

Supporting online information for Bonn et al., BAERLIN2014: Sources and sinks - The influence of surface types and horizontal heterogeneity on air pollutant levels in Berlin.

The supporting online information document contains additional information on gas- and aerosol properties in different environments. A volatile organic compound (VOC) canister sample in the vicinity of a common air blower in action, which was performed by the Research Centre Juelich, is provided in addition to Table 5, too. The SOI are structured as follows:

- S1. Additional information on ambient basic gas-phase air pollutants
- S2. Exemplary VOC sample in the vicinity of an air blower in use
- S3. Additional information on ambient particulate matter parameters
- S4. Details on measured temperatures for different land usage types
- S5. Further information on the second flight

S1. Additional information on ambient basic gas-phase air pollutants

Table S1.1. Absolute CO characteristics (van measurements) at different surface usage types. The 25th, 50th and 75th percentiles, the mean values and the number of data points are provided as columns. “-“ indicates areas, which have not been tested by the method. Values are presented in ppb_v.

surface type	25th	median (50 th)	75th	mean	no. of data
Reference	200	230	280	256.9	171237
(Neukölln): UBA					
Urban block build.	127.8	145.3	165.8	151.6	16501
single build.					
Urban	119.6	131.9	149.5	145.6	60257
Industry	134.1	152.7	178.9	164.8	10900
Com.+transp	153.6	165.7	190.2	177.1	3656
Airport	137.9	148.8	156.5	156.0	578
Dump+construction	131.1	148.7	148.7	142.6	26
Parks	130.2	143.9	167.4	207.0	8367
Sport&leisure	127.5	145.9	156.6	145.3	2540
Arable land	119.9	127.2	135.8	129.2	6908
Pasture	122.1	128.0	142.4	123.4	695
Nat. grassl.	128.8	129.8	132.4	131.3	274
Dec. forest	115.1	130.0	141.6	133.6	6124
Con. forest	115.3	120.5	140.0	127.9	4508
mix. forest	121.6	131.1	142.1	133.1	1300

Table S1.2. Relative CO burden characteristics (van/van (background) measurements) at different surface usage types divided by the reference concentration in Berlin-Neukölln. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method.

<i>surface type</i>	<i>25th</i>	<i>median (50th)</i>	<i>75th</i>	<i>mean</i>	<i>no. of data</i>
Urban - block build.	127.8/0.19	145.3/0.21	165.8/0.25	151.6/0.23	16501
Urban -single build.	119.6/0.19	131.9/0.21	149.5/0.25	145.6/0.22	60257
Industry	134.1/0.2	152.7/0.22	178.9/0.28	164.8/0.24	10900
Com.+transp.	153.6/0.24	165.7/0.25	190.2/0.26	177.1/0.25	3656
Airport	137.9/0.21	148.8/0.23	156.5/0.23	156.0/0.22	578
Parks	130.2/0.21	143.9/0.25	167.4/0.26	207.0/0.24	8367
Arable land	119.9/0.20	127.2/0.20	135.8/0.21	129.2/0.20	6908
Pasture	122.1/0.20	128.0/0.20	142.4/0.21	123.4/0.21	695
Nat. grassl.	128.8/0.02	129.8/0.22	132.4/0.22	131.3/0.21	274
Dec. forest	115.1/0.20	130.0/0.22	141.6/0.25	133.6/0.23	6124
Con. forest	115.3/0.20	120.5/0.22	140.0/0.25	127.9/0.23	4508
mix. forest	121.6/0.20	131.1/0.22	142.1/0.23	133.1/0.22	1300

Table S1.3. Absolute NO characteristics (van measurements) at different surface usage types. The 25th, 50th and 75th percentiles, the mean values and the number of data points are provided as columns. “-“ indicates areas, which have not been tested by the method. Values are presented in ppb.

surface type	25th	median (50 th)	75th	mean	no. of data
Reference	0.69	1.13	2.93	2.32	11869
(Neukölln): UBA					
Urban block build.	6.87	32.47	106.40	86.82	1473
Urban single build.	4.25	22.80	88.92	81.56	5958
Industry	13.28	45.80	142.03	111.86	1021
Com.+transp.	27.49	70.17	129.52	101.17	352
Airport	11.30	33.14	69.68	68.54	63
Dump+construction	16.03	30.06	43.37	29.34	4
Parks	15.07	48.88	217.69	147.14	758
Sport&leisure	10.76	38.77	173.31	124.55	217
Arable land	0.70	5.14	23.26	28.01	732
Pasture	6.88	18.83	37.42	27.52	64
Nat. grassl.	0.33	3.49	15.54	20.95	26
Dec. forest	1.27	10.86	38.77	31.03	654
Con. forest	-	-	-	-	-
mix. forest	2.53	10.96	46.30	43.72	136

Table S1.4. Relative NO characteristics (van measurements) at different surface usage types divided by the reference concentration in Berlin-Neukölln. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method.

surface type	25th	median (50 th)	75th	mean	no. of data
Urban - block build.	6.87/0.83	32.47/2.35	106.40/3.76	86.82/3.71	1473
Urban -single build.	4.25/0.69	22.80/1.13	88.92/2.76	81.56/2.26	5958
Industry	13.28/0.79	45.80/1.29	142.03/4.00	111.86/3.23	1021
Com.+transp.	27.49/1.05	70.17/1.85	129.52/3.28	101.17/2.63	352
Airport	11.30/0.18	33.14/1.08	69.68/1.52	68.54/1.05	63
Parks	15.07/0.83	48.88/2.08	217.69/3.93	147.14/2.51	758
Arable land	0.70/0.66	5.14/0.8	23.26/1.18	28.01/1.20	732
Pasture	6.88/0.66	18.83/1.1	37.42/1.29	27.52/1.09	64
Nat. grassl.	0.33/0.54	3.49/0.62	15.54/0.68	20.95/0.63	26
Dec. forest	1.27/0.5	10.86/1.3	38.77/2.29	31.03/1.54	654
Con. forest	-	-	-	-	-
mix. forest	2.53/0.55	10.96/1.11	46.30/2.29	43.72/1.54	136

Table S1.5. Absolute NO₂ characteristics (van measurements) at different surface usage types. The 25th, 50th and 75th percentiles, the mean values and the number of data points are provided as columns. “-“ indicates areas, which have not been tested by the method. Values are presented in ppb.

surface type	25th	median (50 th)	75th	mean	no. of data
Reference	8.06	11.35	20.21	15.98	12419
(Neukölln): UBA					
Urban block build.	9.193	23.85	85.26	96.68	1473
Urban single build.	5.827	18.1	63.23	81.95	5958
Industry	12.74	30.34	97.01	117.2	1021
Com.+transp.	22.73	63.45	171.4	122.9	352
Airport	12.59	25.16	74.3	64.52	63
Dump+construction	19.06	23.28	27.5	23.28	4
Parks	11.93	35.56	121.2	109.2	758
Sport&leisure	5.408	12.65	40.22	46.17	217
Arable land	1.456	4.595	20.92	24.61	732
Pasture	4.095	19.02	41.01	31.31	64
Nat. grassl.	1.111	2.24	17.93	37.4	26
Dec. forest	2.64	7.575	31.02	33.77	654
Con. forest	-	-	-	-	-
mix. forest	2.229	17.95	44.11	55.73	136

Table S1.6. Relative NO₂ burden characteristics (van measurements) at different surface usage types divided by the reference concentration in Berlin-Neukölln. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method.

<i>surface type</i>	<i>25th</i>	<i>median (50th)</i>	<i>75th</i>	<i>mean</i>	<i>no.</i>	<i>of</i>
						<i>data</i>
Urban - block build.	9.19/8.12	23.85/12.94	85.26/26.12	96.68/18.47	1473	
Urban -single build.	5.83/7.94	18.1/10.7	63.23/20.21	81.95/15.84	5958	
Industry	12.74/8.53	30.34/15.52	97.01/35.14	117.2/19.73	1021	
Com.+transp.	22.73/17.84	63.45/23.02	171.4/35.14	122.9/24.6	352	
Airport	12.59/10.4	25.16/10.4	74.3/17.22	64.52/13.39	63	
Parks	11.93/8.35	35.56/18.48	121.2/23.02	109.2/18.08	758	
Arable land	1.46/5.47	4.60/8.06	20.92/10.47	24.61/8.29	732	
Pasture	4.10/7.24	19.02/8.11	41.01/10.47	31.31/8.57	64	
Nat. grassl.	1.11/5.47	2.24/7.41	17.93/7.41	37.4/7.181	26	
Dec. forest	2.64/9.38	7.58/12.0	31.02/18.79	33.77/15.16	654	
Con. forest	-	-	-	-	-	
mix. forest	2.23/9.06	17.95/11.86	44.11/16.90	55.73/13.75	136	

Table S1.7. Absolute ozone burden characteristics (van measurements) at different surface usage types. The 25th, 50th and 75th percentiles, the mean values and the number of data points are provided as columns. “-“ indicates areas, which have not been tested by the method. Values are presented in ppb.

<i>surface type</i>	<i>25th</i>	<i>median (50th)</i>	<i>75th</i>	<i>mean</i>	<i>no. of data</i>
Reference	32.25	39.83	49.10	39.98	50158
(Neukölln): UBA					
Urban block build.	15.48	25.58	33.71	24.87	6549
Urban single build.	17.78	28.74	37.46	28.64	24503
Industry	11.72	21.73	34.14	24.02	4145
Com.+transp.	12.73	18.35	25.1	19.47	1462
Airport	17.13	24.89	39.75	27.79	230
Dump+construction	18.79	19.47	32.16	25.1	8
Parks	13.62	19.91	30.72	22.48	2676
Sport&leisure	19.23	31.54	45.84	31.87	1008
Arable land	31.06	37.7	45.86	37.43	2874
Pasture	28.88	37.22	46.81	37.43	284
Nat. grassl.	43.77	46.53	50.63	45.58	109
Dec. forest	18.34	25.67	37.53	27.97	2667
Con. forest	17.66	22.68	38.6	27.37	2099
mix. forest	17.54	27.32	43.77	29.99	548

Table S1.8. Relative ozone burden characteristics (van measurements) at different surface usage types divided by the reference concentration in Berlin-Neukölln. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method.

<i>surface type</i>	<i>25th</i>	<i>median (50th)</i>	<i>75th</i>	<i>mean</i>	<i>no.</i>	<i>of</i>
						<i>data</i>
Urban - block build.	15.48/30.53	25.58/34.02	33.71/44.35	24.87/36.11	6549	
Urban -single build.	17.78/32.25	28.74/41.44	37.46/49.15	28.642/40.22	23907	
Industry	11.72/32.25	21.73/39.5	34.14/46.05	24.02/37.06	4145	
Com.+transp.	12.73/19.76	18.35/37.63	25.1/39.5	19.47/32.07	1462	
Airport	17.13/43.75	24.89/47.03	39.75/51.09	27.79/44.89	230	
Parks	13.62/26.21	19.91/34.67	30.72/44.75	22.48/35.89	2676	
Arable land	31.06/41.6	37.7/47.26	45.86/49.15	37.43/45.54	2874	
Pasture	28.88/37.34	37.22/47.26	46.81/53.22	37.43/45.89	284	
Nat. grassl.	43.77/49.15	46.53/55.32	50.63/59.54	45.58/54.06	109	
Dec. forest	18.34/33.33	25.67/43.96	37.53/52.64	27.97/42.1	2667	
Con. forest	17.66/32.25	22.68/45.09	38.6/52.64	27.37/42.95	2099	
mix. forest	17.54/35.16	27.32/44.6	43.77/52.77	29.99/43.29	548	

S2. Exemplary VOC sample in the vicinity of an air blower in use

Table S2.1. Canister sample analysed for VOC compositions in the vicinity of an air blower in use adjoined with the results for the reference site at Nansenstraße. An ozone scrubber was applied in front of the inlet to prevent sampling losses and artefacts. All values are provided as mean volume mixing ratios in ppt_v. Elevated anthropogenic compounds with respect to vegetated background area concentration (>average+2STD of the two smaller mixing ratios of vegetated areas) are marked in bold. Underlined numbers mark biogenic compounds exceeding the average of the two smaller mixing ratios for anthropogenic dominated areas + 2 standard deviations. “b.d.” abbreviates *below detection limit*.

Compound	<i>Locations affect by both emission types</i>	
	<i>air blower</i>	<i>Nansenstraße (see Tab. 5)</i>
	<i>1 sample</i>	<i>14 samples</i>
ethene	33487	465±263
ethyne	40003	286±239
ethane	5642	1686±1514
propene	20445	251±64
propane	991	825±613
propyne	2574	73±28
acetaldehyde	108	336±139
2-methylpropane	1888	504±441
methanol	1244	4996±3082
1-butene / i-butene	22974	300±412
1,3-butadiene	1777	43±11
n-butane	9867	b.d.
trans-2-butene	b.d.	16±3
cis-2-butene	1025	74±38
1,2-butadiene	120	33±7
ethanol	546	333±189
3-methyl-1-butene	b.d.	52±6
2-methylbutane	27819	465±178
acetone	1002	10721±24004
1-pentene	265	35±8

2-propanol	b.d.	44±14
2-methyl-1-butene	1544	b.d.
n-pentane	1883	242±106
isoprene	<u>1012</u>	266±159
trans-2-pentene	490	28±13
cis-2-pentene	230	22±9
propanal	b.d.	54±24
2-methyl-2-butene	b.d.	11±8
acetic acid methylic ester	b.d.	b.d.
1,3-pentadiene	b.d.	14±4
cyclopentadiene	b.d.	35±14
2,2-dimethylbutane	8847	117±111
2-butanol	b.d.	117±156
1-propanol	b.d.	342±377
cyclopentene	b.d.	39±11
methacrolein	b.d.	<u>80±37</u>
cyclopentane / 2,3-di-methylbutane	9838	275±316
2-methylpentane	10049	232±112
methylvinylketone	b.d.	<u>102±</u>
butanal	b.d.	133±56
1-hexene	b.d.	<u>113±68</u>
3-methylpentane	5651	73±40
2-methyl-1-pentene	b.d.	14±3
n-hexane	373	127±99
trans-2-hexene	b.d.	110±53
cis-2-hexene	b.d.	107±21
1,3-hexadiene (trans)	b.d.	53±10
methylcyclopentane	b.d.	49±13
2,4-dimethylpentane	8355	54±28

methylcyclopentene	b.d.	14±5
benzene	420	303±238
1-butanol	b.d.	28±14
cyclohexane	6705	39±23
2-methylhexane	432	36±14
2,3-dimethylpentane	1169	23±14
3-methylhexane	363	82±34
pentanal	b.d.	11±2
cyclohexene	b.d.	18±4
1,3-dimethylcyclo-pentane (cis)	b.d.	11±5
1-heptene	b.d.	17±10
2,2,4-trimethyl-pentane	47404	28±15
heptane	b.d.	32±11
2,3-dimethyl-2-pentene	b.d.	b.d.
octene	b.d.	b.d.
methylcyclohexane	b.d.	27±15
2,3,4-trimethylpentane	16235	20±14
toluene	16253	407±237
2-methylheptane	b.d.	25±17
4-methylheptane	b.d.	14±9
3-methylheptane	b.d.	17±13
hexanal	b.d.	72±46
acetic acid butylic ester	b.d.	b.d.
n-octane	b.d.	28±23
dimethylcyclo-hexane isomer	b.d.	b.d.
ethylbenzene	b.d.	76±40
m/p-xylene	235	151±97
heptanal	b.d.	22±14
styrene	b.d.	57±40

1-nonene	b.d.	b.d.
o-xylene	124	64±38
n-nonane	b.d.	21±4
i-propylbenzene	b.d.	30±70
α-pinene	b.d.	<u>31±26</u>
n-propylbenzene	b.d.	20±13
m-ethyltoluene	b.d.	31±26
p-ethyltoluene	b.d.	24±14
1,3,5-trimethylben-zene (1,3,5-TMB)	b.d.	46±55
sabinene	b.d.	b.d.
o-ethyltoluene	b.d.	36±24
octanal	b.d.	13±5
β-pinene	b.d.	15±8
1,2,4-trimethylbenzene / t-butylbenzene	b.d.	63±37
n-decane	b.d.	22±8
1,2,3-trimethylbenzene (1,2,3-TMB)	b.d.	120±296
limonene	b.d.	b.d.
eucalyptol	b.d.	b.d.
indane	b.d.	b.d.
1,3-diethylbenzene	b.d.	13±11
1,4-diethylbenzene	b.d.	522±1380
butylbenzene	b.d.	b.d.l.
n-undecane	b.d.	10±13
n-dodecane	b.d.	26±24
n-tridecane	b.d.	b.d.

S3. Additional information on ambient particulate matter parameters

Table S3.1. Absolute particle number burden characteristics (bicycle/ van (background) measurements) at different surface usage types. The 25th, 50th and 75th percentiles, the mean values and the number of data points are provided as columns. “-“ indicates areas, which have not been tested by the method. Values are presented in particles per cm³.

surface type	25th	median (50 th)	75th	mean	no. of data
Reference	5930	7793	10466	8697	2892
(Neukölln): UBA					
Urban block build.	8589/7555	13050/10114	21155/13390	25862/11356	55132/21646
Urban single build.	6021/4550	9490/6181	15405/10078	17044/8861	139597/81293
Industry	6269/7201	8629/10614	16226/16710	17330/14488	9966/13784
Com.+transp.	5918/9808	8553/14240	14805/19040	14391/16280	4367/4856
Airport	5364/8308	6147/9424	7855/15930	7214/21970	968/781
Dump+construction	8144/7817	11382/7817	22715/8951	25372/8256	273/31
Parks	4561/6555	7053/10680	11165/17820	11165/16740	14493/10287
Sport&leisure	5434/4967	8523/7325	12757/8995	13722/8983	4420/3357
Arable land	-/2973	-/4817	-/7125	-/7388	0/9271
Pasture	-/3373	-/5733	-/7050	-/6343	0/934
Nat. grassl.	-/2878	-/2878	-/3233	-/3586	0/371
Dec. forest	3613/3846	4991/5466	8394/9169	8657/24740	38485/8806
Con. Forest	3646/3501	5802/4993	10619/5658	12192/14630	28726/7020
mix. forest	3828/3501	6059/5093	10523/7685	11686/11860	7215/1810

Table S3.2. Relative particle number burden characteristics (bicycle/ van (background) measurements) at different surface usage types divided by the reference concentration in Berlin-Neukölln. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method.

surface type	25th	median (50 th)	75th	mean	no. of data
Urban - block build.	1.05/0.97	1.58/1.42	2.52/2.19	3.23/2.17	48259/21646
Urban -single build.	0.73/0.68	1.09/0.97	1.87/1.43	2.05/1.24	121969/81293
Industry	0.66/0.98	0.98/1.51	1.83/2.04	1.80/1.92	8465/13784
Com.+transp.	1.03/1.07	1.50/1.48	1.96/2.10	2.07/1.70	4219/4856
Airport	0.65/1.00	0.95/1.26	1.17/1.88	1.00/2.56	678/781
Parks	0.70/0.83	1.01/1.23	1.63/2.09	1.79/1.84	12641/10287
Arable land	-/0.42	-/0.77	-/1.12	-/1.20	0/9271
Pasture	-/0.43	-/0.85	-/1.01	-/0.99	0/934
Nat. grassl.	-/0.40	-/0.40	-/0.45	-/0.53	0/371
Dec. forest	0.58/0.47	0.76/0.80	1.18/1.21	1.28/3.06	27718/8806
Con. forest	0.55/0.40	0.85/0.69	1.49/0.90	1.83/1.89	35480/7020
mix. forest	0.61/0.42	0.91/0.77	1.57/1.09	1.75/1.66	6858/1810

Table S3.3. Absolute particle mass (PM_{10}) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types provided in $\mu\text{g}/\text{m}^3$. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25th	median (50 th)	75th	mean	no. of data
Reference	12.7, 11.5	16.6, 16.0	22.0, 22.4	18.2, 18.2	4928, 3317
(Neukölln):					
BLUME, UBA					
Urban - block build.	6.9/17.4	13.6/32.8	22.7/74.7	24.3/75.6	8260/21801
Urban single build.	7.9/18.6	15.0/34.3	25.2/69.4	29.0/67.9	19143/82502
Industry	13.6/19.6	23.9/35.9	36.5/72.2	30.7/73.9	1464/14047
Com.+transp.	8.1/40.8	15.9/55.5	27.8/78.7	23.2/77.2	341/4875
Airport	6.6/34.4	9.9/41.4	14.7/60.8	11.3/130.2	137/738
Dump+ construction	4.6/21.6	8.1/80.1	12.7/123.5	10.4/97.0	34/33
Parks	5.5/14.8	10.0/25.7	16.3/56.6	15.2/71.9	1961/9598
Leisure area	2.3/29.5	9.4/36.7	19.5/67.7	30.8/77.0	509/3378
Arable land	-/18.1	-/29.5	-/45.3	-/46.8	0/9488
Pasture	-/24.7	-/29.7	-/53.9	-/68.2	0/938
Nat. grassl.	-/14.2	-/27.4	-/30.2	-/27.0	0/362
Dec. forest	2.8/19.1	5.9/38.0	10.4/71.4	8.9/58.2	1842/8874
Con. forest	3.2/17.8	7.1/38.3	12.6/70.9	12.7/52.7	3410/7078
mix. forest	3.4/15.8	7.8/32.7	13.5/65.9	13.8/53.6	620/1820

Table S3.4. Relative particle mass (PM_{10}) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types divided by the corresponding concentrations in Berlin-Neukölln. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25th	median (50 th)	75th	mean	no. of data
Urban - block build.	0.47/0.83(1.14)	0.79/1.08(1.75)	1.42/1.47(4.75)	1.65/1.85(5.53)	7813/21801
Urban -single build.	0.47/0.91(1.06)	0.78/1.11(1.58)	1.36/1.54(3.79)	1.89/1.58(3.83)	15758/82502
Industry	0.64/0.72(0.94)	1.13/1.07(1.56)	2.00/1.63(3.87)	1.71/1.50(4.15)	1172/14047
Com.+transp.	0.52/1.00(1.42)	0.89/1.18(1.88)	1.56/1.43(2.80)	1.48/1.32(2.96)	341/4875
Airport	0.41/1.08(1.32)	0.54/1.25(1.56)	0.78/1.31(2.65)	0.89/1.29(5.86)	137/738
Parks	0.38/0.80(0.97)	0.66/1.00(1.41)	1.14/1.28(2.75)	1.22/1.29(3.80)	1961/9598
Leisure area	0.16/0.98(1.20)	0.62/1.11(1.47)	1.54/1.29(3.14)	3.89/1.52(4.31)	509/3378
Arable land	-/0.90(0.98)	-/1.02(1.21)	-/1.24(2.23)	-/1.14(2.49)	0/9488
Pasture	-/0.74(0.93)	-/0.91(1.19)	-/1.20(2.24)	-/1.11(3.01)	0/938
Nat. grassl.	-/0.67(0.71)	-/0.92(1.05)	-/1.10(1.16)	-/0.91(1.15)	0/362
Dec. forest	0.20/0.83(1.07)	0.45/1.20(1.94)	0.78/2.24(4.20)	0.67/1.73(3.57)	1842/8874
Con. forest	0.23/0.84(0.96)	0.53/1.10(1.93)	0.89/2.67(4.40)	0.87/1.83(3.39)	3410/7078
mix. forest	0.30/0.83(0.91)	0.62/1.05(1.62)	1.08/1.65(3.87)	1.18/1.57(3.33)	620/1820

Table S3.5. Absolute particle mass (PM_{2.5}) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types provided in µg/m³. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25th	median (50 th)	75th	mean	no. of data
Reference (Neukölln): UBA	5.7	8.0	12.9	10.6	3317
Urban block build.	4.0/15.1	6.7/26.8	10.0/40.6	8.0/34.8	8260/21801
Urban single build.	4.4/15.8	6.8/27.2	10.6/39.4	8.9/35.2	19143/82502
Industry	6.8/19.1	9.8/32.1	15.1/47.1	12.1/39.5	1464/14047
Com.+transp.	4.0/39.4	6.3/51.1	8.6/67.4	7.2/57.1	341/4875
Airport	3.1/30.5	5.0/40.5	7.3/49.8	5.3/50.4	137/738
Dump+ construction	3.6/21.6	4.9/36.7	6.2/47.1	5.3/36.0	34/33
Parks	3.6/14.2	5.2/23.3	7.2/39.4	6.0/36.4	1961/9598
Leisure area	1.2/26.3	3.3/34.9	7.1/43.3	5.2/39.8	509/3378
Arable land	-/15.7	-/28.1	-/32.7	-/27.9	0/9488
Pasture	-/15.9	-/28.3	-/37.3	-/28.3	0/938
Nat. grassl.	-/14.2	-/26.3	-/29.9	-/22.6	0/362
Dec. forest	2.0/14.7	3.3/24.9	5.2/35.2	4.0/27.3	1842/8874
Con. forest	2.1/15.7	3.6/23.0	6.0/31.1	4.9/25.5	3410/7078
mix. forest	2.5/14.2	3.7/23.1	5.7/34.6	4.6/26.8	620/1820

Table S3.6. Relative particle mass (PM_{2.5}) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types divided by the corresponding concentrations in Berlin-Neukölln. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25th	median (50 th)	75th	mean	no. of data
Urban - block build.	0.62/1.81	0.85/2.47	1.15/4.41	0.99/4.17	7813/21801
Urban -single build.	0.57/1.69	0.81/2.26	1.08/3.28	1.00/3.11	15758/82502
Industry	0.83/1.37	1.15/2.23	1.57/4.16	1.26/3.43	1172/14047
Com.+transp.	0.64/2.09	0.88/2.68	1.25/3.52	1.05/3.15	341/4875
Airport	0.52/2.21	0.60/2.54	0.68/3.84	0.67/4.02	137/738
Parks	0.47/1.70	0.59/2.17	0.85/3.53	0.69/3.21	1961/9598
Leisure area	0.17/1.73	0.40/2.28	0.73/3.79	0.65/3.55	509/3378
Arable land	-/1.32	-/1.71	-/2.32	-/2.13	0/9488
Pasture	-/1.33	-/1.60	-/2.15	-/1.96	0/938
Nat. grassl.	-/0.95	-/1.22	-/1.42	-/1.30	0/362
Dec. forest	0.25/1.77	0.43/2.41	0.64/3.25	0.48/2.78	1842/8874
Con. forest	0.26/1.88	0.49/2.41	0.72/3.49	0.54/2.75	3410/7078
mix. forest	0.34/1.31	0.54/2.23	0.72/3.10	0.60/2.69	620/1820

Table S3.7. Absolute particle mass ($\text{PM}_{1.0}$) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types provided in $\mu\text{g}/\text{m}^3$. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25th	median (50 th)	75th	mean	no. of data
Reference (Neu- kölln): UBA	3.3	5.5	10.4	8.1	3317
Urban block build.	2.7/14.4	4.9/23.9	7.0/34.3	5.7/29.6	8260/21801
Urban single build.	2.8/14.8	4.5/23.9	6.2/33.5	7.2/29.5	19143/82502
Industry	4.7/18.8	7.2/29.1	10.6/40.3	9.2/34.4	1464/14047
Com.+transp.	2.5/34.5	4.5/44.0	5.7/57.0	4.6/48.8	341/4875
Airport	1.4/27.6	3.7/36.7	6.3/43.8	4.1/42.0	137/738
Dump+ construction	2.7/20.8	3.6/23.2	4.6/30.3	3.9/25.0	34/33
Parks	2.3/13.9	3.6/20.9	5.1/34.3	4.1/30.5	1961/9598
Leisure area	0.8/21.3	1.7/32.7	4.3/38.1	3.0/35.5	509/3378
Arable land	-/15.0	-/27.3	-/30.5	-/25.3	0/9488
Pasture	-/15.3	-/26.9	-/32.8	-/26.1	0/938
Nat. grassl.	-/14.2	-/25.5	-/28.9	-/21.9	0/362
Dec. forest	1.5/14.1	2.0/18.9	2.9/28.2	2.6/22.3	1842/8874
Con. forest	1.5/14.9	2.1/18.1	3.7/22.3	3.3/20.7	3410/7078
mix. forest	1.7/14.0	2.3/18.6	3.4/28.4	2.9/22.3	620/1820

Table S3.8. Relative particle mass (PM_{1.0}) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types divided by the corresponding concentrations in Berlin-Neukölln. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25 th	median (50 th)	75 th	mean	no. of data
Urban - block build.	0.68/2.49	0.95/3.52	1.21/5.60	1.04/5.11	7813/21801
Urban -single build.	0.62/2.09	0.92/2.78	1.14/4.23	0.99/3.74	15758/82502
Industry	0.87/1.70	1.24/2.68	1.60/5.23	1.33/4.08	1172/14047
Com.+transp.	0.70/2.42	0.98/3.03	1.28/3.82	1.04/3.50	341/4875
Airport	0.60/2.47	0.64/3.17	0.68/4.61	0.66/4.88	137/738
Dump+ construction	0.56/3.85	0.74/5.27	0.93/6.90	0.74/5.39	34/33
Parks	0.46/2.32	0.65/2.98	0.78/4.72	0.66/3.99	1961/9598
Leisure area	0.19/2.11	0.34/2.75	0.66/4.81	0.50/4.26	509/3378
Arable land	-/1.54	-/1.94	-/2.99	-/2.58	0/9488
Pasture	-/1.53	-/1.94	-/2.45	-/2.19	0/938
Nat. grassl.	-/1.08	-/1.37	-/1.58	-/1.50	0/362
Dec. forest	0.27/2.52	0.47/3.05	0.66/3.95	0.49/3.34	1842/8874
Con. forest	0.28/2.33	0.53/3.18	0.73/3.88	0.55/3.32	3410/7078
mix. forest	0.35/1.51	0.59/2.89	0.73/3.90	0.58/3.21	620/1820

Table S3.9. Absolute particle mass ($\text{PM}_{\text{inhalable}}$) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types provided in $\mu\text{g}/\text{m}^3$. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25th	median (50 th)	75th	mean	no. of data
Reference (Neukölln): UBA	13.5	18.5	26.1	20.8	3317
Urban block build.	7.5/17.0	14.9/31.9	28.0/69.2	53.9/68.2	8260/21801
Urban single build.	8.6/18.1	16.9/33.1	30.9/63.3	65.9/61.9	19143/82502
Industry	14.7/19.3	28.5/35.1	52.8/68.2	53.8/35.1	1464/14047
Com.+transp.	8.8/40.1	18.5/54.1	37.3/76.2	44.2/73.0	341/4875
Airport	6.9/33.6	10.7/40.5	18.7/59.0	14.4/115.8	137/738
Dump+ construction	4.8/21.3	8.6/72.9	13.4/86.7	13.2/72.9	34/33
Parks	5.8/14.6	10.7/25.2	18.6/53.6	23.8/65.5	1961/9598
Leisure area	2.3/28.9	10.4/35.9	23.8/64.0	68.5/70.0	509/3378
Arable land	-/17.7	-/28.9	-/43.0	-/43.1	0/9488
Pasture	-/24.1	-/29.1	-/50.7	-/61.2	0/938
Nat. grassl.	-/14.0	-/26.9	-/29.6	-/25.8	0/362
Dec. forest	2.9/18.4	6.2/36.2	11.5/64.6	12.3/52.6	1842/8874
Con. forest	3.3/17.4	7.5/35.6	14.0/64.0	20.3/47.8	3410/7078
mix. forest	3.5/15.5	8.2/31.3	15.2/60.6	19.7/48.7	620/1820

Table S3.10. Relative particle mass (PM_{inhal}) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types divided by the corresponding concentrations in Berlin-Neukölln. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25 th	median (50 th)	75 th	mean	no. of data
Urban - block build.	0.43/0.98	0.75/1.51	1.51/3.83	3.44/4.34	7813/21801
Urban -single build.	0.42/0.93	0.75/1.36	1.48/3.05	3.68/3.07	15758/82502
Industry	0.58/0.82	1.18/1.38	2.59/3.28	2.73/3.36	1172/14047
Com.+transp.	0.47/1.27	0.85/1.67	2.02/2.45	2.53/2.53	341/4875
Airport	0.36/1.17	0.48/1.37	0.80/2.16	1.09/4.61	137/738
Dump+ construction	0.29/1.48	0.44/6.75	0.74/10.28	0.66/7.86	34/33
Parks	0.27/0.82	0.49/1.21	0.93/2.31	1.35/3.04	1961/9598
Leisure area	0.11/1.06	0.46/1.30	1.36/2.62	6.76/3.43	509/3378
Arable land	-/0.88	-/1.09	-/1.94	-/2.05	0/9488
Pasture	-/0.85	-/1.10	-/1.97	-/2.49	0/938
Nat. grassl.	-/0.66	-/0.94	-/1.09	-/1.03	0/362
Dec. forest	0.14/0.90	0.33/1.59	0.59/3.29	0.65/2.83	1842/8874
Con. forest	0.16/0.82	0.39/1.58	0.68/3.42	1.01/2.68	3410/7078
mix. forest	0.21/0.76	0.46/1.37	0.84/3.08	1.18/2.66	620/1820

Table S3.11. Absolute particle mass ($\text{PM}_{\text{thoracic}}$) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types provided in $\mu\text{g}/\text{m}^3$. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

<i>surface type</i>	<i>25th</i>	<i>median (50th)</i>	<i>75th</i>	<i>mean</i>	<i>no. of data</i>
Reference (Neukölln): UBA	12.3	17.0	23.6	19.2	3317
Urban block build.	7.2/16.9	14.3/31.7	24.7/66.8	27.4/64.0	8260/21801
Urban single build.	8.2/18.1	16.1/32.6	27.2/60.7	32.7/58.8	19143/82502
Industry	14.2/19.3	25.9/34.8	39.8/66.3	33.8/64.0	1464/14047
Com.+transp.	8.6/40.0	17.1/54.0	30.6/75.6	26.0/71.3	341/4875
Airport	6.9/33.5	10.5/40.5	16.4/58.1	12.1/107.2	137/738
Dump+ construction	4.7/21.3	8.5/70.4	13.2/105.5	11.0/81.6	33/34
Parks	5.7/14.6	10.5/25.1	17.5/52.6	16.6/62.1	1961/9598
Leisure area	2.3/28.9	9.9/35.9	21.0/61.5	35.1/66.1	509/3378
Arable land	-/17.5	-/28.8	-/41.8	-/41.0	0/9488
Pasture	-/22.1	-/29.0	-/49.2	-/57.1	0/938
Nat. grassl.	-/14.0	-/26.9	-/29.6	-/25.3	0/362
Dec. forest	2.9/18.2	6.2/35.5	11.1/61.7	9.5/49.7	1842/8874
Con. Forest	3.3/17.3	7.5/34.6	13.4/61.2	13.8/45.3	3410/7078
mix. forest	3.5/15.5	8.1/30.7	14.5/57.8	15.1/46.1	620/1820

Table S3.12. Relative particle mass (PM_{thor}) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types divided by the corresponding concentrations in Berlin-Neukölln. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25 th	median (50 th)	75 th	mean	no. of data
Urban - block build.	0.46/1.06	0.78/1.60	1.46/3.88	1.77/4.39	7813/21801
Urban -single build.	0.46/0.99	0.78/1.45	1.39/3.13	2.02/3.11	15758/82502
Industry	0.63/0.88	1.15/1.46	2.06/3.40	1.78/3.39	1172/14047
Com.+transp.	0.50/1.34	0.89/1.76	1.64/2.57	1.55/2.59	341/4875
Airport	0.40/1.23	0.54/1.45	0.80/2.37	0.91/4.57	137/738
Dump+ construction	0.10/1.60	0.47/7.13	0.81/10.69	0.61/8.08	34/33
Parks	0.30/0.90	0.53/1.30	0.93/2.42	1.01/3.09	1961/9598
Leisure area	0.12/1.13	0.50/1.37	1.28/2.73	3.42/3.47	509/3378
Arable land	-/0.92	-/1.14	-/1.97	-/2.06	0/9488
Pasture	-/0.88	-/1.13	-/1.96	-/2.42	0/938
Nat. grassl.	-/0.68	-/0.99	-/1.11	-/1.05	0/362
Dec. forest	0.16/0.99	0.36/1.70	0.63/3.40	0.54/2.86	1842/8874
Con. forest	0.17/0.89	0.42/1.67	0.72/3.51	0.73/2.72	3410/7078
mix. forest	0.23/0.83	0.50/1.46	0.86/3.17	0.98/2.68	620/1820

Table S3.13. Absolute particle mass ($\text{PM}_{\text{alveolic}}$) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types provided in $\mu\text{g}/\text{m}^3$. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25 th	median (50 th)	75 th	mean	no. of data
Reference (Neukölln): UBA	8.2	11.5	16.1	13.6	3317
Urban block build.	5.3/16.6	9.2/31.1	13.9/62.1	11.8/58.3	8260/21801
Urban single build.	6.1/17.7	9.9/31.9	15.5/54.9	13.5/53.9	19143/82502
Industry	9.9/19.2	13.5/34.6	20.1/62.6	16.4/59.2	1464/14047
Com.+transp.	5.6/39.9	9.9/53.4	14.4/73.7	11.6/68.0	341/4875
Airport	4.8/33.3	6.7/40.4	9.1/57.2	7.1/96.6	137/738
Dump+ construction	4.1/21.3	5.9/61.7	9.2/71.6	7.0/92.2	34/33
Parks	4.7/14.6	7.3/24.9	10.5/50.1	9.1/56.9	1961/9598
Leisure area	1.9/28.7	5.5/35.7	11.8/58.2	10.9/61.1	509/3378
Arable land	-/17.4	-/28.7	-/40.3	-/38.5	0/9488
Pasture	-/20.8	-/28.9	-/47.6	-/52.0	0/938
Nat. grassl.	-/14.0	-/26.9	-/29.5	-/24.8	0/362
Dec. forest	2.6/17.7	4.7/34.0	7.4/55.5	5.8/45.1	1842/8874
Con. Forest	2.9/17.1	5.3/32.3	8.7/54.4	7.2/41.1	3410/7078
mix. forest	3.2/15.4	5.6/29.6	8.4/53.0	7.4/42.2	620/1820

Table S3.14. Relative particle mass ($\text{PM}_{\text{alveol}}$) burden characteristics (bicycle/van background (van all) meas.) at different surface usage types divided by the corresponding concentrations in Berlin-Neukölln. “-“ indicates areas, which have not been tested by the method. Further masses can be found in supporting information.

surface type	25 th	median (50 th)	75 th	mean	no. of data
Urban - block build.	0.56/1.44	0.81/2.14	1.17/5.04	1.06/	7813/21801
Urban -single build.	0.53/1.36	0.79/1.98	1.11/3.93	1.12/	15758/82502
Industry	0.78/1.15	1.06/1.92	1.45/4.46	1.25/	1172/14047
Com.+transp.	0.59/1.73	0.84/2.25	1.32/3.22	1.14/	341/4875
Airport	0.51/1.72	0.59/2.00	0.73/3.31	0.72/	137/738
Dump+ construction	0.39/2.26	0.56/8.30	0.75/12.4	0.62/	34/33
Parks	0.39/1.27	0.59/1.81	0.81/3.37	0.79/	1961/9598
Leisure area	0.18/1.51	0.44/1.83	0.88/3.56	1.16/	509/3378
Arable land	-/1.15	-/1.43	-/2.48	-/2.73	0/9488
Pasture	-/1.05	-/1.36	-/2.37	-/2.82	0/938
Nat. grassl.	-/0.82	-/1.16	-/1.37	-/1.24	0/362
Dec. forest	0.21/1.38	0.40/2.34	0.63/4.26	0.48/3.61	1842/8874
Con. forest	0.24/1.30	0.48/2.31	0.73/4.39	0.56/3.48	3410/7078
mix. forest	0.30/1.22	0.54/2.03	0.80/4.08	0.68/3.37	620/1820

Table S3.15. Absolute lung deposable surface area (LDSA) characteristics (bicycle) at different surface usage types in $\mu\text{m}^2/\text{cm}^3$. The 25th, 50th and 75th percentiles, the mean values and the number of data points are provided as columns. “-“ indicates areas, which have not been tested by the method. Values are presented in particles per cm^3 .

<i>surface type</i>	<i>25th</i>	<i>median (50th)</i>	<i>75th</i>	<i>mean</i>	<i>no. of data</i>	
Reference	24.3	25.8	33.5	28.8	37632	
(Neukölln): UBA						
Urban block build.	26.1	37.2	56.8	57.3	55132	
Urban build.	single	19.2	28.4	44.4	40.4	139597
Industry	25.0	30.9	45.4	44.1	9966	
Commerc.+transport	14.9	19.2	38.0	31.7	4367	
Airport	16.4	20.9	28.6	22.7	968	
Dump+construction	24.6	37.3	57.8	50.3	273	
Parks	15.4	21.8	33.7	30.7	14493	
Sport&leisure	17.6	26.3	40.0	34.8	4420	
Dec. forest	13.8	18.6	26.5	24.2	38485	
Con. forest	14.4	20.4	31.5	28.9	28726	
mix. forest	14.1	18.6	29.2	27.2	7215	

Table S3.16. Relative LDSA characteristics (bicycle) at different surface usage types divided by the reference concentration in Berlin-Neukölln. Listed are the 25th, 50th and 75th percentiles, the mean values and the number of data points. “-“ indicates areas, which have not been tested by the method.

<i>surface type</i>	<i>25th</i>	<i>median (50th)</i>	<i>75th</i>	<i>mean</i>	<i>no. of data</i>
Urban - block build.	0.99	1.32	2.02	2.03	55132
Urban -single build.	0.74	1.06	1.65	1.52	139597
Industry	0.84	1.30	1.98	1.75	9966
Com.+transp.	0.72	0.82	1.03	1.10	4367
Airport	0.63	0.82	1.02	0.85	968
Parks	0.58	0.84	1.18	1.12	273
Dec. forest	0.57	0.72	0.96	0.93	14493
Con. forest	0.57	0.79	1.23	1.11	4420
mix. forest	0.59	0.77	1.12	1.08	38485

S4. Details on measured temperatures for different land usage types

Table S4.1. Changes in air temperature between mobile measurements and the reference site in Berlin-Neukölln (BLUME). Values are provided as T(“bicycle”)/T(“van”) both in degree C.

surface type	25 th	median (50 th)	75 th	mean	no. of data
Urban - block build.	-0.89/-1.07	-0.42/-0.35	0.21/0.20	-0.21/-0.42	749/17570
Urban -single build.	-1.13/-1.51	-0.48/-0.73	0.43/0.10	-0.20/-0.68	1680/62395
Industry	-2.39/-1.56	-0.74/-0.55	0.08/0.74	-1.35/-0.45	140/10830
Com.+transport	-0.77/-0.05	-0.56/0.33	-0.10/1.21	-0.54/1.08	30/4414
Airport	-1.41/-1.70	-0.96/-1.70	-0.86/-1.64	-1.16/-1.46	13/457
Parks	-1.43/-0.86	-0.77/0.19	-0.13/0.61	-0.69/-0.04	209/8391
Leisure area	-1.24/-1.80	-0.43/-1.56	0.01/-1.24	-0.43/-1.45	53/2013
Arable land	-/-1.92	-/-1.33	-/-0.43	-/-1.01	0/7909
Pasture	-/-1.57	-/-0.78	-/-0.21	-/-0.83	0/776
Nat. grassl.	-/-1.95	-/-1.78	-/1.43	-/-1.62	0/357
Dec. forest	-2.71/-1.27	-2.11/-0.71	-1.41/-0.16	-1.94/-0.63	195/5497
Con. forest	-2.72/-1.38	-1.85/-0.65	-0.83/-0.31	-1.53/-0.62	362/3482
mix. forest	-2.49/-1.45	-1.61/-0.81	-0.55/-0.35	-1.39/-0.67	56/1153

S5. Further information on the second flight

Figure S5.1. Flight track (green line) displayed with wind directions and speeds during the observations at around 500 m (1700 ft) altitude.

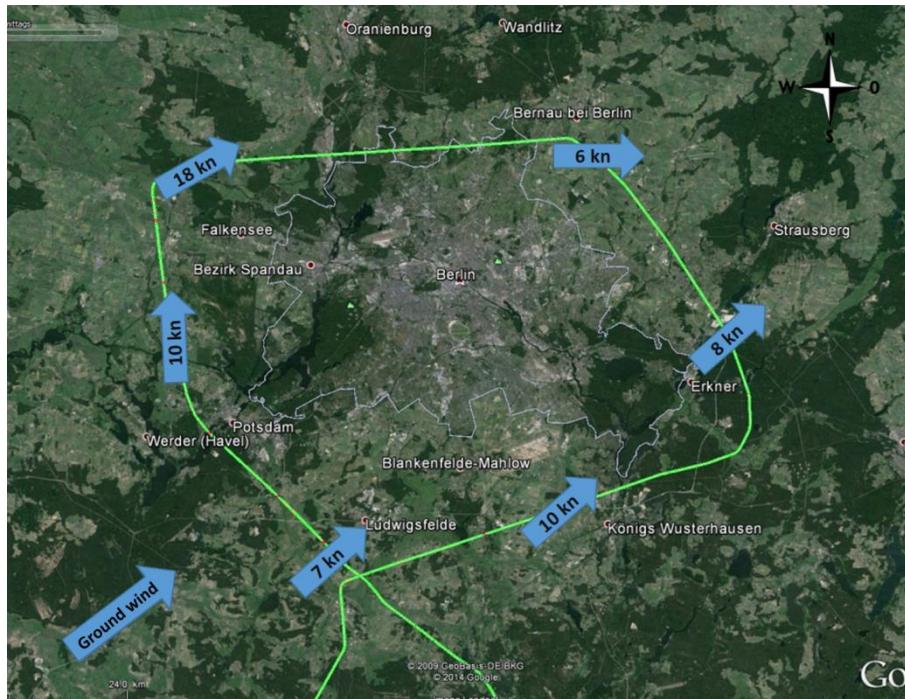


Figure S5.2. Total particle mass (PM) values for different upper cut of diameters provided in μm measured during the flight on the 10th of October 2014.

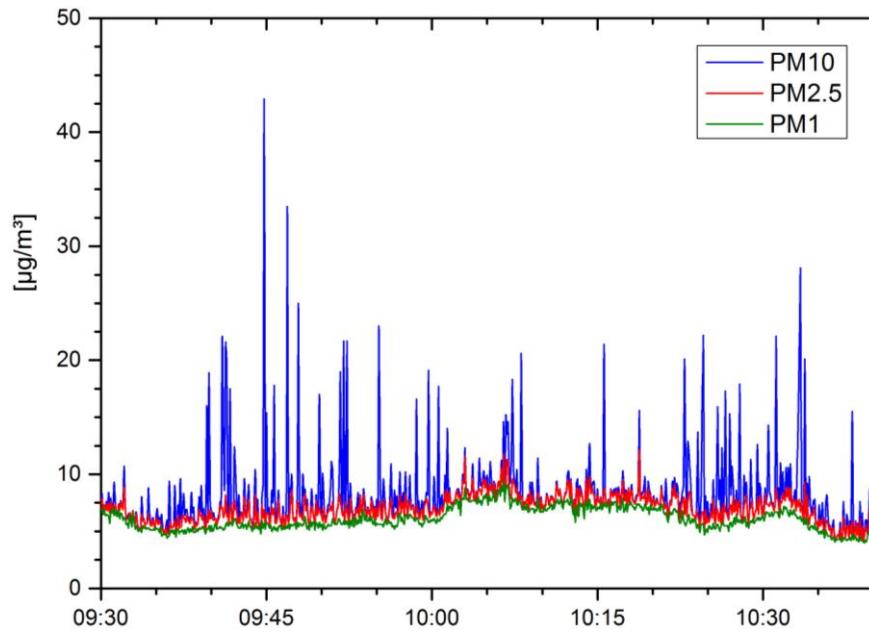


Figure S5.3. Spatial distribution of PM₁₀ (top) and PM_{2.5} (bottom) flight measurements on the 10th of October 2014.

