



Supplement of

Assessing the sources of particles at an urban background site using both regulatory instruments and low-cost sensors – a comparative study

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Table S1: Atmospheric conditions for the simultaneous occurrence of the clusters formed from the OPC and SMPS datasets

NO ₂ (ppb)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	14.27	22.59	3.98	14.49	17.80	14.86	18.56
OPC.2	12.60	9.10	NA	10.14	NA	8.17	9.64
OPC.3	NA	NA	NA	13.10	NA	NA	13.10
OPC.4	13.64	14.42	4.30	11.44	2.50	10.25	11.50
OPC.5	23.40	17.24	5.32	21.17	30.99	17.58	18.30
OPC.6	8.68	10.84	3.03	8.80	NA	8.17	8.58
Avg. SMPS	16.03	16.80	4.38	14.26	29.83	13.20	

BC (ng m ⁻³)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	351.1	602.6	82.2	392.5	370.1	357.3	554.6
OPC.2	237.8	223.8	NA	261.0	NA	190.6	232.9
OPC.3	NA	NA	NA	278.0	NA	NA	278.0
OPC.4	295.4	278.5	85.7	329.5	29.4	261.6	280.6
OPC.5	1029.7	481.7	94.4	849.1	1448.5	510.3	659.3
OPC.6	194.8	189.5	83.2	240.9	NA	198.2	197.5
Avg. SMPS	485.5	405.7	88.1	451.7	1389.1	340.1	

O ₃ (ppb)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	32.5	28.7	42.1	33.8	26.6	35.0	31.9
OPC.2	38.4	39.3	NA	38.3	NA	38.7	38.6
OPC.3	NA	NA	NA	37.6	NA	NA	37.6
OPC.4	33.4	34.2	41.2	37.6	44.2	37.2	36.5
OPC.5	28.4	33.0	40.2	32.3	15.0	33.3	31.5
OPC.6	40.2	37.0	44.0	40.6	NA	40.4	40.0
Avg. SMPS	32.2	32.9	41.6	35.6	16.1	36.0	

PM ₁ (μg m ⁻³)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	2.88	3.28	2.40	3.43	4.60	2.53	4.32
OPC.2	1.30	1.95	NA	3.10	NA	2.50	2.56
OPC.3	NA	NA	NA	2.95	NA	NA	2.95
OPC.4	2.42	1.97	2.42	3.20	0.30	2.33	2.51
OPC.5	5.63	3.16	2.78	5.38	18.72	3.14	6.27
OPC.6	2.25	2.31	2.73	3.23	NA	3.04	2.85
Avg. SMPS	3.35	2.70	2.64	3.77	17.95	2.68	

PM₁₀ (µg m⁻³)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	6.97	9.77	8.95	9.23	8.60	7.98	9.97
OPC.2	5.90	8.75	NA	11.46	NA	12.17	10.65
OPC.3	NA	NA	NA	9.70	NA	NA	9.70
OPC.4	7.32	6.54	7.97	11.11	0.90	7.66	8.33
OPC.5	17.26	10.48	10.18	13.98	26.11	10.81	13.30
OPC.6	8.32	8.84	8.66	11.16	NA	11.62	10.31
Avg. SMPS	9.52	8.91	9.26	11.12	25.09	9.12	

Organic (µg m⁻³)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	0.201	0.219	0.061	0.293	0.603	0.230	0.254
OPC.2	0.012	0.183	NA	0.191	NA	0.076	0.142
OPC.3	NA	0.145	NA	0.088	0.738	0.116	0.241
OPC.4	0.127	0.074	0.051	0.168	0.747	0.121	0.192
OPC.5	0.373	0.115	0.041	0.396	1.425	0.170	0.338
OPC.6	0.118	0.094	0.110	0.102	0.739	0.081	0.116
Avg. SMPS	0.215	0.132	0.062	0.249	1.066	0.164	

NO₃⁻ (µg m⁻³)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	0.055	0.037	0.057	0.084	0.323	0.065	0.089
OPC.2	0.003	0.019	NA	0.018	NA	0.016	0.016
OPC.3	NA	0.030	NA	0.008	0.350	0.032	0.084
OPC.4	0.026	0.013	0.015	0.092	0.642	0.026	0.108
OPC.5	0.097	0.029	0.008	0.119	0.641	0.028	0.131
OPC.6	0.016	0.020	0.011	0.018	0.639	0.013	0.036
Avg. SMPS	0.055	0.026	0.021	0.081	0.574	0.039	

SO₄²⁻ (µg m⁻³)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	0.034	0.013	0.045	0.057	0.099	0.033	0.041
OPC.2	0.004	-0.013	NA	0.058	NA	0.020	0.030
OPC.3	NA	0.058	NA	-0.007	0.154	0.037	0.067
OPC.4	0.020	0.020	0.081	0.042	0.163	0.026	0.045
OPC.5	0.037	0.028	0.003	0.050	0.139	0.031	0.041
OPC.6	0.027	0.027	0.065	0.026	0.205	0.024	0.035
Avg. SMPS	0.031	0.025	0.037	0.047	0.141	0.029	

RH (%)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	86.5	80.5	79.3	82.0	98.3	83.5	83.9
OPC.2	70.8	67.8	NA	68.3	NA	55.1	65.1
OPC.3	NA	92.4	NA	69.6	99.0	94.5	91.8
OPC.4	86.3	84.0	79.7	79.8	94.4	82.3	83.4
OPC.5	83.4	78.1	79.0	78.2	91.6	77.4	82.6
OPC.6	79.7	88.5	83.8	75.5	98.3	78.0	80.8
Avg. SMPS	85.1	83.2	80.1	79.3	93.9	80.9	

WS (m s ⁻¹)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	4.24	3.55	6.38	4.81	2.36	4.97	4.16
OPC.2	6.30	6.90	NA	7.07	NA	7.62	7.10
OPC.3	NA	3.44	NA	5.90	2.09	4.07	3.47
OPC.4	4.01	3.68	6.98	4.28	3.97	5.13	4.46
OPC.5	3.33	4.16	7.13	4.55	2.06	4.04	4.38
OPC.6	5.78	3.27	8.38	5.41	2.76	4.76	4.99
Avg. SMPS	4.10	3.74	7.19	4.77	2.60	4.83	

T (°C)	SMPS.1	SMPS.2	SMPS.3	SMPS.4	SMPS.5	SMPS.6	Avg. OPC
OPC.1	5.17	4.15	5.48	5.99	5.28	5.76	5.20
OPC.2	5.44	6.64	NA	7.06	NA	8.42	7.16
OPC.3	NA	4.10	NA	7.47	5.50	3.73	4.60
OPC.4	5.42	4.24	6.19	7.24	6.84	6.55	6.26
OPC.5	5.73	6.76	8.10	7.56	3.72	6.20	6.68
OPC.6	7.72	3.16	9.11	8.18	5.80	5.79	6.42
Avg. SMPS	5.53	4.64	7.43	6.97	4.90	6.10	NA

Table S2: Weekly averages of meteorological conditions and atmospheric chemical composition for the time of the study (week number refers to weeks from the start of the year 2020)

Week	NO ₂ (ppb)	BC (ng m ⁻³)	PM ₁ (μg m ⁻³)	PM _{2.5} (μg m ⁻³)	PM ₁₀ (μg m ⁻³)	O ₃ (ppb)	NH ₄ ⁺ (μg m ⁻³)	Org (μg m ⁻³)	SO ₄ ²⁻ (μg m ⁻³)	NO ₃ ⁻ (μg m ⁻³)	RH (%)	WS (m s ⁻¹)	T (°C)
W4	NA	NA	NA	NA	NA	NA	0.223	0.663	0.149	0.547	97.3	2.43	5.41
W5	8.11	208	3.63	7.65	12.8	39.0	0.067	0.315	0.068	0.131	89.7	4.21	6.81
W6	21.3	865	8.27	12.2	18.1	28.0	0.081	0.570	0.070	0.212	82.6	3.30	5.96
W7	10.0	210	2.27	4.67	8.02	37.2	0.005	0.073	0.016	0.010	79.1	6.68	5.40
W8	7.34	189	2.71	5.32	8.45	42.0	0.010	0.102	0.038	0.012	77.1	7.27	9.17
W9	14.6	360	2.18	3.58	6.05	34.2	0.019	0.183	0.037	0.036	83.0	4.61	5.41
W10	22.2	711	6.40	8.93	12.9	30.6	0.029	0.156	0.018	0.072	83.0	2.96	4.38
W11	9.49	232	2.28	4.46	7.68	38.5	0.004	0.035	0.009	0.006	79.1	5.74	8.34

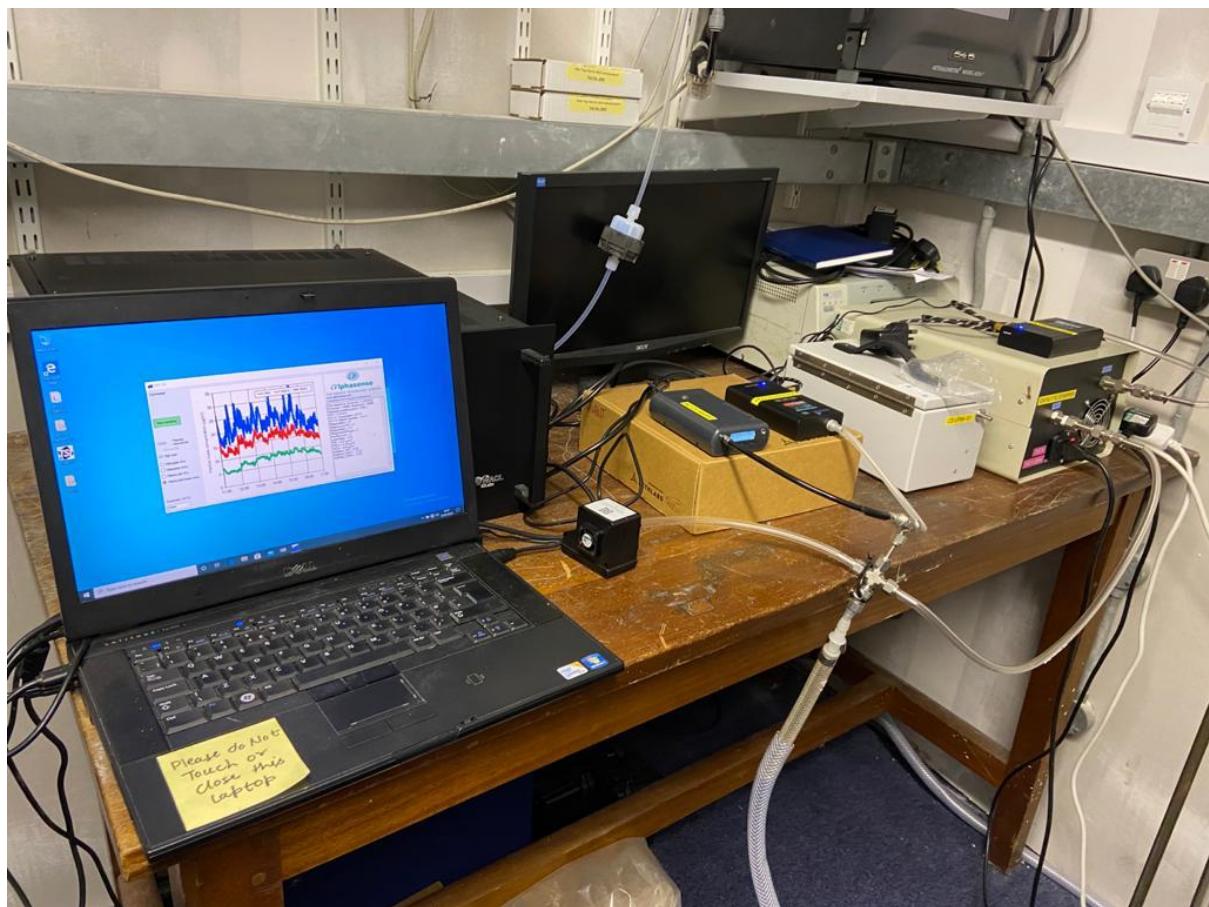


Figure S1: The low-cost sensors used at the BAQS site.

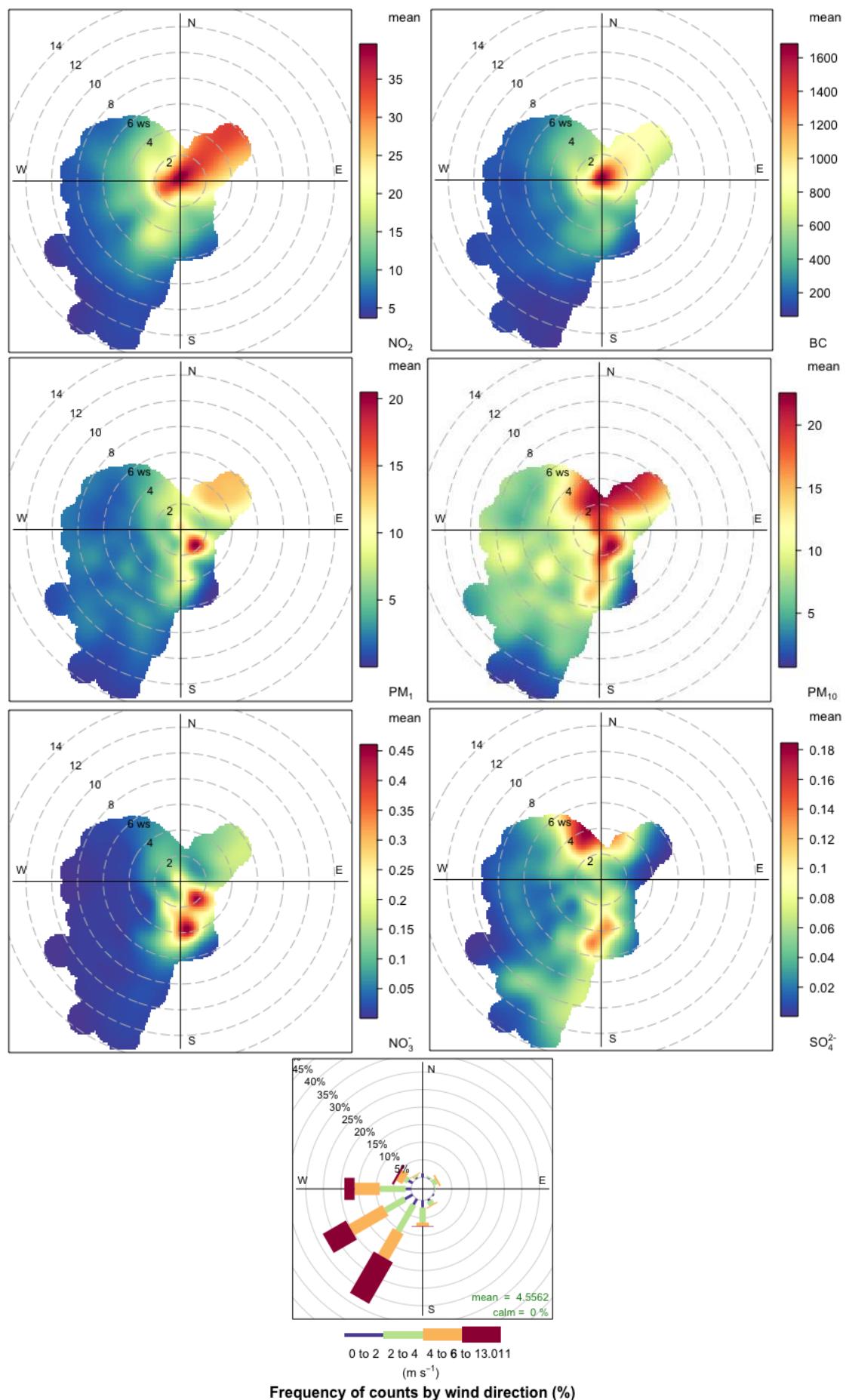


Figure S2: Polar plots of the average conditions and wind rose for the period studied (NO₂ in ppb, BC in ng m⁻³, PM₁, PM₁₀, NO₃⁻ and SO₄²⁻ in µg m⁻³)

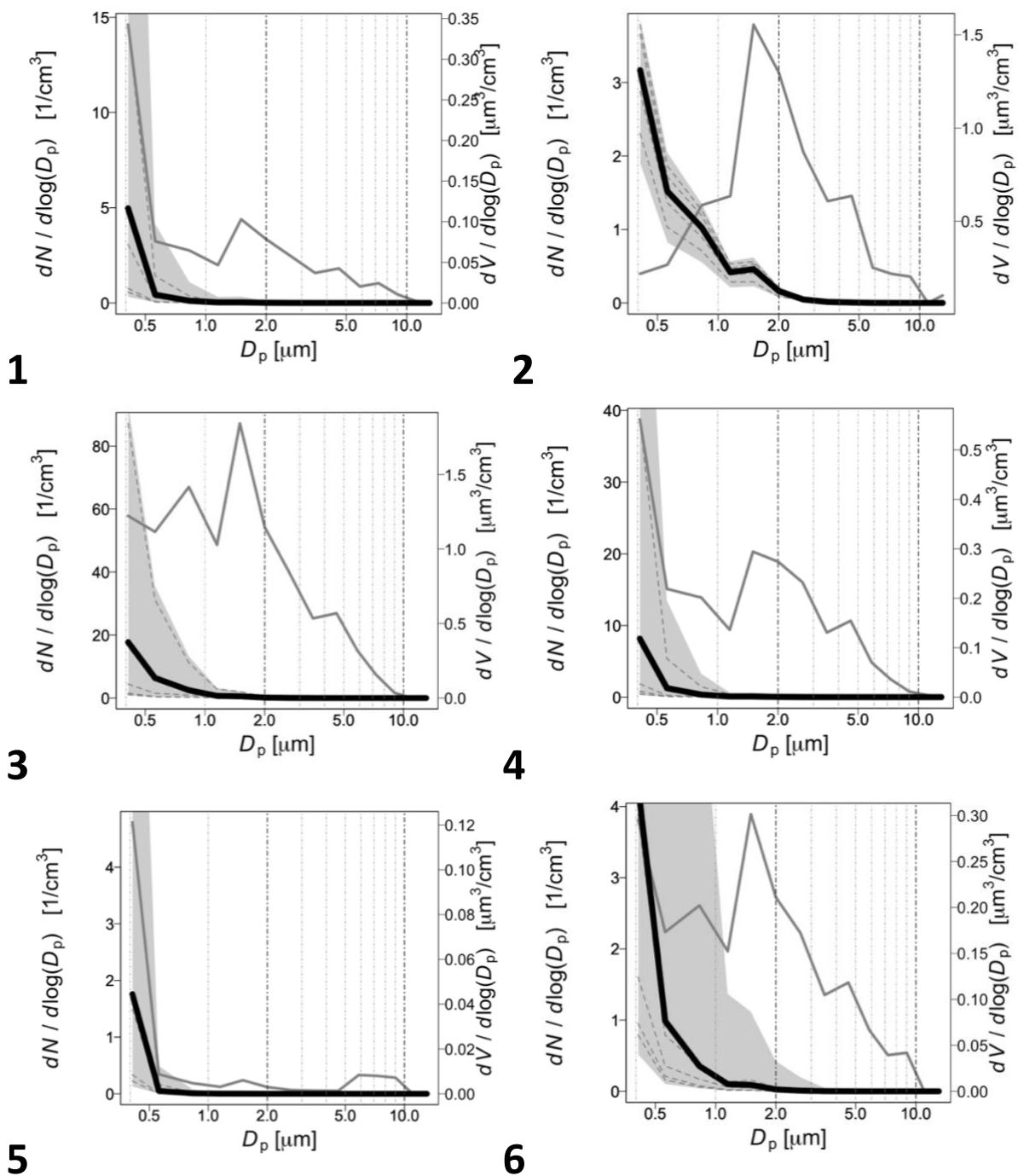
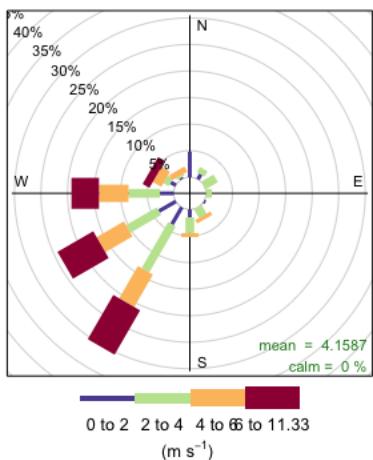
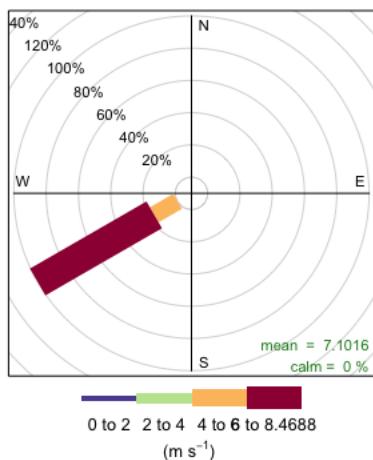


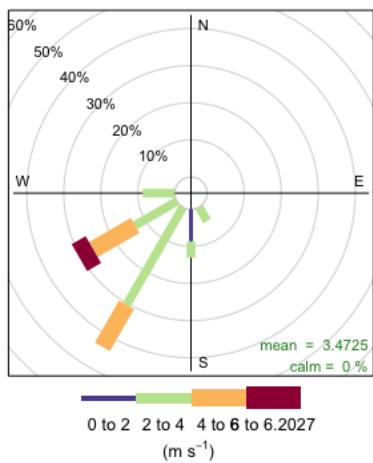
Figure S3: Average particle number size (black line) and volume (grey line) distribution for the clusters formed from the OPC data



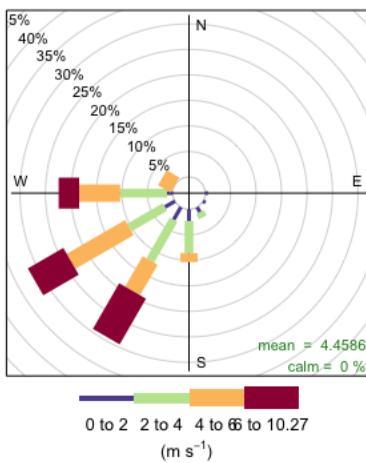
1 Frequency of counts by wind direction (%)



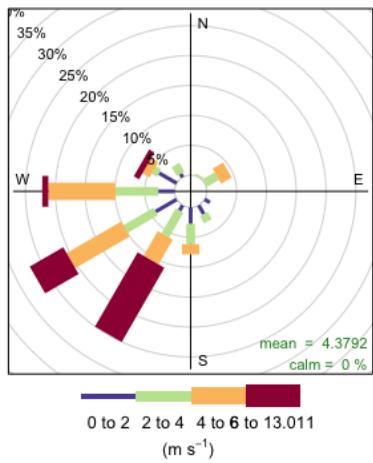
2 Frequency of counts by wind direction (%)



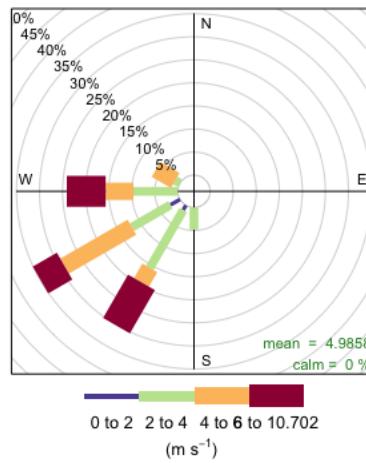
3 Frequency of counts by wind direction (%)



4 Frequency of counts by wind direction (%)



5 Frequency of counts by wind direction (%)



6 Frequency of counts by wind direction (%)

Figure S4: Wind roses for the clusters formed from the OPC data.

NOAA HYSPLIT MODEL
 Backward trajectories ending at 1400 UTC 12 Mar 20
 GDAS Meteorological Data

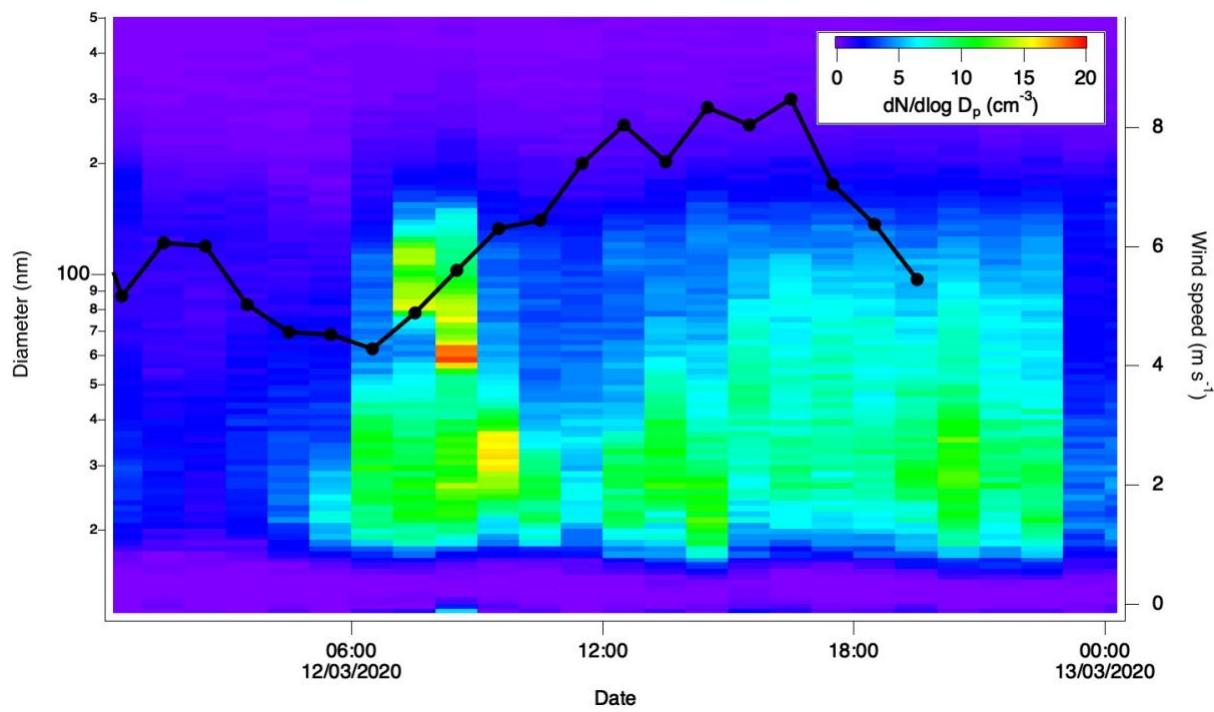
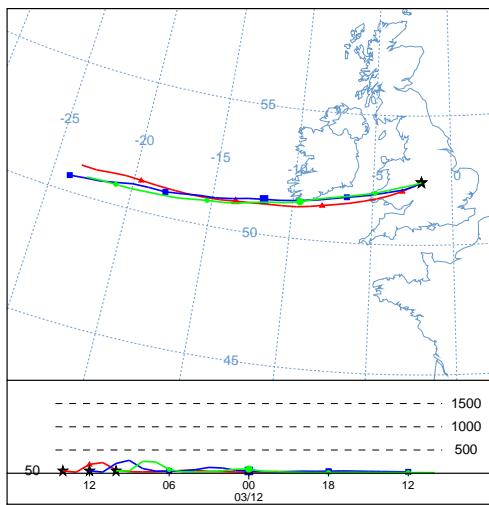


Figure S5: Air mass back trajectories (top) and particle size distribution (bottom) as found by the SMPS data on the 12th of March 2020.

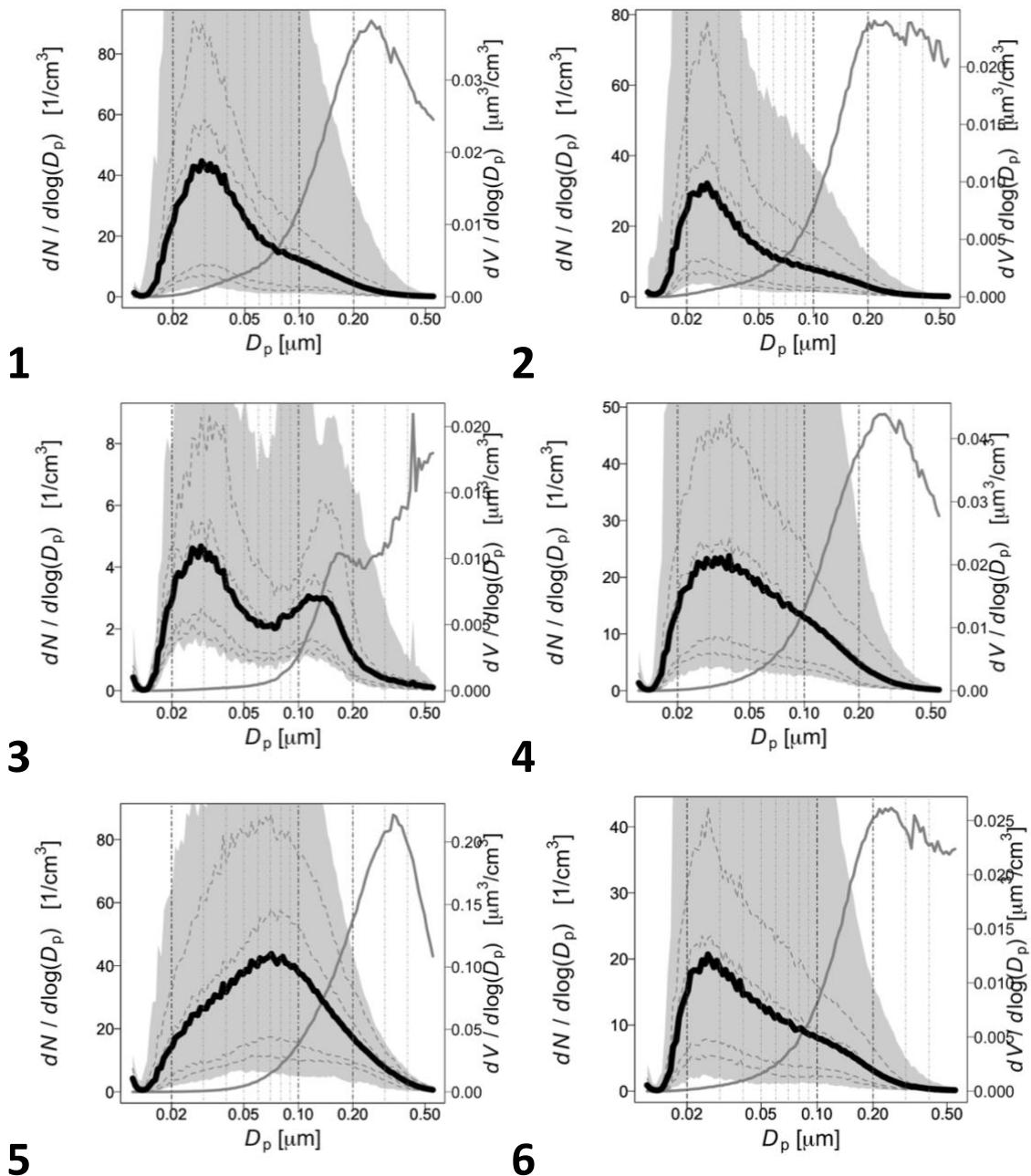
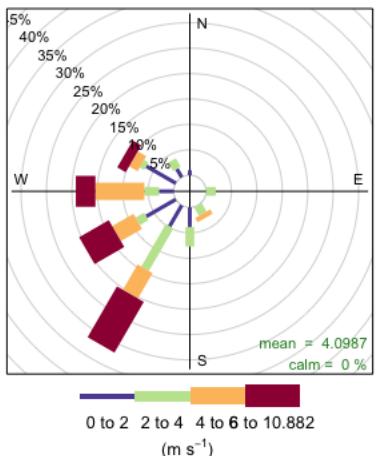
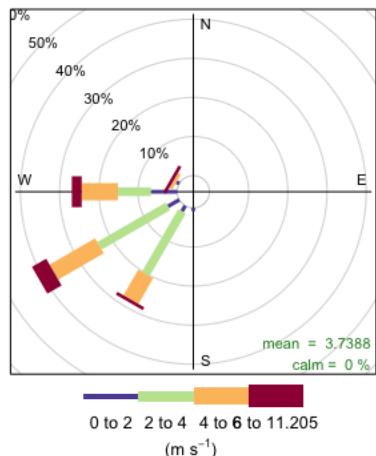


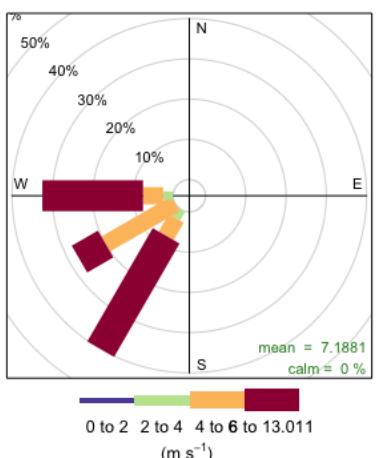
Figure S6: Average particle number size (black line) and volume (grey line) distribution for the clusters formed from the SMPS data.



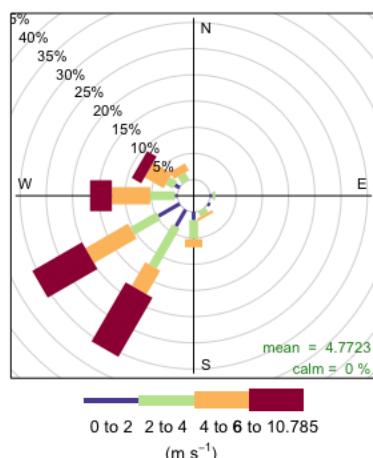
1 Frequency of counts by wind direction (%)



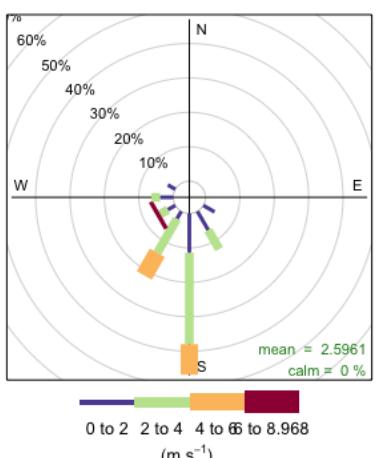
2 Frequency of counts by wind direction (%)



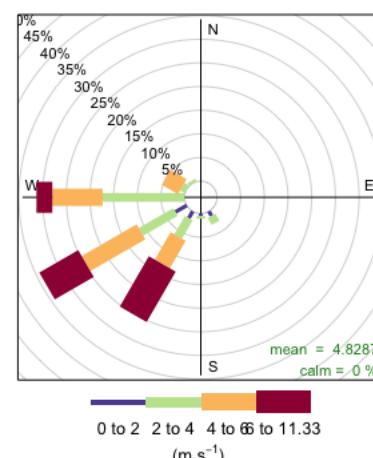
3 Frequency of counts by wind direction (%)



4 Frequency of counts by wind direction (%)



5 Frequency of counts by wind direction (%)



6 Frequency of counts by wind direction (%)

Figure S7: Wind roses for the clusters formed from the SMPS data.

