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Atmospheric Chemistry and Physics Discussions

Supplement of

Aerosol composition and sources during the Chinese Spring Festival: fireworks, secondary aerosol, and holiday effects

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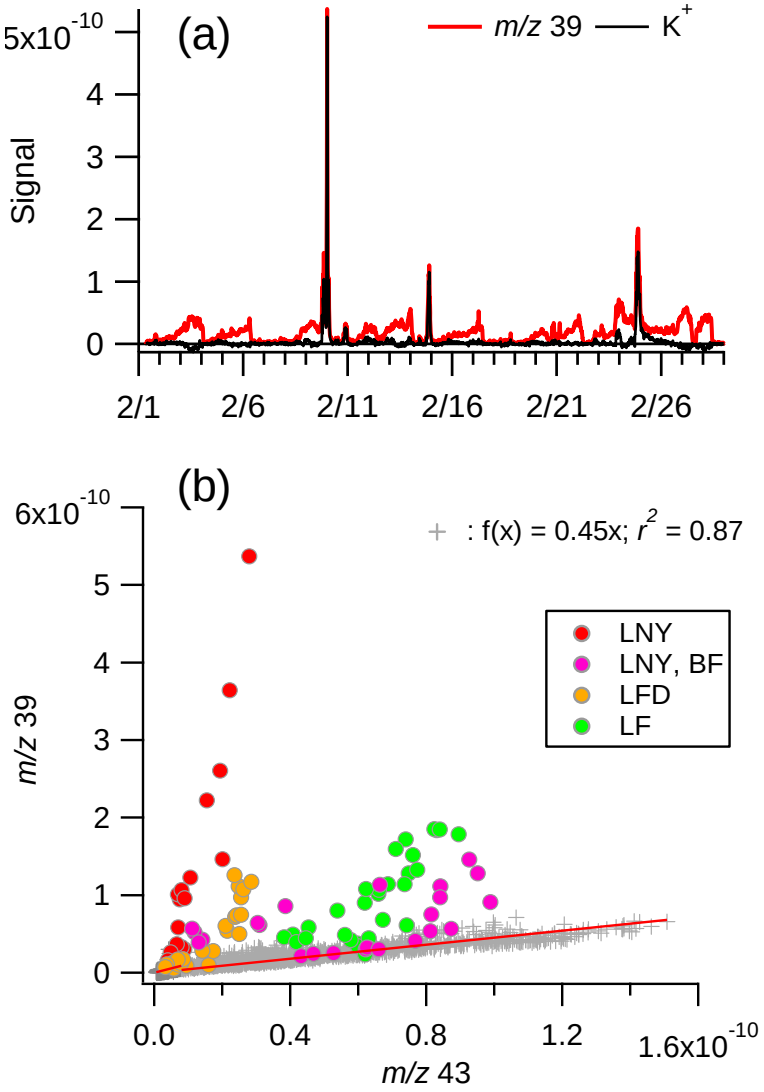

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22 **Fig. S1.** (a) Time series of signals of *m/z* 39 and K^+, (b) correlation of *m/z* 39 vs. *m/z*
23 43. The data in (b) are segregated into three FW events, i.e., Lunar New Year (LNY),
24 Lunar Fifth Day (LFD), and Lantern Festival (LF), and NFW periods. The data during
25 the FW period of 18:00 – 23:30, 9 February (LNY, BF) that have large influences of
26 NFW sources are also shown for a comparison. The K^+ signal in (a) was calculated as
27 *m/z* 39 – *m/z* 43 × $(m/z\ 39/\ 43)_{NFW}$, i.e., *m/z* 39 – *m/z* 43 × 0.45.

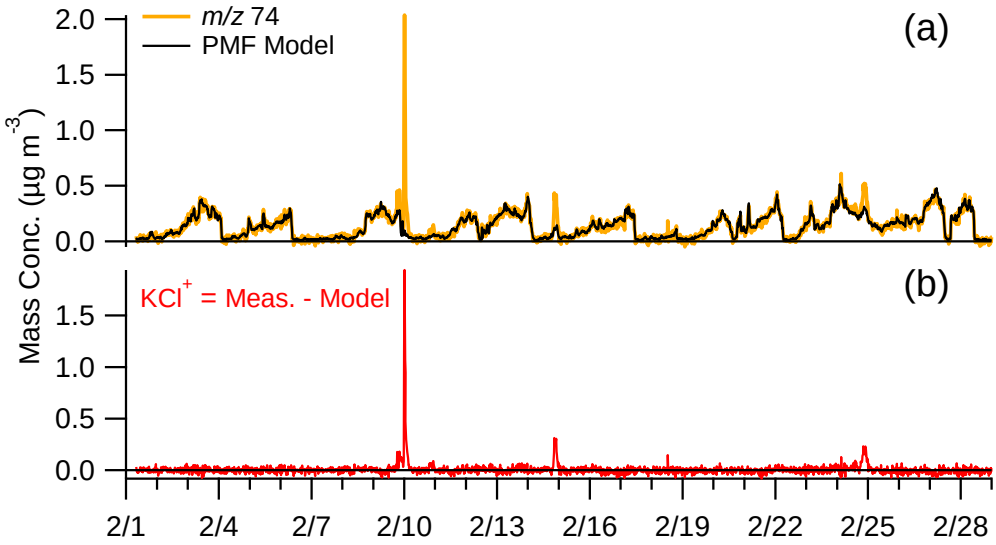


Fig. S2. Time series of (a) measured and PMF modeled *m/z* 74, (b) the difference between measured and modeled *m/z* 74.

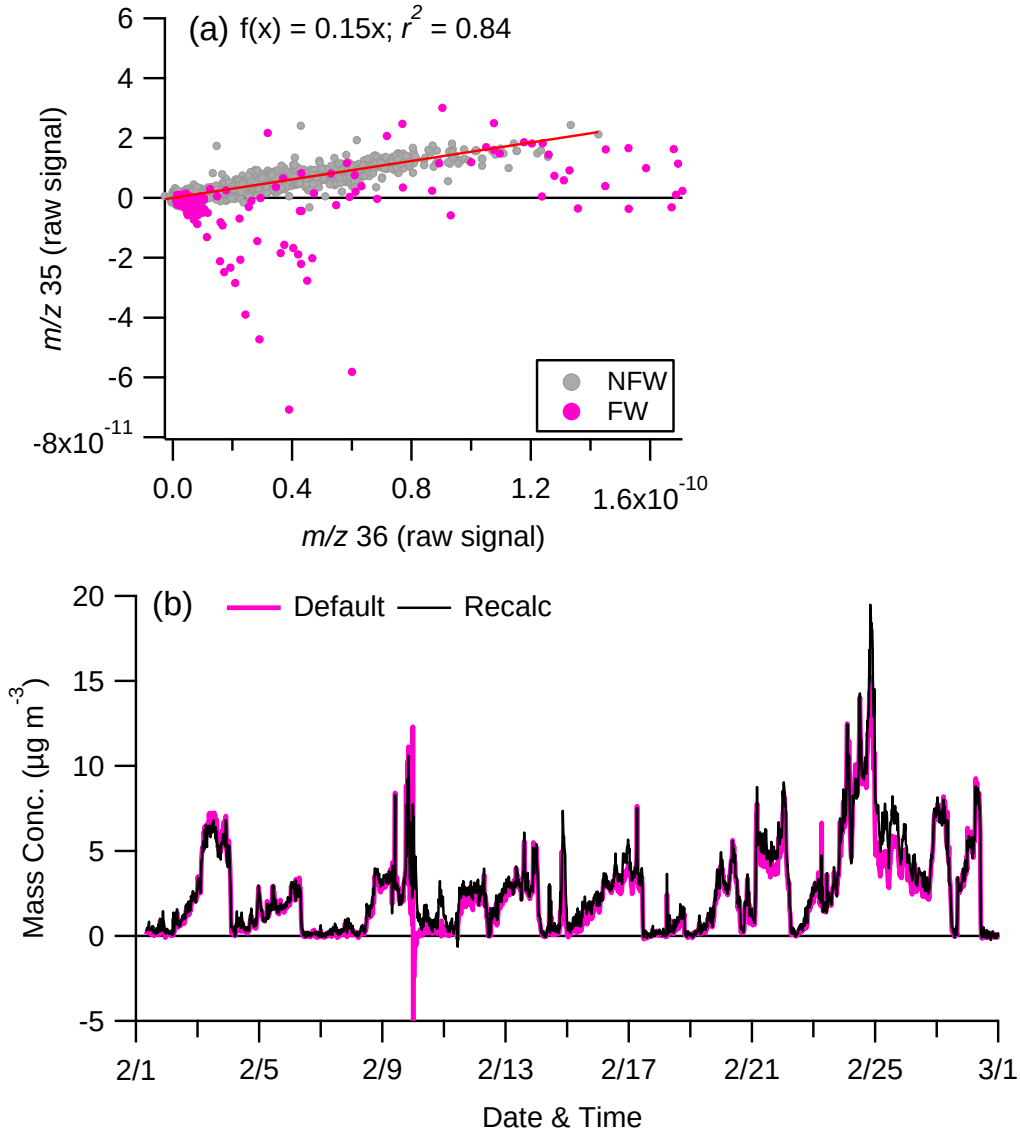


Fig. S3. (a) Correlation of *m/z* 35 vs. *m/z* 36 during FW and NFW periods, (b) Time series of the default chloride analyzed by the ACSM standard software and the recalculated chloride using the corrected $^{35}Cl^+$ and $^{37}Cl^+$, which is $^{35}Cl^+$ = *m/z* 36 × 0.15 and $^{37}Cl^+ = 0.323 \times {}^{35}Cl^+$.

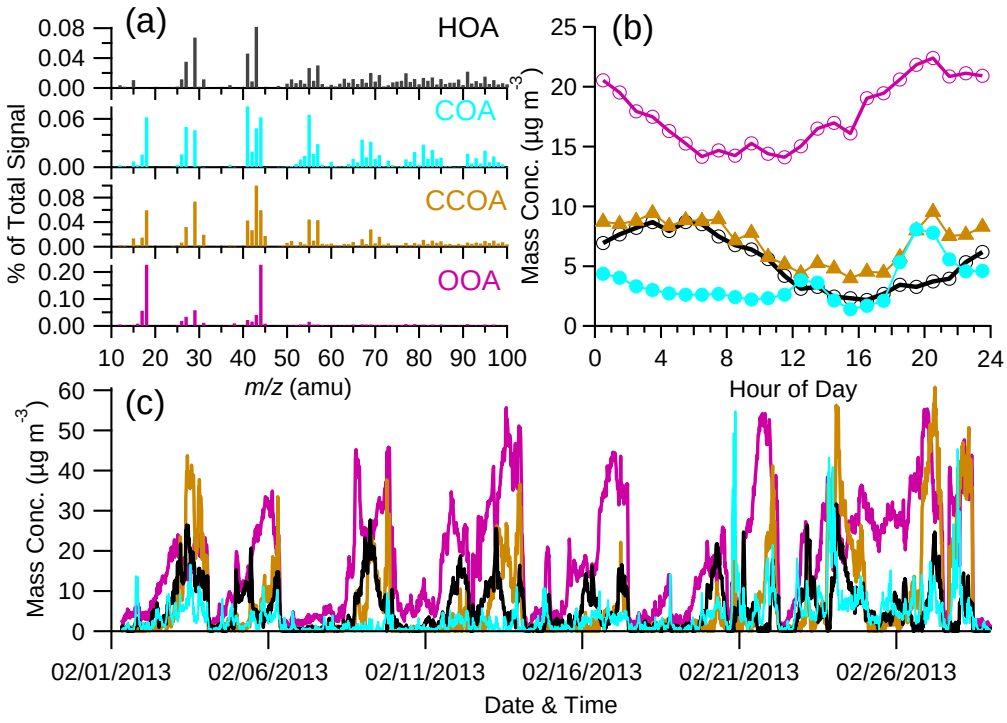


Fig. S4. (a) Mass spectra, (b) diurnal profiles, and (c) time series of the four OA components, i.e., HOA, COA, CCOA, and OOA.

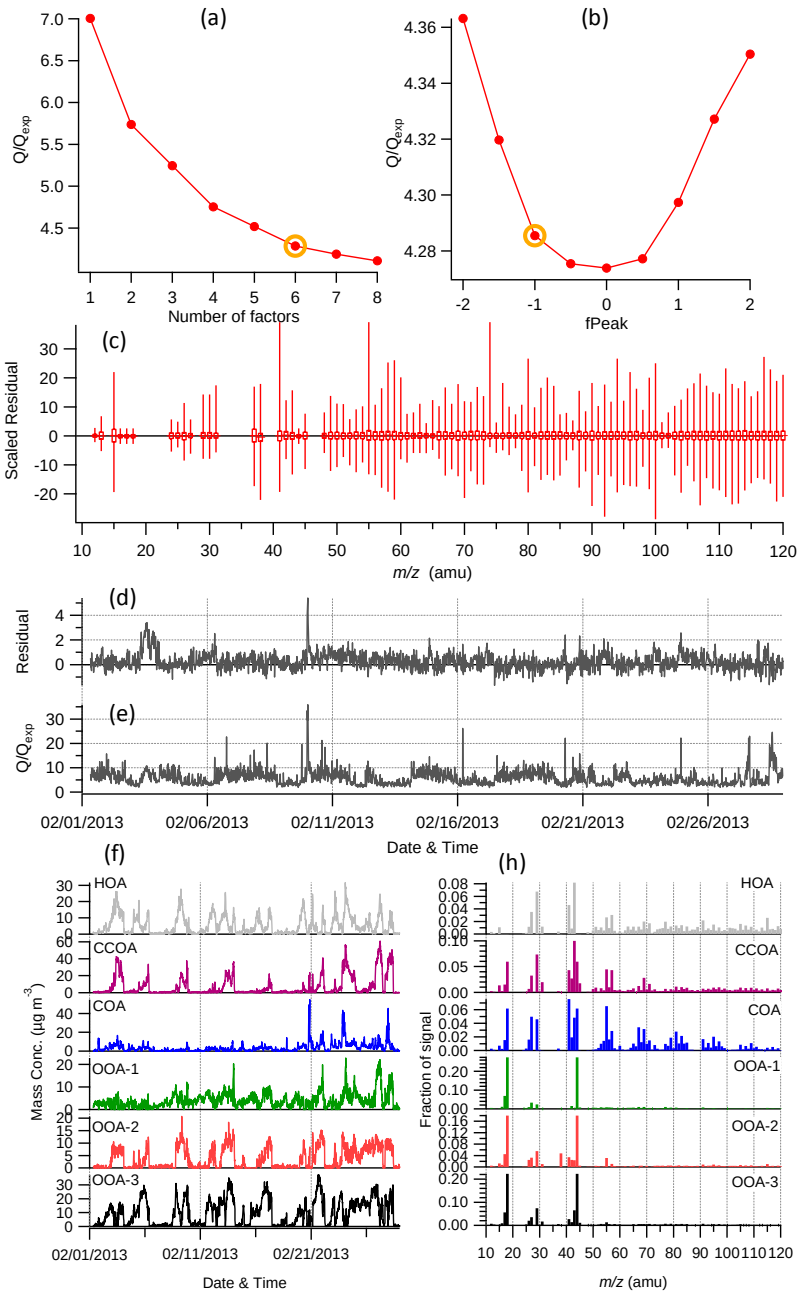


Fig. S5. Summary of key diagnostic plots of the PMF results for 6-factor solution: (a) Q/Q_{exp} as a function of number of factors, (b) Q/Q_{exp} as a function of FPEAK, (c) the box and whiskers plot showing the distributions of scaled residuals for each *m/z*, (d) variations of the residual (= measured − reconstructed), (e) Q/Q_{exp} for each point in time, (f) time series of 6 factors and (h) factor profiles of 6 factors. The three OOA factors, i.e., OOA-1, OOA-2, and OOA-3 were combined into one OOA factor that is shown in Figure S4.

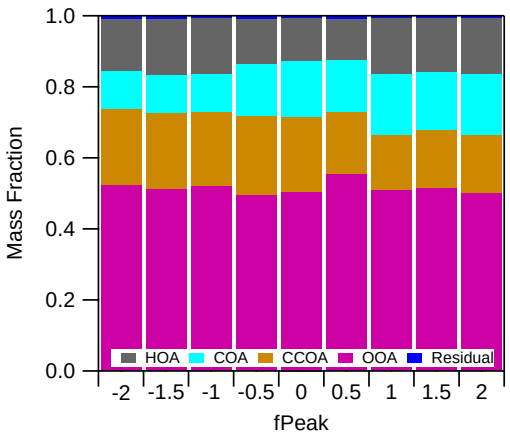


Fig. S6. Mass fraction of four OA factors (from 6-factor solution; three OOA factors were combined into one OOA factor as discussed in the text) as a function of fpeak values. Overall, the contribution of each OA factor was relatively stable across different fpeak values (average ± 1σ; min – max): HOA (14±1.6%; 12 – 16%); COA (14±2.8%; 11 – 17%); CCOA (19±2.7%; 15 – 22%); OOA (51±1.7; 49 – 55%).

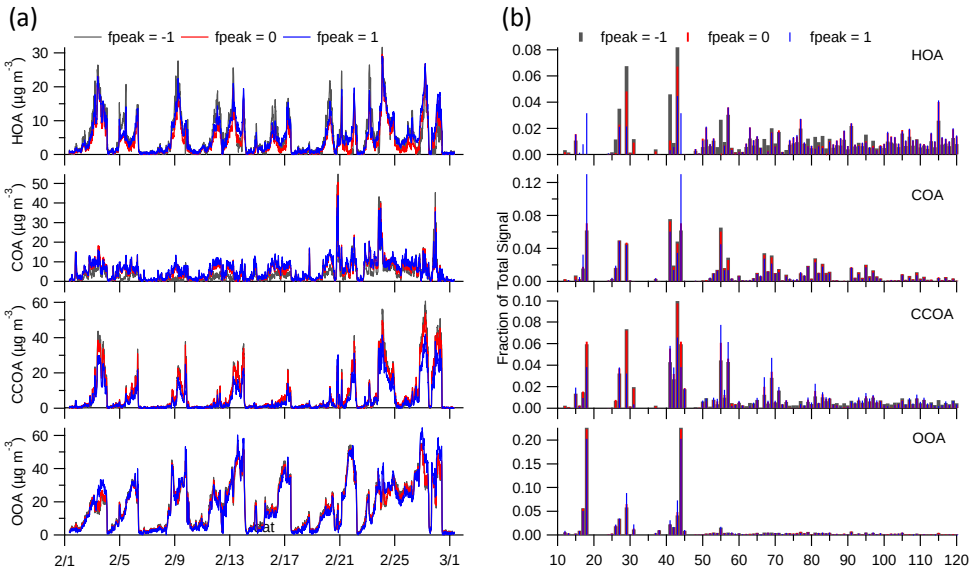


Fig. S7. Time series and mass spectra of four OA factors for three different fpeak values (-1, 0, and 1). The time series of four OA factors for different fpeak values agree overall well. However, the mass spectra of OA factors have large differences. Note that most mass spectra of OA factors at fpeak > 1 are largely different from the standard mass spectra reported in Ng et al. (2011) and those resolved in Beijing in winter 2011-2012 (Sun et al., 2013).

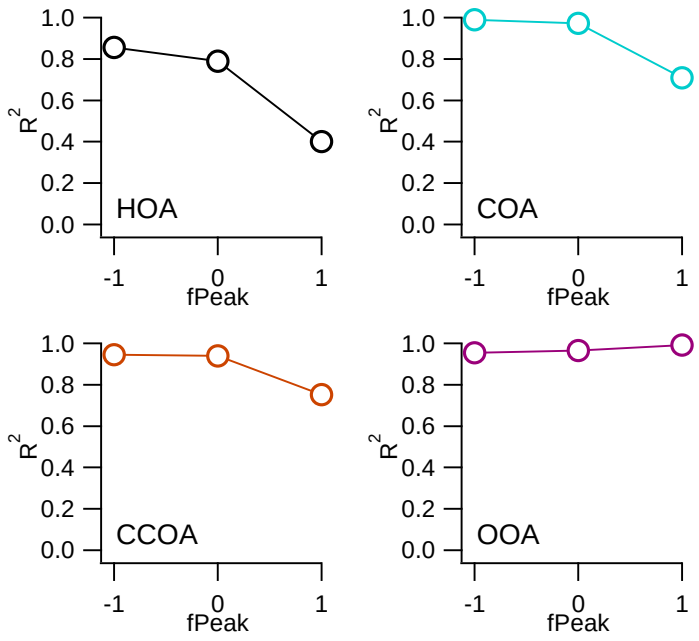


Fig. S8. Mass spectra correlations between this study and those identified in Beijing in winter 2011-2012 (Sun et al., 2013). The mass spectra of OA factors at fpeak = -1 presented the best correlation with those identified in winter 2011-2012 (Sun et al., 2013). Therefore, four factor solution with fpeak = -1 was chosen in this study.

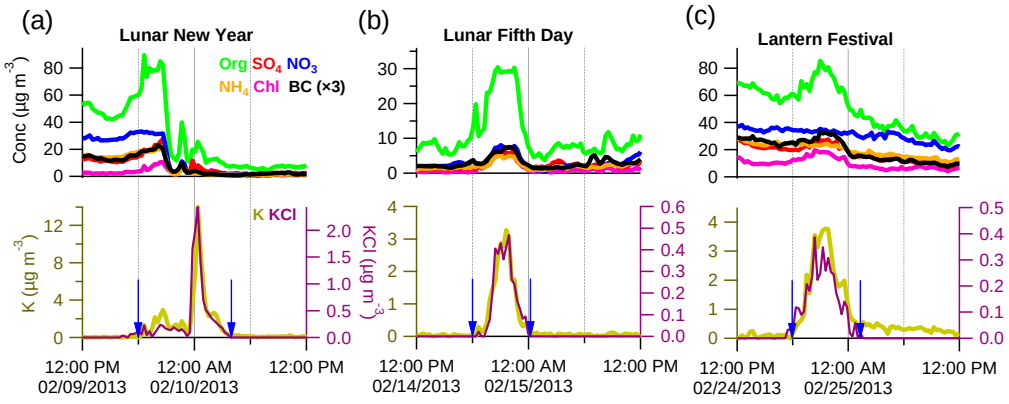


Fig. S9. Time series of NR-PM_1 species (Org, SO_4^{2-}, NO_3^-, NH_4^+, Chl), K, KCl, and BC during three firework events, i.e., Lunar New Year, Lunar Fifth Day, and Lantern Festival.

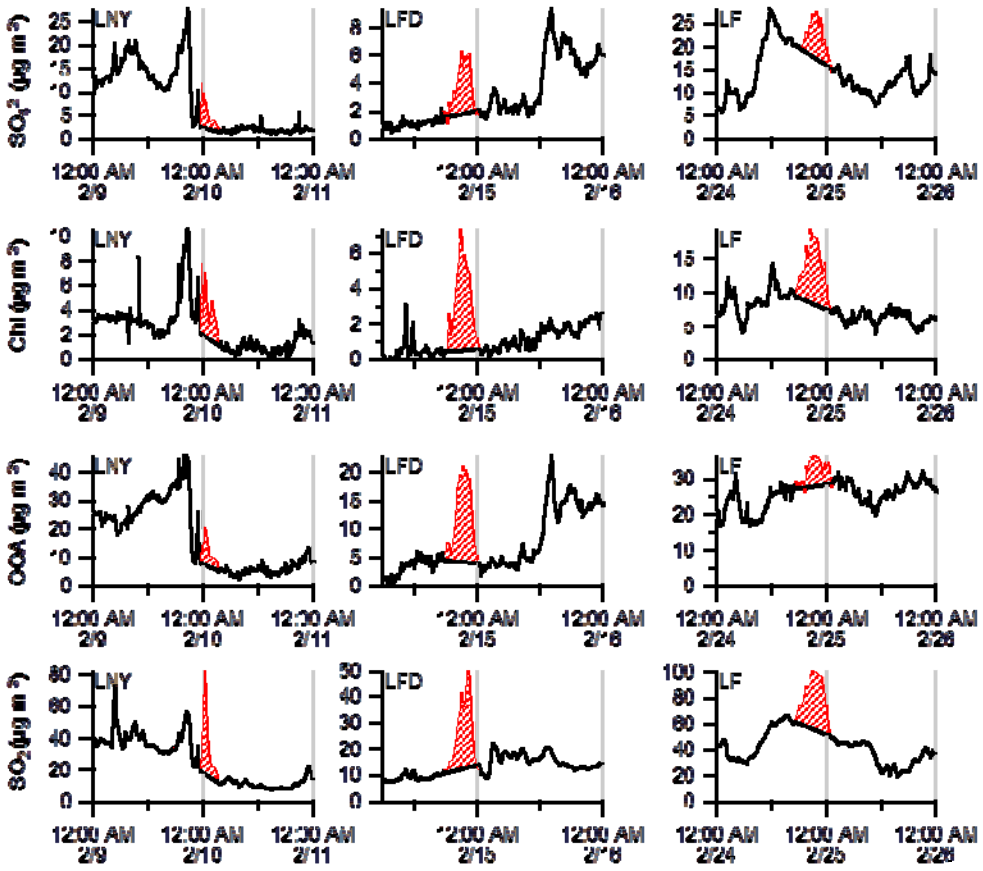
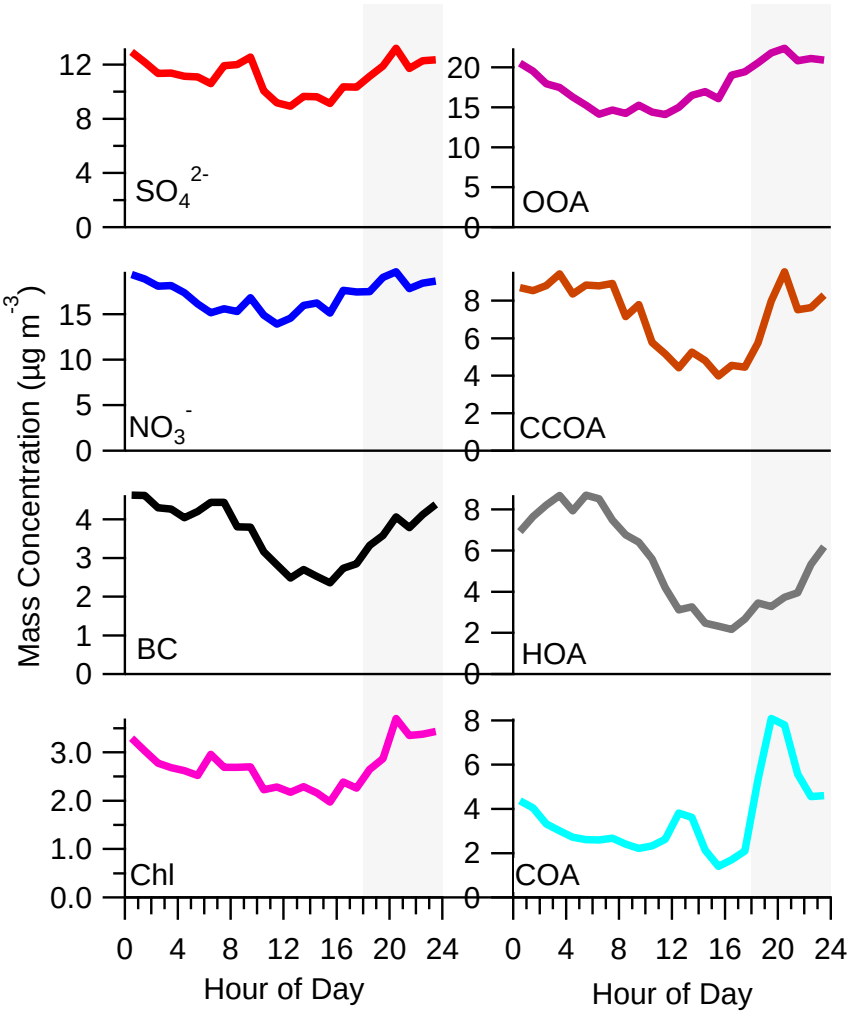


Fig. S10. Estimation of firework contributions (red shaded areas) for selected species (SO_4^{2-}, Chl, OOA, and SO_2) during LNY, LFD, and LF.



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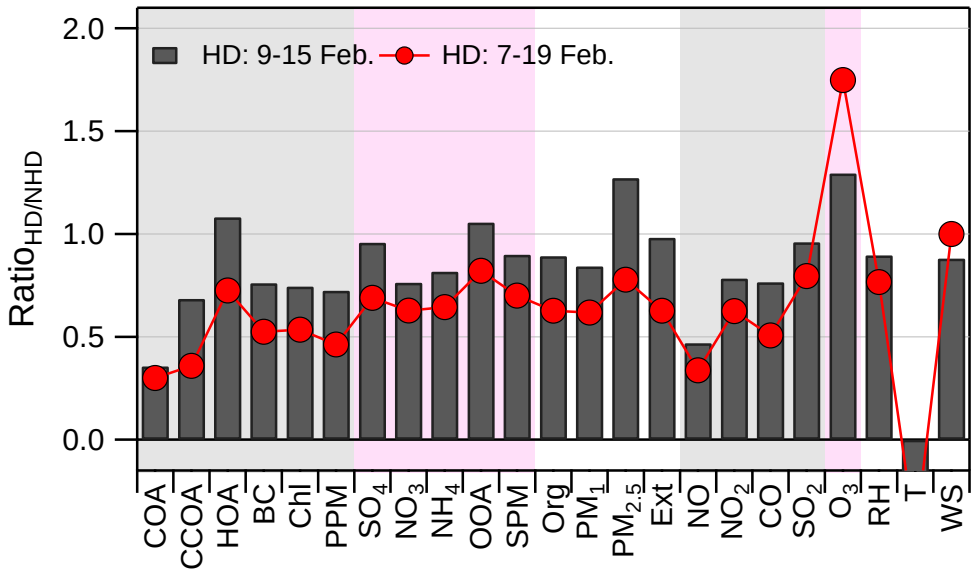
74 **Fig. S11.** Diurnal cycles of SO_4^{2-}, NO_3^-, BC, Chl, OOA, CCOA, HOA, and COA for
75 the entire study. The shaded areas show the typical time intervals with fireworks
76 impacts.



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78 **Fig. S12.** The average ratios of aerosol species, gaseous species, PM mass
79 concentrations, extinction coefficient, and meteorological parameters between holiday
80 (HD) and non-holiday (NHD) periods. Two different holidays, i.e., the official
81 holiday of 9 – 15 February and the informal holiday of 7 – 20 February were used for
82 averages. Also note that the averages were made by excluding clean periods and
83 firework events during both HD and NHD days.

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85 **References:**

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