

## Supplementary

### Factor Analysis of Combined Organic and Inorganic Aerosol Mass Spectra from High Resolution Aerosol Mass Spectrometer Measurements

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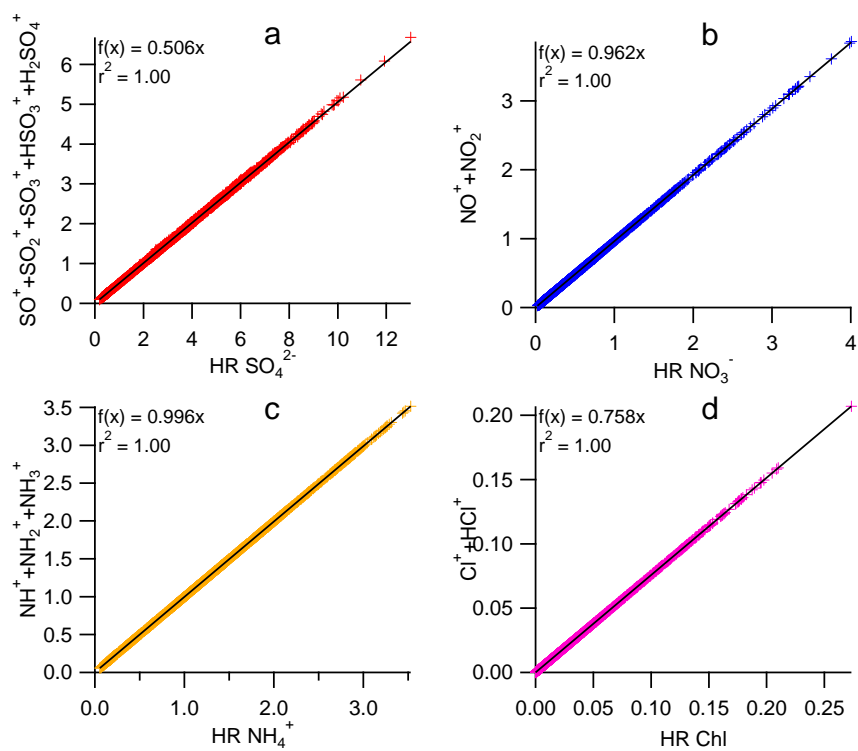


Fig. S1. Correlations between the sum of selected fragmentation ions for PMF analysis and the total mass concentrations of (a) sulfate, (b) nitrate, (c) ammonium, and (d) chloride from high resolution (HR) analysis.

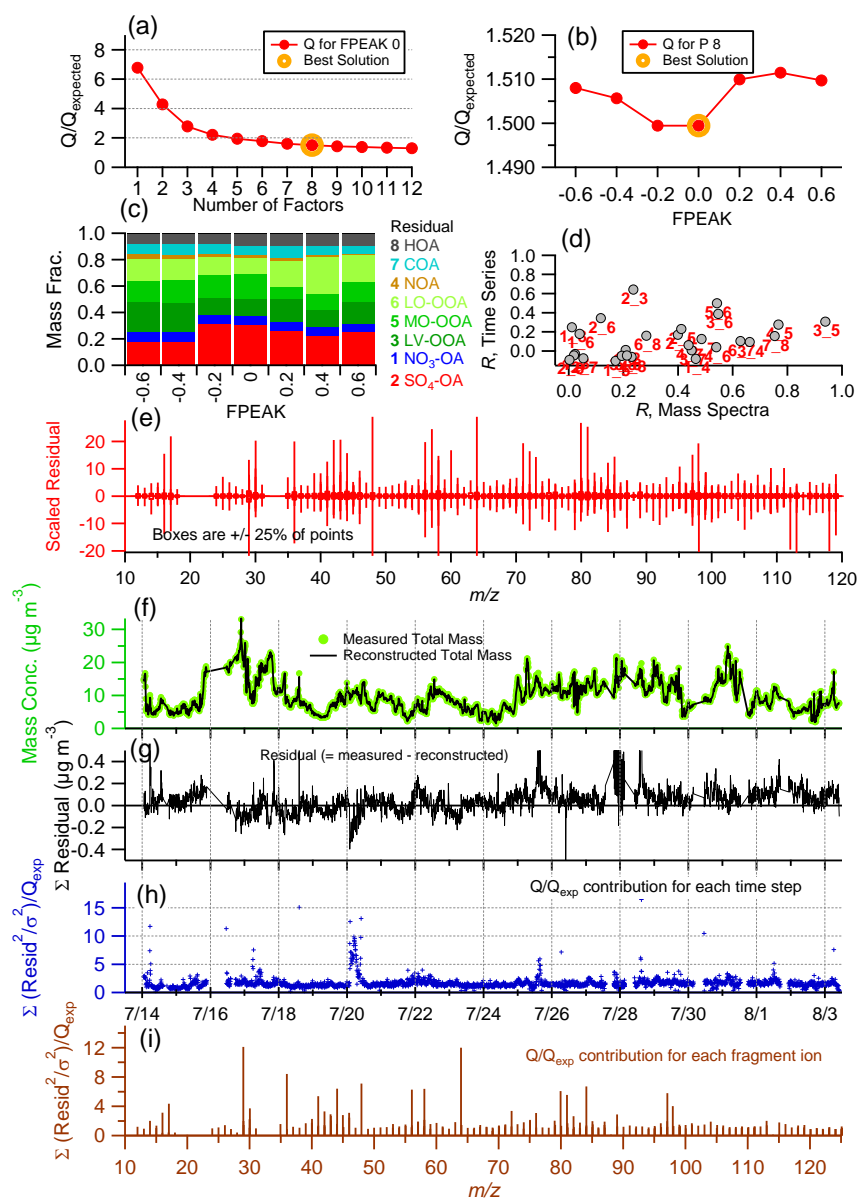


Fig. S2. Summary of the evaluation of the PMF analysis of the unified organic and inorganic aerosols dataset. (a)  $Q/Q_{\text{expected}}$  as a function of number of factors ( $p$ ) selected for PMF modeling; (b)  $Q/Q_{\text{expected}}$  as a function of fPeak; (c) mass fraction of each factor vs. fPeak values for the 8-factor solution. The residual fraction for different fpeak values is  $\sim 0.6\%$ ; (d) correlations of mass spectra and time series among PMF factors. The numbers refer to the OA factors in (c); (e) the box and whiskers plot showing the distributions of scaled residuals for each fragment ion; (f) time series of the measured mass concentration and the reconstructed mass; (g) variations of the residual of the fit; (h) the  $Q/Q_{\text{expected}}$  values for each point in time; and (i) the  $Q/Q_{\text{expected}}$  values for each fragment ion.

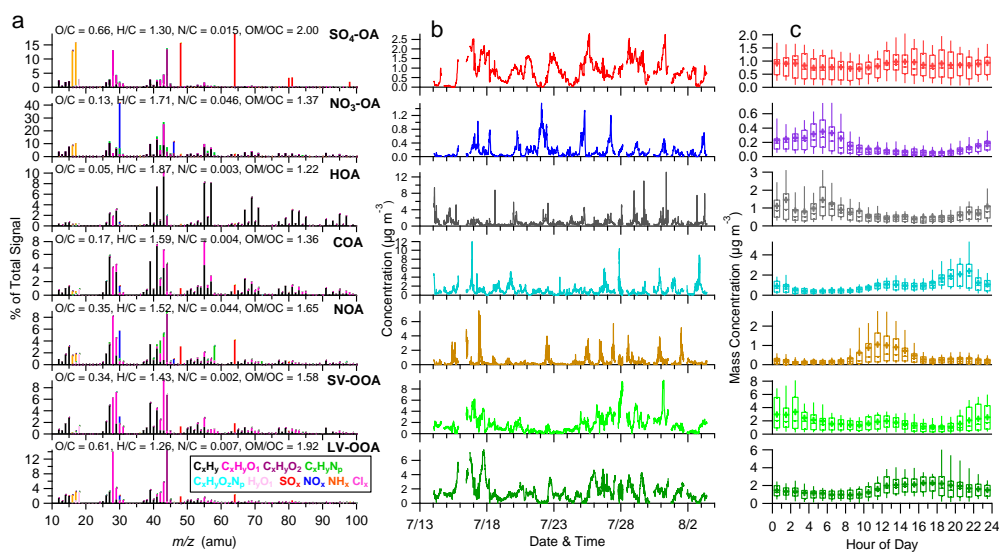


Fig. S3. (a) High resolution mass spectra of seven factors. The signals of OA in SO<sub>4</sub>-OA and NO<sub>3</sub>-OA were enhanced by a factor of 3 and 10, respectively, for clarity. (b) Time series of mass concentration of OA in each factor, and (c) Diurnal profile of OA in each factor.

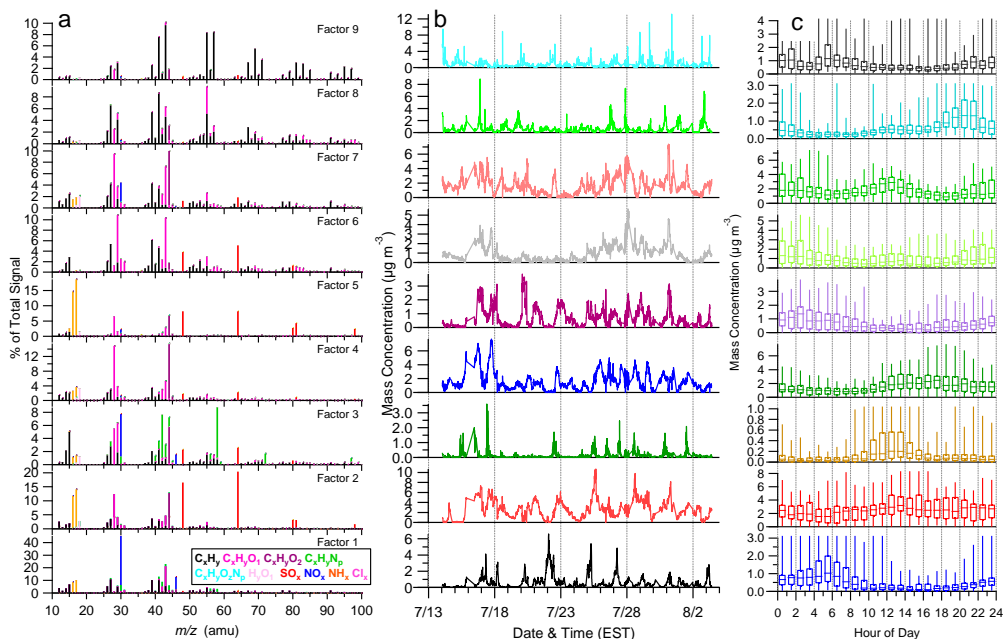


Fig. S4. (a) High resolution mass spectra of nine factors. The signals of OA in factor 2 and factor 1 were enhanced by a factor of 3 and 10, respectively, for clarity. (b) Time series of mass concentration of OA in each factor, and (c) Diurnal profile of OA in each factor.

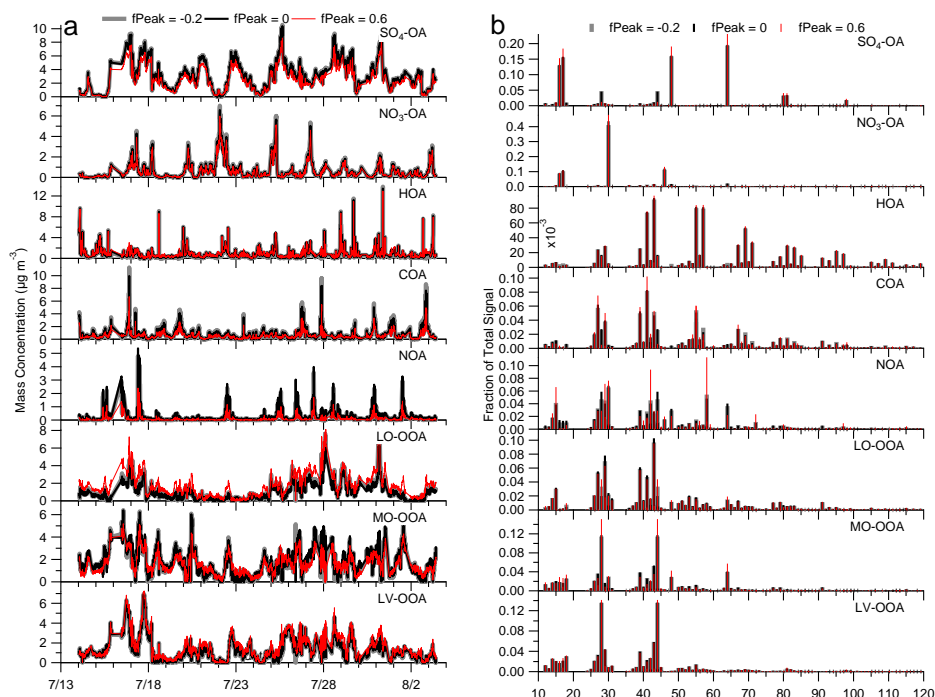


Fig. S5. Comparisons of (a) time series and (b) mass spectra profiles of PMF factors from 8-factor solution for three selected  $f_{\text{Peak}}$  values (-0.2, 0, and 0.6).

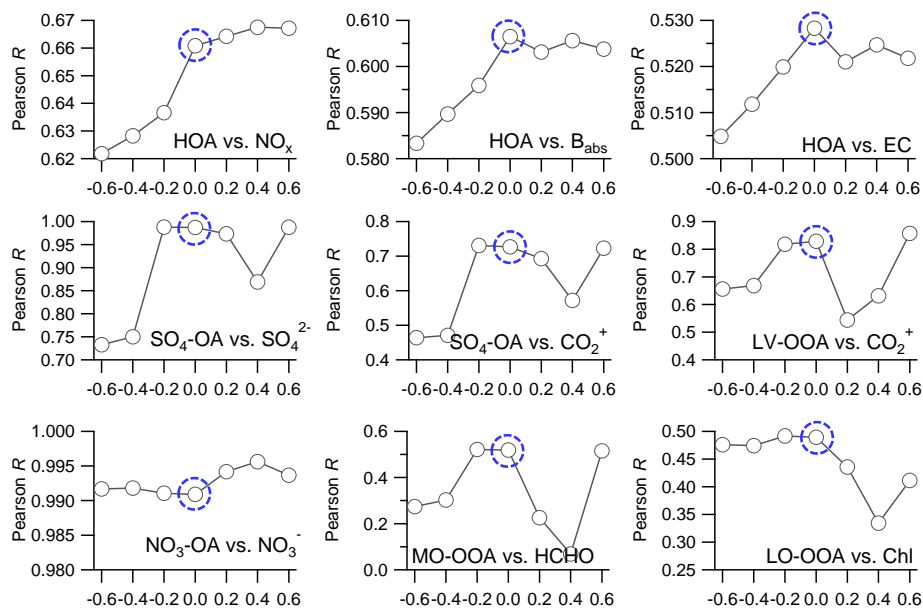


Fig. S6. Correlations of selected PMF factors with external tracer species as a function of  $f_{\text{Peak}}$ . The blue circles refer to the best solution, i.e.,  $f_{\text{Peak}} = 0$ .

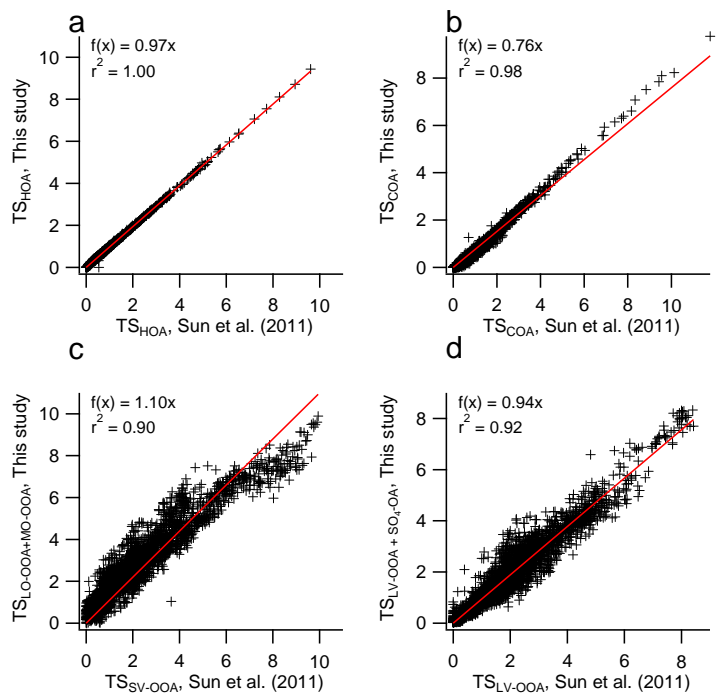


Fig. S7. Time series (TS) comparison of (a) HOA, (b) COA, (c) LO-OOA + MO-OOA vs. SV-OOA, and (d) LV-OOA + SO<sub>4</sub>-OA vs. LV-OOA from 8-factor solution of PMF analysis of the combined organic and inorganic aerosols in this study and 5-factor solution of PMF analysis of OA in Sun et al. (2011).

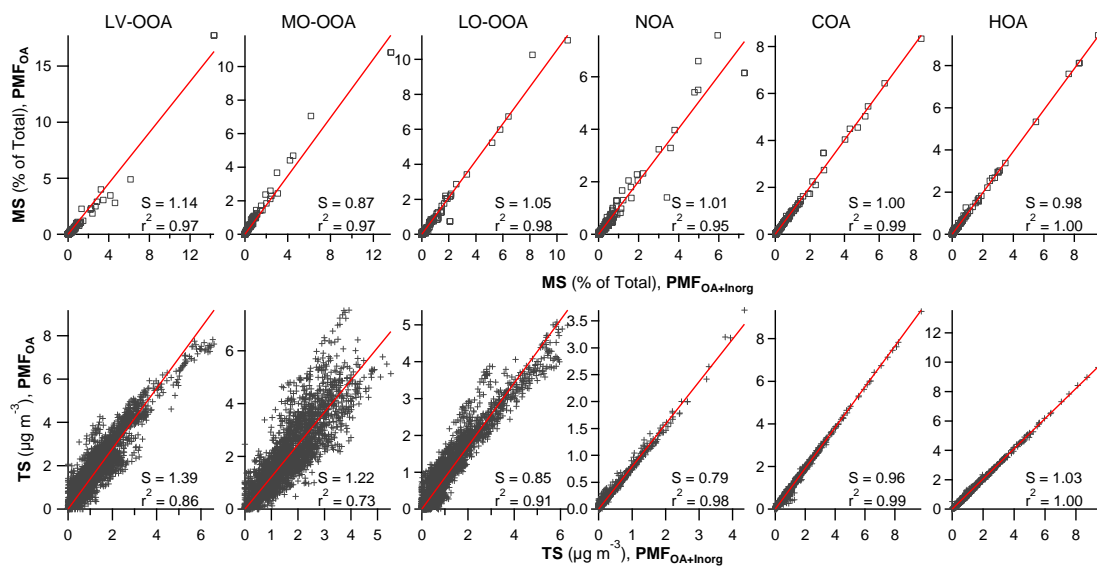


Fig. S8. Mass spectra (MS) and time series (TS) comparison of six OA factors from PMF analysis of the combined organic and inorganic aerosols, and OA only.

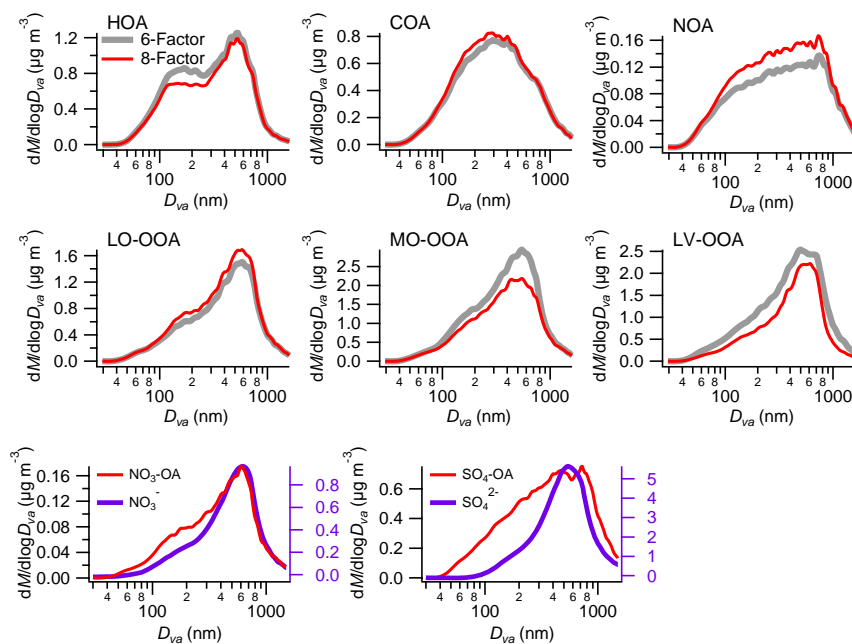


Fig. S9. Comparisons of the size distributions of OA factors from multiple linear regression analysis using six OA factors from PMF of only the OA (6-factor in the figure) and eight OA factors from PMF of the combined organic and inorganic aerosol (8-factor in the figure). The last two plots show the comparisons of the size distributions of  $\text{NO}_3\text{-OA}$  and  $\text{SO}_4\text{-OA}$  with nitrate and sulfate, respectively.

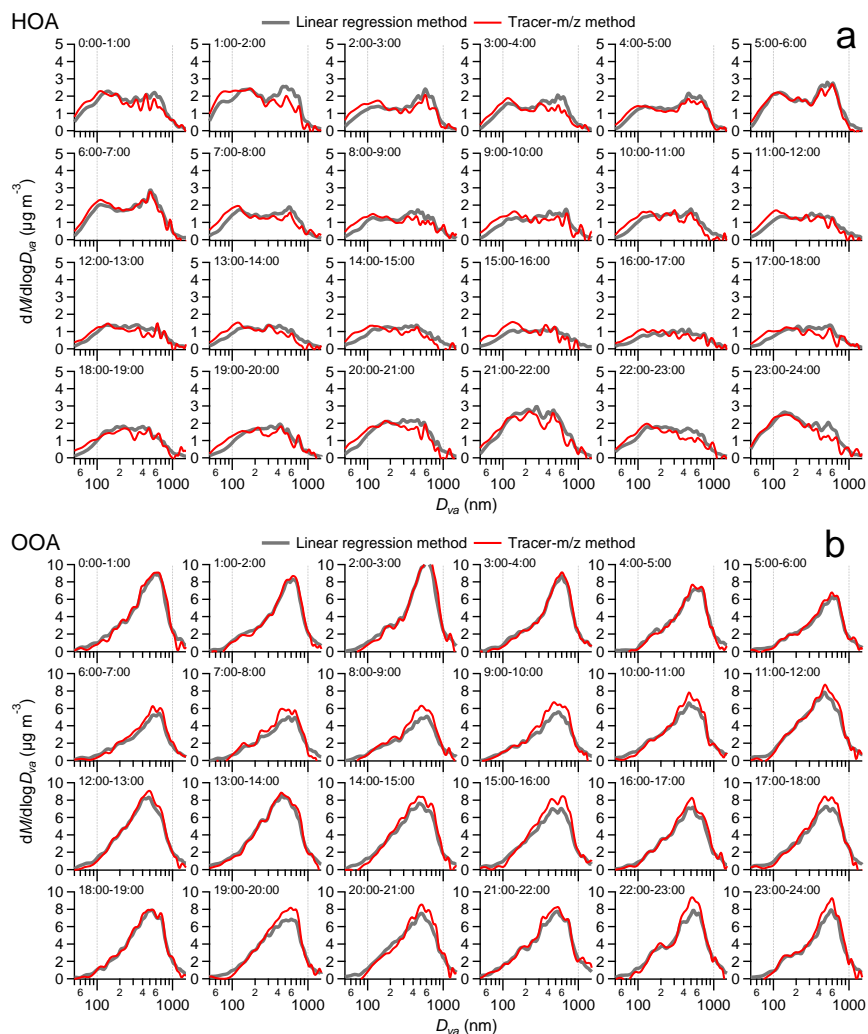


Fig. S10. Comparisons of size distributions of (a) HOA and (b) OOA from linear regression method and tracer- $m/z$  method for each hour in the day.



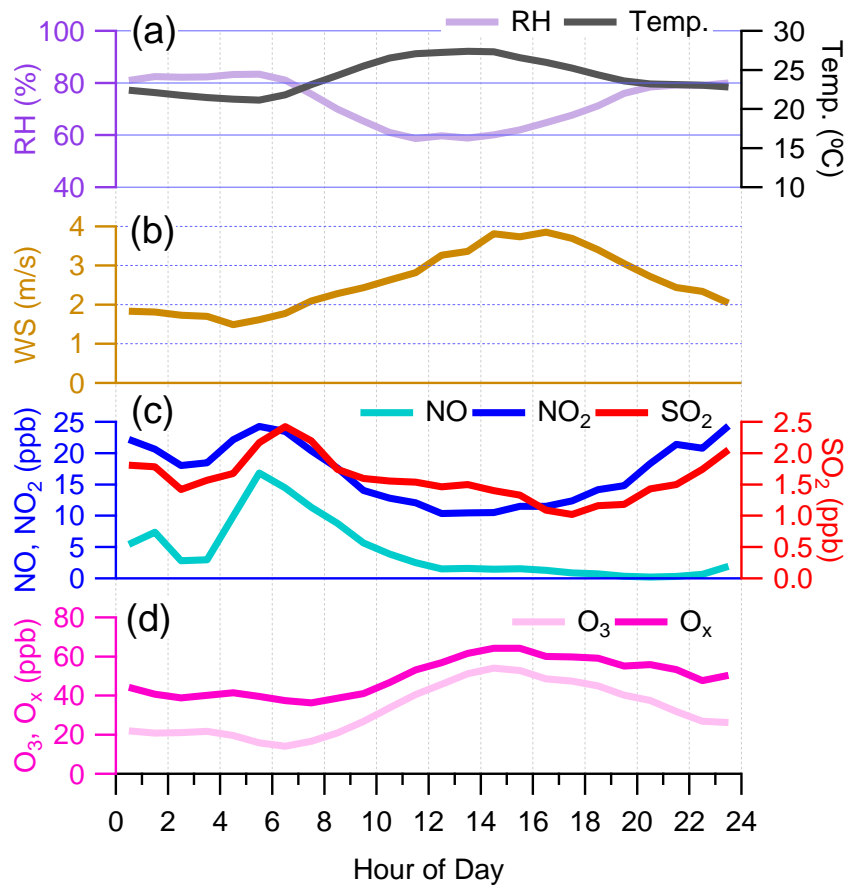


Fig. S10. Diurnal profiles of (a) relative humidity (RH) and temperature, (b) wind speed (WS), (c) NO, NO<sub>2</sub>, and SO<sub>2</sub>, and (d) O<sub>3</sub> and O<sub>x</sub> for the entire study.

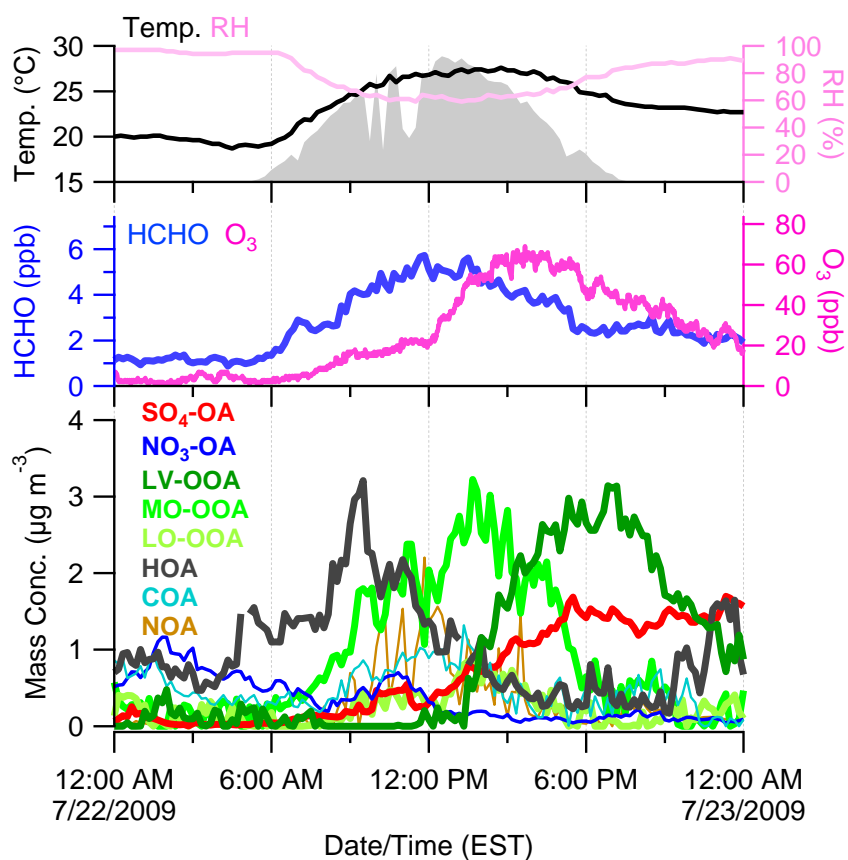


Fig. S11. Time series of meteorology (temperature, relative humidity and solar radiation), HCHO and O<sub>3</sub>, and OA concentrations in PMF factors of SO<sub>4</sub>-OA, NO<sub>3</sub>-OA, LV-OOA, MO-OOA, LO-OOA, NOA, COA, and HOA.

Table S1. Summary of the contribution of OA in each factor to the total OA for different fPeak values. Note only solutions that converged and generated realistic mass spectra are included.

	Average	Std Dev	Min	Max
LV-OOA	17.1%	2.0%	15.3%	19.0%
MO-OOA	22.5%	0.7%	21.8%	23.5%
LO-OOA	21.1%	3.2%	17.5%	23.9%
NOA	3.6%	1.0%	2.6%	4.8%
COA	11.7%	0.4%	11.1%	12.0%
HOA	11.4%	0.8%	10.8%	12.6%
NO <sub>3</sub> -OA	2.7%	0.8%	1.8%	3.7%
SO <sub>4</sub> -OA	9.9%	2.4%	7.8%	12.3%

References:

- Sun, Y. L., Zhang, Q., Schwab, J. J., Demerjian, K. L., Chen, W. N., Bae, M. S., Hung, H. M., Hogrefe, O., Frank, B., Rattigan, O. V., and Lin, Y. C.: Characterization of the sources and processes of organic and inorganic aerosols in New York City with a high-resolution time-of-flight aerosol mass spectrometer, *Atmos. Chem. Phys.*, 11, 1581-1602, 10.5194/acp-11-1581-2011, 2011.