Supplement of Atmos. Chem. Phys. Discuss., 14, 26939–26970, 2014
http://www.atmos-chem-phys-discuss.net/14/26939/2014/
doi:10.5194/acpd-14-26939-2014-supplement

Atmospheric Chemistry and Physics Discussions

Supplement of

Polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and chlorinated pesticides in background air in central Europe – investigating parameters affecting wet scavenging of polycyclic aromatic hydrocarbons

P. Shahpoury et al.

Correspondence to:

Supporting Information

Polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and chlorinated pesticides in background air in central Europe - investigating parameters affecting wet scavenging of polycyclic aromatic hydrocarbons

Pourya Shahpoury,[1] Gerhard Lammel,[1,2] Adéla Holubová Šmejkalová,[3,4] Jana Klánová,[2] Petra Přibylová,[2] Milan Váňa[3,4]

[1] Max-Planck Institute for Chemistry, Mainz, Germany

[2] Research Centre for Toxic Compounds in the Environment, Masaryk University, Brno, Czech Republic

[3] Czech Hydrometeorological Institute, Košetice, Czech Republic

[4] Global Change Research Centre, ASCR, Prague, Czech Republic

Table of Contents

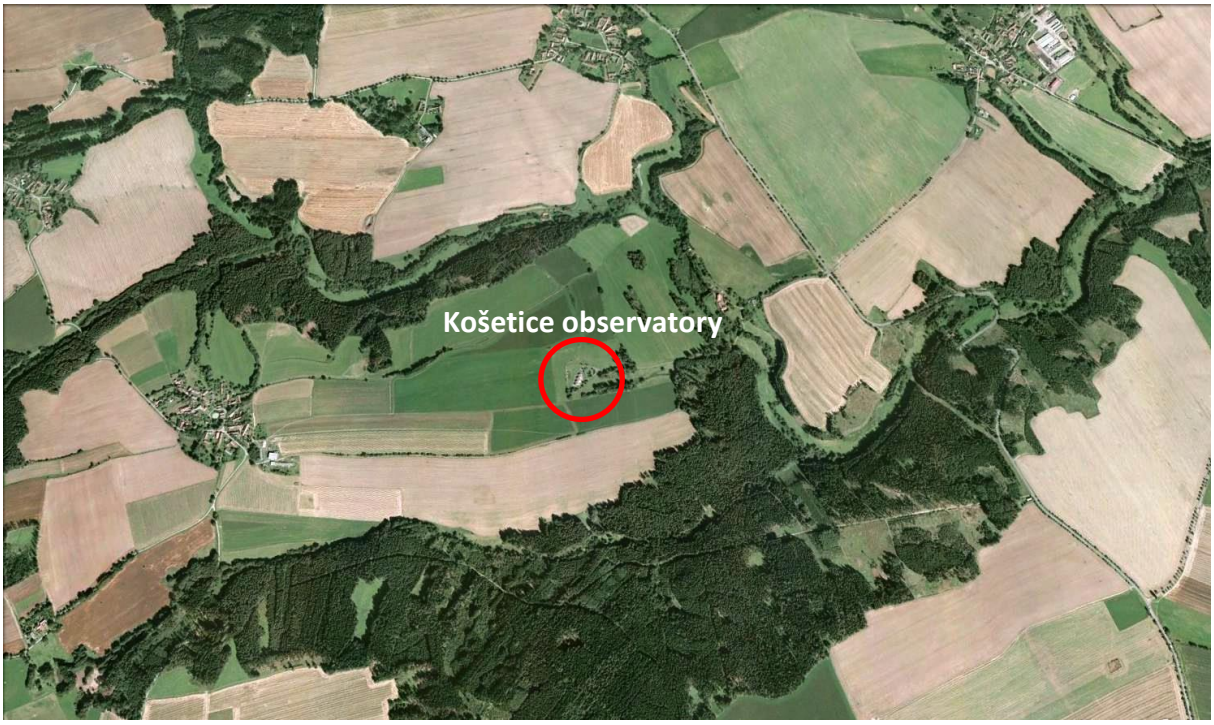

Figure S1. Aerial picture of Košetice observatory (49° 34' N, 15° 05' E, 534 m a.s.l.). The source of the picture is Google Earth 2014.

Table S1. Rainwater and air sample information.

	Collection period	Number of samples (*n*)	[a] *n* considered for calculating scavenging ratios	[b] *n* used for calculating scavenging ratios
Rainwater	2 Dec 2011 – 14 Jan 2014	231	54	32
Air	7 Dec 2011 – 20 Nov 2013	162	54	32

[a] air samples collected 6 – 35 hours prior to the onset of rain events; [b] frontal passage was not expected prior to the onset of rain.

Table S2. Sample information and cloud heights for 32 selected rain events.

Air sampling start & stop date	[a] Air sampling duration (h)	Precipitation duration (h)	[b] Cloud heights (m)	
			Base	Top
6 – 7 Jan 12	24	18	780	3713
15 – 16 Jan 12	17	16	1230	2860
6 – 7 Feb 12	15	7	1500	2886
7 – 8 Mar 12	20	3	3000	3529
14 – 14 Apr 12	14	7	1170	4216
2 – 3 Jun 12	22	8	1500	6026
10 – 11 Aug 12	23	2	1290	4713
21 – 22 Sep 12	20	2	2400	5831
30 Sep – 1 Oct 12	15	2	1500	5830
3 – 4 Oct 12	19	4	1050	5299
11 – 12 Oct 12	22	6	300	5248
31 Oct – 1 Nov 12	19	3	2100	4963
27 – 28 Nov 12	28	4	60	4873
25 – 26 Dec 12	26	11	630	NA
4 – 4 Jan 13	6	16	780	4457
15 – 17 Jan 13	35	12	120	3007
28 – 29 Jan 13	23	21	900	4011
2 – 3 Feb 13	22	10	1200	2591
11 – 12 Feb 13	21	1	210	3064
18 – 19 Feb 13	19	24	780	3569
17 – 18 May 13	22	7	1800	5187
23 – 24 May 13	21	10	1110	3743
25 – 26 May 13	16	10	510	3998
31 May – 1 Jun 13	16	21	3900	5075
28 – 29 Jul 13	26	5	1110	6604
3 – 4 Aug 13	22	1	1500	6400
8 – 9 Aug 13	28	7	480	6084
24 – 25 Aug 13	23	18	900	5780
9 – 10 Oct 13	29	8	570	4952
14 – 15 Oct 13	22	8	2400	4470
2 – 3 Nov 13	15	1	3000	4901
19 – 20 Nov 13	16	3	180	4656

[a] Duration of air sampling conducted prior to the onset of rain; [b] cloud base and top heights were estimated through ceilometer and radiosonde measurements, respectively; NA: not available.

Table S3. Meteorological parameters, aerosol and rainwater chemical properties, as well as PAH scavenging ratios for 32 selected rain events.

Air sampling start & stop date	Precipitation Intensity ($mm\ h^{-1}$)	[a] Type	[b] T (°C)	[c] Concentrations ($\mu g\ m^{-3}$) $PM_{2.5}$	PM_{10}	PM Ions	PM EC	PM OC	[d] PM SA (μm^2)	[e] Rain ions ($mg\ L^{-1}$)	$\sum$ PAHs W_t
6–7 Jan 12	0.5	S/R	1.1	5.9	10.0	2.3	NA	NA	1.5×10^3	<MDL	1.7×10^4
15–16 Jan 12 *	0.3	**S/H**	-3.9	7.2	10.8	4.1	0.2	2.0	2.3×10^3	<MDL	1.5×10^4
6–7 Feb 12	0.1	S/H	-14.1	43.5	57.8	15	NA	NA	1.2×10^4	<MDL	3.5×10^3
7–8 Mar 12	0.2	S	-0.3	21.4	31.0	12.7	NA	NA	7.0×10^3	<MDL	1.3×10^4
14–14 Apr 12 *	0.1	R	7.1	17.5	26.9	15.6	0.6	3.2	6.3×10^3	8.4	$\mathbf{2.3\times10^5}$
2–3 Jun 12 *	1.1	R	16	7.4	14.6	6.6	0.1	1.5	3.5×10^3	2.4	2.3×10^4
10–11 Aug 12 *	0.8	R	15	7.3	12.0	6.3	0.2	1.8	2.8×10^3	2.0	7.4×10^3
21–22 Sep 12 *	0.4	R	9.2	8.8	14.7	6.5	0.3	2.3	3.1×10^3	3.5	9.1×10^3
30 Sep–1 Oct 12	0.4	R	11.5	11.8	15.7	9.0	NA	NA	4.0×10^3	5.0	5.3×10^3
3–4 Oct 12 *	0.7	R	12.5	7.8	10.0	4.7	0.2	2.3	2.7×10^3	<MDL	2.6×10^4
11–12 Oct 12 *	0.5	R	7	15.0	19.4	8.9	0.5	3.1	5.1×10^3	0.8	3.4×10^3
31 Oct–1 Nov 12	0.4	R	4.2	16.0	20.4	10.6	NA	NA	5.6×10^3	2.7	2.6×10^3
27–28 Nov 12 *	0.7	R/H	5.3	12.0	19.2	13.8	1.0	4.1	5.4×10^3	2.7	1.4×10^4
25–26 Dec 12	0.8	R	5.1	7.3	10.0	2.4	NA	NA	2.8×10^3	2.2	5.9×10^3
4–4 Jan 13	1.0	NA	7	4.6	8.4	3.3	NA	NA	NA	2.2	5.6×10^3
15–17 Jan 13 *	0.1	NA	-4.1	29.8	37.5	16.1	1.5	7.5	NA	<MDL	2.7×10^4
28–29 Jan 13	0.8	NA	2.6	9.5	15.6	6.3	NA	NA	NA	4.2	4.2×10^3
2–3 Feb 13 *	0.3	NA	-0.8	6.0	8.0	3.5	0.0	1.1	NA	0.8	1.3×10^4
11–12 Feb 13	5.6	NA	-4	30.2	33.2	15.2	NA	NA	NA	<MDL	2.4×10^3
18–19 Feb 13 *	0.2	NA	-1.5	34.8	40.2	15.2	0.4	3.1	NA	2.7	3.3×10^3
17–18 May 13	0.3	NA	15.9	13.2	26.9	6.0	NA	NA	NA	1.0	1.2×10^4
23–24 May 13	0.2	NA	8.1	10.9	15.8	11.4	NA	NA	NA	15.1	1.6×10^4
25–26 May 13 *	0.3	NA	6.2	11.4	13.1	5.8	0.1	0.6	NA	2.3	5.2×10^3
31 May–1 Jun 13 *	2.4	NA	10.4	5.4	7.0	3.0	0.1	1.6	NA	2.1	4.3×10^3

Table S3 continued

Air sampling start & stop date	Precipitation Intensity (mm h^{-1})	[a] Type	[b] T (°C)	[c] Concentrations (μg m^{-3}) $PM_{2.5}$	PM_{10}	PM Ions	PM EC	PM OC	[d] PM SA (μm^2)	[e] Rain ions (mg L^{-1})	∑ PAHs W_t
28–29 Jul 13	6.9	NA	21.1	23.2	28.0	9.5	NA	NA	NA	2.1	5.8×10^3
3–4 Aug 13	28.5	NA	20.2	16.7	23.6	6.9	NA	NA	NA	2.5	5.4×10^3
8–9 Aug 13 *	1.5	NA	16	19.7	24.8	13.5	0.1	4.3	NA	4.8	8.9×10^3
24–25 Aug 13 *	1.6	NA	14.1	20.3	24.0	9.4	0.4	4.6	NA	1.4	1.1×10^4
9–10 Oct 13	0.6	NA	10.7	30.6	37.7	21.4	NA	NA	NA	8.9	1.1×10^4
14–15 Oct 13	0.7	NA	8.9	11.3	16.3	6.6	NA	NA	NA	2.3	8.7×10^3
2–3 Nov 13	0.2	NA	9.9	9.1	10.3	5.7	NA	NA	NA	<MDL	4.7×10^3
19–20 Nov 13	0.6	NA	3.6	28.8	33.4	17.6	NA	NA	NA	4.1	1.9×10^4

[a] precipitation type, S: snow, R: rain, H: haze; [b] mean near-ground temperature measured during air sampling; [c] concentrations of particulate matter (PM) with diameter <2.5 μm ($PM_{2.5}$) and <10 μm (PM_{10}), PM ionic species (i.e. the sum of SO_4^{2-}, NO_3^-, NH_4^+), PM elemental carbon (EC) and organic carbon (OC); [d] particulate matter surface area; [e] the sum of the concentrations of SO_4^{2-}, NO_3^-, and Cl^- in rainwater; asterisk in the first column indicate events for which correlation analysis with environmental parameters were performed; NA: not available.

Table S4. Analyte particulate mass fractions (Θ).

	Θ				
Compound	**Min**	**Max**	**Mean ± SD**	**Median**	[a] r^2
ACY	0.00	0.63	0.09±0.11	0.06	0.03 (*n* = 141)
ACE	0.00	0.12	0.03±0.03	0.02	0.25 (*n* = 144)
FLN	0.00	0.13	0.01±0.02	0.01	0.29 (*n* = 156)
ANT	0.01	0.56	0.19±0.13	0.16	0.35 (*n* = 126)
PHE	0.00	0.53	0.05±0.08	0.03	0.53 (*n* = 154)
RET	0.01	0.99	0.31±0.26	0.22	**0.75** (*n* = 156)
PYR	0.01	0.96	0.40±0.22	0.36	**0.72** (*n* = 150)
FLT	0.00	0.92	0.28±0.19	0.24	**0.69** (*n* = 155)
BAA	0.05	1.00	0.90±0.17	0.96	0.26 (*n* = 142)
CHR	0.08	1.00	0.74±0.21	0.80	0.52 (*n* = 162)
BFN	0.02	1.00	0.59±0.25	0.61	0.59 (*n* = 131)
BGF	0.04	1.00	0.65±0.24	0.70	0.69 (*n* = 151)
PER	0.70	1.00	0.94±0.06	0.96	0.37 (*n* = 97)
CPP	0.74	1.00	0.96±0.06	0.99	0.39 (*n* = 116)
BBF	0.69	1.00	0.97±0.06	0.99	0.39 (*n* = 152)
BJF	0.74	1.00	0.95±0.06	0.99	0.43 (*n* = 145)
TPH	0.09	1.00	0.69±0.24	0.75	**0.73** (*n* = 162)
BKF	0.73	1.00	0.95±0.07	0.98	0.52 (*n* = 140)
BAP	0.74	1.00	0.96±0.05	0.99	0.47 (*n* = 132)
DCA	0.72	1.00	0.92±0.07	0.94	0.34 (*n* = 87)
BEP	0.77	1.00	0.96±0.05	0.98	0.40 (*n* = 141)
IPY	0.74	1.00	0.97±0.05	0.99	0.37 (*n* = 131)
DHA	0.74	1.00	0.93±0.06	0.95	0.33 (*n* = 88)
BPE	0.81	1.00	0.97±0.05	0.99	0.46 (*n* = 146)
COR	0.67	1.00	0.95±0.07	0.98	0.16 (*n* = 102)
BNT	0.66	1.00	0.87±0.09	0.87	0.42 (*n* = 75)
ATT	0.69	1.00	0.91±0.08	0.94	0.24 (*n* = 76)
PeCB	0.00	0.15	0.02±0.03	0.01	
HCB	0.00	0.03	0.00±0.00	0.00	
PCB 28	0.01	0.17	0.06±0.04	0.04	
PCB 52	0.01	0.21	0.09±0.04	0.08	
a-HCH	0.00	0.11	0.03±0.02	0.03	
γ-HCH	0.01	0.23	0.06±0.04	0.05	
PCB 101	0.02	0.32	0.16±0.07	0.16	
o,p′-DDE	0.06	0.32	0.18±0.07	0.18	
o,p′-DDT	0.03	0.33	0.12±0.07	0.11	
PCB 138	0.05	0.31	0.18±0.07	0.19	
p,p′-DDE	0.00	0.52	0.04±0.08	0.02	0.39 (*n* = 160)
PCB 153	0.02	0.33	0.16±0.08	0.15	
p,p′-DDT	0.03	0.33	0.14±0.08	0.11	
PCB 118	0.04	0.33	0.18±0.09	0.19	
PCB 180	0.07	0.33	0.23±0.07	0.25	
p,p′-DDD	0.10	0.32	0.20±0.07	0.19	

SD: standard deviation; ^{a} coefficient of regression between near-ground temperature and Θ. Note that in order to enhance comparison, the analytes are sorted in increasing order according to their octanol-air partitioning coefficients. Θ values are only reported for chlorinated compounds with DF >10% in gas or particulate phase.