Supplement of Atmos. Chem. Phys., 26, 155–169, 2026
https://doi.org/10.5194/acp-26-155-2026-supplement

Atmospheric Chemistry and Physics
Open Access
EGU

Supplement of

Measurement report: Lessons learned from the comparison and combination of fine carbonaceous aerosol source apportionment at two locations in the city of Strasbourg, France

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S0. ACSM data analysis

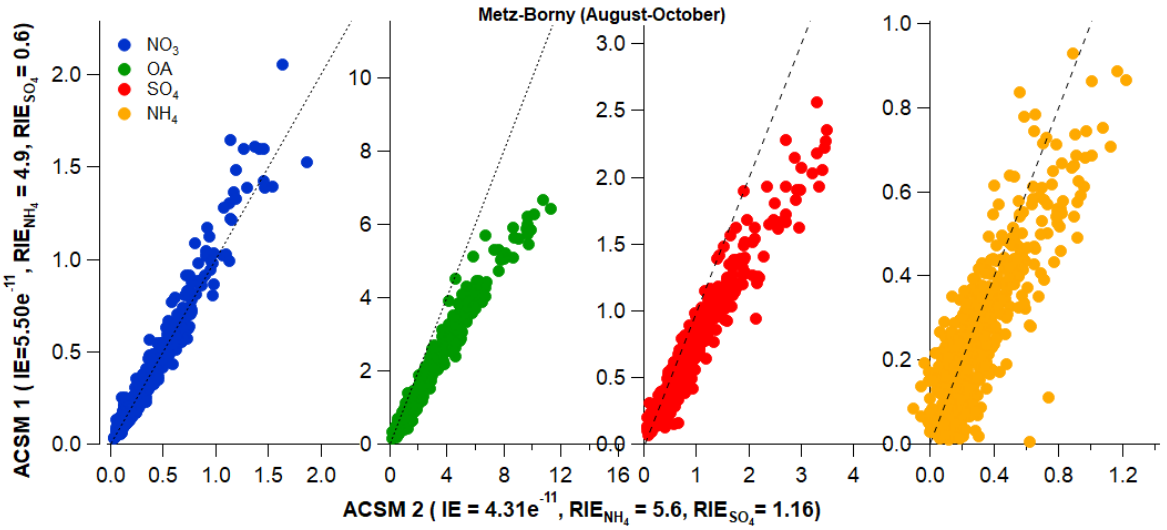


Figure S1: Scatter plots between ACSM #1 (further deployed at the Clemenceau site) and #2 (deployed at the Danube site) for non-refractory chemical species (OA, NO_3, NH_4, and SO_4), while measuring at the Metz-Borny site from August to October 2019. RIE refers to relative ionization efficiency.

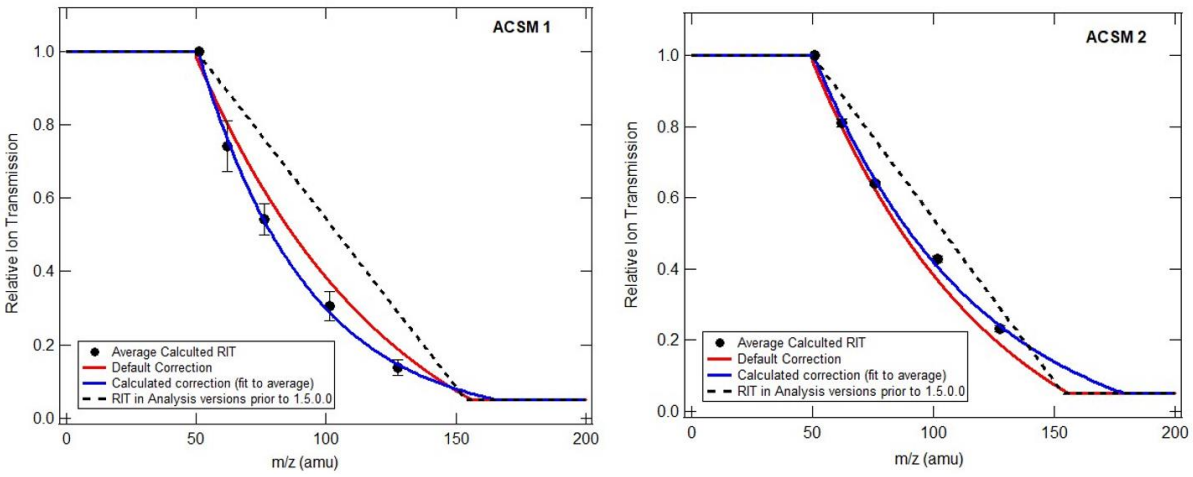


Figure S2: Relative ion transmission (RIT) as a function of m/z for ACSM #1 (Clemenceau) and #2 (Danube).

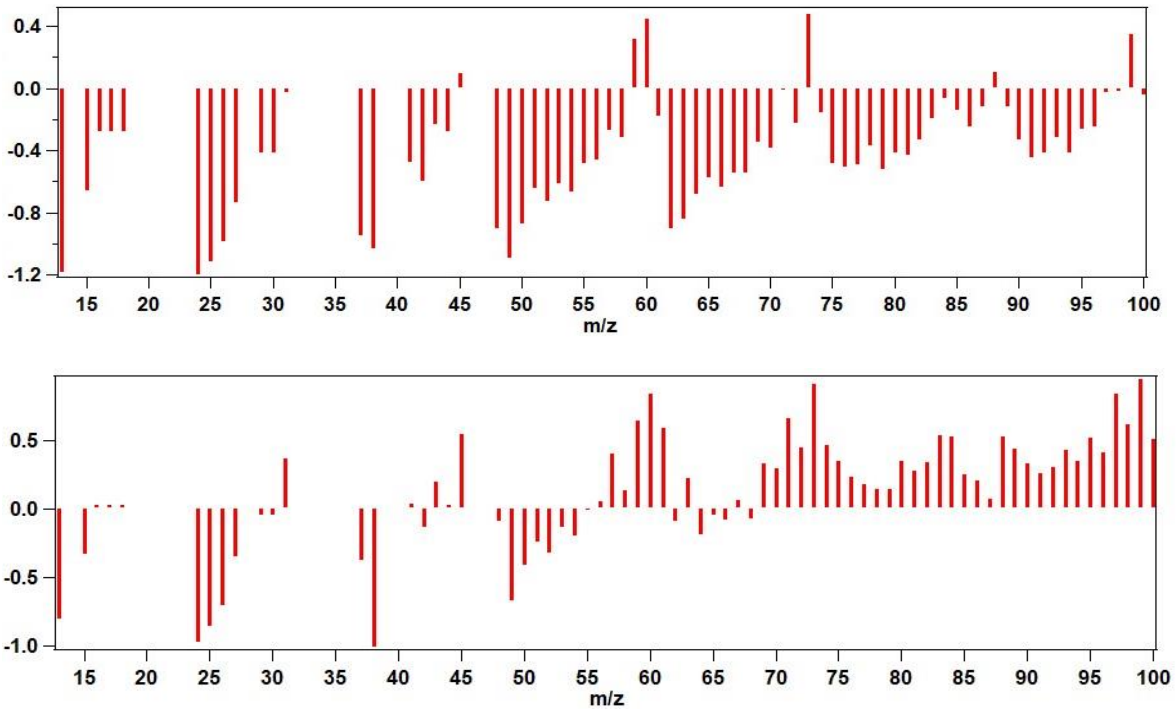


Figure S3: Comparison of the intensities of the different m/z fragments of the average OA mass spectra of ACSM #1 (Clemenceau) and #2 (Danube), normalized by the total OA intensity. Upper panel: during the pre-campaign intercomparison exercise in Metz-Borny; Lower panel: during concomitant measurements at both sites in Strasbourg.

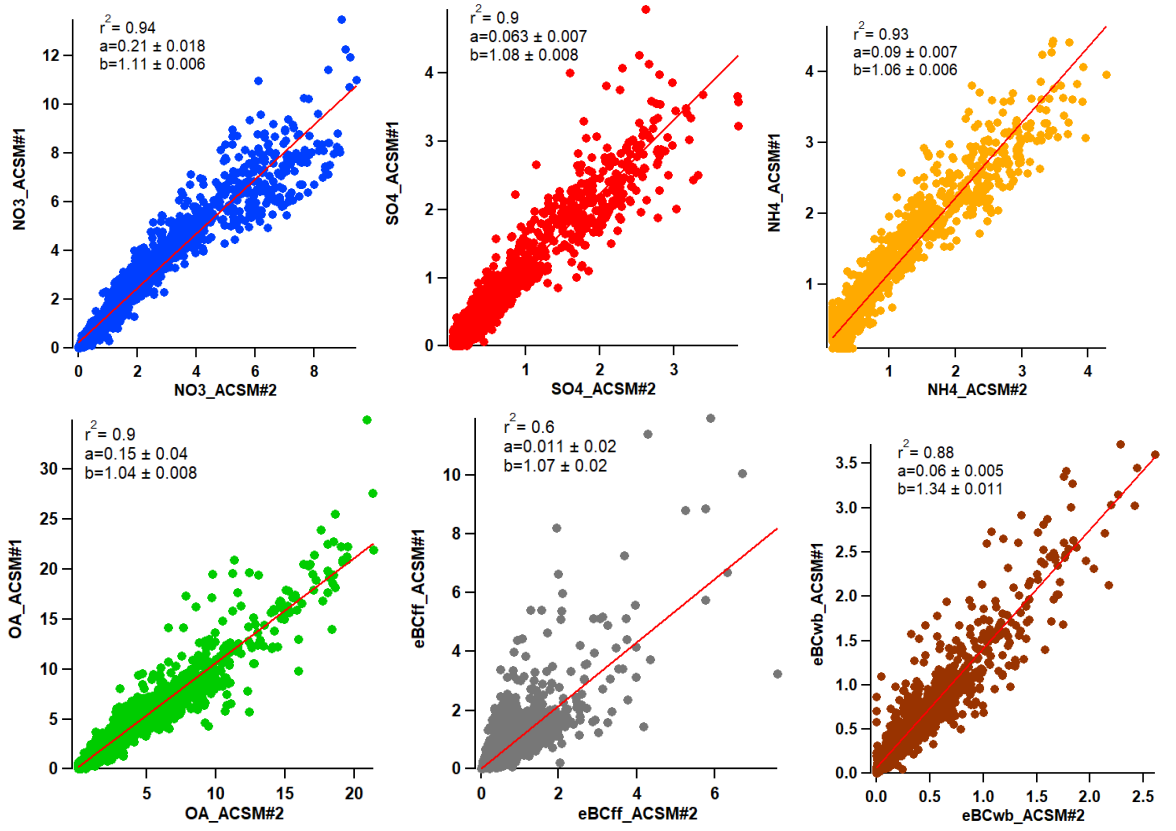


Figure S4: Scatter plots between ACSM #1 (further deployed at the Clemenceau site) and #2 (deployed at the Danube site) for the chemical species (OA, NO3, NH4, SO4, eBCff and eBCwb) (the b values represent the slopes).

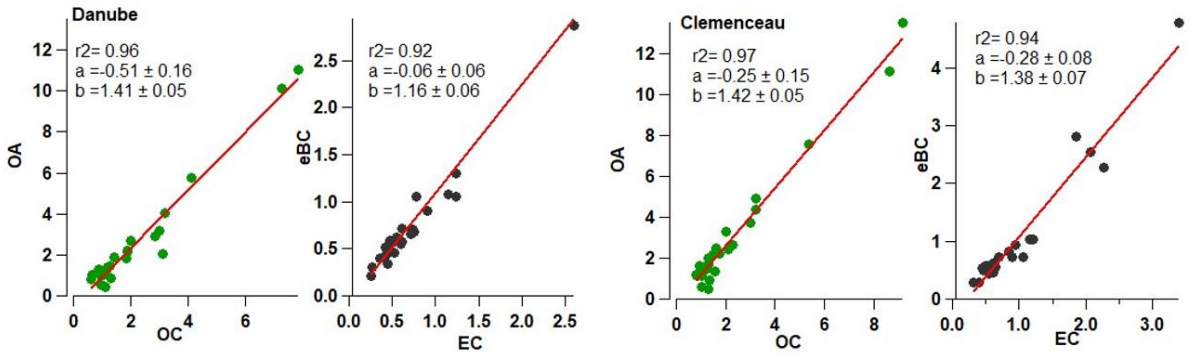
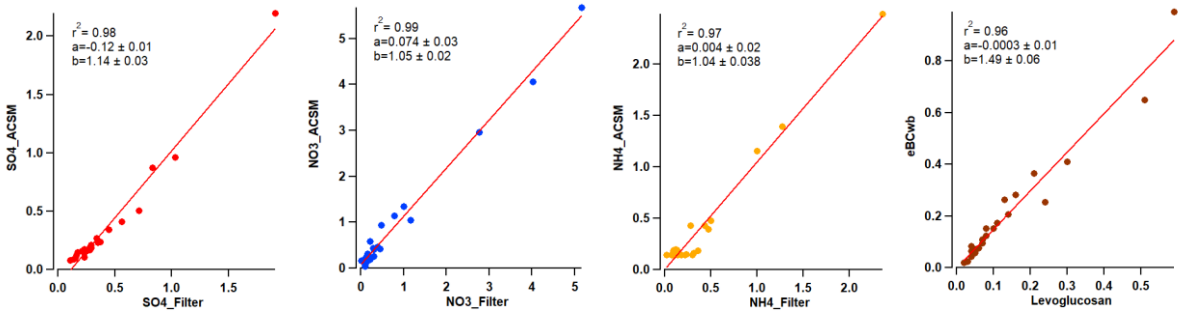


Figure S5: Scatter plots of OA vs. OC and eBC vs. EC in PM_1 for both Strasbourg sites: Danube (left) and Clemenceau (right).

Figure S6 shows the comparison between the filter's measurement and the ACSM/AE33 species for the Danube and Clemenceau sites. The results for ACSM species (SO_4, NO_3, and NH_4) showed very good correlation coefficient values ($r^2 > 0.9$) for both sites, with ratios of approximately 1 for the Danube site and ratios of approximately 1.2 and 1.3 for the Clemenceau site, showing a good agreement between ACSM chemical species and offline measurements. For the eBC_{wb} vs. levoglucosan comparison, the differences are important with a ratio of 1.5 for the Danube site and around 2.5 for the Clemenceau site. This can be explained by both emission sources and the methodological separation of eBC fractions. As Clemenceau is a traffic-dominated urban site, the separation between eBC_{wb} and eBC_{ff} is not always well-defined, leading to potential overestimation of eBC_{wb} and higher eBC_{wb}/levoglucosan ratio.

Danube



Clemenceau

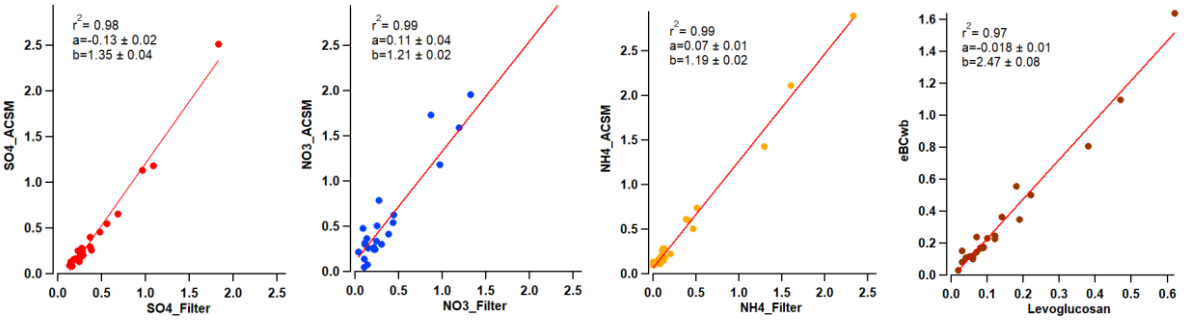


Figure S6: Scatter plots of ACSM/AE33 species vs. offline measurements for both Strasbourg sites: Danube and Clemenceau.

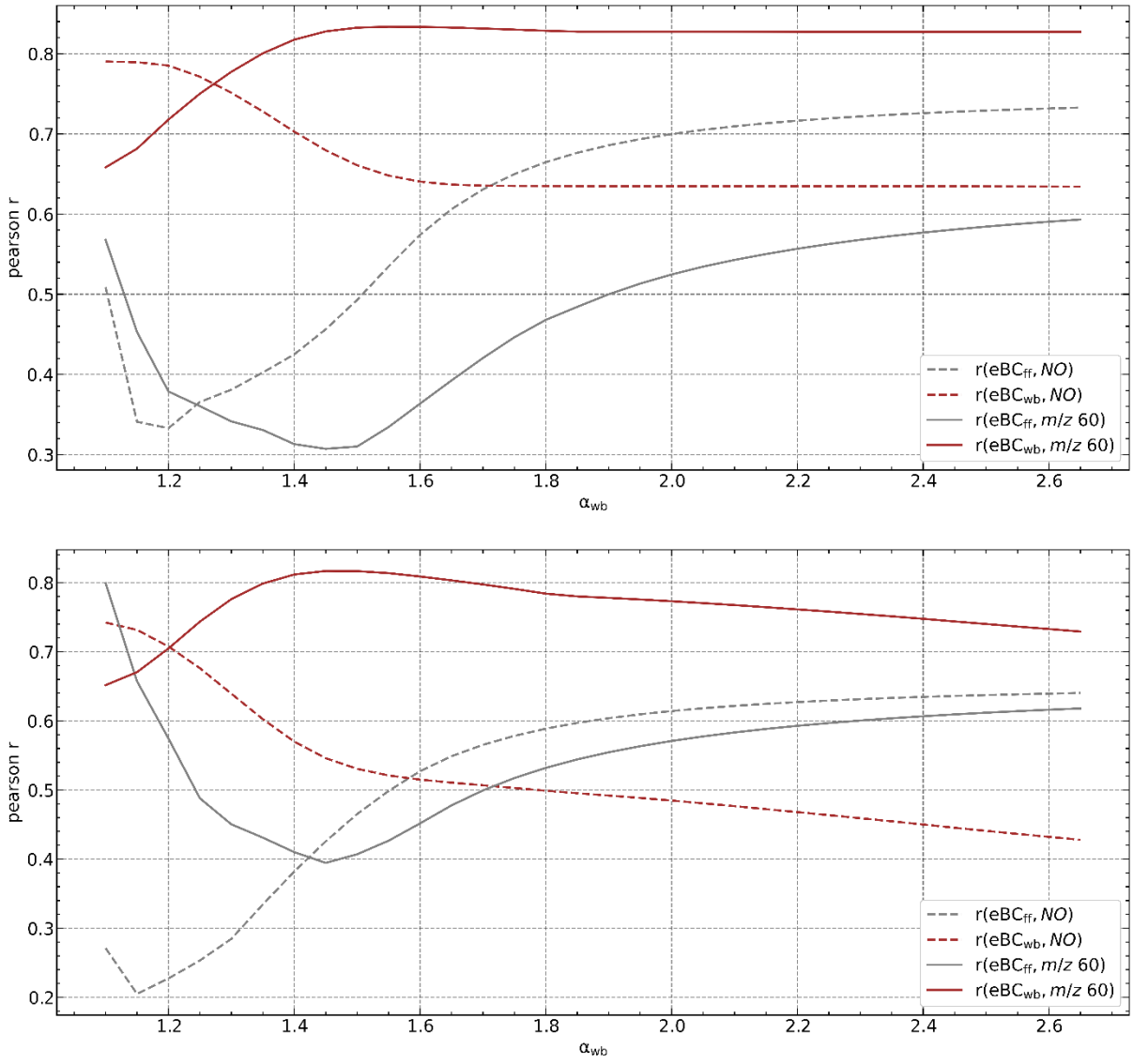


Figure S7: Determination of α_{ff} and α_{wb} values for the Danube (top) and Clemenceau (bottom) sites.

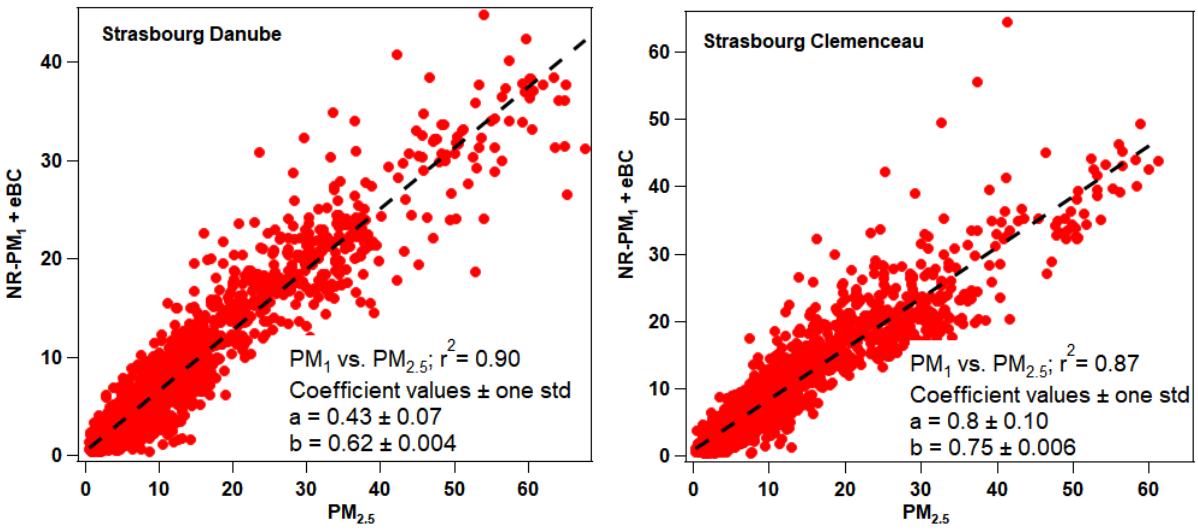


Figure S8: Comparison between Recalculated PM_1 (NR-PM_1 + eBC) and $PM_{2.5}$ for Strasbourg Danube (left) and Strasbourg Clemenceau (right). The a values correspond to the y-intercept and the b values correspond to the slopes.

S1. Individual PMF analysis

The 5-factor solution was chosen for the Clemenceau site. The two primary factors HOA and COA-like were constrained using the reference profiles derived from Crippa et al. (2013) with a-values ranging from 0 to 0.3. Multiple PMF tests were also carried out with a factor number ranging from 3 to 7. The 5-factor solution was selected. Increasing the number of factors is not relevant, as it leads to OOA factors split. A specific factor 58-OA was observed for solutions from 3 factors, highlighting the influence of this specific source. The 5 factors identified were HOA, BBOA, COA-like, 58-OA, and OOA. Their identification was based on the study of their mass spectra in comparison with reference profiles, their diel profiles, and correlations with external measurements.

The individual PMF applied for the Danube dataset was implemented in the same way as the Clemenceau site with multiple PMF runs tested to identify the better solution (a-values between 0 to 0.3 for the HOA and COA-like profiles, 3 to 7 number of factors). The presence of a COA-like was not relevant for this site, notably due to the absence of a peak at midday. As the Danube site is more residential, there may not be as many people returning for lunch, which could explain the only evening peak observed at this site. 5 factors were identified for this site as well: HOA, BBOA, COA-like, 58-OA, and OOA.

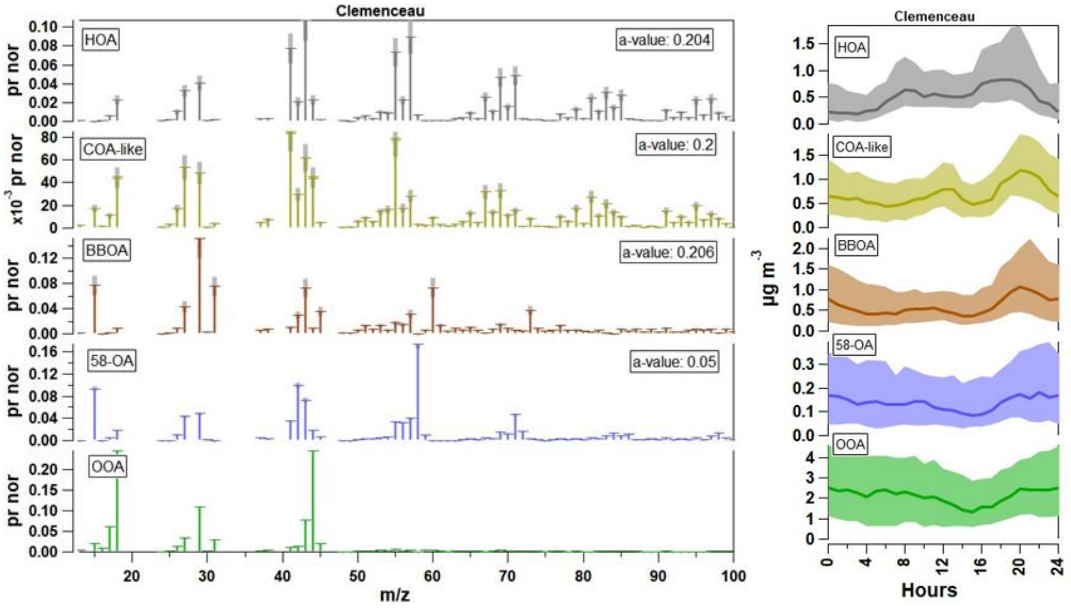


Figure S9: Mass spectra (left) and diel cycles (right) of OA factors for the Clemenceau site. The shaded areas represent the interquartile range and the bold line in the middle represents the median.

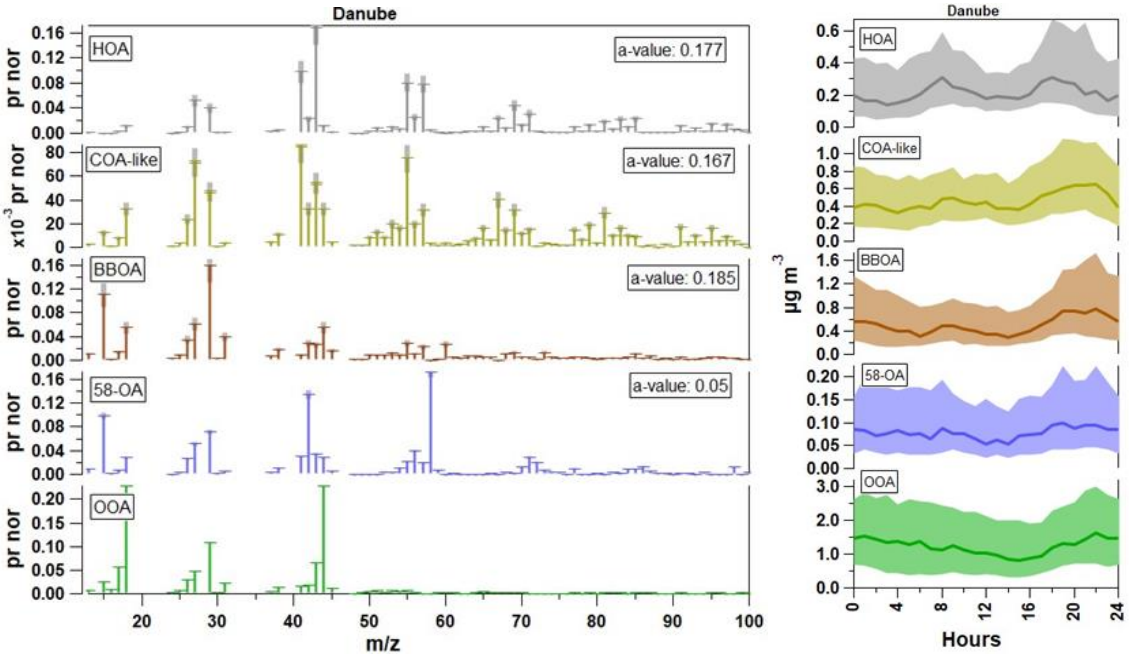


Figure S10: Mass spectra (left) and diel cycles (right) of OA factors for the Danube site. The shaded areas represent the interquartile range and the bold line in the middle represents the median.

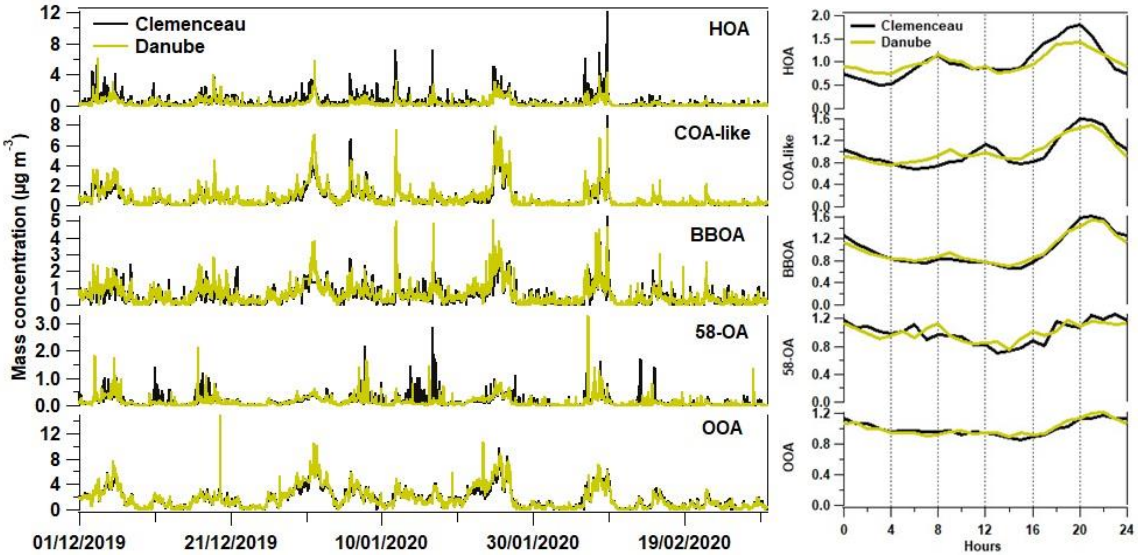


Figure S11: Time series (left) and normalized diel cycles (right) of OA factors from individual PMF at both sites during the studied period.

S2. Combined PMF analysis

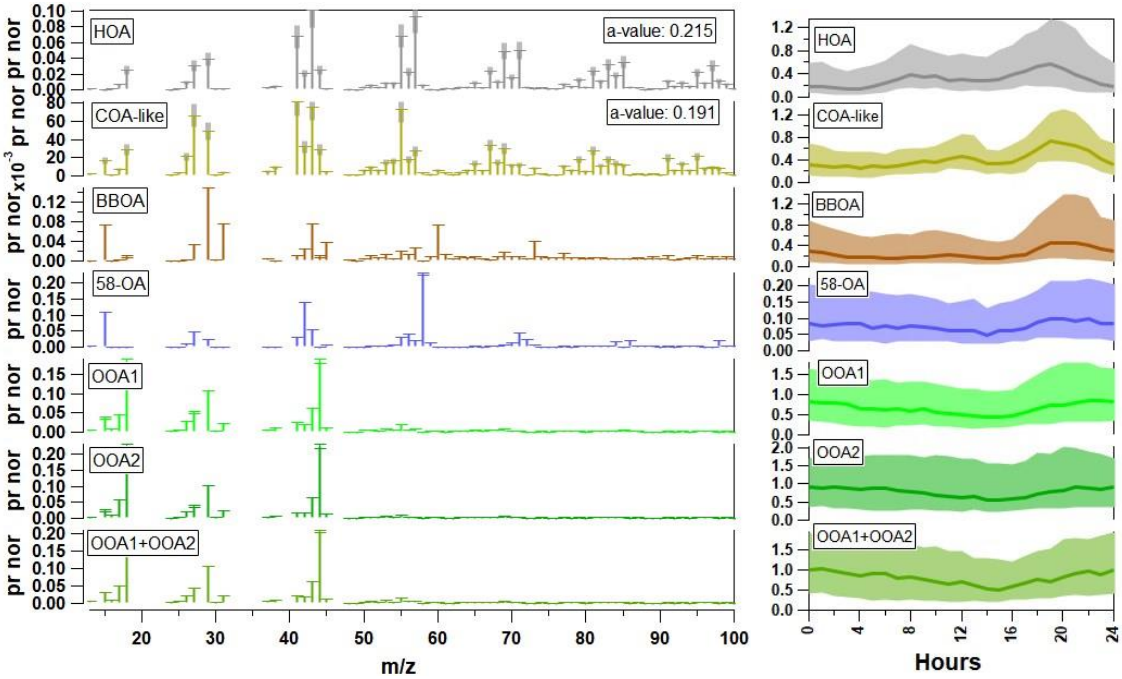


Figure S12: Mass spectra (left) and diel cycles (right) of OA factors for the combined PMF at both sites. The shaded areas represent the interquartile range and the bold line in the middle represents the median.

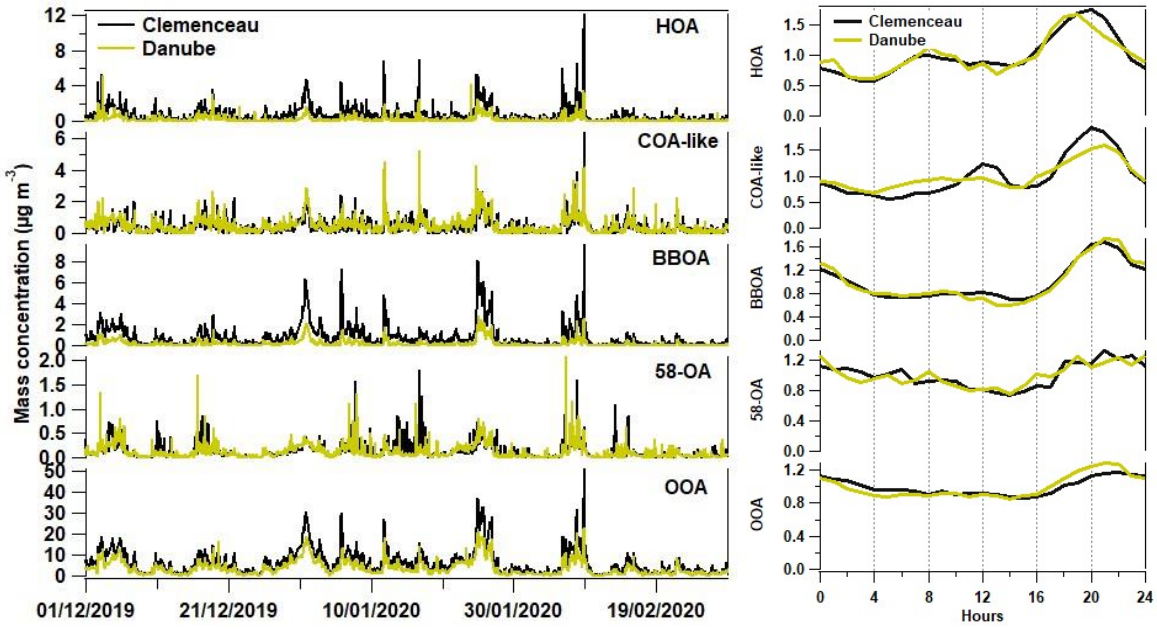


Figure S13: Time series (left) and normalized diel cycles (right) of OA factors from the combined PMF at both sites.

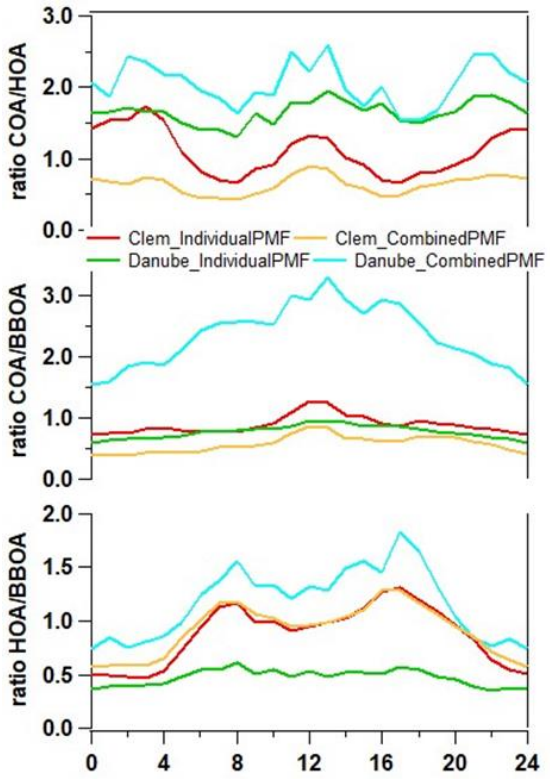
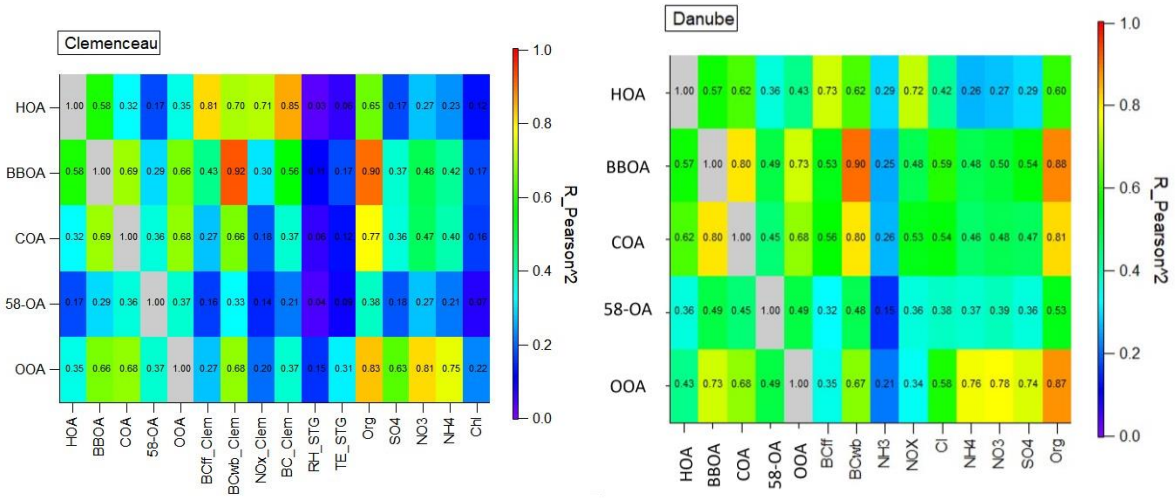


Figure S14: From top to bottom, diel cycles of the COA-like/HOA, COA-like/BBOA, and HOA/BBOA ratios for each PMF and site.



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106 Figure S15: Correlations between OA factors and external variables for both sites

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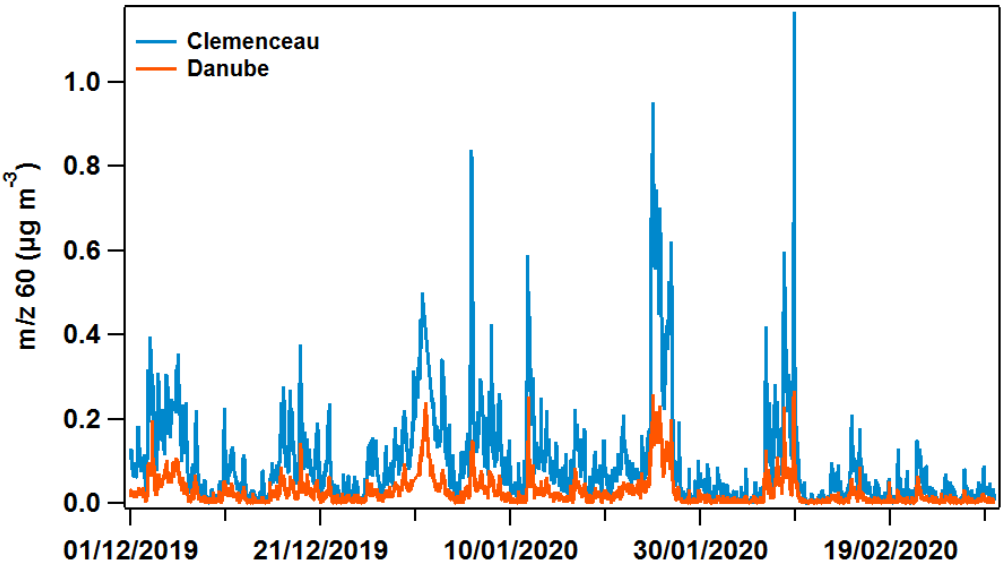

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109 Figure S16: Time series of m/z 60 at the Danube and Clemenceau sites.

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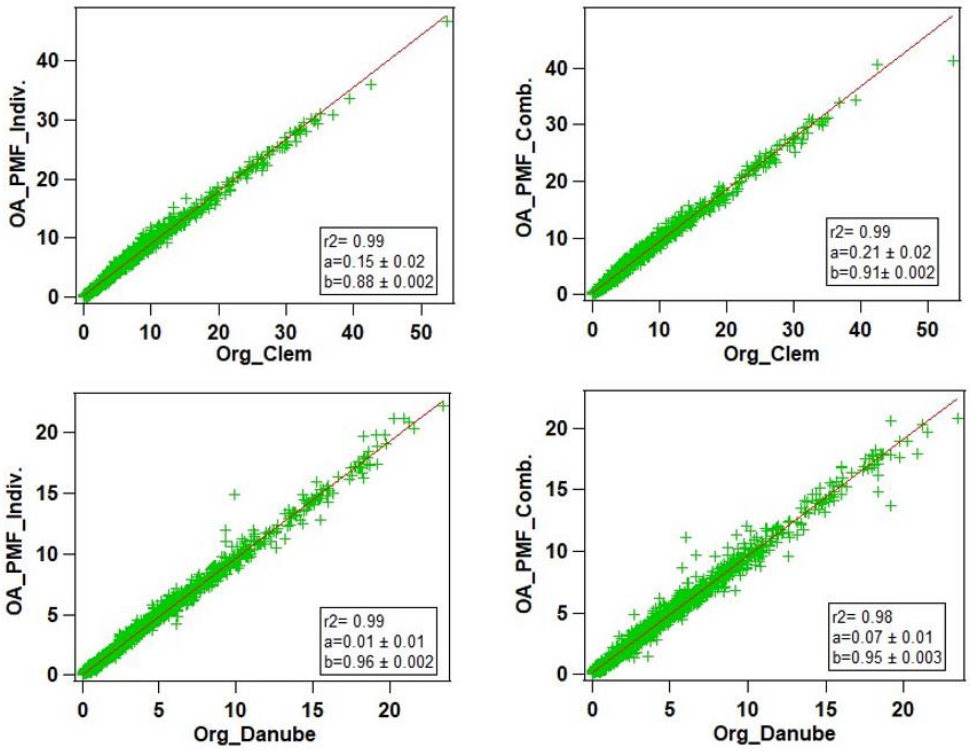

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112 Figure S17: Scatterplots of OA (sum of the different OA factors) resolved in both PMFs vs. the organic mass
113 concentration from ACSM at both sites.

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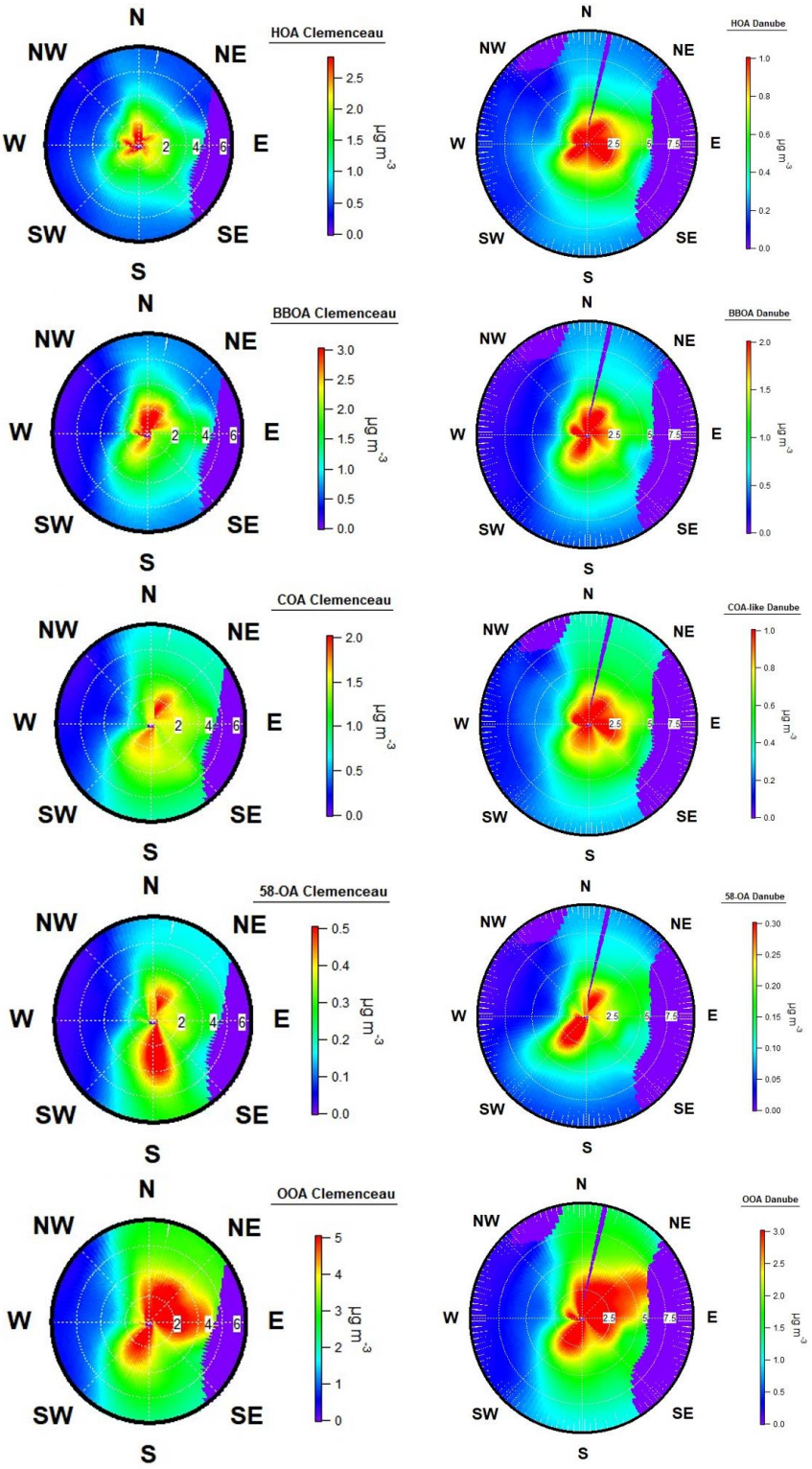

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116 Figure S18: Pollution roses for OA factors, including HOA, BBOA, COA-like, 58-OA, and OOA at both sites:
117 Clemenceau (left) and Danube (right).

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