Supplement for

Disentangling Mechanistic Controls on Ultrafine Particle Number and Growth Across Seasons in an Urban Street Canyon

Yanxia Li et al.

Corresponding authors: Yanxia Li (yanxia.li@kit.edu) and Harald Saathoff (Harald.Saathoff@kit.edu)

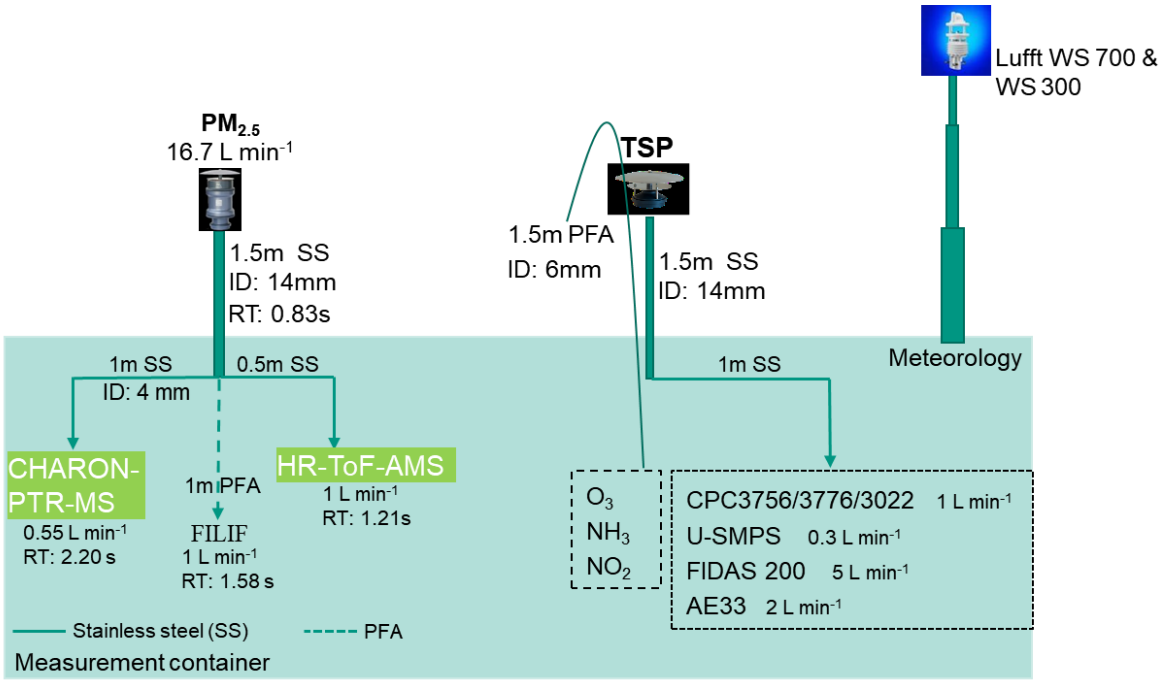

Figure **S1**: Schematic of the sampling setup showing the $PM_{2.5}$, TSP, and gas-phase inlet lines and their connections to the instruments inside the measurement container. Tube material, inner diameter (ID), line length, flow rate, and estimated residence time for each sampling line

Table S1. Pearson correlation coefficients (R) between UFP number concentrations and individual OA, SVOA, and VOC source factors, derived from PMF factor analysis for August 2023 in Munich (Li et al., 2026).

Category	Factor	R with UFP
Organic aerosol particles (OA)	**Traffic**	**0.74**
	cooking	**0.49**
	BOA	0.37
	Aged BBOA	0.42
	LVOOA	0
Semi volatile organic aerosol (SVOA)	Weakly oxidized terpene	0.19
	Iso OA & BBOA	0.08
	BBOA	0.20
	Background	0.31
	More oxidized BOA	0.19
Volatile organic compounds (VOC)	**Traffic**	**0.55**
	Oxidized BVOC	0.46
	BVOC	0.18
	Aged VOC	0.01
	Biomass burning	0.14

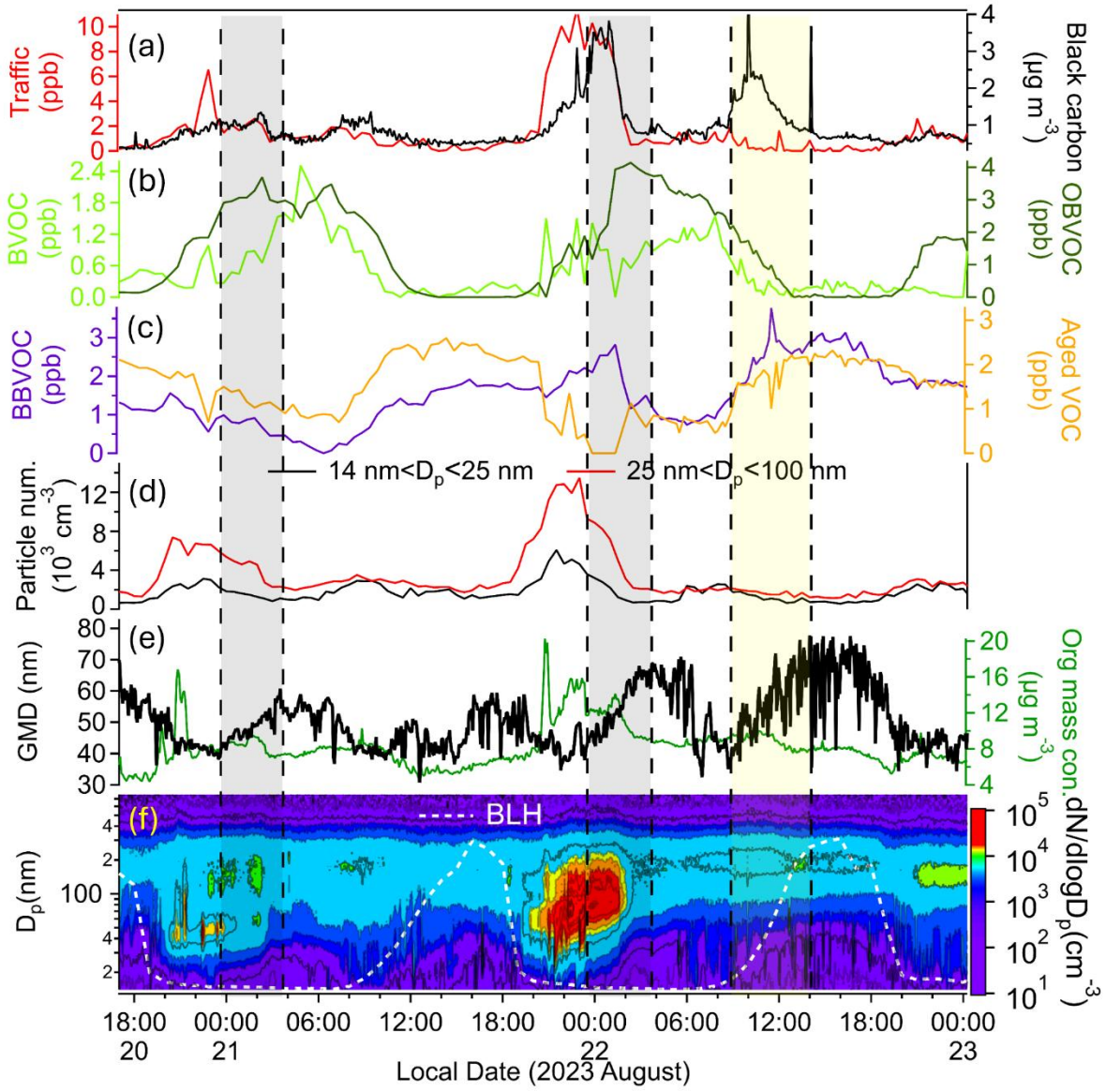

Figure S2. Evolution of VOC source factors and UFP size distribution properties during the summer period. Panels show (a) Traffic VOC and black carbon, (b) BVOC and OBVOC, (c) BBVOC and Aged VOC, (d) number concentrations of 14-25 nm and 25-100 nm particles, (e) geometric mean diameter (GMD) and total organic mass concentration, and (f) particle number size distribution ($dN/dlogD_p$) with boundary layer height (BLH). Grey shaded regions denote night non-nucleation UFP growth periods; yellow shaded region denotes a daytime UFP growth period.

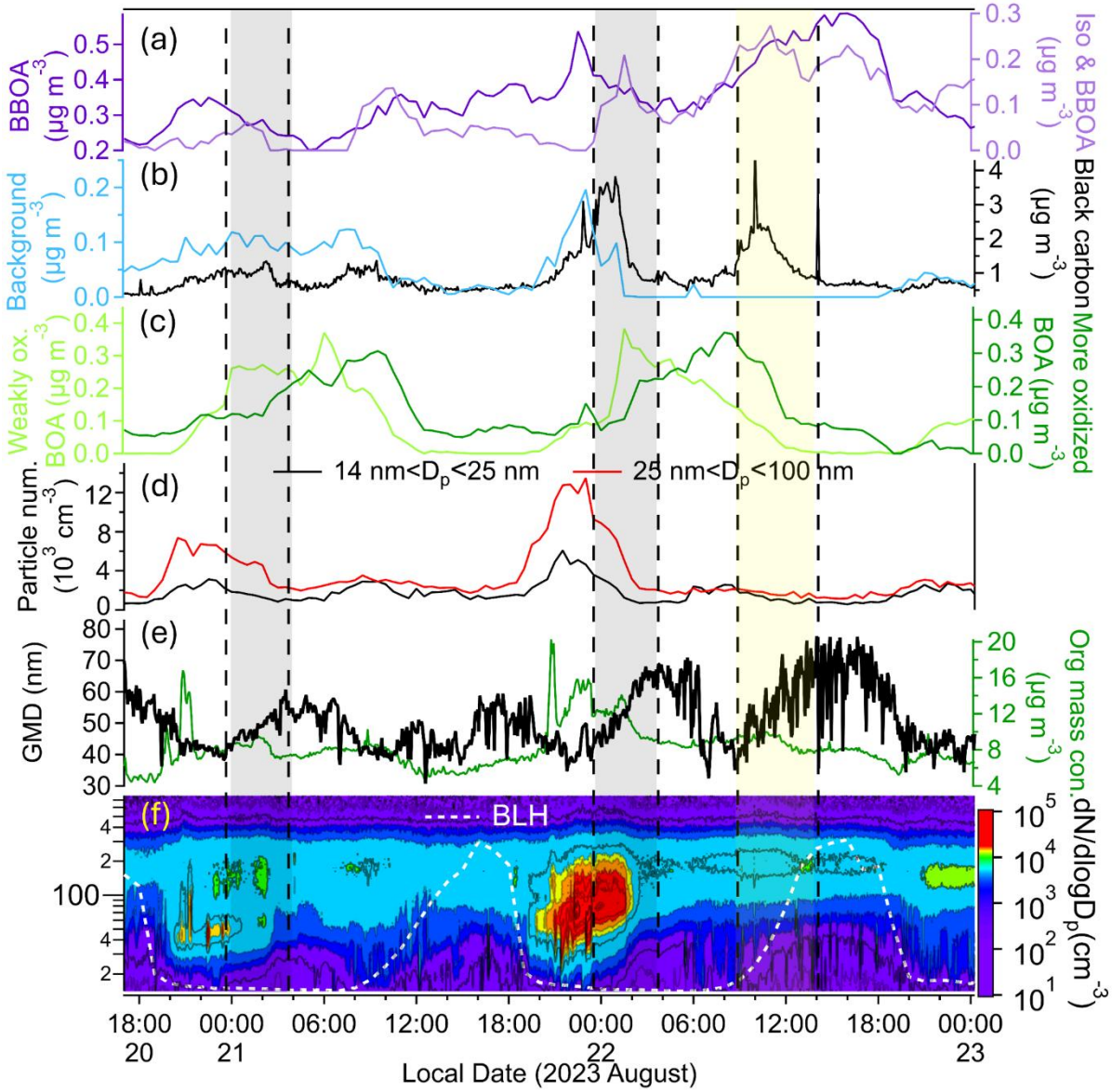

Figure S3. Evolution of SVOA source factors and UFP size distribution properties during the summer period. Panels show (a) Biomass burning OA (BBOA) and Isoprene oxidized OA & BBOA (Iso & BBOA), (b) Regional background and black carbon, (c) Weakly oxidized biogenic OA and More oxidized biogenic OA, (d) number concentrations of 14-25 nm and 25-100 nm particles, (e) geometric mean diameter (GMD) and total organic mass concentration, and (f) particle number size distribution ($dN/dlogD_p$) with boundary layer height (BLH). Grey shaded regions denote night non-nucleation UFP growth periods; yellow shaded region denotes a daytime UFP growth period.

Table S2. Pearson correlation coefficients (R) between UFP number concentrations and individual OA, SVOA, and VOC source factors, derived from PMF factor analysis for 1st -3rd March 2024 in Munich.

Category	Factor	R with UFP
Organic aerosol particles (OA)	**Traffic**	**0.75**
	Cooking	**0.69**
	Fresh BBOA	**0.79**
	Aged BBOA	0.18
	LVOOA	0.13
Semi volatile organic aerosol (SVOA)	**Night time aged BBOA**	**0.86**
	Cooking	**0.61**
	Day time aged BBOA	**0.53**
	Combustion	0.26
	Regional	**0.79**
Volatile organic compounds (VOC)	**Traffic 1**	**0.47**
	Monoterpene	0.31
	Biomass burning	-0.35
	Traffic 2	0.38
	Background	**0.73**

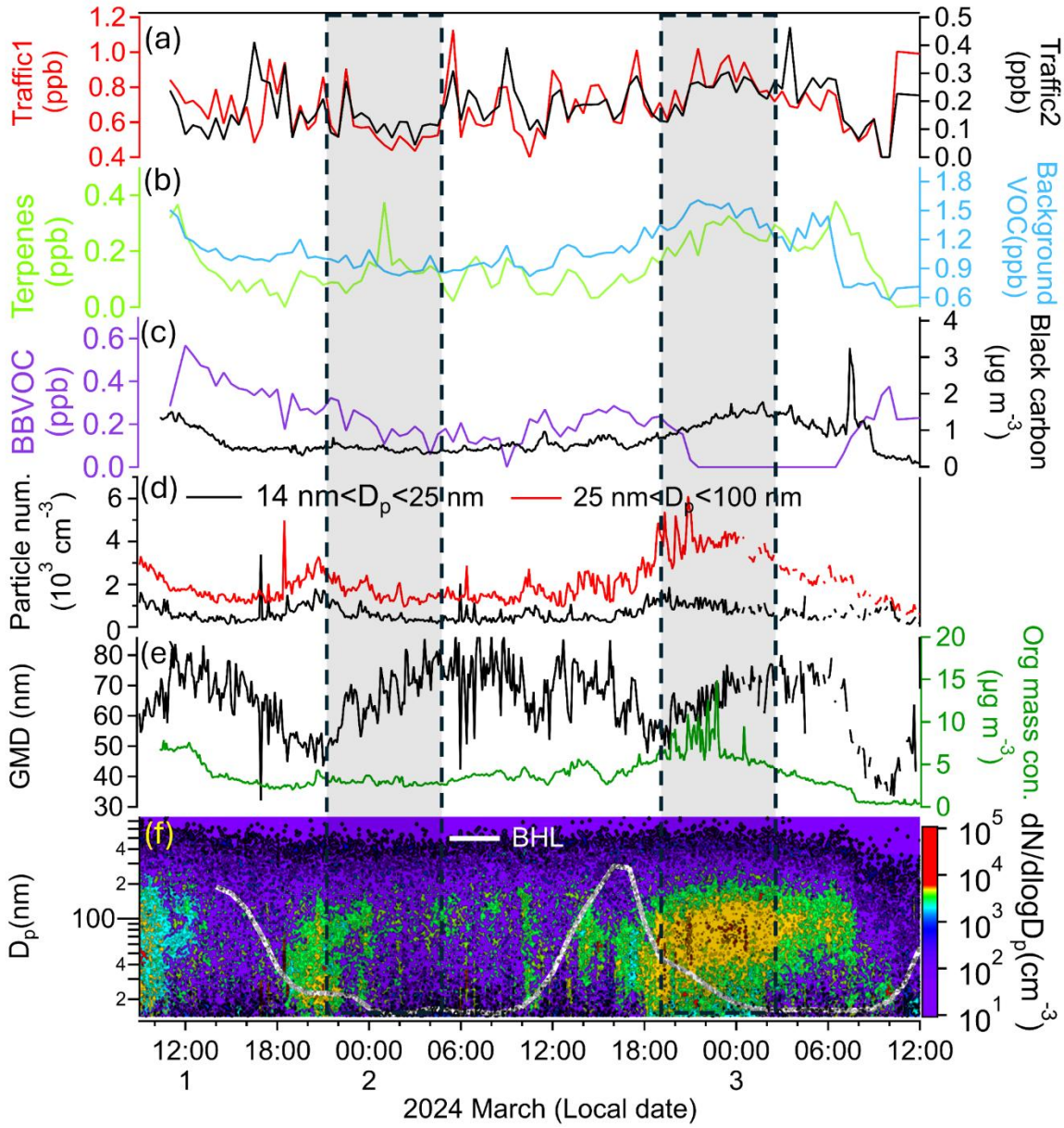

Figure S4. The evolution of VOC source factors and UFP size distribution properties during the summer period. Panels show (a) Traffic 1 VOC and Traffic 2 VOC, (b) Monoterpenes VOC and Regional background VOC, (c) BBVOC and Black carbon, (d) number concentrations of 14-25 nm and 25-100 nm particles, (e) geometric mean diameter (GMD) and total organic mass concentration, and (f) particle number size distribution ($dN/dlogD_p$) with boundary layer height (BLH). Grey shaded regions denote nighttime non-nucleation UFP growth periods.

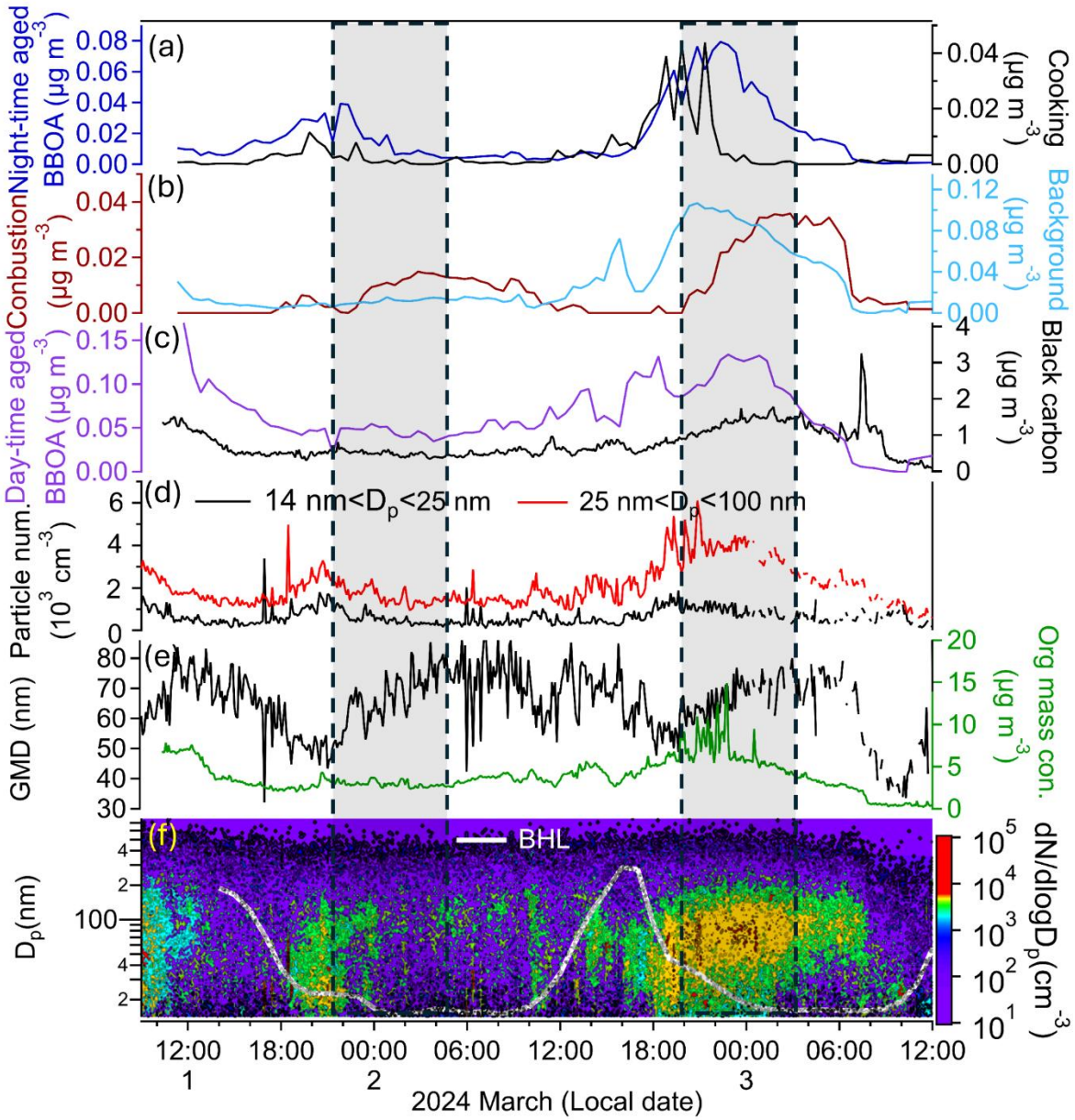

Figure S5. The evolution of SVOA source factors and UFP size distribution properties during the summer period. Panels show (a) Night-time aged BBOA and Cooking OA, (b) Combustion OA and Regional background OA, (c) Day-time aged BBOA and Black carbon, (d) number concentrations of 14-25 nm and 25-100 nm particles, (e) geometric mean diameter (GMD) and total organic mass concentration, and (f) particle number size distribution ($dN/dlogD_p$) with boundary layer height (BLH). Grey shaded regions denote nighttime non-nucleation UFP growth periods.

Table S3. Pearson correlation coefficients (R) between UFP number concentrations and individual OA, SVOA, and VOC source factors, derived from PMF factor analysis for Spring (9th - 27th March, 2024) in Munich.

Category	Factor	R with UFP
Organic aerosol particles (OA)	**Traffic**	**0.74**
	Cooking	**0.70**
	Fresh BBOA	**0.64**
	Aged BBOA	0.06
	LVOOA	-0.01
Semi volatile organic aerosol (SVOA)	**Night time aged BBOA**	**0.59**
	Cooking	**0.59**
	Day time aged BBOA	0.11
	Combustion	0.32
	Regional	0.19
Volatile organic compounds (VOC)	**Traffic 1**	**0.73**
	Monoterpene	0.43
	Biomass burning	0.36
	Traffic 2	**0.75**
	Background	-0.11

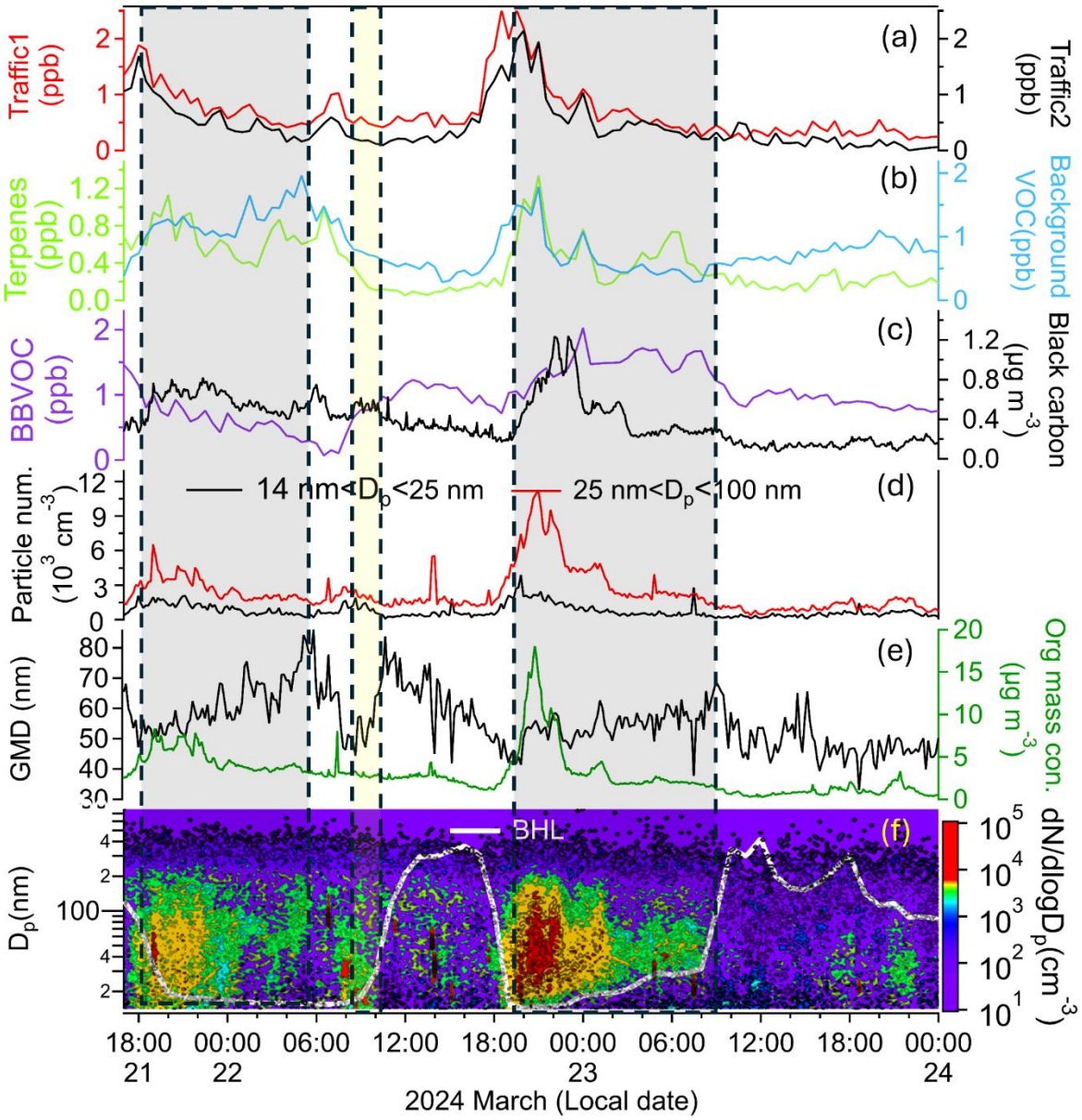

Figure S6. Representative evolution of organic aerosol source factors and UFP size distribution properties during the spring period. Panels show (a) Traffic1 VOC and Traffic2 VOC, (b) Terpenes VOC and Regional background VOC, (c) Biomass burning VOC (BBVOC) and Black carbon, (d) number concentrations of 14-25 nm and 25-100 nm particles, (e) geometric mean diameter (GMD) and total organic mass concentration, and (f) particle number size distribution ($dN/dlogD_p$) with boundary layer height (BLH). Grey shaded regions denote nighttime non-nucleation UFP growth periods; yellow shaded region denotes a daytime UFP growth period.

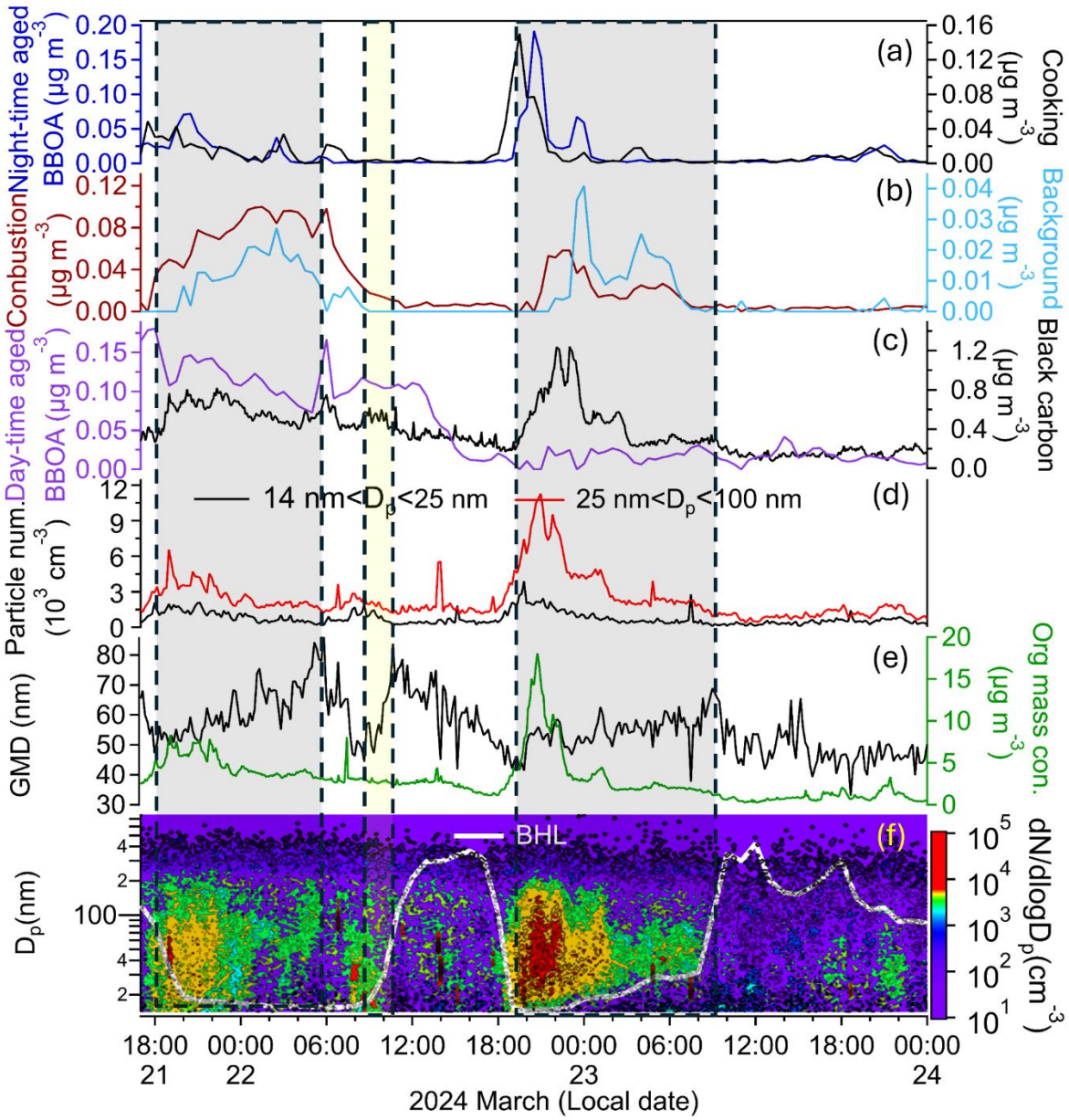

Figure S7. Representative evolution of organic aerosol source factors and UFP size distribution properties during the spring period. Panels show (a) Night-time aged BBOA and Cooking OA, (b) Combustion OA and Regional background OA, (c) Day-time aged BBOA and Black carbon, (d) number concentrations of 14-25 nm and 25-100 nm particles, (e) geometric mean diameter (GMD) and total organic mass concentration, and (f) particle number size distribution ($dN/dlogD_p$) with boundary layer height (BLH). Grey shaded regions denote nighttime non-nucleation UFP growth periods; yellow shaded region denotes a daytime UFP growth period.

Reference

Li, Y., Zhang, H., Shi, X., Li, Y., Abou-Rizk, S., Smith, J., An, Z., Wenzel, A., Song, J., Leisner, T., Keutsch, F., Chen, J., and Saathoff, H.: Sources, concentrations, and seasonal variations of VOC and aerosol particles in downtown Munich in 2023/24, EGUsphere [preprint], https://doi.org/10.5194/egusphere-2025-5191, 2026.