



Supplement of

Hygroscopic enhancement of suburban aerosol light scattering measured using a single-nephelometer system in Central Europe

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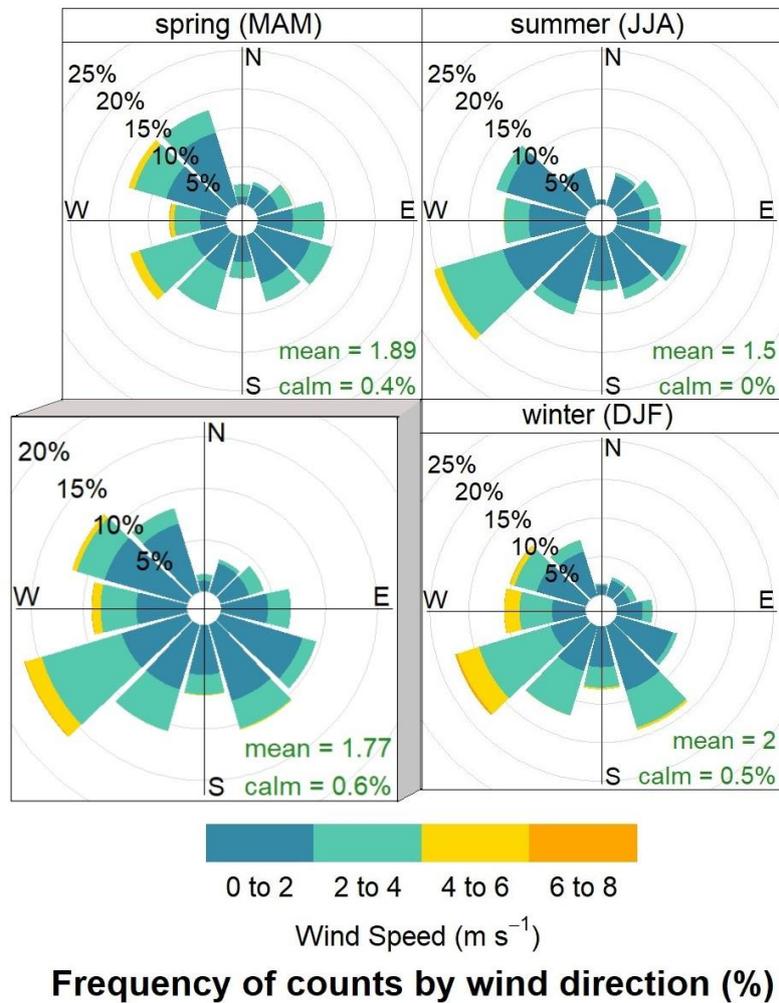


Figure S1: The frequency of counts by wind direction from November 2022 to August 2023 (see bottom left) and wind directions by seasons alongside the mean wind speed and percentage of calm days (0 ms⁻¹). It should be noted that the fall season is not presented due to an insufficient amount of data.

Table S1: Overall and seasonal data availability expressed as f(RH) and f(RH)_{bsp} data points (%) at 450, 550, and 700 nm (November 2022 – August 2023).*

	f(RH)			f(RH) _{bsp}		
	450 nm	550 nm	700 nm	450 nm	550 nm	700 nm
Whole period	5145 (77 %)	5145 (77 %)	5145 (77 %)	5134 (77 %)	5142 (77 %)	5143 (77 %)
Fall	366 (96 %)	366 (96 %)	366 (96 %)	366 (96 %)	366 (96 %)	366 (96 %)
Winter	1478 (68 %)	1478 (68 %)	1478 (68 %)	1477 (68 %)	1477 (68 %)	1477 (68 %)
Spring	1741 (79 %)	1741 (79 %)	1741 (79 %)	1739 (79 %)	1739 (79 %)	1740 (79 %)
Summer	1560 (81 %)	1560 (81 %)	1560 (81 %)	1552 (81 %)	1560 (81 %)	1560 (81 %)

* Data availability was calculated as the percentage of actual hourly measurements compared to the total possible hourly measurements within each season during the campaign period.

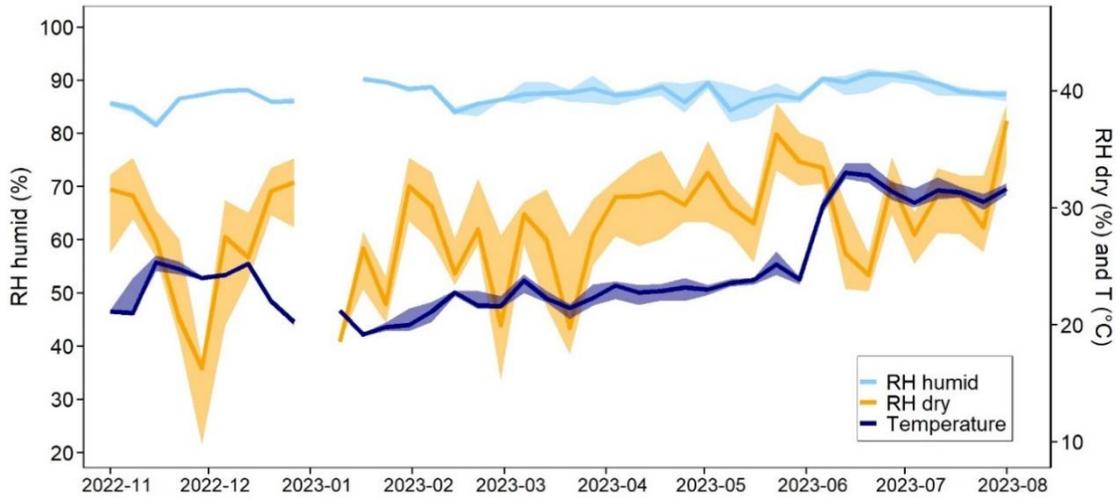


Figure S2: Variability of RH in humidified (RH humid) and dry (RH dry) mode and temperature in dry mode over the study period. Solid lines represent weekly median variation, and shaded areas 25th and 75th percentiles.

Table S2: The RH (%) and T (K) statistics in the cell during humidified and dry modes. P10, P25, P50, P75, and P90 denote respective percentiles.

	Humidified mode		Dry mode	
	RH _{cell} (%)	T _{cell} (K)	RH _{cell} (%)	T _{cell} (K)
Mean ± sd	87.34 ± 2.67	297.91 ± 4.15	28.36 ± 5.85	297.94 ± 4.16
P10	83.62	293.57	20.30	293.46
P25	85.81	295.01	25.05	294.92
P50	87.64	296.83	28.84	296.77
P75	89.31	299.13	32.43	299.29
P90	90.50	304.94	35.34	304.93

Table S3: Slopes, intercepts, and R² retrieved from the weighted bivariate fit of f(RH)_{bsp} vs. the f(RH) at λ = 550 nm. Values in brackets characterize respective uncertainties.

	Slope			Intercept			R ²		
	450 nm	550 nm	700 nm	450 nm	550 nm	700 nm	450 nm	550 nm	700 nm
Whole	0.755 (0.008)	0.633 (0.003)	0.502 (0.005)	0.248 (0.011)	0.285 (0.005)	0.414 (0.008)	0.64	0.88	0.72
Fall	0.681 (0.016)	0.453 (0.007)	0.779 (0.017)	0.385 (0.022)	0.527 (0.009)	-0.028 (0.030)	0.84	0.93	0.85
Winter	0.850 (0.014)	0.723 (0.004)	0.511 (0.007)	0.131 (0.019)	0.172 (0.006)	0.397 (0.013)	0.71	0.95	0.77
Spring	0.751 (0.013)	0.661 (0.006)	0.440 (0.007)	0.264 (0.019)	0.257 (0.008)	0.537 (0.013)	0.65	0.89	0.68
Summer	0.720 (0.021)	0.673 (0.007)	0.431 (0.007)	0.265 (0.029)	0.207 (0.010)	0.519 (0.013)	0.44	0.84	0.70

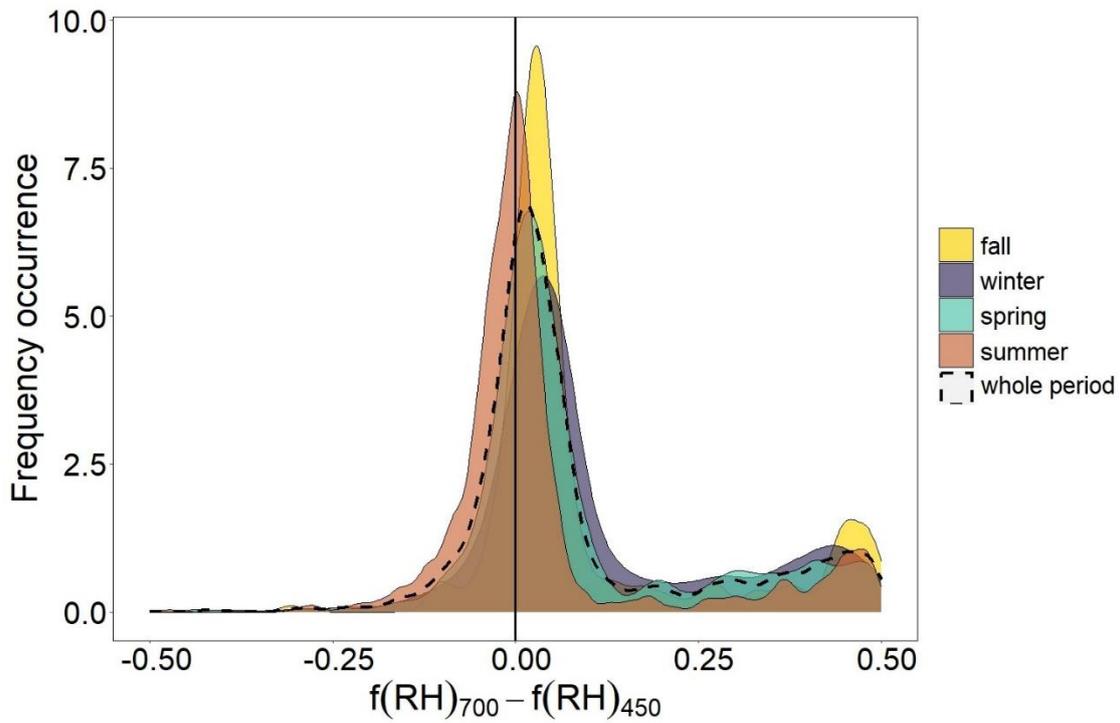


Figure S3: Frequency occurrence of $f(\text{RH})$ measured at 700 and 450 nm for the whole measurement campaign and the individual seasons.

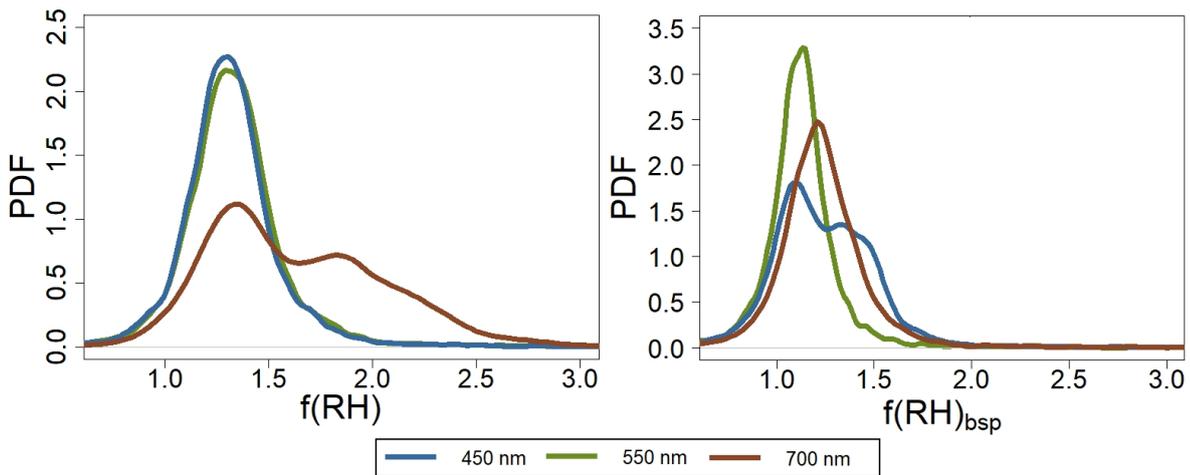


Figure S4: The probability density functions (PDF) of the $f(\text{RH})$ (left) and the $f(\text{RH})_{\text{bsp}}$ (right) at 450, 550, and 700 nm for the whole measuring campaign (November 2022 – August 2023).

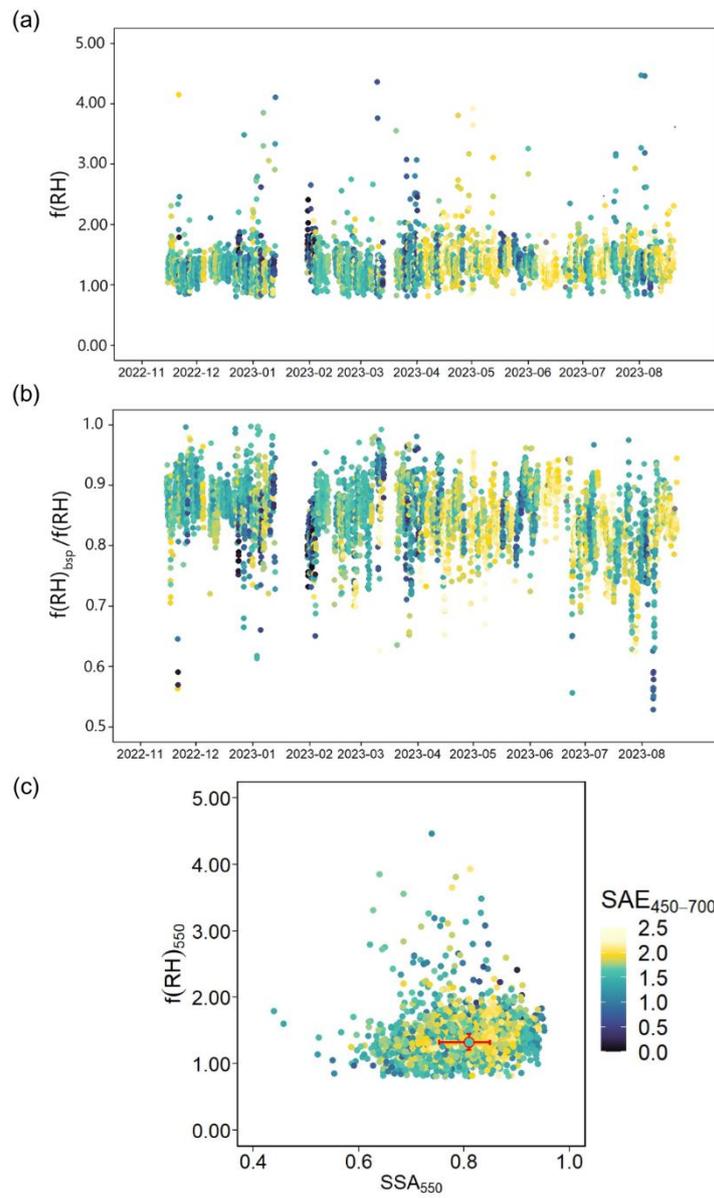


Figure S5: Temporal variation of $f(\text{RH})$ (a) and the ratio of $f(\text{RH})_{\text{bsp}}$ and $f(\text{RH})$ (b) at 550 nm, color-coded with a dry $\text{SAE}_{450-700}$. Scatterplot of the $f(\text{RH})$ at 550 nm vs SSA_{550} during the campaign, color-coded with median $\text{SAE}_{450-700}$ (c). The red circle with red error bars estimated the median point with interquartile ranges.

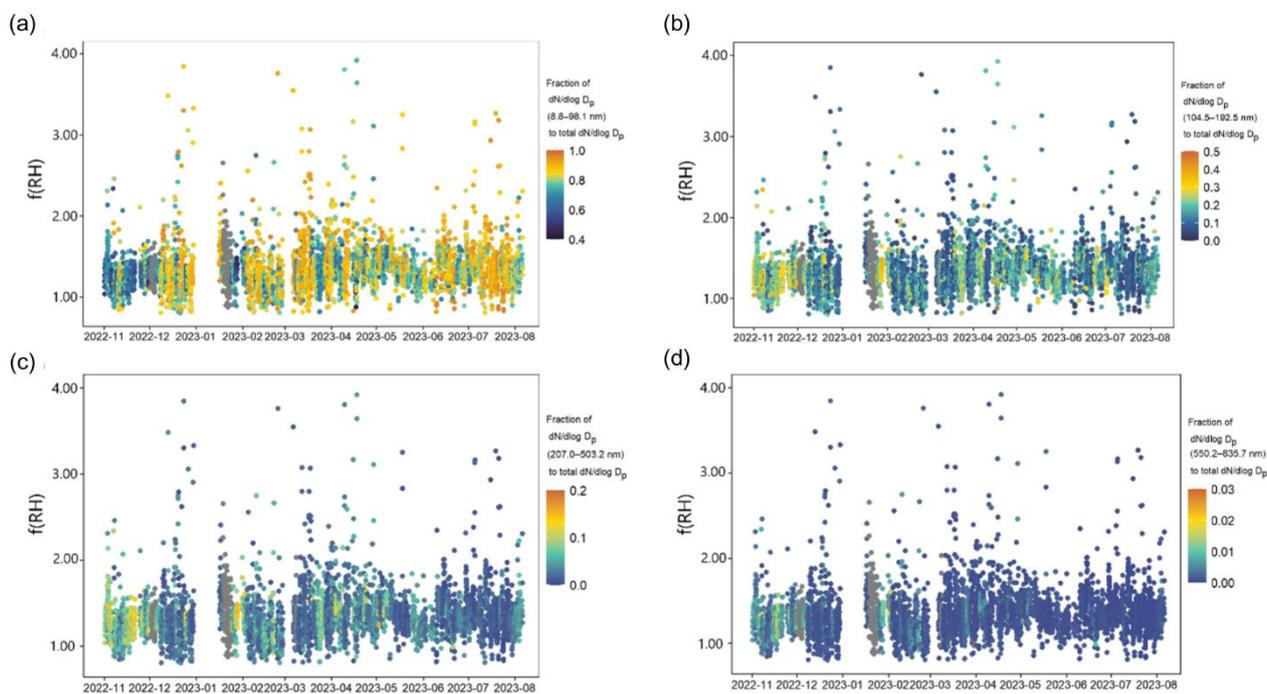


Figure S6: Temporal variation of $f(\text{RH})$ at 550 nm color-coded with the fraction of the size selected $dN/d\log D_p$ to the overall $dN/d\log D_p$. $8.8 \text{ nm} < D_p < 98.1 \text{ nm}$ (a), $104.5 \text{ nm} < D_p < 192.5 \text{ nm}$ (b), $207.0 \text{ nm} < D_p < 503.2 \text{ nm}$ (c), and $550.2 \text{ nm} < D_p < 835.7 \text{ nm}$ (d). It should be noted that the fractions of the respective size modes have different scales for better readability. The gray points represent missing PNSD measurements.

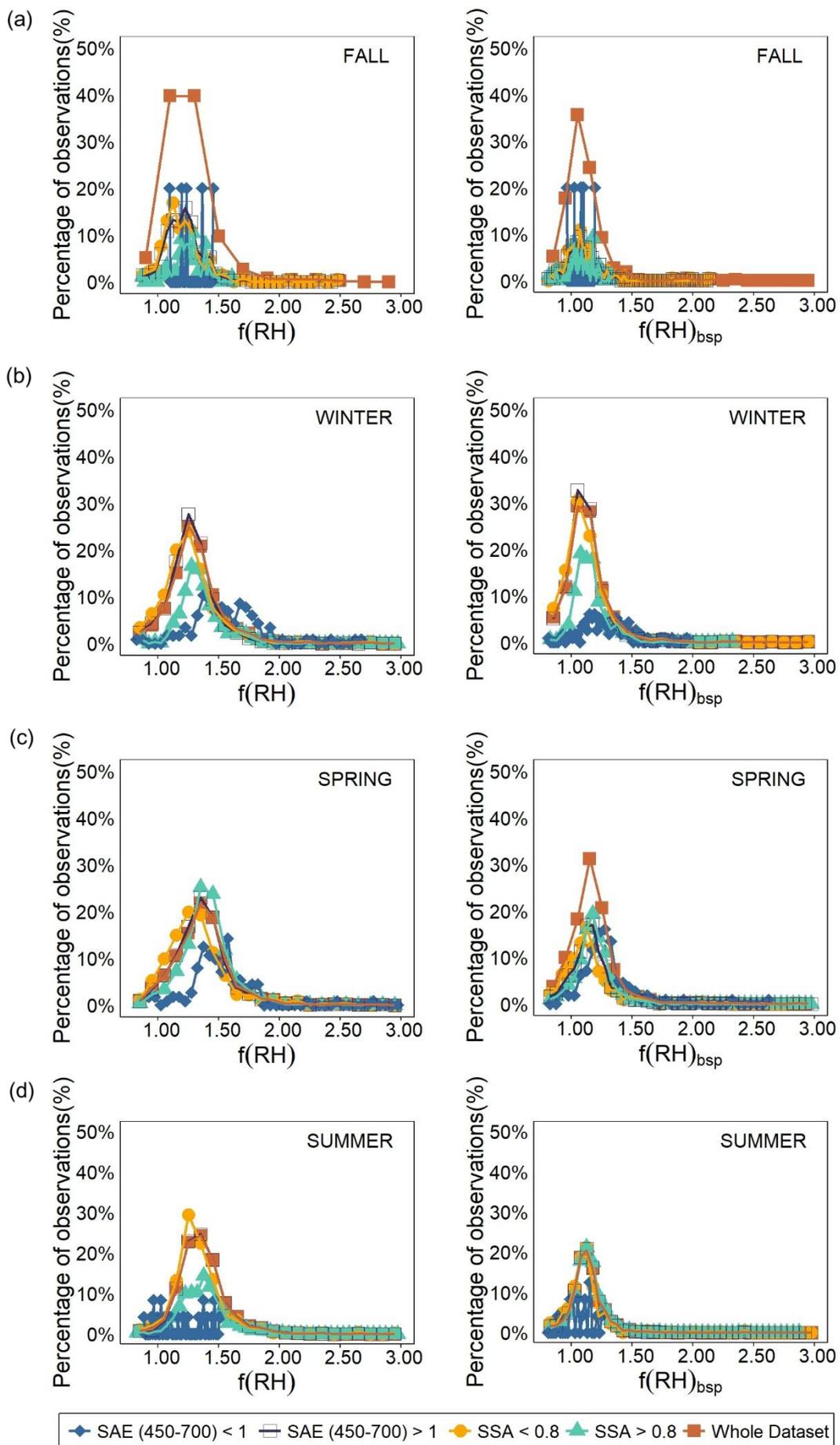


Figure S7: Frequency distribution of $f(\text{RH})$ (left) and $f(\text{RH})_{\text{bsp}}$ (right) at 550 nm during fall (a), winter (b), spring (c), and summer (d), color and symbol-coded based on $\text{SAE}_{450-700}$ and SSA_{550} .

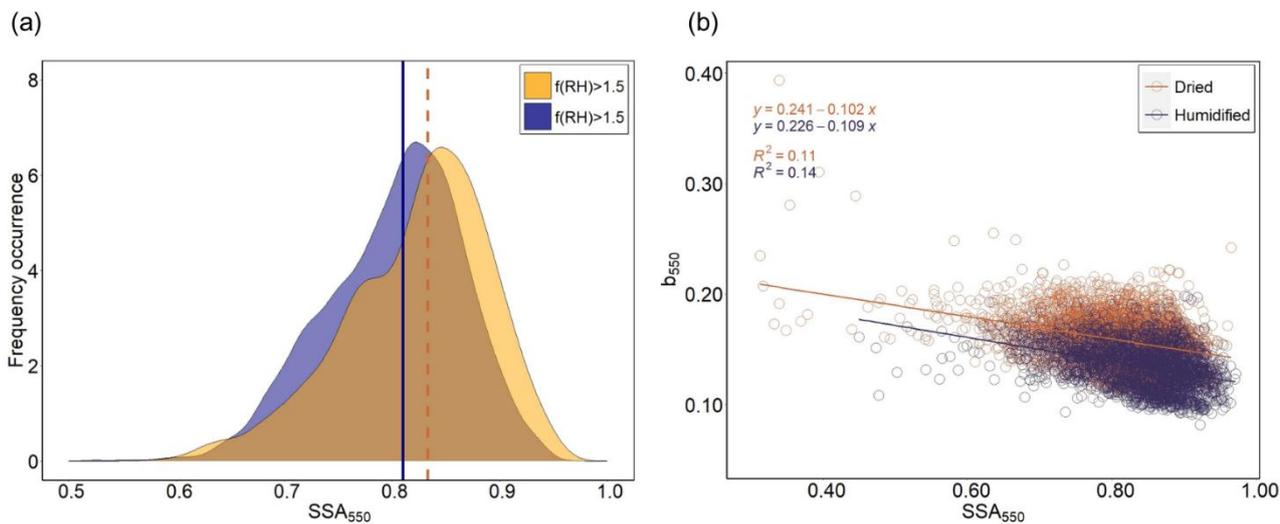


Figure S8: Frequency distribution of dry SSA₅₅₀ for f(RH) > 1.5 (ochre) and f(RH) < 1.5 (purple) with respective median values (vertical solid purple line for f(RH) < 1.5 and vertical dashed line for f(RH) > 1.5 represents median value of SSA₅₅₀ for f(RH) > 1.5, respectively) (a). Relationship between b₅₅₀ and SSA₅₅₀ at dried (orange) and humidified (purple) conditions (b).

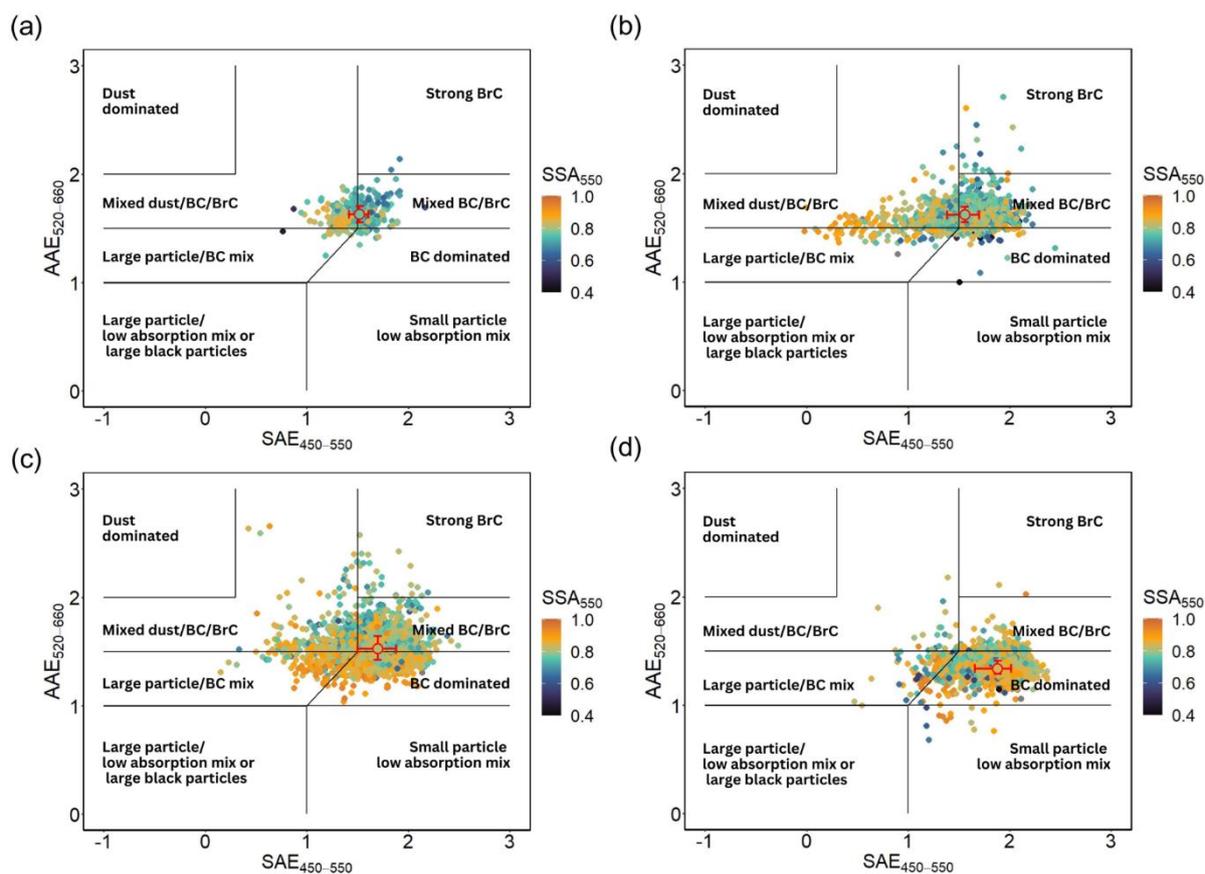


Figure S9: AAE₅₂₀₋₆₆₀ vs. SAE₄₅₀₋₅₅₀ hourly means color-coded with SSA₅₅₀ with the aerosol characterization matrix for fall (a), winter (b), spring (c), and summer (d) adopted from Cappa et al. (2016) and Cazorla et al. (2013). The red circle with red error bars estimated the median AAE₅₂₀₋₆₆₀-SAE₄₅₀₋₅₅₀ point with interquartile ranges. The circle color is coded by the median of SSA₅₅₀.

Table S4: Spearman correlation coefficients between $f(\text{RH})$ and $f(\text{RH})_{\text{bsp}}$ at 550 nm and the concentration of total carbon (TC), organic carbon (OC), elemental carbon (EC), primary organic carbon (POC), secondary organic carbon (SOC), the ratio of SOC and OC, the ratio of more volatile OC fractions (OC1+OC2) to less volatile OC fractions (OC3+OC4) and the ratio of OC and EC for whole period and individual seasons. Bold coefficients are significant at $p < 0.0001$.

Spearman correlation coefficients R							
		f(RH)	f(RH) _{bsp}		f(RH)	f(RH) _{bsp}	
TC	Whole	-0.30	-0.13	OC	Whole	-0.28	-0.12
	Fall	-0.38	-0.15		Fall	-0.38	-0.16
	Winter	-0.33	< 0.01		Winter	-0.22	< 0.01
	Spring	-0.25	-0.12		Spring	-0.23	< 0.01
	Summer	-0.33	-0.17		Summer	-0.32	-0.18
EC	Whole	-0.33	-0.17	POC	Whole	-0.33	-0.17
	Fall	-0.36	-0.11		Fall	-0.36	-0.11
	Winter	-0.20	< 0.01		Winter	-0.20	< 0.01
	Spring	-0.30	-0.24		Spring	-0.31	-0.24
	Summer	-0.30	-0.12		Summer	-0.30	-0.12
SOC	Whole	-0.20	< 0.01	SOC/OC	Whole	0.29	0.17
	Fall	-0.30	-0.13		Fall	0.14	< 0.01
	Winter	-0.22	< 0.01		Winter	0.17	< 0.01
	Spring	-0.13	< 0.01		Spring	0.31	0.30
	Summer	-0.28	-0.17		Summer	0.21	< 0.01
OC1+OC2/O C3+OC4	Whole	0.30	0.18	OC/EC	Whole	0.29	0.17
	Fall	0.02	< 0.01		Fall	0.14	< 0.01
	Winter	0.21	0.12		Winter	0.17	< 0.01
	Spring	0.43	0.28		Spring	0.31	0.30
	Summer	0.22	0.16		Summer	0.19	< 0.01
OC/TC	Whole	0.29	0.17				
	Fall	0.16	< 0.01				
	Winter	0.17	< 0.01				
	Spring	0.32	0.30				
	Summer	0.19	< 0.01				