Supplementary Materials for:

Evaluating the degree of oxygenation of organic aerosol during foggy and hazy days in Hong Kong using high-resolution time-of-flight aerosol mass spectrometry (HR-ToF-AMS)

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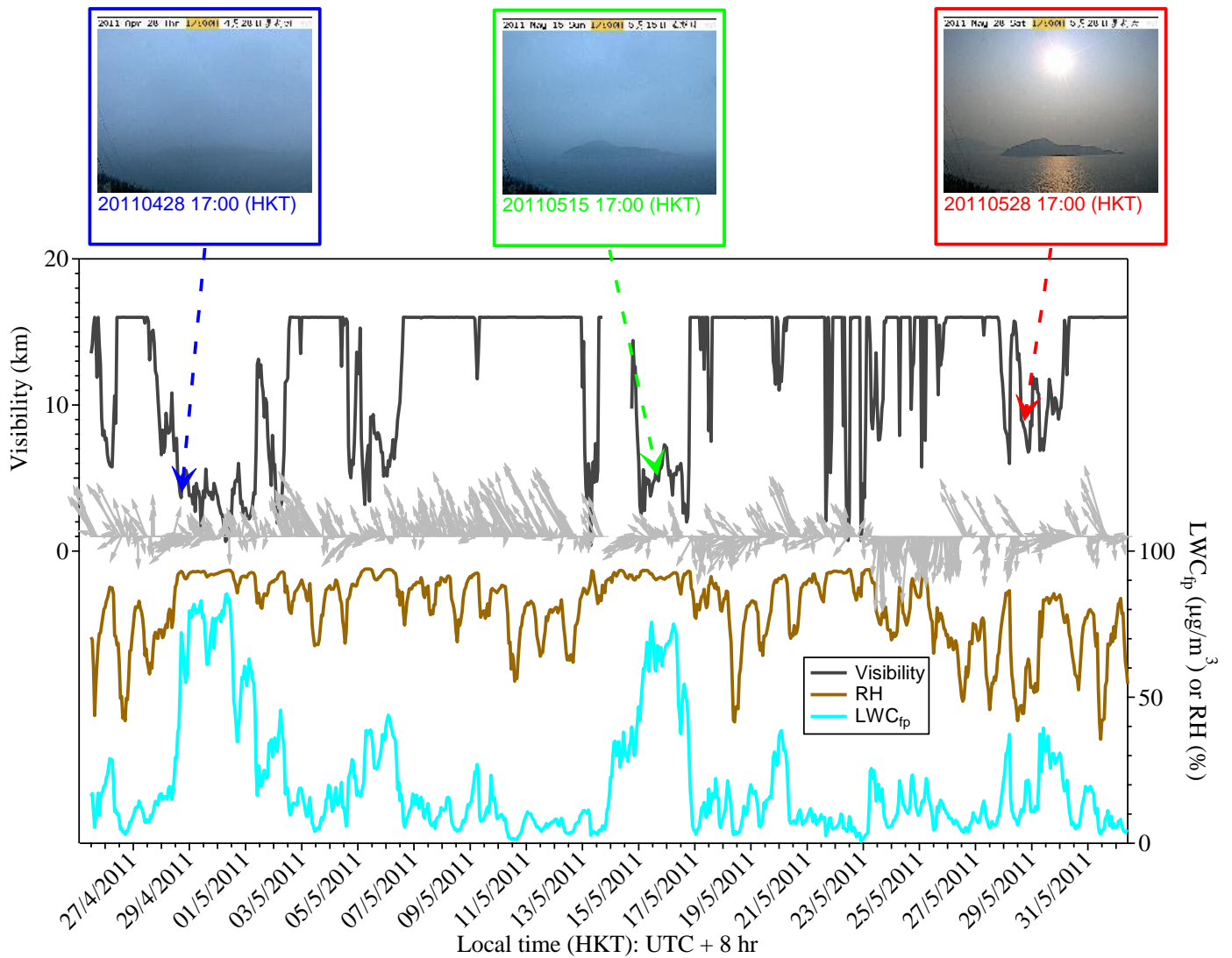
1. Supporting graphs

FIGURE S1. Visibility, wind vector, RH, and estimated liquid water content in fine particles (LWC$_{fp}$), as well as selected pictures taken during the campaign. Pictures were taken with an automatic camera on an island approximately 20 km south of the sampling site.
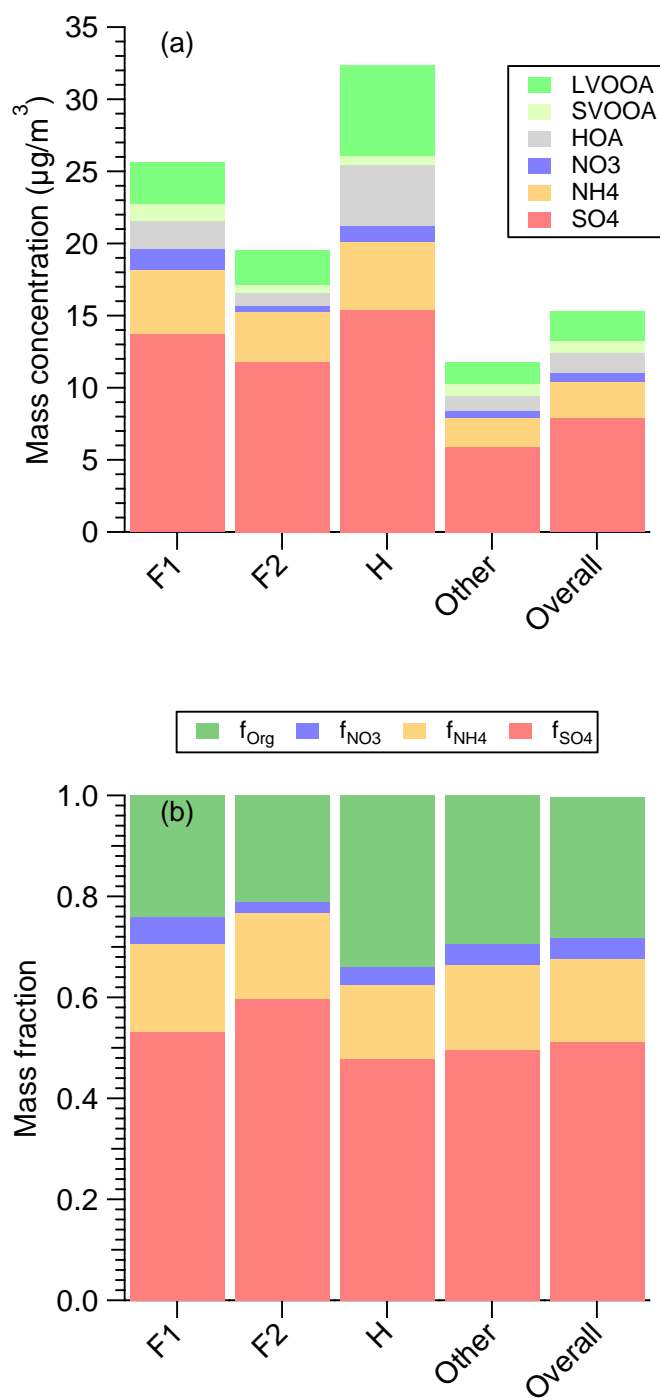
FIGURE S2. (a) Average mass concentrations of LVOOA, SVOOA, HOA, nitrate, ammonium and sulfate in five periods: foggy periods (*F1* and *F2*), hazy period (*H*), non-foggy and non-hazy period ("other"), and overall period. (b) Average mass fractions of organics, nitrate, ammonium and sulfate in the five periods.
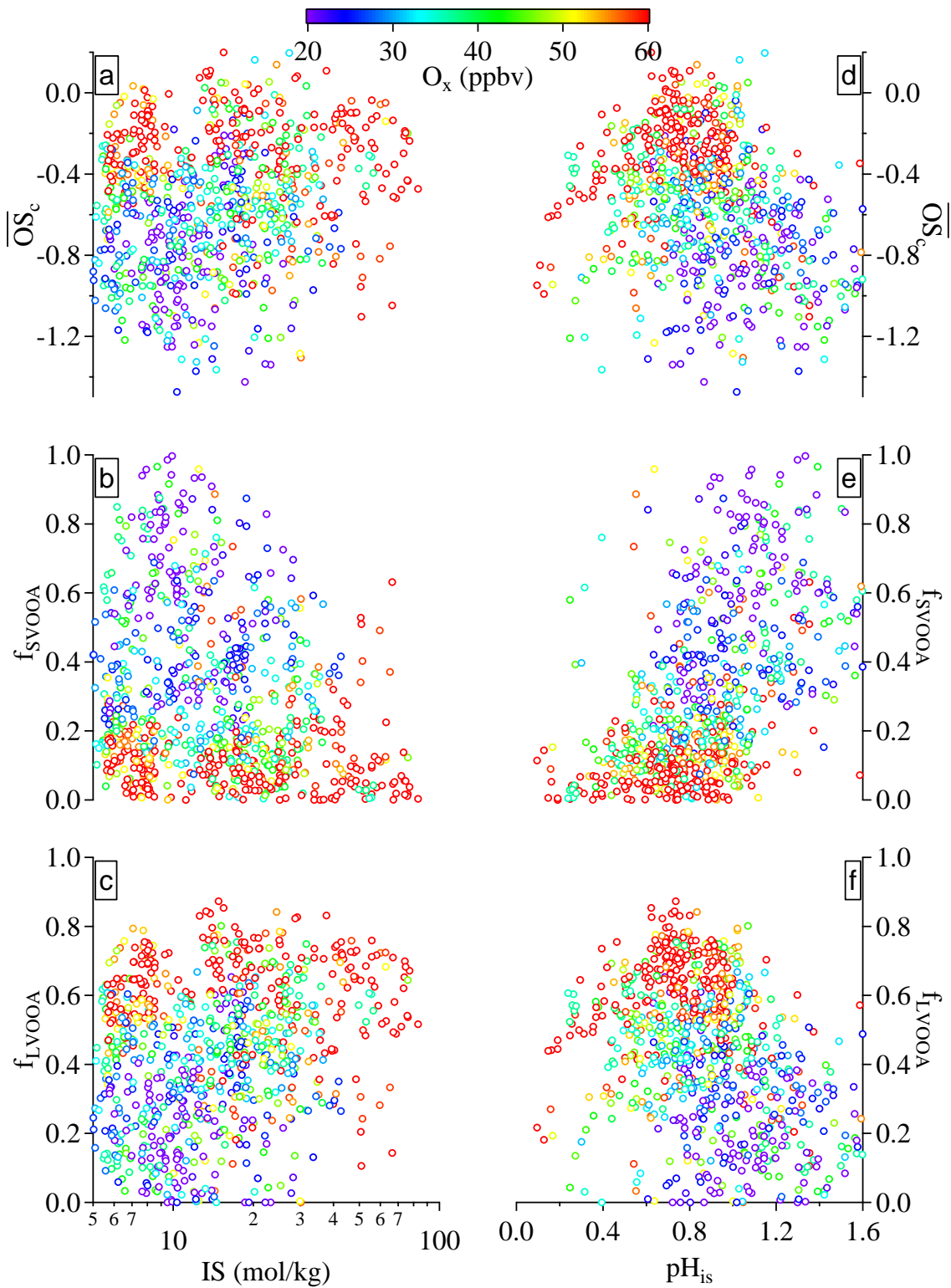
FIGURE S3. Hourly averaged carbon oxidation state ($\overline{OS}_c$) (a), SVOOA fraction (f_{SVOOA}) (b), and LVOOA fraction (f_{LVOOA}) (c) plotted against estimated ionic strength (IS). Carbon oxidation state ($\overline{OS}_c$) (d), SVOOA fraction (f_{SVOOA}) (e), and LVOOA fraction (f_{LVOOA}) (f) plotted against estimated fine particle in situ pH (pH_{is}). All data points are color coded according to O_x concentration.

2. Positive matrix factorization (PMF)

High-resolution mass spectral data were used to run the positive matrix factorization (PMF) analysis. PMF was run for 1 to 7 factors, with FPeak and Seed both set to 0. A three-factor solution was chosen based on Q/Q_{exp} values and mass spectral features. The diagnostic plots (Zhang et al., 2011) are shown in Figure S4. These three factors are hydrocarbon-like organic aerosol (HOA), semi-volatile organic aerosol (SVOOA), and low-volatility organic aerosol (LV-OOA). The four-factor solution would only split the LV-OOA factor to two sub-factors and was thus not chosen. The mass fractions of these factors from PMF analysis of high-resolution mass spectral data were used directly, while they were multiplied by mass concentration of organics obtained by unit-mass-resolution data analysis when mass concentrations of these three factors were presented.
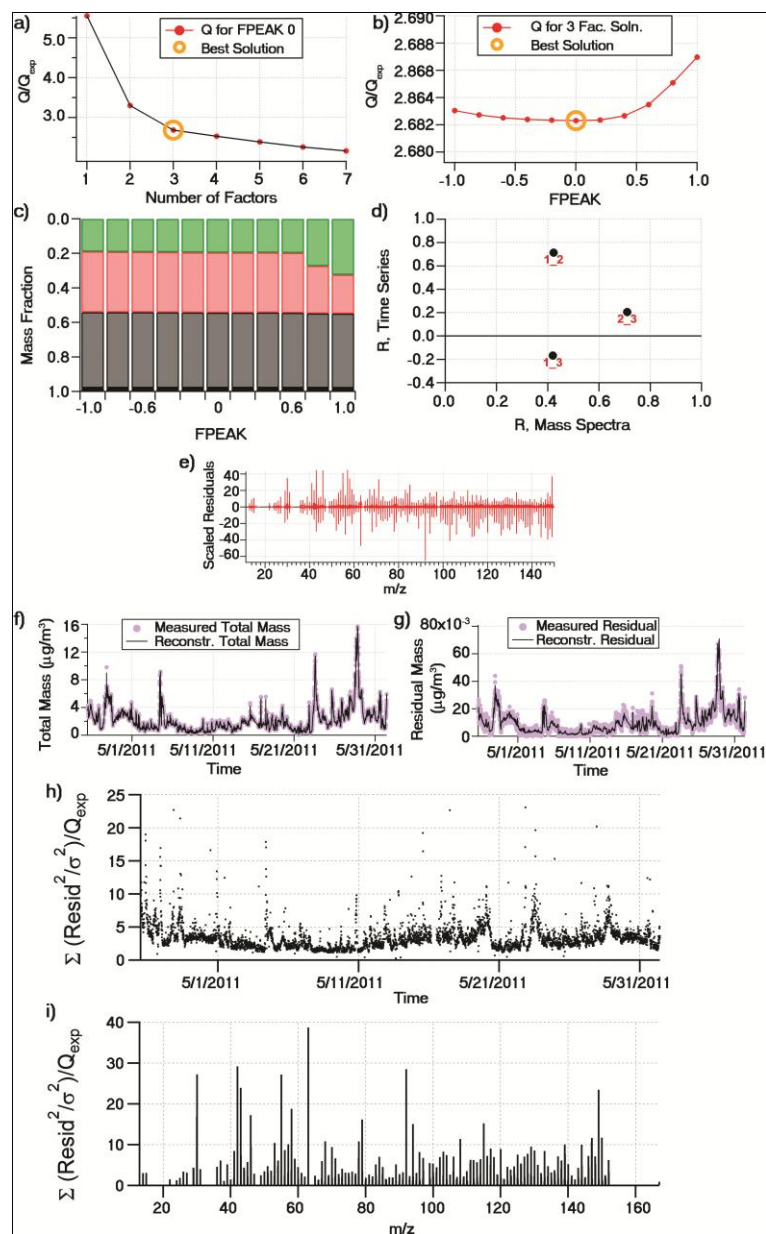
FIGURE S4. Summary of key diagnostic plots of the PMF analysis on the V-mode OA spectra. (a) Q/Q_{exp} as a function of number of factors (P) selected for PMF modeling; (b) Q/Q_{exp} as a function of FPEAK; (c) fractions of OA factors vs. FPEAK; (d) correlations among PMF factors; (e) the box and whiskers plot showing the distributions of scaled residuals for each m/z; (f) time series of the measured organic mass and the reconstructed organic mass; (g) variations of the residual (= measured − reconstructed) of the fit; (h) the Q/Q_{exp} for each point in time; (i) the Q/Q_{exp} values for each m/z

3. Reference

Zhang, Q., Jimenez, J. L., Canagaratna, M. R., Ulbrich, I. M., Ng, N. L., Worsnop, D. R., and Sun, Y. L.: Understanding atmospheric organic aerosols via factor analysis of aerosol mass spectrometry: a review, Anal. Bioanal. Chem., 401, 3045-3067, 2011.