



Supplement of

Aerosol absorption using in situ filter-based photometers and ground-based sun photometry in the Po Valley urban atmosphere

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Table S1: Summary table of meteorological variables in Modena during the investigated period.

Variable	Weekdays			Holidays		
	med	25th q	75th q	med	25th q	75th q
Mixing layer height (m)	81	38	243	101	39	289
Global downward radiation (W m^{-2})	1	-1	93	1	-1	59
Relative humidity (%)	76	59	89	86	67	95
Mean atmospheric temperature ($^{\circ}\text{C}$)	5.7	3.2	8.5	5.2	3.4	7.3

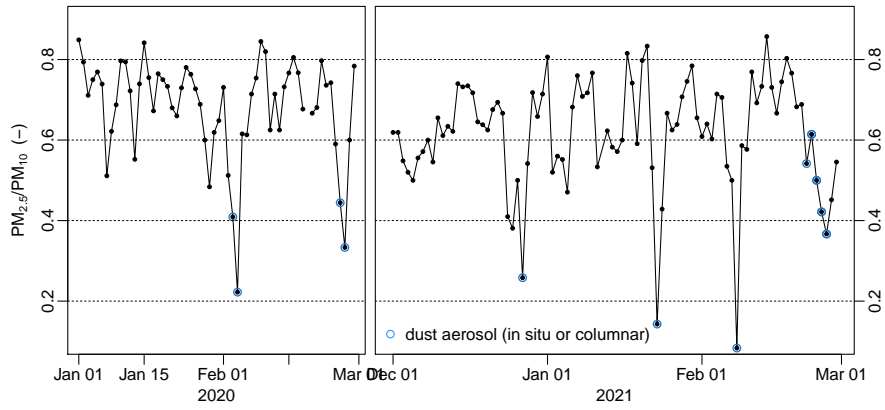


Figure S1: Time series of daily PM_{2.5} / PM₁₀ ratio at the urban background site.

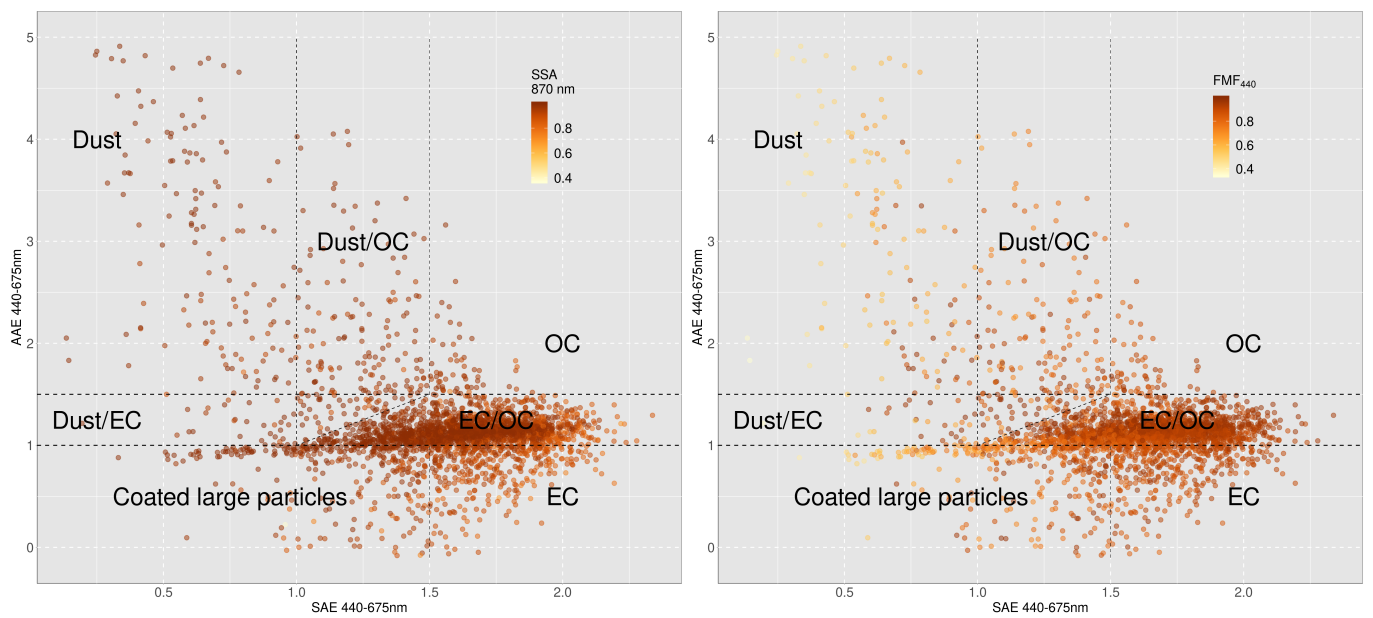


Figure S2: Preliminary classification of AERONET retrievals in Modena (Jan 2016– June 2021) based on Cazorla et al. (2013).

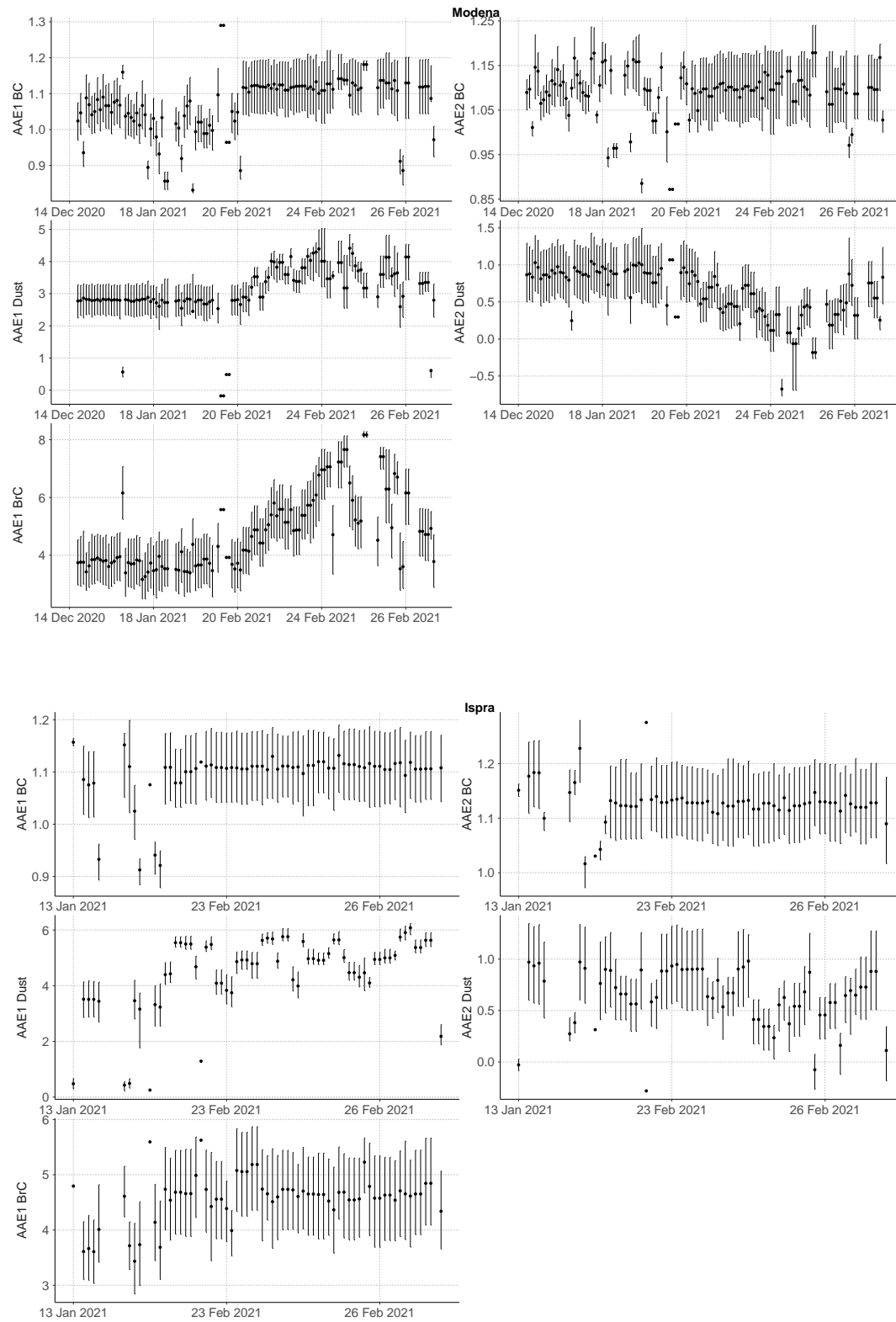


Figure S3: Time series of AAEs resulting from the apportionment of AAOD retrievals in Modena (top panel) and Ispra (lower panel). Vertical bars represent the 25th-75th quantile range.

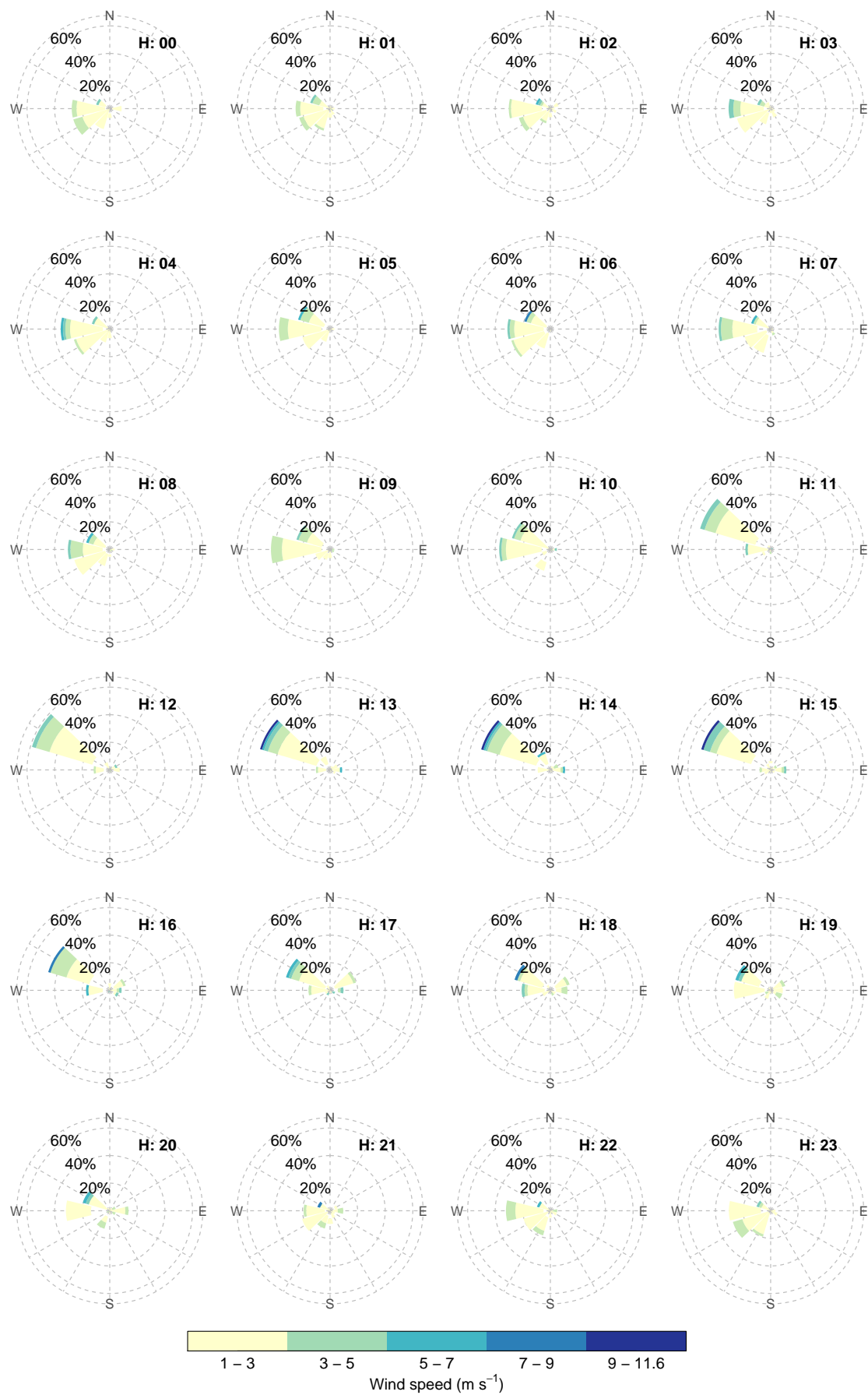


Figure S4: Hourly wind rose (in local time) for Modena during the investigated period

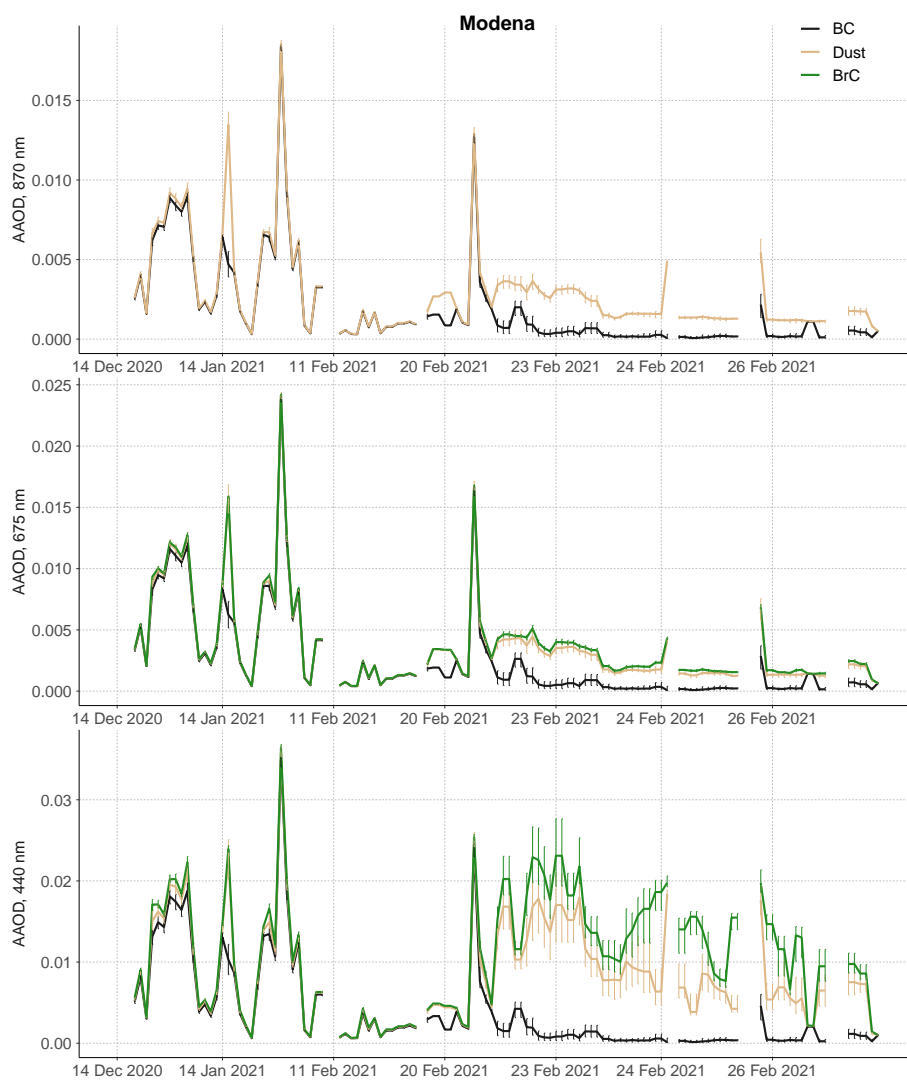


Figure S5: Total AAOD in Modena apportioned to BC, Dust and BrC, represented as stacked lines, based on Bahadur et al. (2012) and tailored AAE estimates: the black line represents the AAOD by BC, the brown line represents the sum of the AAOD by BC and dust, the green line represents the total AAOD with the contribution of BrC summed to the AAOD by BC and dust. For a better readability the scale of the x-axis is fixed and not proportional to time.

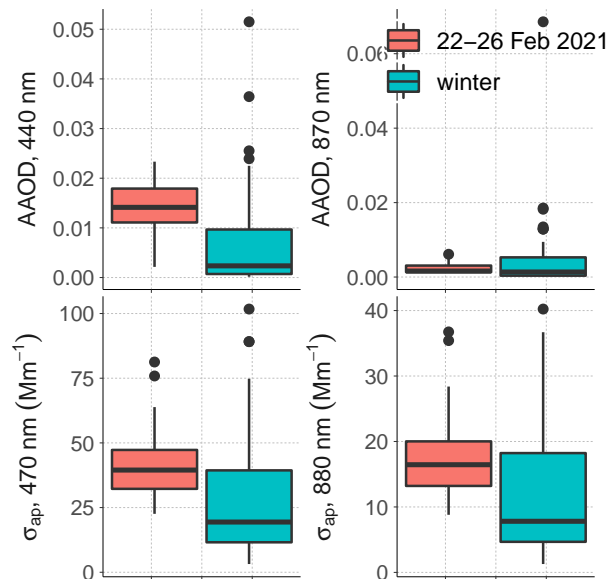


Figure S6: Boxplot of AAOD and σ_{ap} in Blue and IR for the whole winter dataset and for 22-26 Feb 2021 in Modena.

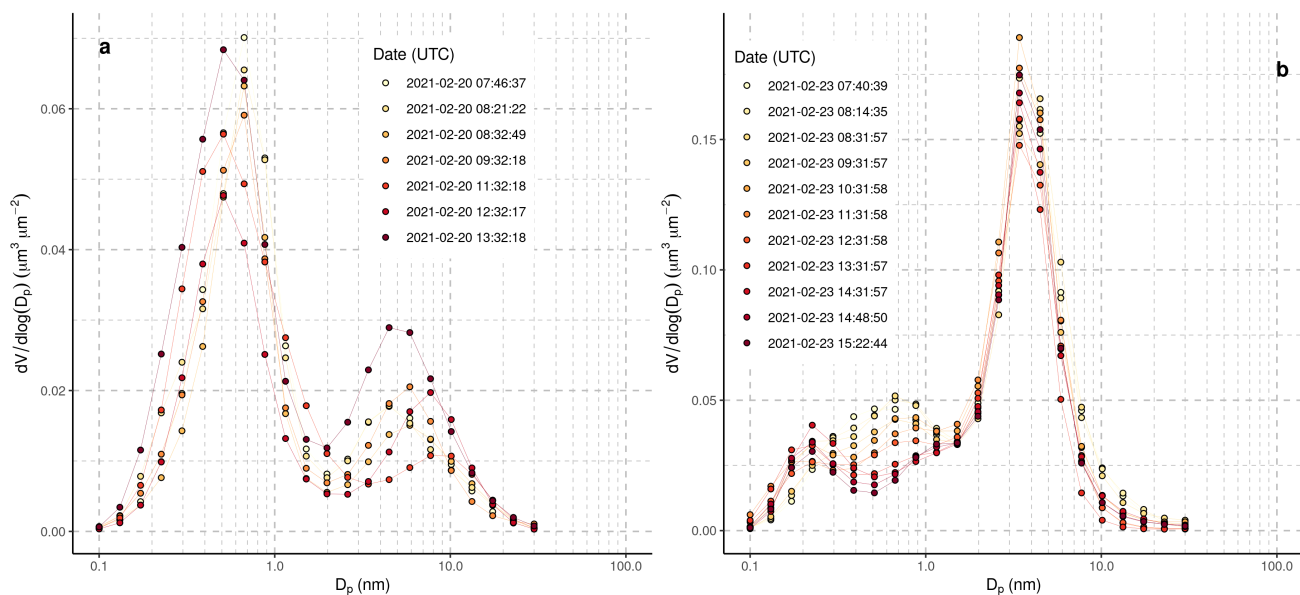


Figure S7: Volume size distribution by AERONET inversion in Modena for Feb 20th 2021 (left) and Feb 23rd 2021 (right).

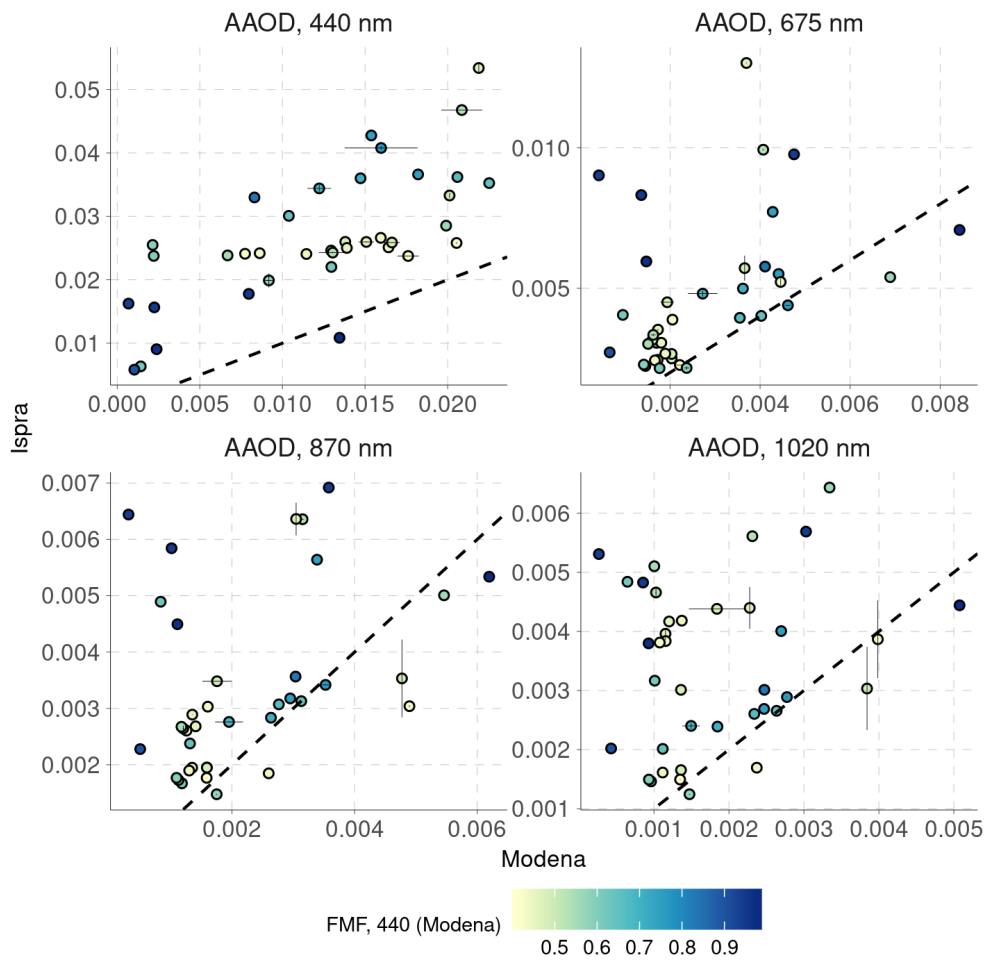


Figure S8: Comparison of hourly median AAOD retrieved in Modena and Ispra at 4 wavelength during the investigated period, color-coded according to the Fine Mode Fraction (FMF) at 440 nm. The dashed line indicates the 1:1 line.

References

- Bahadur, R., Praveen, P. S., Xu, Y., and Ramanathan, V.: Solar absorption by elemental and brown carbon determined from spectral observations, *Proceedings of the National Academy of Sciences*, 109, 17 366–17 371, <https://doi.org/10.1073/pnas.1205910109>, 2012.
- Cazorla, A., Bahadur, R., Suski, K. J., Cahill, J. F., Chand, D., Schmid, B., Ramanathan, V., and Prather, K. A.: Relating aerosol absorption due to soot, organic carbon, and dust to emission sources determined from in-situ chemical measurements, *Atmospheric Chemistry and Physics*, 13, 9337–9350, <https://doi.org/10.5194/acp-13-9337-2013>, 2013.