SUPPLEMENT

Table S1. List showing which compounds were analysed from each sample types and which detector was use.

	Canister Samples	In situ Samples	Tube Samples		Canister Samples	In situ Samples	Tube Samples
Ethane	FID			4-Ethyltoluene		MS	MS
Ethene	FID			1,3,5-Trimethylbenzene		MS	MS
Propane	FID			2-Ethyltoluene		MS	MS
Propene	FID			1,2,4-Trimethylbenzene		MS	MS
2-Methylpropane	FID			1,2,3-Trimethylbenzene		MS	MS
Butane	FID			Hexane		MS	MS
Ethyne	FID			Heptane		MS	MS
T-but-2-ene	FID			Octane		MS	MS
But-1-ene	FID			Nonane		MS	MS
Cis-but-2-ene	FID			Decane		MS	MS
2-Methylbutane	FID			Undecane		MS	MS
n-pentane	FID			Dodecane		MS	MS
1,3-butadiene	FID			Tridecane		MS	MS
T-pent-2-ene	FID			Tetradecane		MS	MS
Pent-1-ene	FID			Pentadecane		MS	MS
Isoprene	FID			Furfural		MS	MS
α-pinene		MS	MS	Benzyl alcohol		MS	MS
Camphene		MS	MS	1,3-Diethylbenzene		MS	MS
Myrcene		MS	MS	o-cresol		MS	MS
β-pinene		MS	MS	1,4-Diethylbenzene		MS	MS
Carene		MS	MS	2-Propyltoluene		MS	MS
p-Cymene		MS	MS	p-cresol		MS	MS
Limonene		MS	MS	2-Ethyl-p-xylene		MS	MS
1,8-Cineol		MS	MS	1,2,4,5-Tetramethylbenzene		MS	MS
Terpinolene		MS	MS	1,3,5-Triethylbenzene		MS	MS
β-caryophyllene		MS	MS	1,4-Dibutylbenzene		MS	MS
Benzene		MS	MS	Naphthalene		MS	MS
Tetrachloromethane		MS	MS	Acenaphthylene		MS	MS
Toluene		MS	MS	Acenaphthene		MS	MS
Ethylbenzene		MS	MS	Fluorene		MS	MS
p/m-xylene		MS	MS	Anthracene		MS	MS
Styrene		MS	MS	Phenanthrene		MS	MS
o-xylene		MS	MS	Fluoranthene		MS	MS
Propylbenzene		MS	MS	Pyrene		MS	MS
3-Ethyltoluene		MS	MS				

Table S2. Instruments at the UB Supersite (SMEAR III).

Mast (31 m, agl)	
Quantity	Instrument
Air temperature (4, 8, 16 and 31 m)	Platimun resistance thermometer (Pt-100)
Wind (4, 8, 16 and 31 m)	2D ultrasonic anemometer (Thies Clima 2.1x)
Global radiation (31 m)	Kipp and Zonen CNR1
Reflected global (31 m)	Kipp and Zonen CNR1
Longwave radiation in (31 m)	Kipp and Zonen CNR1
Longwave radiation out (31 m)	Kipp and Zonen CNR1
Photosynthetic Active Radiometer (PAR, 31 m)	Kipp and Zonen PAR lite
Reflected PAR (31 m)	Kipp and Zonen PAR lite
Flux of momentum and heat (Eddy Covariance, 31)	Ultrasonic anemometer (Metek USA-1)
Flux of CO_2 and H_2O (Eddy Covariance, 31)	High frequency gas analyser (Li-Cor 7500 & 7000, infra-red absorbtion)
Total number concentration flux of aerosol particles (Eddy Covariance)	Water Condesation Particle Counter (WCPC, TSI-3781)
(2-4 m agl)	
Particle size distribution (size range **:** 3–950 nm)	The Differential Mobility Particle Sizer (Hauke-type DMA, 10.9 cm+TSI 3025; Hauke-type DMA, 28 cm+TSI 3010)
Particle concentration (size range >7 nm (Dp50), and the maximum detectable particle size > 3 μm)	Condensation particle counter (CPC, TSI 3756)
Particle size distribution (size range: 0.5– 20 nm)	Aerodynamic particle sizer (APS, TSI 3321)
Particle size distribution (size range: 1.3-4.5 nm)	Nano Condensation Nucleus Counter System (Airmodus A11 nCNC)

Mobility distribution of ions (0.8–40 nm) and size distribution of particles (2–40 nm)	Neutral cluster and Air Ion Spectrometer (Airel Ltd)
Nitrogen oxides (NO_x)	Chemiluminescence + thermal converter (TEI42S)
Ozone (O_3)	IR-absorption photometer (TEI49)
Carbon monoxide (CO)	Non-dospersive infrared (NDIR) absorption (Horiba APMA 370)
Sulphur dioxide (SO2)	UV-flurescence (Horiba APSA 360)
$PM_{2.5}$ and PM_{10}	TEOM 1405 (Thermo Scientific)
Physicum roof (29 m agl)	
Wind	Cup anemometer (Vaisala WAA141)
Air temperature	Platimun resistance thermometer
Sea level pressure	Barometer (Vaisala HMP243)
Relative humidity	Platimun resistance thermometer + thin film polymer sensor (Vaisala DPA500)
Dew point temperature	Platimun resistance thermometer + thin film polymer sensor (Vaisala DPA500)
Precipitation	Weighting rain gauge (Ott Pluvio)
Global radiation	Kipp and Zonen CNR1
Reflected global	Kipp and Zonen CNR1
Longwave radiation in	Kipp and Zonen CNR1
Longwave radiation out	Kipp and Zonen CNR1
PAR	Kipp and Zonen PAR lite
Reflected PAR	Kipp and Zonen PAR lite
Visibility	PWD

6

Table S3. Average concentrations of measured components during the traffic (averages without episodes) dominated period on workdays and weekends and their averages during four different episodes at the UB Supersite. PN concentration at UB Supersite was measured using an ultrafine CPC (Dp > 2.5 nm).

Compound	**Traffic workdays**	**Traffic weekends**	**E1** 22.1.2022 15:00 23.1.2022 10:00	**E2** 31.1.2022 07:00 5.2.2022 16:00	**E3** 13.2.2022 12:00 17.2.2022 23:00
PN *(p cm^{-3})*	7347	5280	12370	13141	7004
LDSA *(μm^2 cm^{-3})*	3.8	3.5	13.0	13.7	9.8
PM$_{2.5}$ *(μg m^{-3})*	1.3	1.2	6.3	7.3	5.6
PM$_{2.5-10}$ *(μg m^{-3})*	1.8	1.9	1.2	3.0	3.1
NO *(μg m^{-3})*	1.5	1.3	b.d.l	10.5	2.7
NO$_2$ *(μg m^{-3})*	9.4	6.7	11.0	24.5	16.2
BC *(μg m^{-3})*	0.18	0.17	0.91	0.98	0.70
CO *(ppb)*	141	146	197	236	192
CO$_2$ *(ppm)*	427	428	433	443	432
CH$_4$ *(ppb)*	2014	2020	2049	2076	2055
O$_3$ *(μg m^{-3})*	59	64	57	29	51
Total particulate organics *(μg m^{-3})*	0.59	0.47	1.83	1.90	2.84
Sulphate *(μg m^{-3})*	0.24	0.30	1.21	1.62	1.01
Nitrate *(μg m^{-3})*	0.22	0.13	1.35	0.65	1.35
Ammonium *(μg m^{-3})*	0.24	0.27	0.88	0.71	0.83
Chloride *(μg m^{-3})*	0.03	0.03	0.05	0.02	0.12

Table S4. Filter steps of the PDA for the figure S17.

Filter step	**Parameter**	**Traffic Supersite**	**UB Supersite**
Deriative filter (IQR)	IQR factor	1.7	1.7
	Window size	24 h	24 h
Threshold filter	Upper threshold	10^4 cm^{-3}	10^4 cm^{-3}
	Lower threshold	60 cm^{-3}	60 cm^{-3}
Neighboring points filter	On/off	On	On
Median filter	Median time interval	30 min	30 min
	Median deviation factor	1.5	1.5
Sparse data filter	Sparse window	30	30
(no. of data points)	Sparse threshold	24	24

Table S5. Filter steps of the PDA for the Figure 7.

Filter step	**Parameter**	**Traffic Supersite**	**UB Supersite**
Deriative filter (IQR)	IQR factor	1.7	1.7
	Window size	24 h	24 h
Threshold filter	Upper threshold	30^5 cm^{-3}	30^5 cm^{-3}
	Lower threshold	60 cm^{-3}	60 cm^{-3}
Neighboring points filter	On/off	On	On
Median filter	Median time interval	30 min	30 min
	Median deviation factor	1.5	1.5
Sparse data filter	Sparse window	30	30
(no. of data points)	Sparse threshold	24	24

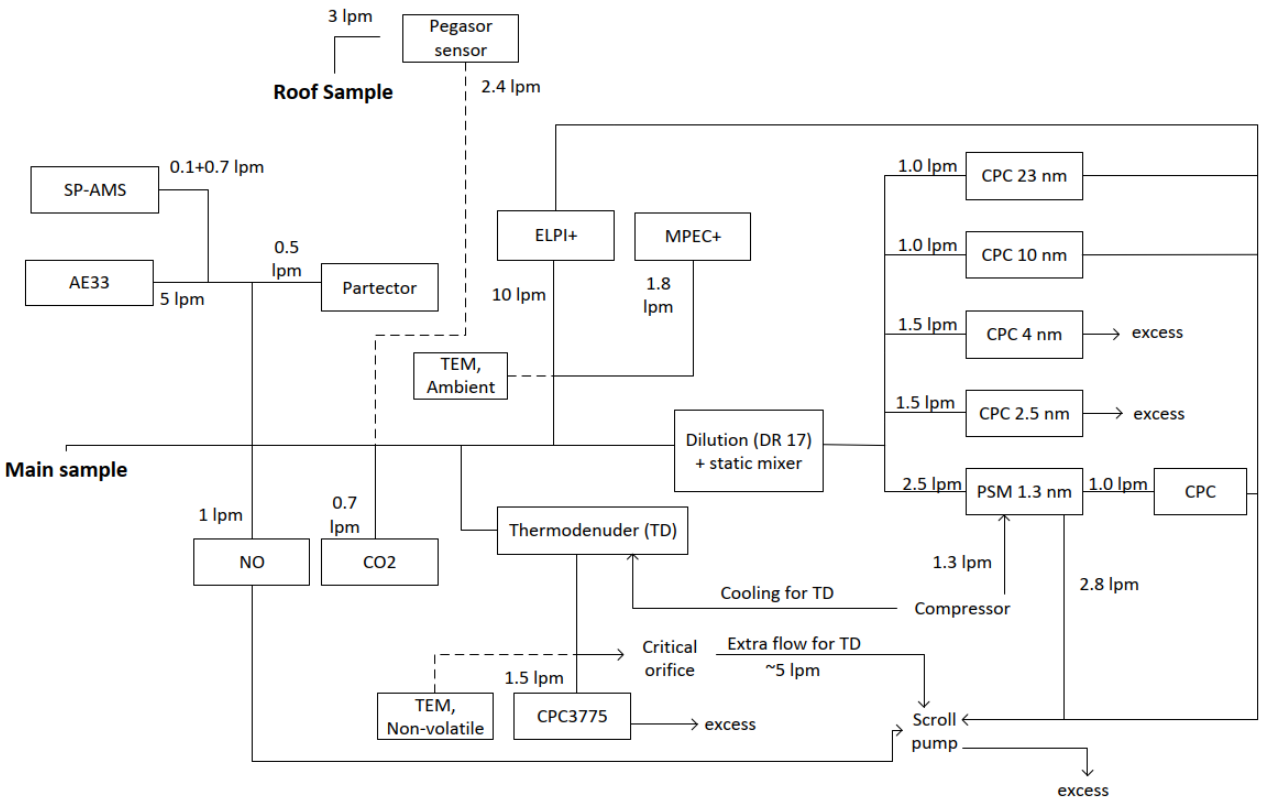


Figure S1. Measurement setup inside the Aerosol and Trace-gas mobile laboratory.

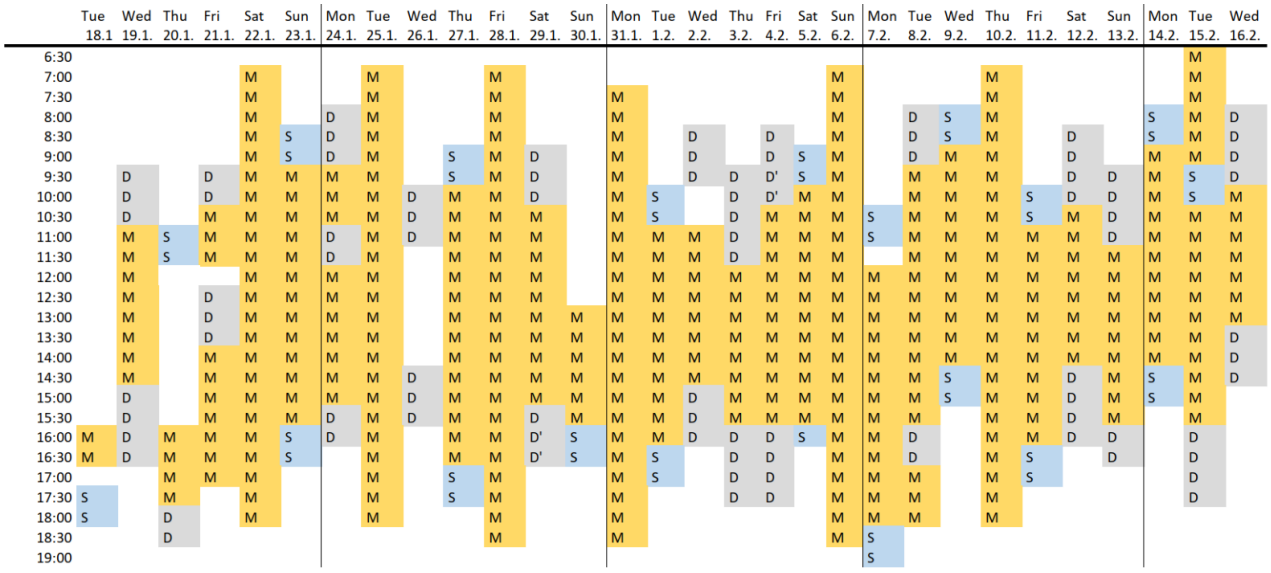


Figure S2. The measurement timeline of the Aerosol and Trace-gas mobile laboratory. Measurement activity is denoted with letters M (main street/Traffic Supersite), S (side street), D (driving), and D' (driving only along main street).

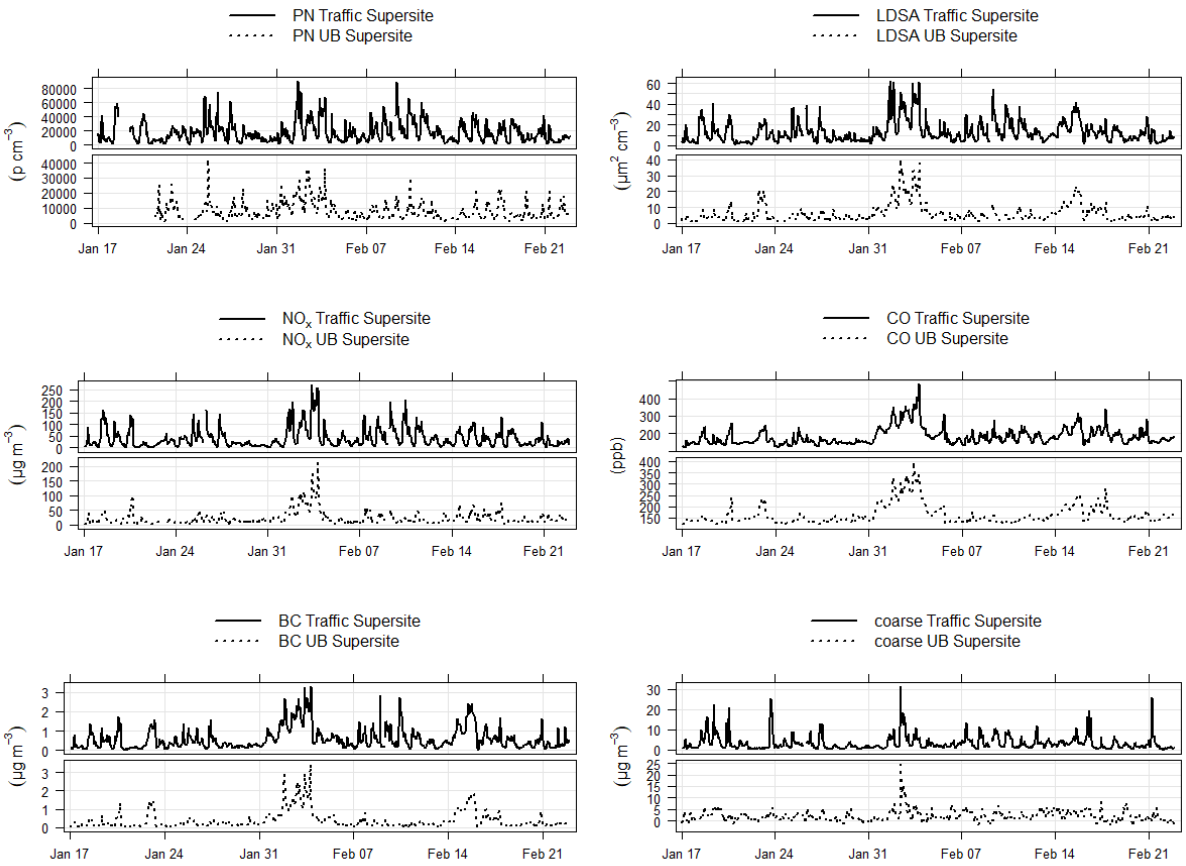


Figure S3. Time series of PN, LDSA, NO_x, CO, BC and $PM_{2.5-10}$ at the Traffic Supersite and at the UB Supersite during the measurement period. The cut size of the CPC at the Traffic Supersite is 5.4 nm and at the UB Supersite 7 nm.

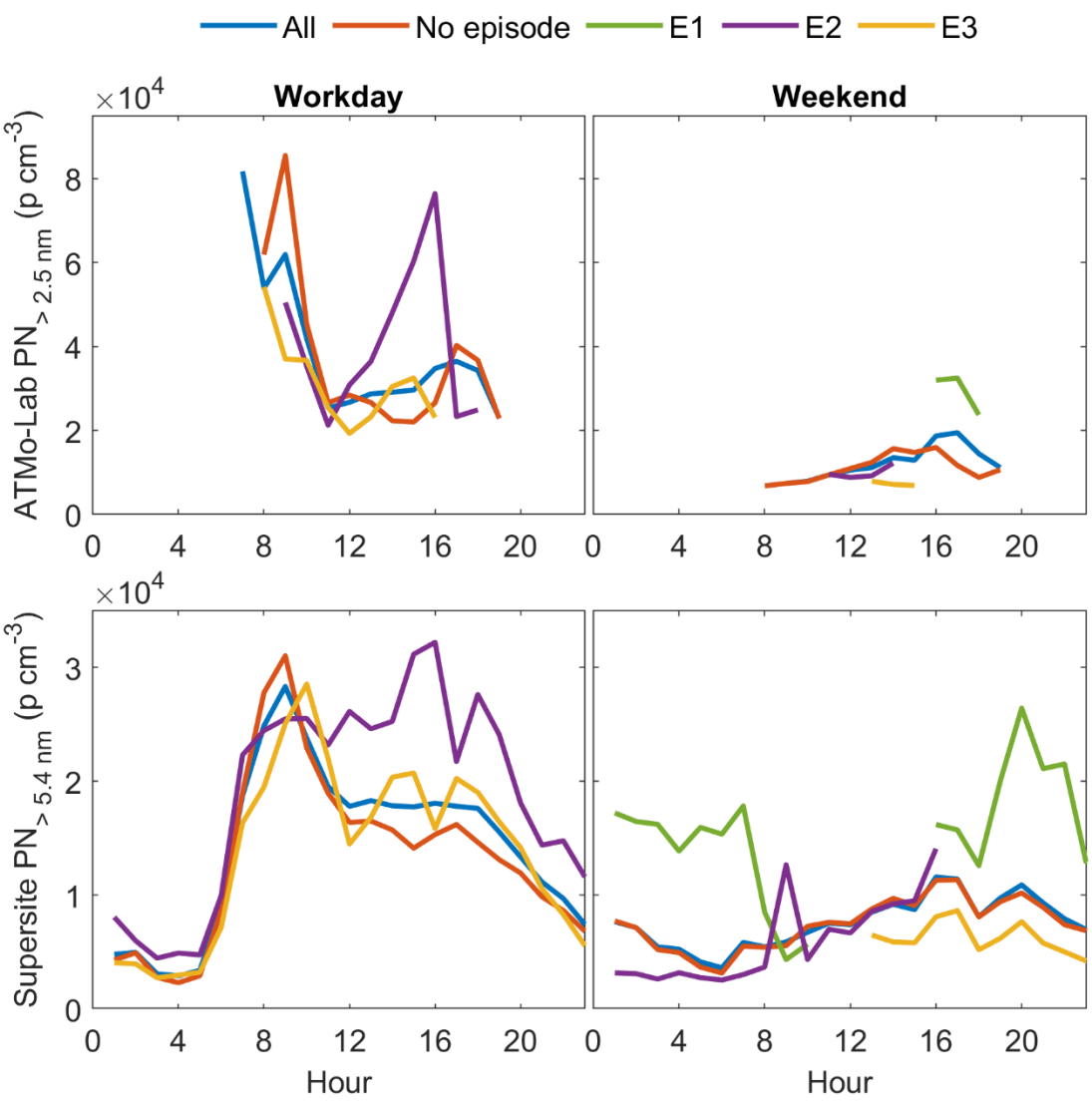


Figure S4. Diurnal variation of particle number concentration measured at the main street by an ATMo-Lab CPC (Dp_{50}: 2.5 nm) and at the Traffic Supersite CPC (Dp_{50}: 5.4 nm) on workdays and on weekends. Different episode time periods are denoted by the label. Geometric mean is used for averaging. Note that the ATMo-Lab did not measure continuously next to the Supersite as it was also utilised in driving measurements during the measurement days. Also, the ATMo-Lab measured during a shorter period between 18 January to 16 February 2022. Diurnal variation hours consisting of less than 30 minutes of measurement data were discarded.

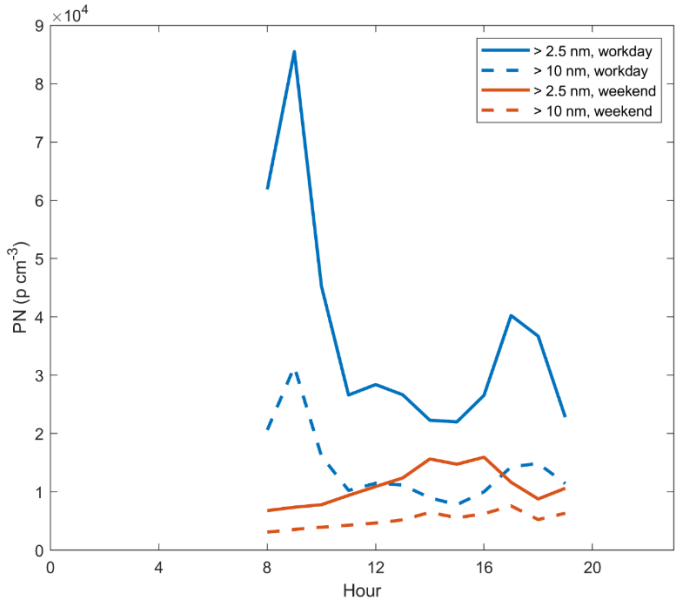


Figure S5. Diurnal variation of particle number concentration measured at the main street by ATMo-Lab on workdays and on weekends. Cut-off sizes (Dp_{50}: 2.5 nm and 10 nm) of the used instruments are indicated by the legend. Episode times are excluded from the data and geometric mean is used for averaging. Diurnal variation hours consisting of less than 30 minutes of measurement data were discarded.

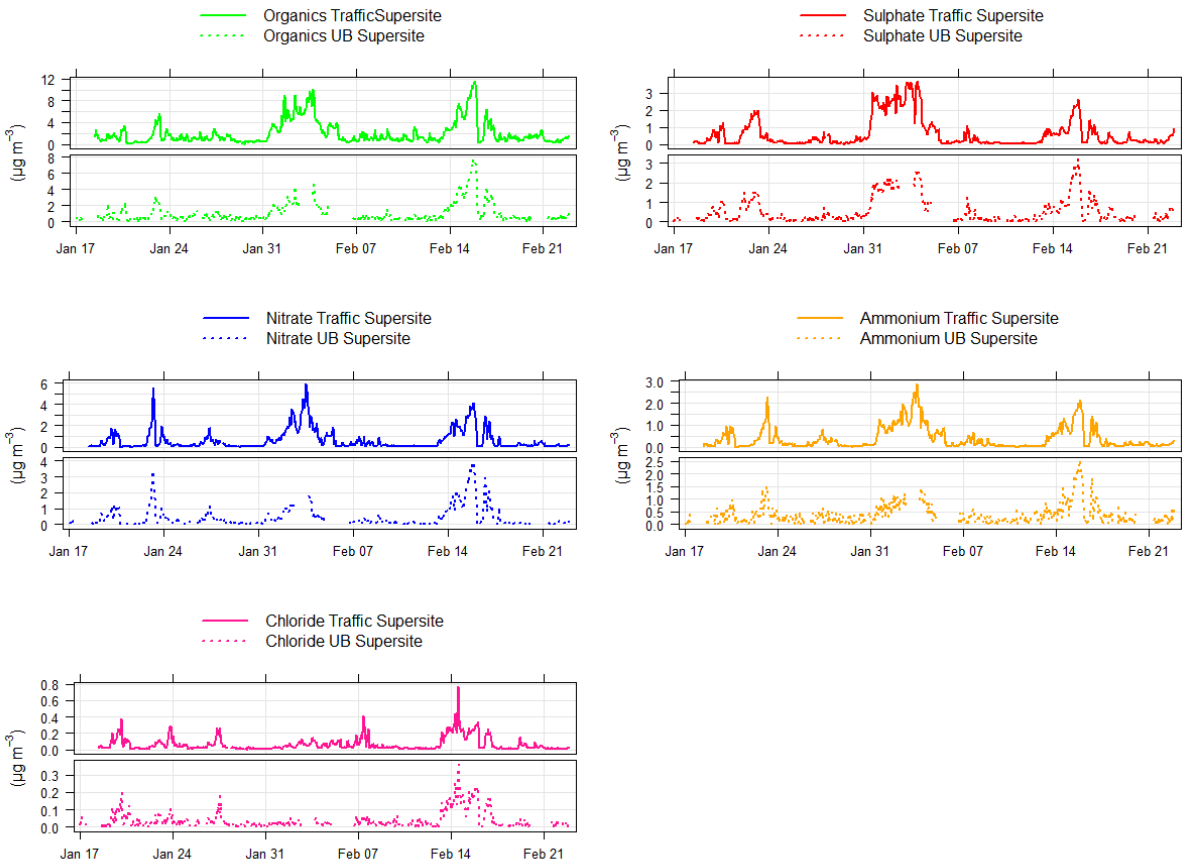


Figure S6. Time series of organics, sulphate, nitrate, ammonium and chloride at the Traffic Supersite and at the UB Supersite during the measurement period.

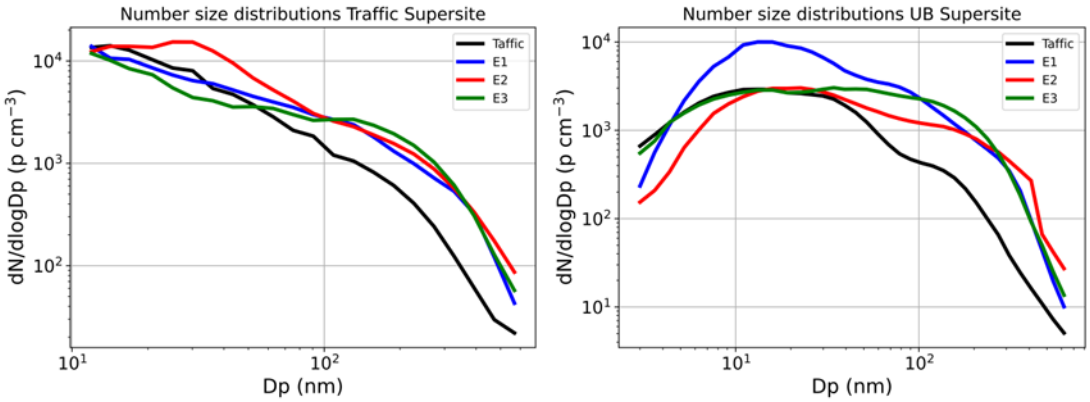
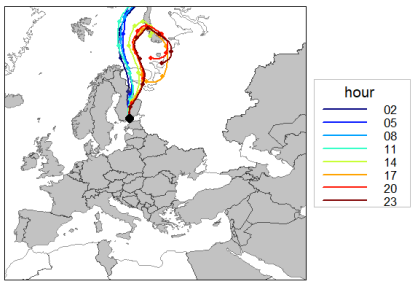


Figure S7. Average particle number size distributions measured with DMPS at the Traffic Supersite and at the UB Supersite stations during non-episodic situation and during the three episodes.

2022-01-22



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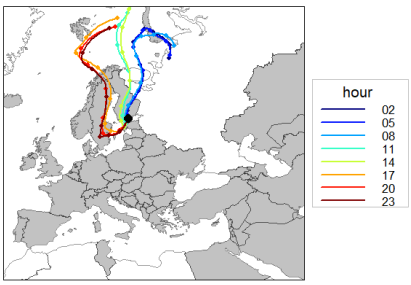

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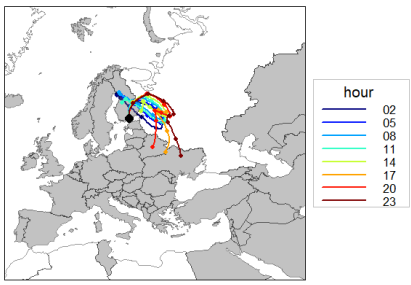

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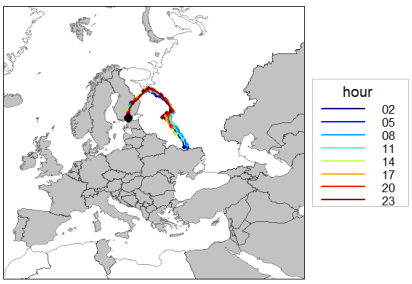

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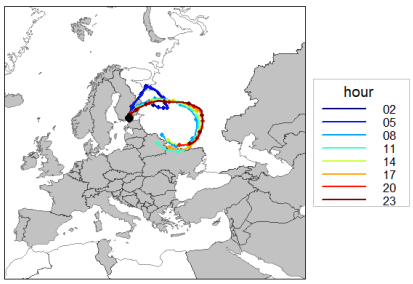

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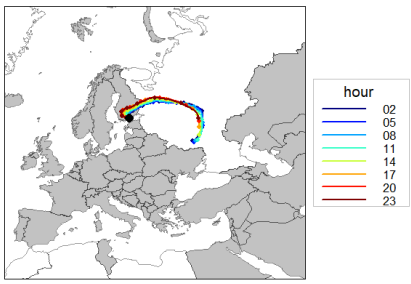

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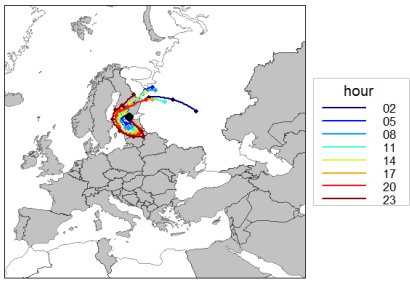

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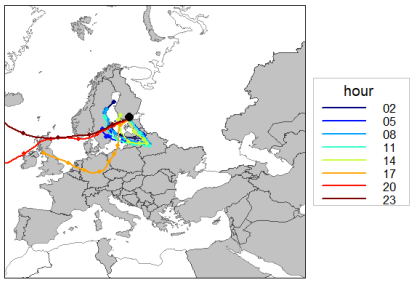

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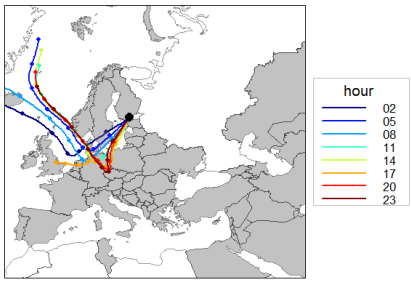

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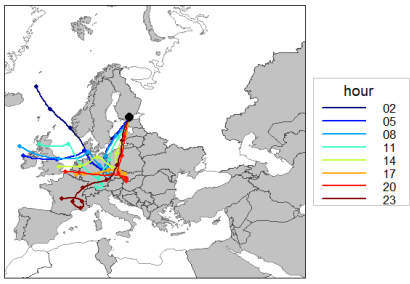

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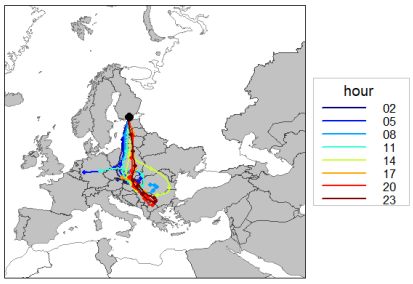

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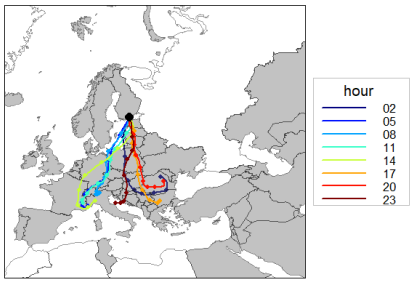

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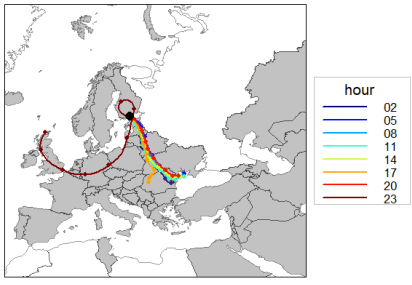

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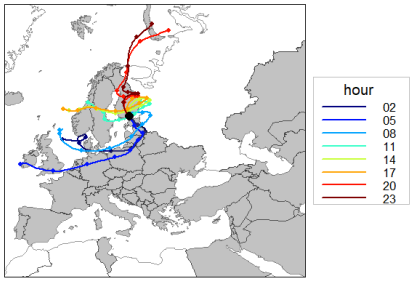

43

Figure S8. Daily 4-hour back trajectories during the episodes (local time).

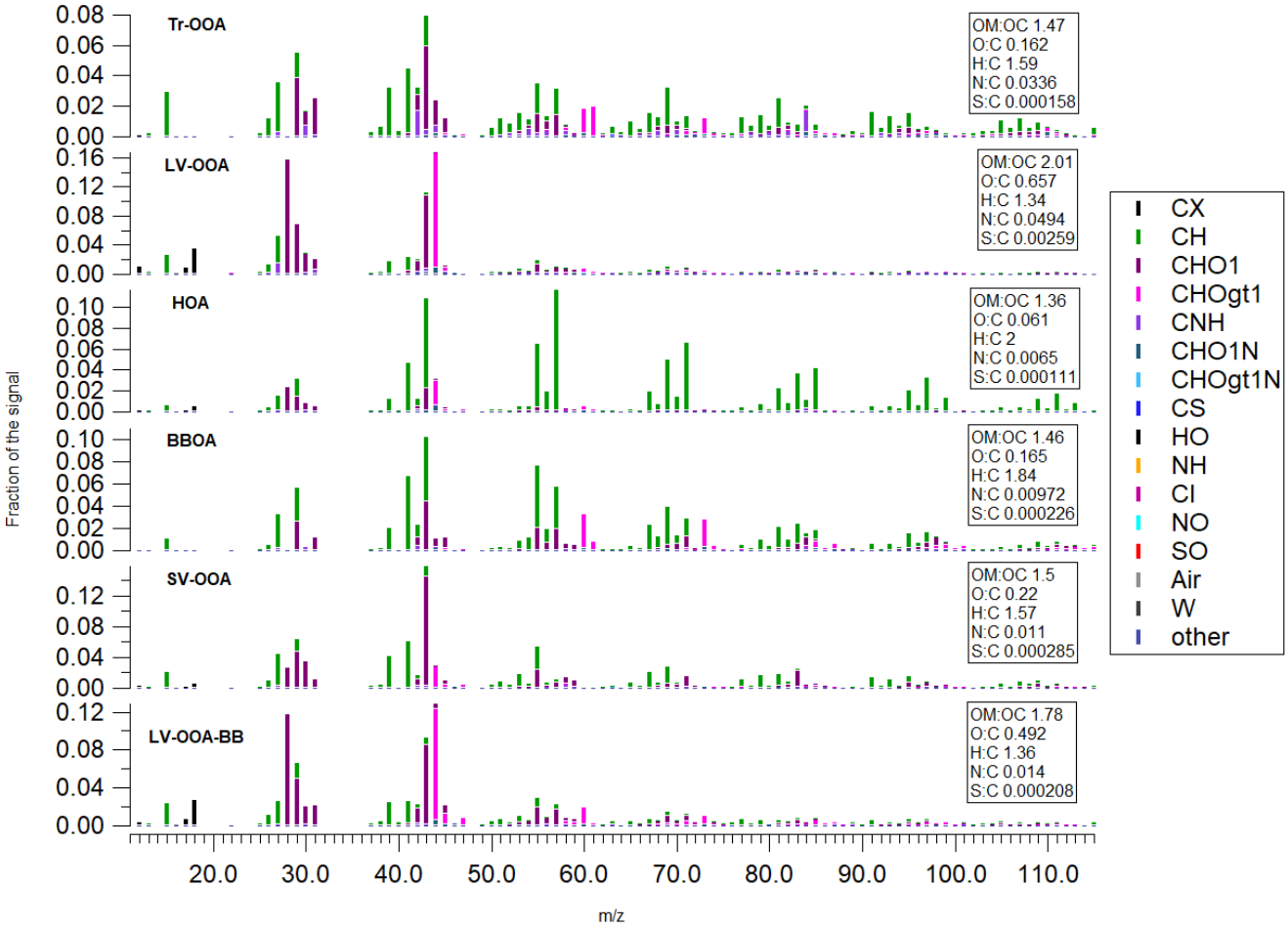

Figure S9. Mass spectra of the six factors obtained from PMF analysis.

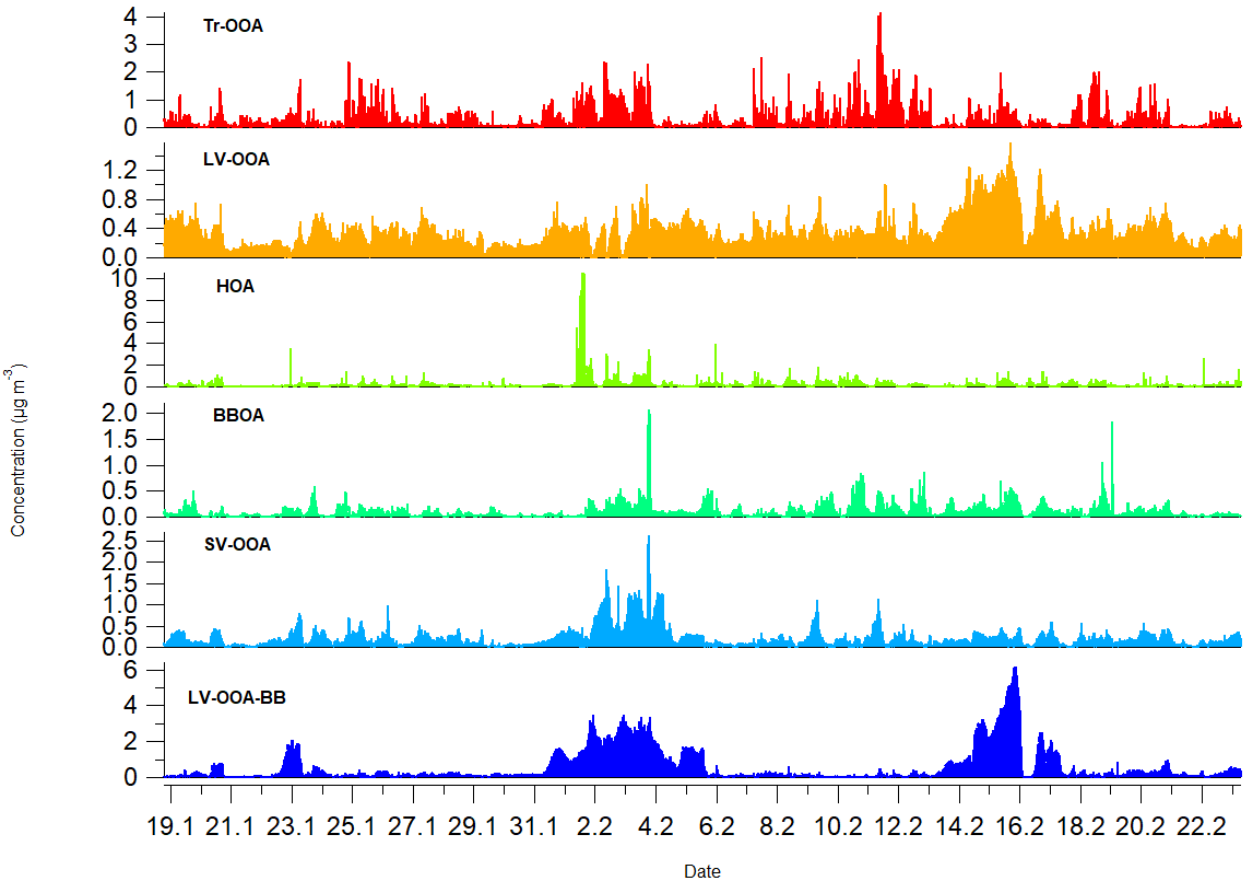

Figure S10. Time series of the six factors obtained from PMF analysis.

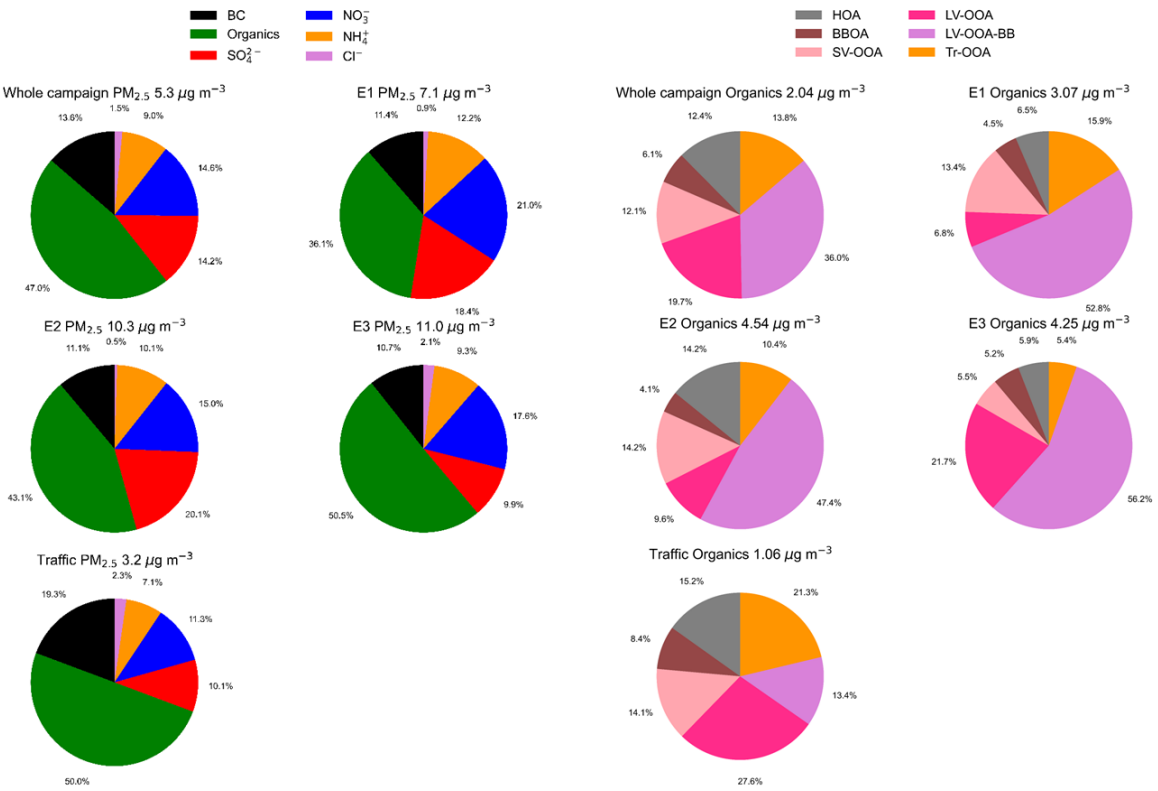

Figure S11. Pies showing the relative abundances of measured chemical components (left) and relative abundances of calculated organic fractions (right) during the whole campaign, during the three episodes (E1–E3) and during the traffic related time (non-episodes) at the Traffic Supersite.

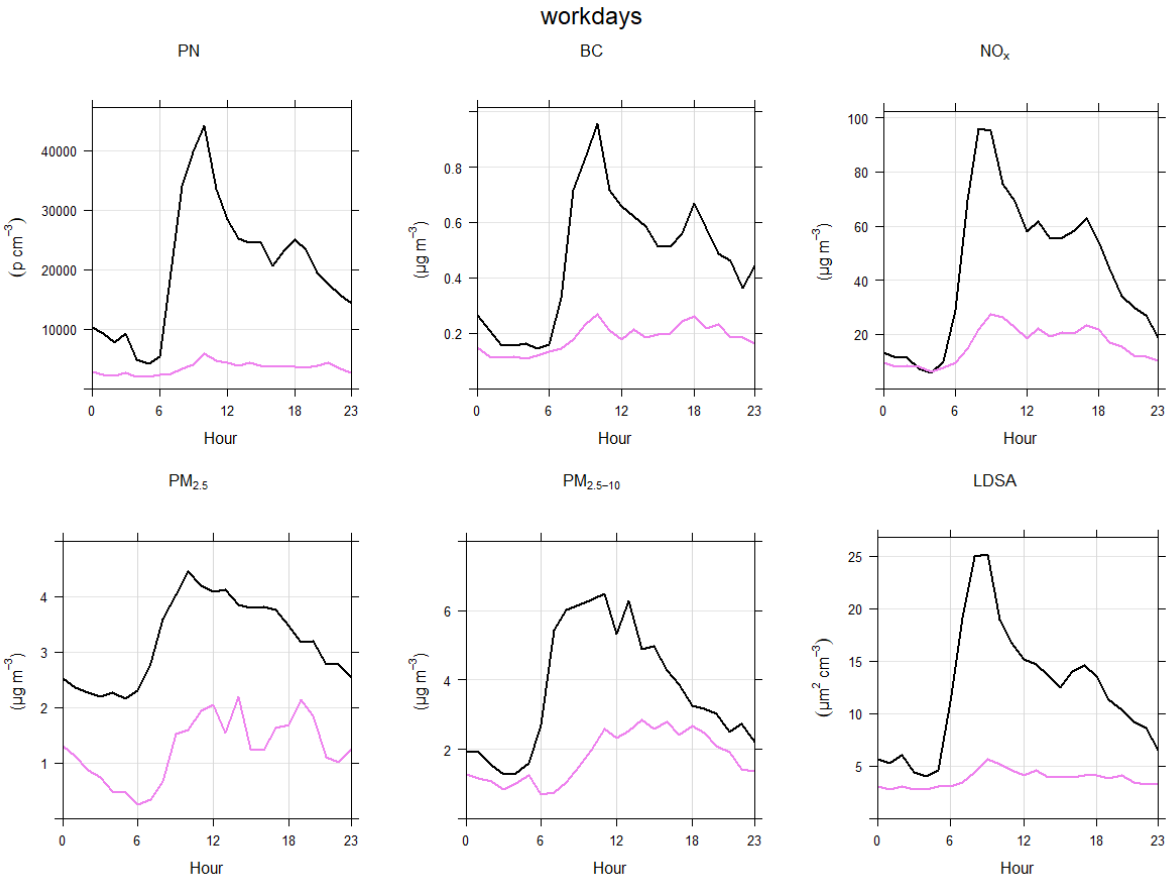

Figure S12. Hourly diurnal variations of concentrations of PN, BC, NO_x, $PM_{2.5}$, $PM_{2.5-10}$, and LDSA without episodes during workdays at the Traffic Supersite (black) and at the UB Supersite (violet) stations.

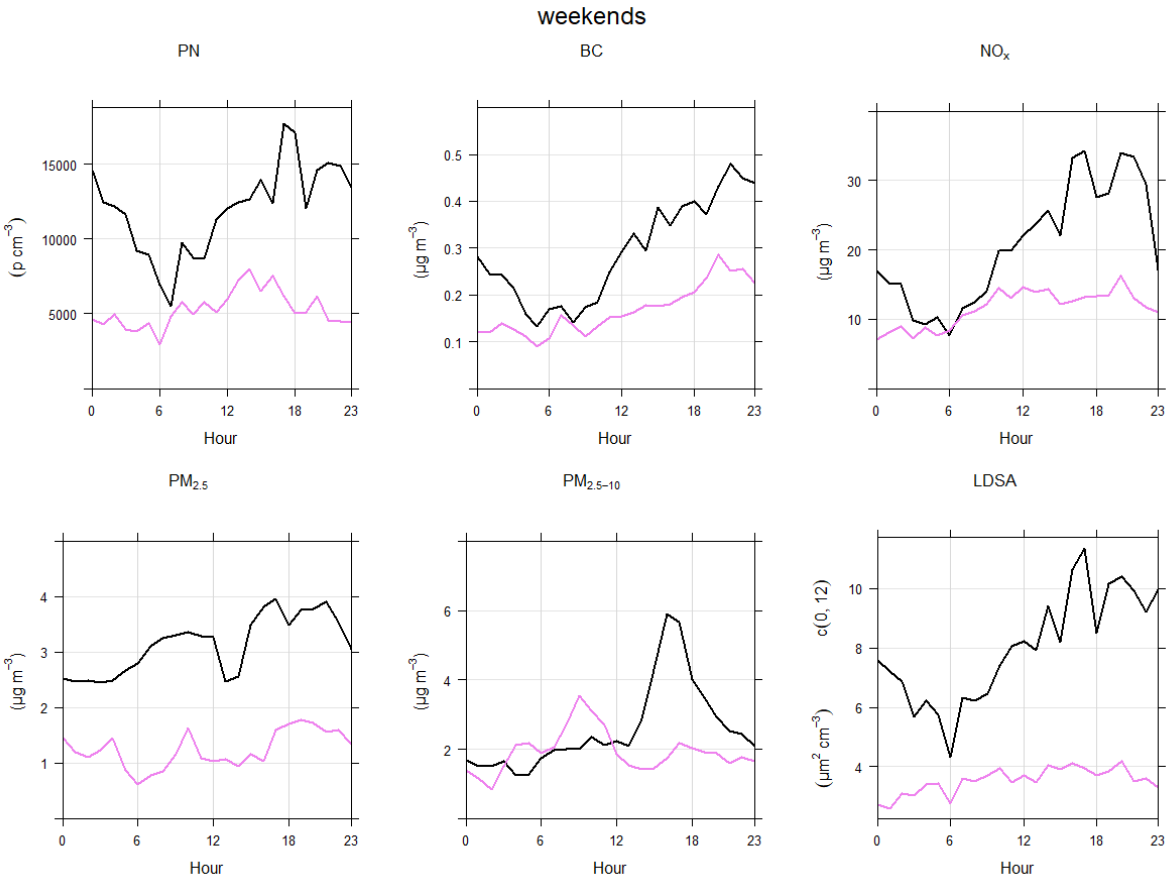

Figure S13. Hourly diurnal variations of concentrations of PN, BC, NO_x, $PM_{2.5}$, $PM_{2.5-10}$, and LDSA without episodes during weekends at the Traffic Supersite (black) and at the UB Supersite (violet) stations.

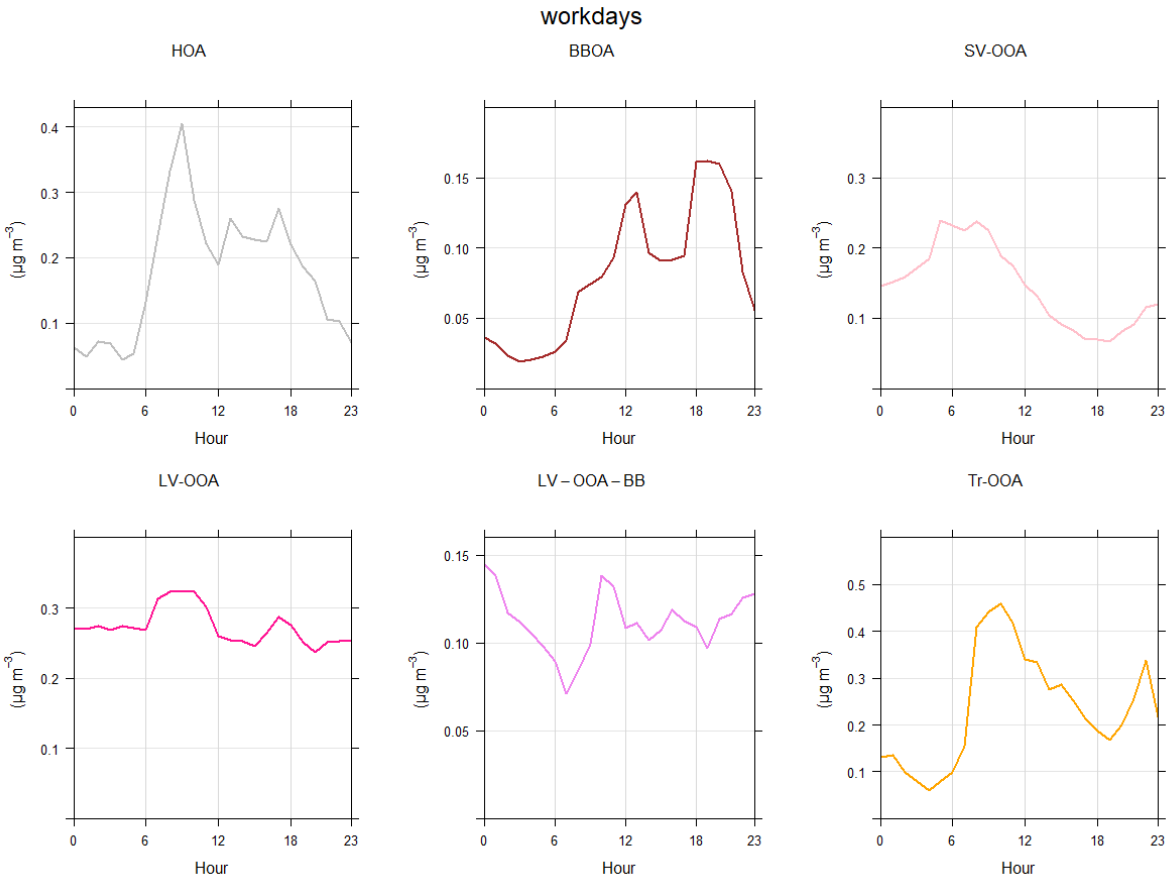

Figure S14. Hourly diurnal variations of concentrations of calculated organic fractions HOA, BBOA, SV-OOA, LV-OOA, LV-OOA-BB, and Tr-OOA without episodes at the Traffic Supersite during workdays.

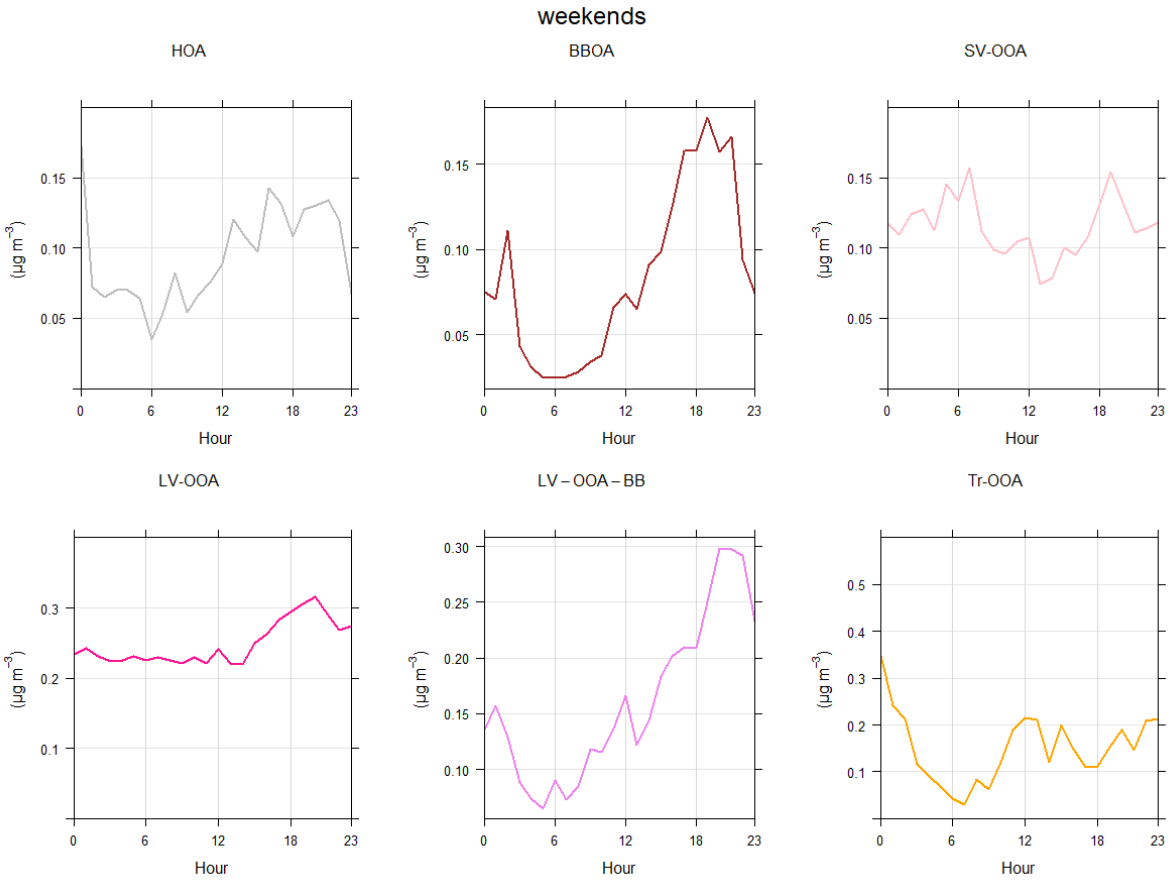

Figure S15. Hourly diurnal variations of concentrations of calculated organic fractions HOA, BBOA, SV-OOA, LV-OOA LV-OOA-BB, and Tr-OOA without episodes at the Traffic Supersite during weekends.

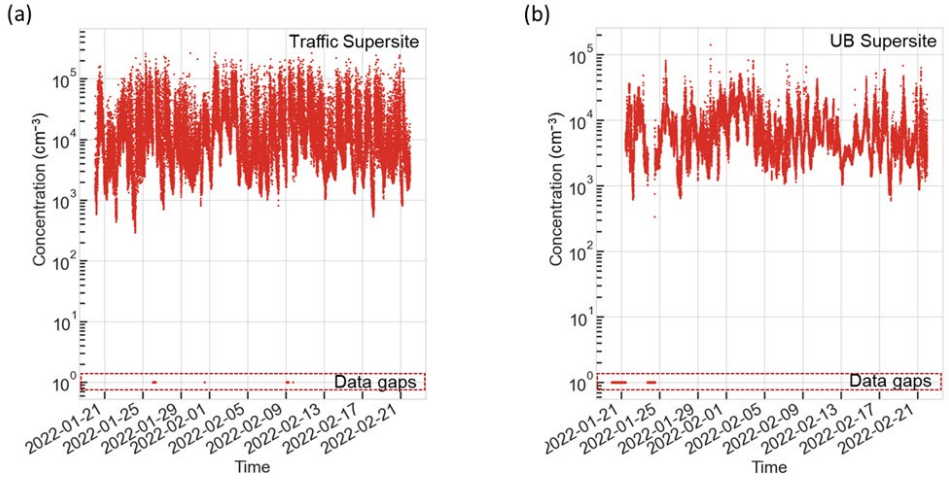

Figure S16. (a) CPC Traffic Supersite, 1 min resolution. (b) CPC UB Supersite, 1 min resolution. Data gaps (assigned to one) are shown in the bottom.

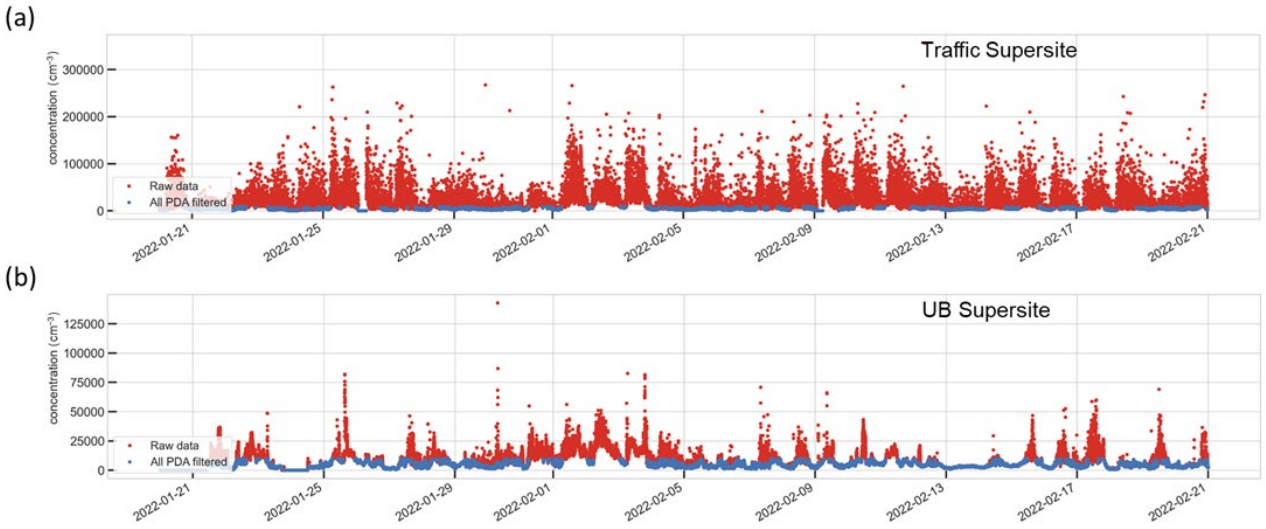

Figure S17. PDA filter results for the Traffic Supersite (a) and the UB Supersite (b). IQR derivative filter, upper threshold 10 000 cm^{-3}. See Table S