



Supplement of

Single-particle characterization of polycyclic aromatic hydrocarbons in background air in northern Europe

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Fig. S1: Vacuum aerodynamic diameter of the general particle classes with respect to LDI mass spectra.

Fig. S2 (below): HYSPLIT back trajectories for 24 h run time, ending at the measurement site.









NOAA HYSPLIT MODEL Backward trajectories ending at 0000 UTC 16 Oct 19 GFSQ Meteorological Data









NOAA HYSPLIT MODEL Backward trajectories ending at 0000 UTC 20 Oct 19 GFSQ Meteorological Data







NOAA HYSPLIT MODEL Backward trajectories ending at 0000 UTC 23 Oct 19 GFSQ Meteorological Data



Fig. S2: HYSPLIT back trajectories for 24 h run time, ending at the measurement site.



Fig. S3: Particles with signatures of only 'parent' PAHs show secondary nitrate more frequently than the "common" type (manuscript, Fig. 5), possibly as a result of PAH degradation by atmospheric ageing. (For figure explanation, see Fig. 5.)

Fig. S4: Additional 'parent' PAH peaks at high masses can result from wood combustion, but the further increased nitrate and sulfate signals could also be indicative for an advanced stage of ageing. (For figure explanation, see Fig. 5.)



Fig. S5: Rows of high-mass OC peaks dominating are frequently associated with strong sulfate signals in addition to the nitrate, indicating enhanced SOA and oligomer formation by particle acidity. (For figure explanation, see Fig. 5.)

Fig. S6: Particles with strong signals from alkylated PAHs of low molecular weight could be attributed to a green waste burning fire at the 15th of October. (For figure explanation, see Fig. 5.)



Fig. S7: Some particles show a characteristic fragment pattern with additional peaks at -2 m/z for each PAH signal and strong signals from secondary nitrate and sulfate. They could so far not be associated with a specific source or atmospheric process. (For figure explanation, see Fig. 5.)

Tab. S1: Assignment of the top-300 clusters of the ART-2a analysis of LDI mass spectra to main particle classes. The cluster spectra and temporal behavior are given in Fig. S8.

Sea salt	K-Nit-Sul	K-Nit-OC	Fe-Nit-Sul	Fe-Nit	Fe-Nit-Soot	Fe-Nit-OC	Fe-Soot	Soot	Soot-Nit
1	2	16	36	10	27	43	62	220	192
3	4	26	37	11	28	53	149		200
5	14	69	40	12	39	67	155		204
6	19	105	70	18	44	68	165		234
7	25	131	73	24	47	77	176		258
8	34	133	124	29	49	83	178		263
9	104	141	125	48	50	84	197		278
13	114	161	127	74	51	85	231		
15	119	175	147	86	52	90			
17	170	181	151	138	55	96			
20	174	186	158	139	58	97			
21	177	193	187	236	60	101			
22	182	199	209	238	66	106			
23	189	206	288		75	109			
30	190	212			76	110			
31	191	228			78	111			
32	194	233			79	112			
33	195	240			80	113			
35	202	245			81	117			
38	205	247			88	121			
41	207	248			89	122			
42	224	249			91	126			
45	229	251			92	128			
46	230	253			94	130			
54	250	262			95	132			

57 254 270 99 150 100 59 225 271 100 152 107 61 225 272 103 153 107 64 264 280 108 157 117 64 264 280 108 157 117 64 224 286 116 166 116 71 290 286 118 172 118 72 233 287 118 172 118 87 299 292 129 198 102 102 136 223 1118 172 1118 1123 140 232 1118 11118 11118 11118 11118 11118 11118 11118 11118 11118 11118 11118 11118 111118 111118 111118 111118 111118 111118 111118 1111118 111118	56	252	265		98	148		
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66 282 281 115 164 164 71 290 286 116 164 164 72 293 287 118 172 102 82 295 291 120 179 102 87 299 292 129 198 102 93 300 134 221 102 123 136 223 102 116 135 144 322 102 116 134 2259 102 102 102 102 142 1446 261 102 102 102 142 1165 266 102 102 102 163 162 284 102 102 102 171 106 1073 102 102 102 183 102 2134 102 102 102 184 102 2137	64	264	280		108	157		
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12 203 207 118 172 118 82 295 291 120 179 179 87 299 222 129 198 118 93 300 134 221 118 118 102 136 223 118 118 123 135 144 235 118 118 123 137 144 235 118 118 11118 11118 11118 11118 11118 $111111111111111111111111111111111111$	71	290	286		115	166		
12 120 170 170 87 299 292 129 198 120 102 134 221 120 134 221 121 102 136 223 121 121 121 121 112 136 223 121 121 121 121 112 144 232 121 121 121 121 1137 144 232 121 121 121 121 121 133 144 232 121 1211 1211 1211 1211 1211 1211 1211 1211 12111 12111 12111 12111 12111 12111 12111 12111 12111 121111 121111 121111 121111 1211111 1211111 12111111 $1211111111111111111111111111111111111$	72	293	287	 	118	172		
37 299 129 134 221 93 300 134 221 121 102 134 221 121 121 123 140 232 121 121 135 144 235 121 121 135 144 235 121 121 142 146 261 121 121 144 235 121 121 121 121 142 146 266 121 12111 12111 12111 12111 12111 12111 121111 121111 121111 1211111 $1211111111111111111111111111111111111$	82	295	207		120	172		
37 122 123 126 126 102 136 223 121 121 112 140 232 121 121 1135 144 235 121 121 1137 144 235 121 121 1137 144 235 121 121 1137 144 235 121 121 1137 144 235 121 121 1142 144 235 121 121 1143 156 266 121 121 1160 159 273 121 121 1161 162 224 121 121 1180 1173 121 121 121 1183 2026 1217 121 121 1184 1217 121 121 121 1184 1217 121 121 121 120 1217 121 121 121 121 1210 1217	87	299	291		120	198		
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133 144 233 145 259 142 145 259 141 142 146 261 141 143 156 266 141 160 159 273 141 163 162 284 141 163 166 141 141 163 167 141 141 180 173 141 141 180 173 141 141 184 208 141 141 184 213 141 141 185 214 141 141 188 214 141 141 196 218 141 141 210 212 141 141 210 212 141 141 210 2137 141 141 225 237 141 141 226 237 141 141 226 237	125				140	232		
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274 277 277 283 279 279 289 294 294 298 296 297	268				276			
283 279 279 289 294 294 298 296 297	274				277			
289 294 298 296	283				279			
298 296 296	289				294			
297	298				296			
					297			

Tab. S2: Assignment of the top-300 clusters of the ART-2a analysis of REMPI mass spectra to main (PAH) particle classes. The cluster spectra and temporal behavior are given in Fig. S9. The missing clusters reveal high-mass signatures of inorganic compounds (e.g. Pb⁺, K₃PO₄⁺ etc.) but no PAHs.

Common	PAH-HMW	Parent	Parent- HMW	PAH-OC- LMW	PAH-OC- HMW	OC-HMW	Alkylated	Alkylated- LMW	Fragmented
12	54	41	36	23	38	35	63	49	46
15	76	43	92	28		39	67		55
19	108	81	107	32			85		57
24	158	90	155	34			180		60
31			165	42					72
37			176	45					79
40			177	53					109
47									110
48									111
68									121
69									123
70									
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118									
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122									
157									
173				1					