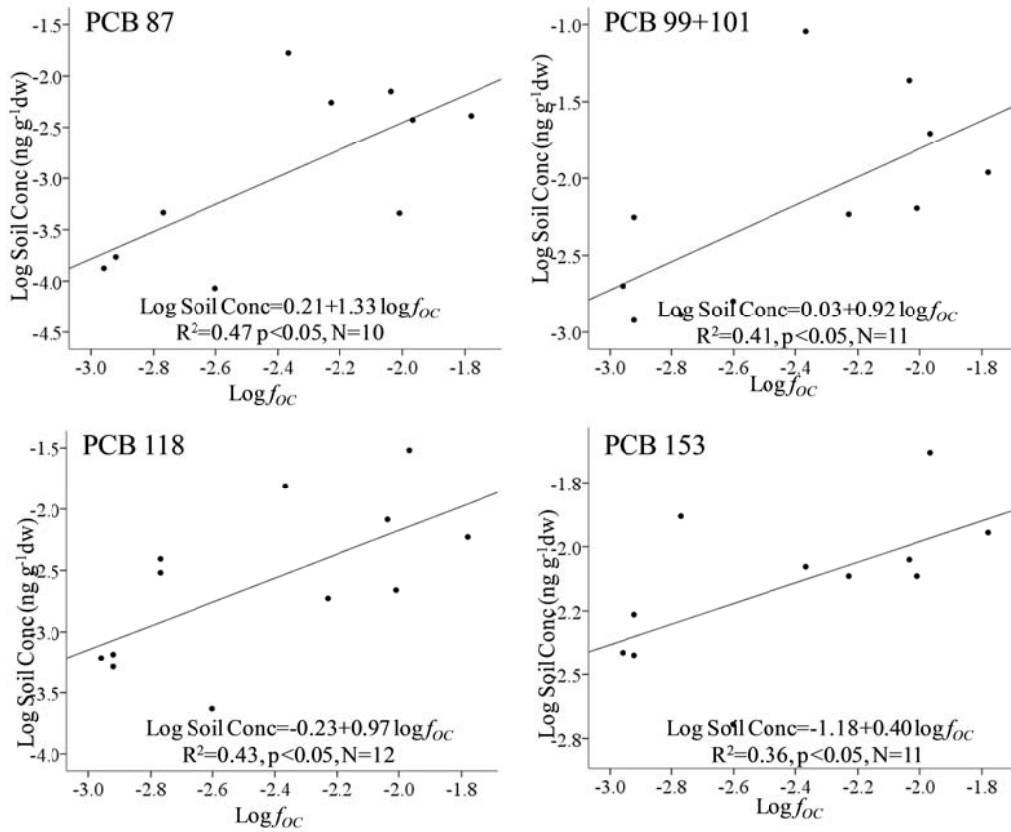
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**Figure S3. The soil-air partition coefficient ( $K_{SA}$ ) regressed against  $1/T$  for selected PCB congeners**



**Figure S4. Soil-air fugacity ratio ( $\text{Log}(f_{\text{soil}}/f_{\text{air}})$ ) regressed against  $\text{Log} f_{\text{OC}}$  for individual PCB congeners**



**Figure S5. Concentration in surface soil (ng g<sup>-1</sup> dw) of selected PCB congeners versus organic carbon content (log  $f_{OC}$ ). Figure taken from Cabrerizo et al, 2012). Only 11 out of 36 soils analyzed had  $f_{OC} > 0.001$  and thus were considered for the regressions.**

## Annex II. List of Tables

**Table S1. Soil concentration (pg g<sup>-1</sup> dw) of individual PCB congeners, ΣPCB congeners (pg g<sup>-1</sup> dw) and soil total organic carbon (TOC). Soil B1 and B2 belongs to soil underneath the soil fugacity sampler deployed at Polish Beach (bare soil) and Soil B3 and B4 to soil underneath the soil fugacity sampler deployed at Pico Radio Hill (soil with vegetation). <loq: data below quantification limit.**

	Soil B1	Soil B2	Soil B3	Soil B4
<b>PCBs</b>				
PCB18	<loq	<loq	<loq	<loq
PCB17	<loq	<loq	<loq	<loq
PCB31	<loq	<loq	<loq	<loq
<i>PCB28</i>	<loq	<loq	1.310	<loq
<i>PCB52</i>	2.630	1.950	8.320	0.150
PCB49	1.480	1.440	12.450	1.130
PCB44	<loq	0.110	0.670	0.190
PCB70	2.800	2.640	9.820	<loq
PCB95	1.180	0.910	<loq	0.130
<i>PCB99+101</i>	2.070	2.000	5.850	1.590
PCB87	0.200	0.130	5.510	0.090
PCB110	0.460	0.110	4.870	12.580
PCB151	<loq	0.190	0.220	<loq
PCB149	0.720	0.320	0.410	0.110
<i>PCB118</i>	1.280	0.610	1.870	0.230
<i>PCB153</i>	5.860	3.870	7.690	2.020
PCB132+105	2.040	0.690	0.150	1.060
<i>PCB138</i>	3.750	2.290	5.100	1.190
PCB158	0.230	0.160	0.150	<loq
PCB187	1.550	0.830	0.750	0.980
PCB183	1.480	0.450	0.110	1.590
PCB128	1.910	0.240	0.070	<loq
PCB177	<loq	0.080	0.520	0.150
PCB171+156	0.260	0.430	0.670	0.020
<i>PCB180</i>	7.040	3.760	5.850	1.590
PCB191	<loq	<loq	0.220	0.110
PCB169	<loq	<loq	<loq	<loq
PCB170	1.780	0.430	0.900	0.130
PCB201/199	0.160	0.080	<loq	0.060
PCB195	0.160	0.030	0.220	<loq
PCB194	1.250	0.370	0.490	0.040
PCB205	0.070	0.190	<loq	0.020
PCB206	0.490	0.130	<loq	0.230
PCB209	<loq	<loq	<loq	<loq
Σtri-PCBs	<loq	<loq	1.310	<loq
Σtetra-PCBs	6.910	6.140	31.270	1.470
Σpenta-PCBs	4.740	3.660	13.240	2.040
Σhexa-PCBs	14.970	7.870	18.670	16.960
Σhepta-PCBs	12.110	5.980	9.040	4.570
Σocta-PCBs	1.650	0.670	0.710	0.130
Σnona-PCBs	0.490	0.130	<loq	0.230
<b>ΣPCBs</b>	40.870	24.450	74.240	25.400
<b>TOC (%)</b>	<0.10	0.11	0.59	0.25



**Table S2. Concentration in lichens (*Usnea Antarctica*) (pg g<sup>-1</sup> dw) of individual PCB congeners, ΣPCB congeners. Veg B1 and Veg B2 belongs to vegetation underneath the soil fugacity sampler deployed at Pico Radio Hill <loq: data below quantification limit.**

	Veg B1	Veg B2
<b>PCBs</b>		
PCB18	1.800	5.560
PCB17	3.320	7.760
PCB31	3.380	8.480
PCB28	2.140	6.720
PCB52	<loq	1.710
PCB49	<loq	<loq
PCB44	0.790	1.490
PCB70	0.620	0.440
PCB95	<loq	2.700
PCB99+101	3.270	3.300
PCB87	3.210	1.100
PCB110	0.960	0.220
PCB151	0.450	0.170
PCB149	2.360	3.740
PCB118	3.100	7.710
PCB153	4.950	14.150
PCB132+105	1.690	2.420
PCB138	3.380	8.750
PCB158	<loq	0.110
PCB187	0.510	1.600
PCB183	0.510	0.990
PCB128	0.450	2.260
PCB177	0.110	0.170
PCB171+156	0.170	0.110
PCB180	3.320	9.090
PCB191	<loq	<loq
PCB169	<loq	<loq
PCB170	1.860	5.120
PCB201/199	0.280	0.110
PCB195	0.230	0.500
PCB194	0.230	1.160
PCB205	<loq	<loq
PCB206	<loq	0.220
PCB209	<loq	<loq
Σtri-PCBs	10.640	28.520
Σtetra-PCBs	1.410	3.630
Σpenta-PCBs	9.570	14.810
Σhexa-PCBs	14.240	31.830
Σhepta-PCBs	6.470	17.070
Σocta-PCBs	0.730	1.760
Σnona-PCBs	<loq	0.220
<b>ΣPCBs</b>	<b>43.070</b>	<b>97.850</b>

**Table S3. Concentrations of individual PCB congeners,  $\Sigma$ PCB congeners in ambient air ( $\text{pg m}^{-3}$ ) and ambient air  $T$  ( $^{\circ}\text{C}$ ) during the daily sampling campaign at Pico Radio Hill using a commercial high volume sampler. <loq: data below detection limit**

	220109	230109	240109	250109	260109	270109	280109	290109	300109	310109	010209	020209	030209	040209	050209
PCB18	0.463	0.290	0.178	0.163	0.620	0.503	0.822	0.300	0.725	0.220	0.356	0.268	0.484	0.223	0.276
PCB17	0.557	0.710	0.695	0.460	0.311	0.217	0.302	0.254	0.390	0.384	0.343	0.663	0.442	0.309	0.376
PCB31	0.873	0.522	0.402	0.535	0.730	0.347	1.079	0.371	0.999	0.288	0.298	0.343	0.351	0.202	0.276
PCB28	0.576	0.290	0.216	0.238	0.633	0.315	0.781	0.281	0.600	0.133	0.186	0.224	0.259	0.144	0.247
PCB33	0.127	<loq	<loq	<loq	<loq	0.110	0.693	0.364	<loq	<loq	0.083	<loq	<loq	<loq	<loq
PCB52	<loq	1.775	<loq	1.325	0.863	0.672	1.977	0.494	2.133	1.290	1.296	0.880	0.505	0.534	0.691
PCB49	0.423	0.113	<loq	<loq	0.257	0.116	0.327	<loq	0.455	<loq	<loq	<loq	0.055	<loq	<loq
PCB44	<loq	<loq	<loq	<loq	0.131	0.057	0.594	<loq	0.304	<loq	<loq	0.022	0.029	<loq	0.029
PCB74	0.333	0.204	0.185	5.677	0.139	0.098	0.115	0.064	0.149	0.270	0.026	0.157	0.288	0.047	0.344
PCB70	0.267	0.113	0.008	0.176	0.257	0.155	0.594	0.136	0.487	0.078	0.051	0.063	0.050	0.039	0.039
PCB95	0.440	0.247	0.070	0.146	<loq	0.280	1.319	0.254	0.800	0.105	0.144	0.160	0.272	0.103	0.150
PCB99+101	0.063	0.016	<loq	0.013	0.021	0.020	<loq	<loq	0.022	0.037	<loq	<loq	0.026	<loq	0.037
PCB87	0.300	0.226	0.162	0.209	0.116	0.088	0.322	0.071	0.434	0.110	0.077	0.060	0.068	0.023	0.032
PCB110	<loq	0.038	0.031	0.025	0.077	0.061	0.446	0.026	0.260	0.050	0.045	0.060	0.045	0.008	0.063
PCB151	2.399	2.194	2.117	1.722	0.920	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	0.020	0.048	0.124	0.108	0.405	0.064	0.339	0.022	0.034	0.020	0.058	0.035	0.036
PCB153	1.359	1.380	1.119	1.175	1.270	1.139	1.211	0.819	1.107	0.854	0.729	0.718	0.783	0.565	0.628
PCB132+105	<loq	0.015	<loq	<loq	0.107	0.011	0.516	<loq	0.042	<loq	<loq	<loq	0.084	<loq	<loq
PCB138	0.281	0.227	0.126	0.174	0.609	0.454	0.881	0.340	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	0.030	0.079	0.030	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	0.340
PCB183	0.164	0.171	0.121	0.152	0.158	0.155	0.140	0.108	0.144	0.110	0.096	0.085	0.089	0.066	0.088
PCB128	0.003	<loq	<loq	<loq	0.004	<loq	0.069	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq
PCB177	0.004	0.008	<loq	0.011	0.064	0.045	0.117	0.034	0.058	<loq	0.020	0.010	0.022	0.005	0.029
PCB171+156	<loq	<loq	<loq	<loq	<loq	<loq	0.025	0.046	<loq	<loq	<loq	<loq	<loq	<loq	<loq
PCB180	0.187	0.196	0.153	0.185	0.215	0.200	0.188	0.130	0.221	0.144	0.143	0.108	0.142	0.108	0.129
PCB191	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq
PCB169	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq
PCB170	0.011	0.004	0.004	0.010	0.023	0.014	0.042	0.013	0.026	0.012	0.003	<loq	0.011	0.008	0.015
PCB201/199	0.008	0.004	0.004	0.008	0.013	0.011	0.013	0.008	0.015	0.002	0.012	0.003	0.016	<loq	0.010
PCB208	0.007	0.013	0.014	0.010	0.009	0.013	<loq	0.009	0.011	0.008	0.002	<loq	0.009	0.003	0.008
PCB195	<loq	<loq	<loq	<loq	<loq	<loq	<loq	0.003	<loq	<loq	<loq	<loq	<loq	<loq	<loq
PCB205	0.003	<loq	<loq	0.001	0.004	0.006	0.012	<loq	0.009	<loq	<loq	<loq	0.013	<loq	<loq
PCB194	<loq	<loq	0.002	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq
PCB206	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq
PCB209	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq	<loq
Σ3PCBs	2.596	1.812	1.491	1.396	2.294	1.493	3.677	1.570	2.715	1.025	1.267	1.498	1.537	0.879	1.174
Σ4PCBs	1.023	2.205	0.193	7.178	1.648	1.097	3.607	0.694	3.528	1.638	1.373	1.122	0.927	0.621	1.103
Σ5PCBs	0.885	0.537	0.252	0.416	0.261	0.496	2.046	0.389	1.595	0.273	0.255	0.240	0.424	0.160	0.254
Σ6PCBs	5.272	4.877	3.949	3.825	4.637	3.686	5.655	2.578	3.889	2.365	2.114	1.883	2.571	1.670	1.919

Σ7PCBs	0.827	0.859	0.651	0.793	0.939	0.869	0.941	0.647	0.861	0.616	0.567	0.506	0.626	0.431	0.601
Σ8PCBs	0.011	0.004	0.005	0.010	0.016	0.017	0.025	0.010	0.024	0.002	0.012	0.003	0.029	<loq	0.010
Σ9PCBs	0.007	0.013	0.014	0.010	0.009	0.013	<loq	0.009	0.011	0.008	0.002	<loq	0.009	0.003	0.008
<b>ΣPCBs</b>	<b>10.621</b>	<b>10.309</b>	<b>6.556</b>	<b>13.628</b>	<b>9.803</b>	<b>7.671</b>	<b>15.951</b>	<b>5.899</b>	<b>12.623</b>	<b>5.929</b>	<b>5.590</b>	<b>5.252</b>	<b>6.122</b>	<b>3.765</b>	<b>5.070</b>
Air T (°C)	2.06	1.73	1.60	2.3041	2.92	2.84	2.91	2.30	2.81	1.61	1.65	0.64	0.77	-0.60	0.54

**Table S4. Five days long integrated concentration of individual PCB congeners,  $\Sigma$ PCB congeners in ambient air ( $\text{pg m}^{-3}$ ) and ambient air  $T$  ( $^{\circ}\text{C}$ ) during the sampling campaign at Polish Beach obtained from the low volume ambient air sampler. <loq: data below quantification limit**

	21-250109	25-300109	30-040209	04-130209
<b>PCBs</b>				
PCB18	0.1855	<loq	<loq	<loq
PCB17	<loq	<loq	<loq	0.5184
PCB31	<loq	<loq	1.9457	6.2684
PCB28	<loq	<loq	<loq	2.2091
PCB33	2.5780	<loq	0.9728	1.4355
PCB52	<loq	<loq	<loq	<loq
PCB49	<loq	<loq	<loq	<loq
PCB44	<loq	<loq	<loq	<loq
PCB74	1.8732	1.0567	0.9563	1.7067
PCB70	<loq	<loq	<loq	0.2552
PCB95	2.3740	1.5119	1.2202	<loq
PCB99+101	2.0401	1.1543	<loq	<loq
PCB87	0.9830	<loq	0.2638	<loq
PCB151	<loq	<loq	0.5936	<loq
PCB149	2.7264	<loq	<loq	0.9012
PCB118	0.3153	<loq	<loq	<loq
PCB138	<loq	<loq	<loq	<loq
PCB158	<loq	<loq	<loq	<loq
PCB187	<loq	0.2601	<loq	<loq
PCB183	<loq	<loq	<loq	<loq
PCB128	0.0371	<loq	<loq	<loq
PCB177	1.4466	<loq	<loq	<loq
PCB171+156	<loq	<loq	<loq	<loq
PCB180	3.0787	1.0405	<loq	<loq
PCB191	0.2782	<loq	<loq	<loq
PCB169	0.4451	<loq	<loq	0.5662
PCB170	<loq	<loq	<loq	<loq
PCB201/199	0.8902	0.7153	0.5441	0.5742
PCB208	<loq	<loq	<loq	<loq
PCB195	<loq	<loq	<loq	<loq
PCB205	<loq	<loq	<loq	0.7975
PCB194	<loq	<loq	<loq	<loq
PCB206	<loq	<loq	<loq	<loq
PCB209	<loq	<loq	<loq	<loq
$\Sigma$ 3PCBs	2.7635	<loq	2.9185	10.4315
$\Sigma$ 4PCBs	1.8732	1.0567	0.9563	1.9619
$\Sigma$ 5PCBs	5.7124	2.6662	1.4840	<loq
$\Sigma$ 6PCBs	3.2086	<loq	0.5936	1.4674
$\Sigma$ 7PCBs	4.8036	1.3006	<loq	<loq
$\Sigma$ 8PCBs	0.8902	0.7153	0.5441	1.3717
$\Sigma$ 9PCBs	<loq	<loq	<loq	<loq
<b><math>\Sigma</math>PCBs</b>	<b>19.2515</b>	<b>5.7388</b>	<b>6.4966</b>	<b>15.2325</b>
Air $T$ ( $^{\circ}\text{C}$ )	2.90	3.40	1.60	3.20

**Table S5. Five days long integrated concentrations of individual PCB congeners,  $\Sigma$ PCB congeners in ambient air ( $\text{pg m}^{-3}$ ) and ambient air  $T$  ( $^{\circ}\text{C}$ ) during the sampling campaign at Pico Radio Hill obtained from the low volume ambient air sampler. <loq: data below quantification limit**

	20-250109	25-300109	30-050209	05-120209
<b>PCBs</b>				
PCB18	<loq	<loq	<loq	<loq
PCB17	<loq	<loq	<loq	<loq
PCB31	<loq	<loq	<loq	<loq
PCB28	<loq	0.7696	0.4496	1.8800
PCB33	<loq	<loq	<loq	6.2522
PCB52	<loq	3.6911	2.6974	2.9031
PCB49	2.6084	<loq	<loq	<loq
PCB44	<loq	<loq	<loq	<loq
PCB74	1.2735	<loq	0.9113	<loq
PCB70	<loq	1.9667	<loq	4.0836
PCB95	3.2068	1.2826	0.9964	1.2329
PCB99+101	6.3521	4.4465	<loq	9.6712
PCB87	<loq	<loq	<loq	<loq
PCB151	<loq	<loq	<loq	<loq
PCB149	0.7211	<loq	<loq	2.0986
PCB118	0.1995	0.7126	0.0243	0.4110
PCB138	0.3222	<loq	<loq	<loq
PCB158	<loq	<loq	<loq	<loq
PCB187	0.0307	0.1283	0.0365	<loq
PCB183	0.0614	0.0713	0.0365	<loq
PCB128	<loq	<loq	<loq	<loq
PCB177	<loq	<loq	<loq	<loq
PCB171+156	<loq	<loq	<loq	<loq
PCB180	<loq	1.0119	1.4095	<loq
PCB191	<loq	<loq	<loq	<loq
PCB169	0.7058	0.6128	0.5346	<loq
PCB170	<loq	<loq	<loq	<loq
PCB201/199	0.3376	0.5131	<loq	<loq
PCB208	<loq	<loq	<loq	<loq
PCB195	<loq	<loq	<loq	<loq
PCB205	<loq	<loq	<loq	<loq
PCB194	<loq	<loq	<loq	<loq
PCB206	<loq	<loq	<loq	<loq
PCB209	<loq	<loq	<loq	<loq
$\Sigma$ 3PCBs	<loq	0.7696	0.4496	8.1322
$\Sigma$ 4PCBs	3.8819	5.6578	3.6087	6.9867
$\Sigma$ 5PCBs	9.7583	6.4417	1.0207	11.3151
$\Sigma$ 6PCBs	1.7491	0.6128	0.5346	2.0986
$\Sigma$ 7PCBs	0.0921	1.2114	1.4824	<loq
$\Sigma$ 8PCBs	0.3376	0.5131	<loq	<loq
$\Sigma$ 9PCBs	<loq	<loq	<loq	<loq
<b><math>\Sigma</math>PCBs</b>	<b>15.8189</b>	<b>15.2064</b>	<b>7.0960</b>	<b>28.5326</b>
Air $T$ ( $^{\circ}\text{C}$ )	2.00	1.30	0.50	2.80

**Table S6. Five days long integrated concentrations of individual PCB congeners,  $\Sigma$ PCB congeners in ambient air ( $\text{pg m}^{-3}$ ) and ambient air  $T$  ( $^{\circ}\text{C}$ ) during the sampling campaign at Sofia Mountain obtained from the low volume ambient air sampler. <loq: data below detection limit**

	21-260109	26-310109	31-050209	05-110209
<b>PCBs</b>				
PCB18	<loq	4.5449	<loq	<loq
PCB17	<loq	<loq	<loq	<loq
PCB31	2.7482	<loq	1.3081	<loq
PCB28	<loq	<loq	<loq	<loq
PCB33	<loq	<loq	<loq	0.4659
PCB52	<loq	<loq	1.4068	<loq
PCB49	<loq	<loq	<loq	<loq
PCB44	<loq	<loq	0.3702	0.5163
PCB74	2.0144	<loq	<loq	1.4984
PCB70	<loq	<loq	<loq	<loq
PCB95	1.3094	1.5683	0.6417	1.0074
PCB99+101	1.8417	<loq	<loq	<loq
PCB87	0.0144	<loq	<loq	<loq
PCB151	<loq	<loq	<loq	<loq
PCB149	<loq	<loq	<loq	<loq
PCB118	<loq	<loq	<loq	<loq
PCB138	<loq	<loq	<loq	<loq
PCB158	<loq	<loq	<loq	<loq
PCB187	0.3165	0.4001	0.2345	0.1385
PCB183	<loq	<loq	<loq	<loq
PCB128	<loq	<loq	<loq	<loq
PCB177	0.8921	0.7041	<loq	0.1385
PCB171+156	<loq	<loq	<loq	<loq
PCB180	<loq	<loq	<loq	<loq
PCB191	0.5755	<loq	<loq	<loq
PCB169	<loq	<loq	<loq	<loq
PCB170	<loq	<loq	<loq	<loq
PCB201/199	0.8345	0.8802	0.3949	0.5415
PCB208	<loq	<loq	<loq	<loq
PCB195	<loq	<loq	<loq	<loq
PCB205	<loq	<loq	<loq	<loq
PCB194	<loq	<loq	<loq	<loq
PCB206	<loq	<loq	<loq	<loq
PCB209	<loq	<loq	<loq	<loq
$\Sigma$ 3PCBs	2.7482	4.5449	1.3081	0.4659
$\Sigma$ 4PCBs	2.0144	<loq	1.7770	2.0147
$\Sigma$ 5PCBs	3.1511	1.5683	0.6417	1.0074
$\Sigma$ 6PCBs	<loq	<loq	<loq	<loq
$\Sigma$ 7PCBs	1.7842	1.1042	0.2345	0.2770
$\Sigma$ 8PCBs	0.8345	0.8802	0.3949	0.5415
$\Sigma$ 9PCBs	<loq	<loq	<loq	<loq
<b><math>\Sigma</math>PCBs</b>	10.5468	8.0976	4.3562	4.3064
Air $T$ ( $^{\circ}\text{C}$ )	1.10	1.30	-0.70	1.70

**Table S7. Five days long integrated concentration of individual PCB congeners,  $\Sigma$ PCB congeners in bare soil equilibrated with air ( $\text{pg m}^{-3}$ ) during the sampling campaign at Polish Beach obtained from the low volume ambient air sampler.**

**<loq: data below quantification limit**

	21-250109	25-300109	30-040209	04-130209
<b>PCBs</b>				
PCB18	6.1205	<loq	2.6629	<loq
PCB17	<loq	<loq	5.7043	<loq
PCB31	11.2763	13.5053	4.6391	12.0512
PCB28	12.9527	5.6226	1.8781	5.2072
PCB33	5.9940	<loq	<loq	4.0922
PCB52	15.7995	7.0558	<loq	<loq
PCB49	4.6655	<loq	<loq	<loq
PCB44	10.1218	4.5201	2.3406	<loq
PCB74	4.0329	4.9198	<loq	<loq
PCB70	13.4272	4.3548	2.2144	4.2701
PCB95	26.9967	15.6276	4.6671	3.9854
PCB99+101	90.6690	25.8255	<loq	<loq
PCB87	9.0780	2.4668	0.8970	1.3285
PCB151	5.7093	3.7622	1.8641	2.0164
PCB149	30.6500	14.6629	5.7183	11.7428
PCB118	18.7885	4.3272	1.5978	2.5146
PCB138	16.2897	6.8629	2.6910	4.9937
PCB158	1.7555	0.3170	0.1121	<loq
PCB187	1.9295	<loq	1.0932	1.7080
PCB183	1.0754	1.3505	0.2383	<loq
PCB128	1.8978	0.3307	0.0561	<loq
PCB177	<loq	4.5891	<loq	1.0201
PCB171+156	<loq	0.5512	<loq	<loq
PCB180	<loq	<loq	<loq	<loq
PCB191	<loq	<loq	<loq	<loq
PCB169	<loq	<loq	<loq	<loq
PCB170	<loq	<loq	<loq	<loq
PCB201/199	<loq	1.0198	0.9110	<loq
PCB208	<loq	<loq	<loq	<loq
PCB195	<loq	<loq	<loq	<loq
PCB205	<loq	1.0336	1.9622	1.4471
PCB194	<loq	<loq	<loq	<loq
PCB206	<loq	<loq	<loq	<loq
PCB209	<loq	<loq	<loq	<loq
$\Sigma$ 3PCBs	36.3435	19.1279	14.8844	21.3505
$\Sigma$ 4PCBs	48.0468	20.8506	4.5550	4.2701
$\Sigma$ 5PCBs	145.5322	48.2471	7.1619	7.8285
$\Sigma$ 6PCBs	56.3024	25.9357	10.4415	18.7529
$\Sigma$ 7PCBs	3.0049	6.4908	1.3315	2.7281
$\Sigma$ 8PCBs	<loq	2.0534	2.8732	1.4471
$\Sigma$ 9PCBs	<loq	<loq	<loq	<loq
<b><math>\Sigma</math>PCBs</b>	<b>289.2298</b>	<b>122.7055</b>	<b>41.2474</b>	<b>56.3773</b>



**Table S8. Five days long integrated concentrations of individual PCB congeners, ΣPCB congeners in vegetated soil equilibrated with air (pg m<sup>-3</sup>) during the sampling campaign at Pico Radio Hill obtained from the low volume ambient air sampler. <loq: data below quantification limit**

	20-250109	25-300109	30-050209	05-120209
<b>PCBs</b>				
PCB18	<loq	<loq	<loq	<loq
PCB17	<loq	<loq	39.4166	28.8021
PCB31	16.4875	<loq	<loq	5.6042
PCB28	11.9229	2.5466	4.1826	6.3021
PCB33	4.8852	<loq	<loq	<loq
PCB52	<loq	<loq	<loq	<loq
PCB49	<loq	1.0010	<loq	<loq
PCB44	<loq	1.0746	<loq	<loq
PCB74	5.7248	<loq	<loq	1.5000
PCB70	1.5266	<loq	0.2568	1.1458
PCB95	2.6716	1.6928	1.3942	1.8021
PCB99+101	<loq	7.9342	<loq	<loq
PCB87	2.4579	<loq	<loq	<loq
PCB151	<loq	0.3238	0.2324	<loq
PCB149	6.1218	2.0461	1.8222	3.5521
PCB118	<loq	<loq	0.1223	<loq
PCB138	<loq	0.8979	0.8439	<loq
PCB158	<loq	<loq	<loq	<loq
PCB187	<loq	0.6771	0.2935	<loq
PCB183	<loq	0.2944	0.0367	<loq
PCB128	<loq	<loq	<loq	<loq
PCB177	<loq	0.0883	0.0978	<loq
PCB171+156	<loq	0.1178	0.1101	<loq
PCB180	<loq	<loq	<loq	<loq
PCB191	<loq	<loq	<loq	<loq
PCB169	<loq	<loq	<loq	<loq
PCB170	<loq	<loq	<loq	<loq
PCB201/199	0.9618	0.5005	0.6115	<loq
PCB208	<loq	<loq	<loq	<loq
PCB195	<loq	<loq	<loq	<loq
PCB205	<loq	<loq	<loq	<loq
PCB194	<loq	<loq	<loq	<loq
PCB206	<loq	<loq	<loq	<loq
PCB209	<loq	<loq	<loq	<loq
Σ3PCBs	33.2957	2.5466	43.5992	40.7083
Σ4PCBs	7.2515	2.0755	0.2568	2.6458
Σ5PCBs	5.1295	9.6270	1.5165	1.8021
Σ6PCBs	6.1218	3.2679	2.8985	3.5521
Σ7PCBs	<loq	1.1776	0.5381	<loq
Σ8PCBs	0.9618	0.5005	0.6115	<loq
Σ9PCBs	<loq	<loq	<loq	<loq
<b>ΣPCBs</b>	<b>52.7601</b>	<b>19.1951</b>	<b>49.4206</b>	<b>48.7083</b>

**Table S9. Five days long integrated concentrations of individual PCB congeners,  $\Sigma$ PCB congeners in snow equilibrated with ambient air ( $\text{pg m}^{-3}$ ) at 1<sup>st</sup> sampler located at Sofia Mountain. <loq: data below detection limit**

	21-260109	26-310109	31-050209	05-110209
<b>PCBs</b>				
PCB18	35.1225	21.6513	56.6551	22.7669
PCB17	12.5099	8.9694	14.1354	2.2124
PCB31	12.0691	4.4145	6.4753	16.1040
PCB28	10.9843	6.3488	7.6925	12.1938
PCB33	8.7467	4.1961	3.7002	6.8944
PCB52	<loq	<loq	7.8710	<loq
PCB49	<loq	1.0607	<loq	<loq
PCB44	3.3563	2.1215	4.6577	5.0936
PCB74	12.6116	10.4201	<loq	2.5211
PCB70	3.0512	0.8111	0.8277	2.3796
PCB95	3.6275	2.3710	0.8926	2.0580
PCB99+101	6.2380	<loq	<loq	<loq
PCB87	1.6782	0.2340	<loq	<loq
PCB151	0.8476	0.4680	<loq	<loq
PCB149	1.5256	1.2635	1.3308	4.7206
PCB118	0.8306	0.9359	0.4057	1.8779
PCB138	1.3391	1.8875	1.6716	1.9423
PCB158	<loq	<loq	<loq	<loq
PCB187	<loq	0.3120	1.2009	<loq
PCB183	<loq	0.2496	<loq	<loq
PCB128	<loq	<loq	<loq	0.5274
PCB177	1.4239	0.6708	0.9737	<loq
PCB171+156	<loq	<loq	<loq	<loq
PCB180	<loq	<loq	<loq	<loq
PCB191	<loq	<loq	<loq	<loq
PCB169	<loq	<loq	<loq	<loq
PCB170	0.8815	<loq	<loq	<loq
PCB201/199	0.6780	0.7331	<loq	<loq
PCB208	<loq	<loq	<loq	<loq
PCB195	<loq	<loq	<loq	<loq
PCB205	<loq	<loq	<loq	<loq
PCB194	<loq	<loq	<loq	<loq
PCB206	<loq	<loq	<loq	<loq
PCB209	<loq	<loq	<loq	<loq
$\Sigma$ 3PCBs	79.4325	45.5800	88.6584	60.1715
$\Sigma$ 4PCBs	19.0190	14.4134	13.3564	9.9943
$\Sigma$ 5PCBs	12.3742	3.5410	1.2983	3.9360
$\Sigma$ 6PCBs	3.7123	3.6189	3.0023	7.1902
$\Sigma$ 7PCBs	2.3053	1.2323	2.1747	<loq
$\Sigma$ 8PCBs	0.6780	0.7331	<loq	<loq
$\Sigma$ 9PCBs	<loq	<loq	<loq	<loq
<b><math>\Sigma</math>PCBs</b>	<b>117.5214</b>	<b>69.1188</b>	<b>108.4901</b>	<b>81.2919</b>

**Table S10. Five days long integrated concentrations of individual PCB congeners,  $\Sigma$ PCB congeners in snow equilibrated with ambient air ( $\text{pg m}^{-3}$ ) at 2<sup>nd</sup> sampler located at Sofia Mountain. <loq: data below detection limit**

	21-260109	26-310109	31-050209	05-110209
<b>PCBs</b>				
PCB18	38.5009	15.7256	14.8409	15.5569
PCB17	<loq	<loq	<loq	<loq
PCB31	27.1842	8.7951	11.0532	10.3207
PCB28	17.8876	9.6746	11.4052	12.2799
PCB33	7.3741	2.6737	3.3934	6.4373
PCB52	13.7990	5.3650	3.0696	18.8571
PCB49	<loq	<loq	<loq	<loq
PCB44	7.3984	2.4802	2.0276	2.2974
PCB74	<loq	<loq	3.0977	1.2711
PCB70	1.8739	0.7388	0.7744	0.9563
PCB95	3.0908	1.7942	5.8857	2.8571
PCB99+101	3.1151	4.5558	3.9707	3.0554
PCB87	0.8518	0.4573	<loq	0.2216
PCB151	0.3407	0.2463	0.3802	0.0700
PCB149	2.3120	1.3720	1.5066	1.6327
PCB118	0.6328	0.9850	0.5491	1.0029
PCB138	0.7544	1.4424	1.1405	1.3644
PCB158	<loq	<loq	<loq	<loq
PCB187	2.2147	<loq	<loq	<loq
PCB183	<loq	<loq	<loq	<loq
PCB128	<loq	<loq	<loq	<loq
PCB177	1.9956	<loq	1.8586	<loq
PCB171+156	<loq	<loq	<loq	<loq
PCB180	<loq	<loq	<loq	0.7114
PCB191	<loq	<loq	<loq	<loq
PCB169	<loq	<loq	<loq	<loq
PCB170	<loq	<loq	0.0845	0.0933
PCB201/199	2.2147	<loq	<loq	<loq
PCB208	<loq	<loq	<loq	<loq
PCB195	<loq	<loq	<loq	<loq
PCB205	<loq	<loq	<loq	<loq
PCB194	<loq	<loq	<loq	<loq
PCB206	<loq	<loq	<loq	<loq
PCB209	<loq	<loq	<loq	<loq
$\Sigma$ 3PCBs	90.9467	36.8690	40.6928	44.5948
$\Sigma$ 4PCBs	23.0713	8.5840	8.9693	23.3819
$\Sigma$ 5PCBs	7.6904	7.7924	10.4055	7.1370
$\Sigma$ 6PCBs	3.4072	3.0607	3.0273	3.0671
$\Sigma$ 7PCBs	4.2103	<loq	1.9431	0.8047
$\Sigma$ 8PCBs	<loq	<loq	<loq	<loq
$\Sigma$ 9PCBs	<loq	<loq	<loq	<loq
<b><math>\Sigma</math>PCBs</b>	<b>129.3259</b>	<b>56.3061</b>	<b>65.0380</b>	<b>78.9854</b>

### Annex III. Maximum reservoir capacity (MRC) for $\Sigma$ PCBs of Antarctic Soils:

The maximum reservoir capacity (MRC) of Antarctic soils for PCBs, which is defined as the ratio of the inventory of PCBs in soil ( $I_S$ , ng m<sup>-2</sup>) to the inventory in the atmospheric boundary layer ( $I_G$ , ng m<sup>-2</sup>) at equilibrium (Dalla Valle et al., 2005), is given by,

$$MRC = \frac{I_S}{I_G} = \frac{C_S * \delta * e}{C_A * ABL} \quad [1]$$

where  $I_S$  depends on the POP concentration in soil ( $C_S$ , ng kg<sup>-1</sup>), soil density ( $\delta$ , kg m<sup>-3</sup>) and the thickness of the soil layer ( $e$ , m) in contact with the atmosphere, and  $I_G$  depends on the ambient gas phase concentration ( $C_A$ , pg m<sup>-3</sup>) and the atmospheric boundary layer height ( $ABL$ ).  $\delta$  was assumed to be 1400 Kg m<sup>-3</sup> for a soil covered by *Usnea Antarctica* (Hill et al, 2011) in the Antarctic Peninsula. Values selected for the soil thickness and the atmospheric boundary layer were 0.5 cm and 1000 m. Inventory of PCBs in for soils covered by *Usnea Antarctica*, Soil B3 and Soil B4) are in the range of 175000 pg m<sup>-2</sup> to 518000 pg m<sup>-2</sup>. On the other hand, inventory in the atmospheric boundary layer are in the range from 7000-29000 pg m<sup>-2</sup>. Thus MRC for  $\Sigma$ PCBs calculated from [1] for Antarctic soils always gave values >1 (in the range of 6-74), which emphasizes the high capacity of soil relative to air, despite the low amounts of SOM.

The uncertainty of these estimations depends on high degree on the value of the height of the atmospheric mixing layer, and the layer of surface soil considered. It is unlikely that the atmospheric boundary layer is higher than 1000 m. On the other hand, for the poorly developed Antarctic soils, more than the top 0.5 cm soil may be in contact with the atmosphere. Therefore, the MRC values estimated above may be a lower estimate of

atmosphere/soil ratio of inventories. The uncertainty associated to  $K_{OA}$  is about a factor of three.

### **Literature cited**

(1) Cabrerizo, A., Dachs, J.; Barceló, D.; Jones, K. C. Influence of Organic Matter Content and Human Activities on the Occurrence of Organic Pollutants in Antarctic Soils, Lichens, Grass and Mosses. *Environ. Sci. Technol.* **2012**, 46 (3), 1396-1405.

(2) Dalla Valle, M.; Jurado, E.; Dachs, J.; Sweetman, A.; Jones, K. C. The maximum reservoir capacity of soils for persistent organic pollutants: implications for global cycling. *Environ. Pollut.* **2005**, 134 (1), 153-164

(3) Hill P. W.; Farrar, J.; Roberts, P.; Farrell, M.; Grant, H.; Newsham, K. K.; Hopkins, D.W.; Bardgett, R.D.; Jones, D.L. Vascular plant success in a warming Antarctic may be due to efficient nitrogen acquisition. *Nature Clim. Change* **2011**, (1), DOI:10.1038.