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Supplement of

Aerosol characterization over the southeastern United States using high-resolution aerosol mass spectrometry: spatial and seasonal variation of aerosol composition and sources with a focus on organic nitrates

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The selection of optimal solutions for PMF analysis on merged organic and nitrate mass spectra (i.e., $PMF_{org+NO3}$) is mainly based on comparing the time series (Fig. S5), mass spectrum (Fig. S5), and campaign-average mass concentration (Fig. S6) with factors from PMF analysis on organic mass spectra only (i.e., PMF_{org}), in addition to examining the typical diagnostic plots (Fig. S3). Based on the identification of a nitrate inorganic aerosol (NIA) factor, we divide all seven datasets into two categories: 1) CTR_June and YRK_July where a NIA factor is not resolved and 2) the other sites where a NIA factor is resolved.

For CTR_June and YRK_July, the same factors are resolved from $PMF_{org+NO3}$ analysis as those from PMF_{org} analysis. The factors from $PMF_{org+NO3}$ show good correlation with corresponding factors from PMF_{org} regarding both time series (R>0.964) and mass spectrum (R>0.997) (Fig. S5).

We note that in the optimal solutions of CTR_June and YRK_July, the residuals of NO^+ and NO_2^+ (i.e., $\sum(Resid^2/\sigma^2)/Q_{exp}$)) are larger than that in the optimal solutions of other sites where NIA factor is resolved (Fig. S3). If one goes to higher number factor solutions, the residuals of NO^+ and NO_2^+ of CTR_June and YRK_July are reduced, but the correlations between factors from $PMF_{Org+NO3}$ and corresponding factors from PMF_{Org} are weakened and splitting behavior of real factors occurs (Ulbrich et al., 2009). Take YRK_July for example, the residual of NO^+ decreases from 155 in the three-factor solution (Fig. S3(c)) to 31 in the five-factor solution (Fig. S16). However, the correlations of the time series between factors from $PMF_{Org+NO3}$ and the corresponding factors from PMF_{Org} are all weakened (Fig. S17 amd S5). In addition, MO-OOA in three-factor solution splits into two factors in five-factor solution. Thus, we select three-factor solution as the optimal solution for YRK_July in the $PMF_{Org+NO3}$ analysis.

For all the sites except CTR_June and YRK_July, a nitrate inorganic aerosol (NIA) factor was resolved. All OA factors except LO-OOA from $PMF_{org+NO3}$ show good correlation with the corresponding PMF_{org} OA factors with R>0.89 for time series and R>0.98 for mass spectrum (Fig. S5). The correlation of the LO-OOA time series obtained from $PMF_{org+NO3}$ and PMF_{org} analysis ranges from 0.77 to 0.98 (Fig. S5), which is not as strong as the correlation of other OA factors. This is likely due to that the time series of LO-OOA being more similar to the total measured nitrate (i.e., $NO_{3,meas}$) than other OA factors, so that PMF has difficulty in separating LO-OOA and NIA factor.

An FPEAK value of 0 is chosen for all datasets except RS_Jan. For RS_Jan dataset, $PMF_{org+NO3}$ solution with FPEAK = 0.2 is selected due to the following reasons. First of all, solution with FPEAK=0 is not converged. Second of all, solution with FPEAK = 0.2 provides the best correlation with PMF_{org} factors for all the OA factors from $PMF_{org+NO3}$ analysis. For example, $PMF_{org+NO3}$ solution with FPEAK =-0.2 cannot resolve a clear LO-OOA factor as shown in Fig. S18.

Unlike all the other sites where all PMF_{org} OA factors can be clearly resolved in the corresponding $PMF_{org+NO3}$ analysis, we cannot resolve MO-OOA factor from $PMF_{org+NO3}$ for YRK_Dec even up to ten-factor solution. From PMF_{org} analysis on YRK_Dec, we resolved three factors, which are MO-OOA, LO-OOA, and BBOA. For $PMF_{org+NO3}$ on YRK_Dec, in the two-factor solution, we resolve one NIA factor and only one OA factor, indicating that a two-factor solution is insufficient to separate BBOA and OOA factors. In the three-factor solution, we resolve clear NIA and BBOA factors, but just one OOA factor. This OOA factor correlates well with the combined LO-OOA and MO-OOA factors from PMF_{org} three-factor solution (R=0.94) (Fig. S19(b)), indicating the OOA factor from $PMF_{org+NO3}$ three-factor solution likely represents the combination of LO-OOA and MO-OOA from PMF_{org} three-factor solution. In $PMF_{org+NO3}$ four-factor solution, we resolve a factor whose correlation with all factors from PMF_{org} is very weak (i.e., the highest R is 0.63) (Fig. S19(c)). This suggests that "splitting" behavior occurs for the $PMF_{org+NO3}$ four-factor solution. Taken together, $PMF_{org+NO3}$ with a three-factor solution is optimal for YRK_Dec. It is also important to note that the focus of $PMF_{org+NO3}$ is for nitrate source apportionment. Although $PMF_{org+NO3}$ resolves different OA factors for different solutions, the concentration of the NIA factor remains almost constant (i.e., the NIA factor concentration ranges from 0.54 - 0.6 $\mu g/m^3$ from 2 to 5 factor solutions). Thus, the number of factors resolved for YRK_Dec has minimal effect on our conclusion.

Figure Captions

Fig. S1. Diagnostic plots of the PMF analysis on the high-resolution organic mass spectra (i.e., PMF_{org}). The following plots are shown for all the datasets: (1) Q/Q_{exp} vs number of factors; (2) Q/Q_{exp} vs. FPEAK for the solution with optimal number of factors; (3) mass fraction of PMF factors vs. FPEAK; (4) correlations of time series and mass spectra among PMF factors; (5) the distribution of scaled residuals for each m/z; (6) the time series of the measured and the reconstructed organic mass; (7) variations of the residual (= measured - reconstructed) of the least-square-fit vs. time; (8) the time series of Q/Q_{exp}; (9) the Q/Qexp values vs. *m/z*.

Fig. S2. Mass spectra and time series of OA factors resolved from PMF analysis on the high-resolution organic mass spectra (i.e. PMF_{org} analysis). Mass spectra are colored by ion type. The time series of independent external tracers are also included.

Fig. S3. Diagnostic plots of the PMF analysis on the high-resolution merged organic and nitrate mass spectra (i.e. $PMF_{org+NO3}$ analysis). The following plots are shown for all the datasets: (1) Q/Q_{exp} vs. number of factors; (2) Q/Q_{exp} vs FPEAK for the solution with optimal number of factors; (3) mass fraction of PMF factors vs. FPEAK; (4) correlations of time series and mass spectra among PMF factors; (5) the distribution of scaled residuals for each m/z; (6) the time series of the measured and the reconstructed organic mass; (7) variations of the residual (= measured - reconstructed) of the least-square-fit vs. time; (8) the time series of Q/Q_{exp}; (9) the Q/Qexp values vs. *m/z*.

Fig. S4. Mass spectra of OA factors resolved from PMF analysis on the high-resolution merged organic and nitrate mass spectra (i.e. $PMF_{org+NO3}$ analysis). Mass spectra are colored by ion type.

Fig. S5. Comparison between factors resolved from PMF analysis on merged organic and nitrate mass spectra (i.e. $PMF_{org+NO3}$) and factors resolved from PMF analysis on organic mass spectra (i.e. PMF_{org}) for all datasets. Each sub-panel shows the correlation coefficients of each factor from $PMF_{org+NO3}$ against all factors from PMF_{org} in terms of either mass spectrum or time series. The factors from $PMF_{org+NO3}$ are color-coded in the same way as Fig. S10, that is, MO-OOA, LO-OOA, Isoprene-OA, HOA, BBOA, COA are dark green, light green, blue, grey, brown, and yellow, respectively.

Fig. S6. The comparison of campaign-averaged mass concentration of factors resolved from PMF analysis on merged organic and nitrate mass spectra (i.e. $PMF_{org+NO3}$) and factors resolved from PMF analysis on organic mass spectra (i.e. PMF_{org}). RIE and CE are not applied.

Fig. S7. Campaign-averaged mass spectra of total OA for all datasets. Mass spectra are colored by ion type.

Fig. S8. Diurnal profiles of brown carbon light absorption for all the datasets.

Fig. S9. Scatter plot of Isoprene-OA vs. brown carbon light absorption for the datasets where a Isoprene-OA factor was resolved.

Fig. S10. The atomic O:C and H:C ratios of OA factors resolved from PMF analysis on high-resolution organic mass spectra (i.e. PMF_{org}).

Fig. S11. Mass fractions of nitrate signals (i.e., NO^+ and NO_2^+) and organic signals in the nitrate inorganic aerosol (NIA) factor for the datasets where a NIA factor was resolved.

Fig. S12. NO^+/NO_2^+ ratio of the nitrate inorganic aerosol (NIA) factor resolved from PMF analysis on merged organic and nitrate mass spectra (i.e. $PMF_{org+NO3}$ analysis). The y-axis is normalized by the NO^+/NO_2^+ ratio of ammonium nitrate of each dataset.

Fig. S13. Time series of sodium and nitrate measured by a PILS-IC at Centreville, AL. The $PM_{2.5}$ cyclone was replaced with a PM_1 cyclone on June 24th, 2013.

Fig. S14. The comparison between ACSM measurements (stationary at the Georgia Tech site) and HR-ToF-AMS measuremens (rotating among different sites) of NR-PM_1 species.

Fig. S15. Diurnal profiles of R_{meas}/R_{AN} for all datasets.

Fig. S16. The Q/Q_{exp} values for each *m/z* in the five-factor solution of $PMF_{org+NO3}$ analysis on the YRK_July dataset.

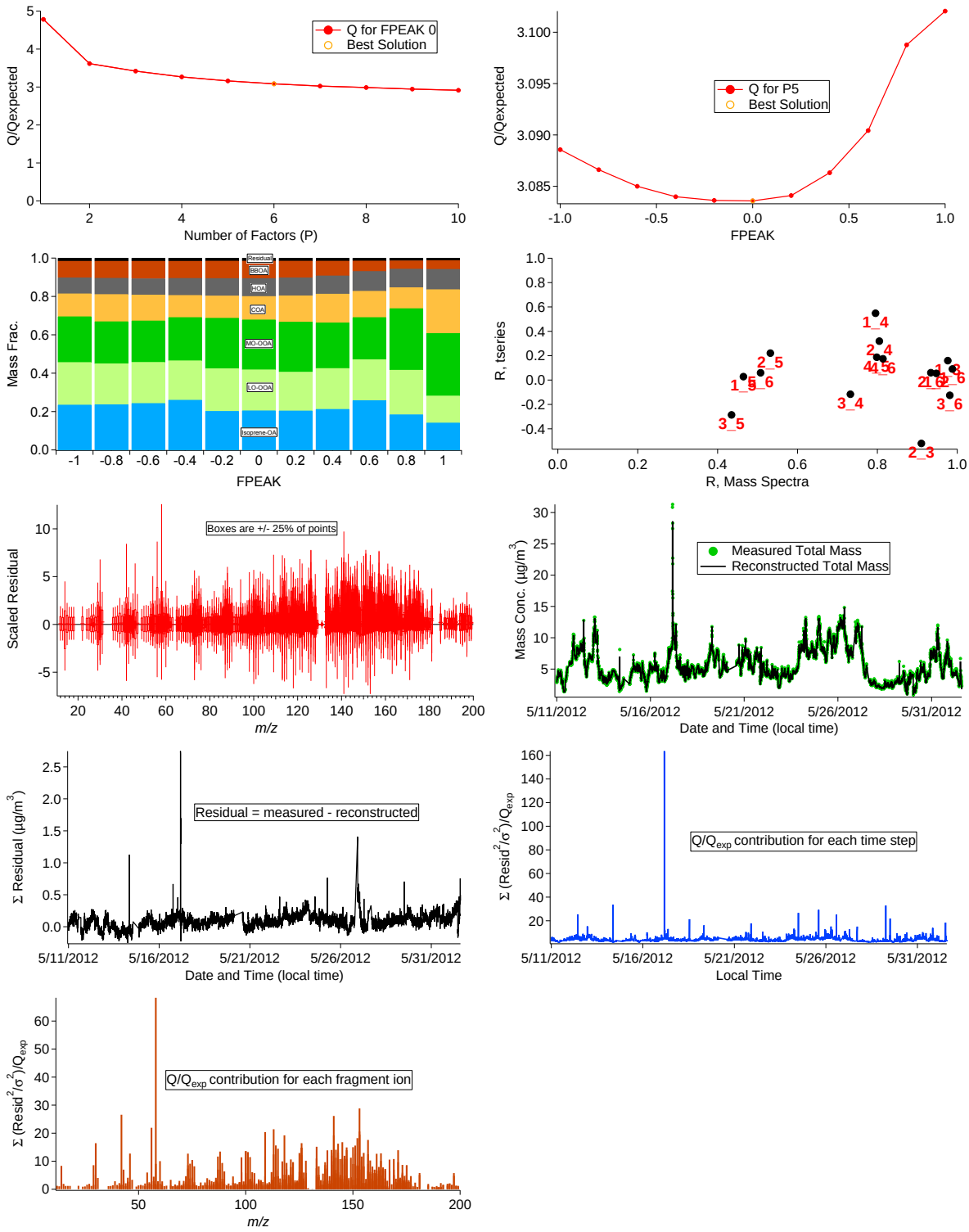
Fig. S17. Correlation coefficients of the time series of factors from $PMF_{org+NO3}$ (five-factor solution) with the time series of factors from PMF_{org} (three-factor solution) for YRK_July.

Fig. S18. Correlation coefficients of the time series of factors from $PMF_{org+NO3}$ (six-factor solution with FPEAK = -0.2) with the time series of factors from PMF_{org} (five-factor solution for RS_Jan.

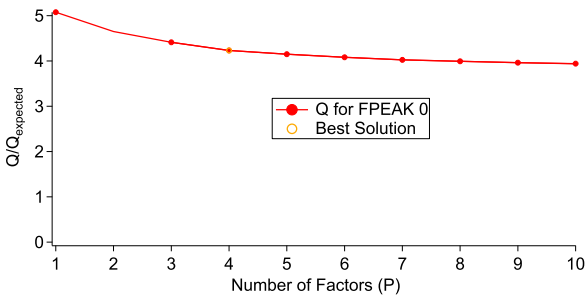
Fig. S19. Correlation coefficients of the time series of factors from $PMF_{org+NO3}$ (from two-factor solution to four-factor solution) with the time series of factors from PMF_{org} (three-factor solution for YRK_Dec.

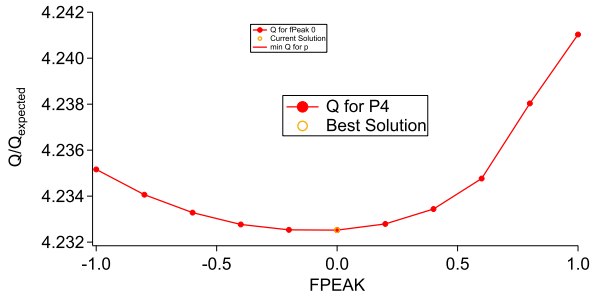
Fig. S1.

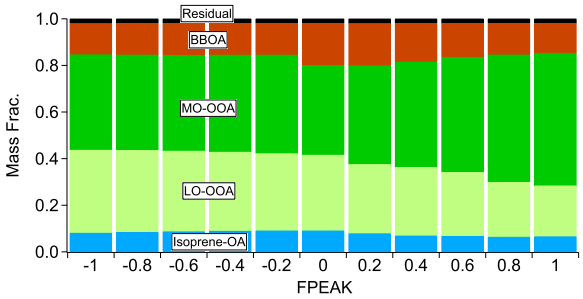
a) JST_May

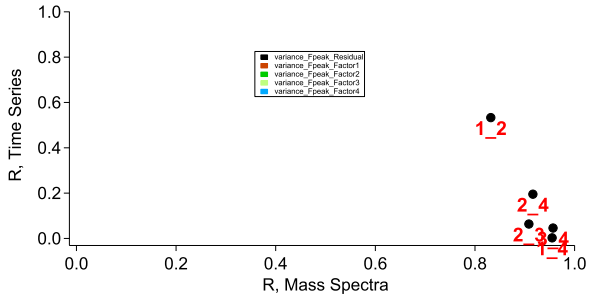


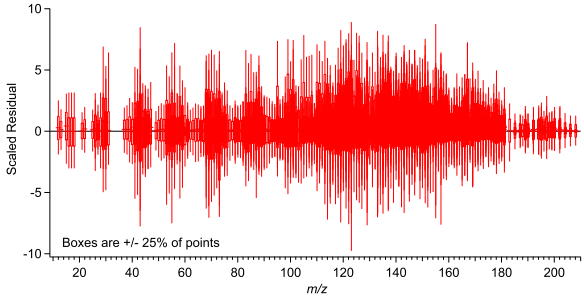
b) CTR_June

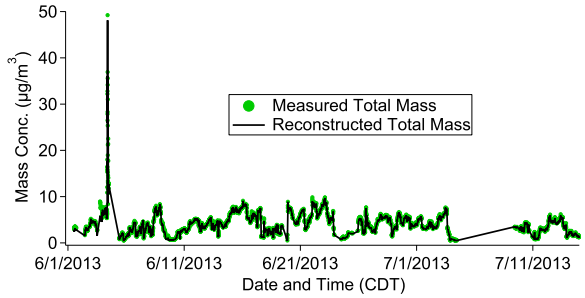

Q/Q_expected
Number of Factors (P)
Q for FPEAK 0
Best Solution

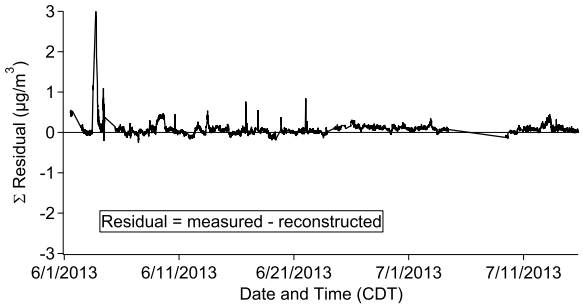

Q/Q_expected
FPEAK
Q for P4
Best Solution

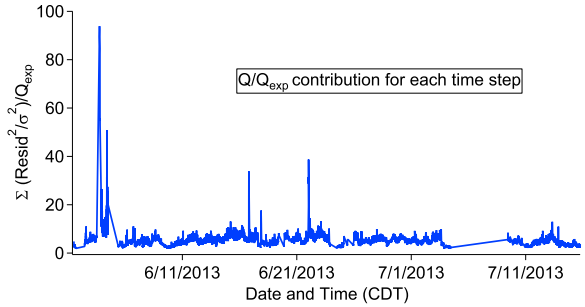

Mass Frac.
FPEAK
Residual
BBOA
MO-OOA
LO-OOA
Isoprene-OA

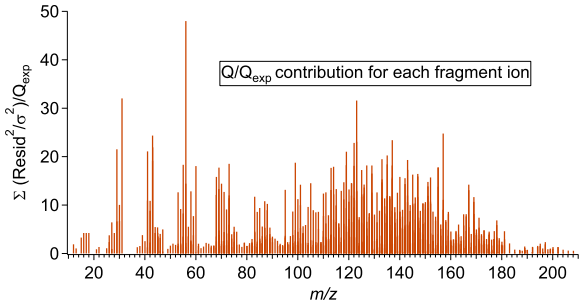

R, Time Series
R, Mass Spectra
1_2
2_4
2_3
1_4


Scaled Residual
m/z
Boxes are +/- 25% of points

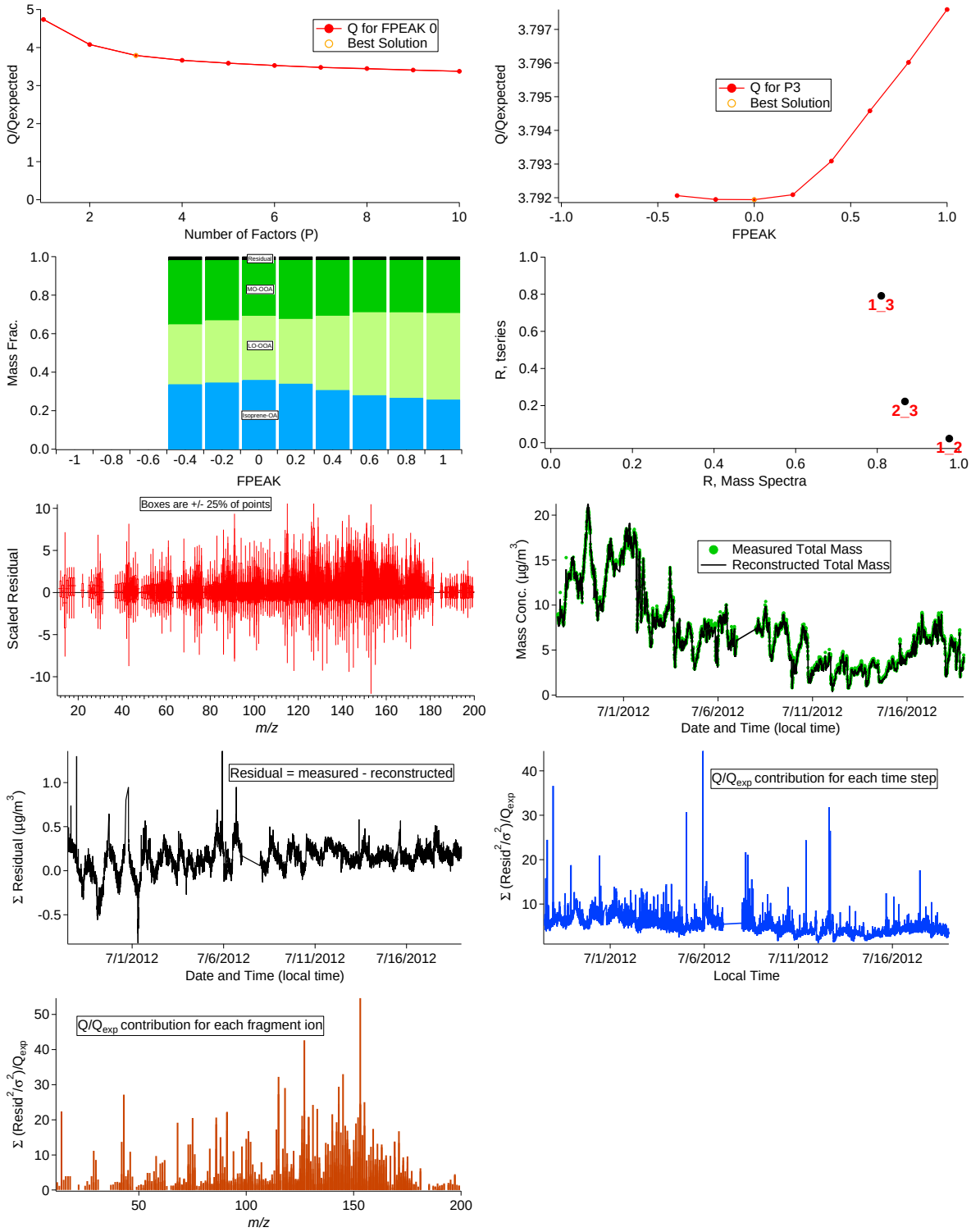

Mass Conc. (μg/m³)
Date and Time (CDT)
Measured Total Mass
Reconstructed Total Mass


Σ Residual (μg/m³)
Date and Time (CDT)
Residual = measured - reconstructed

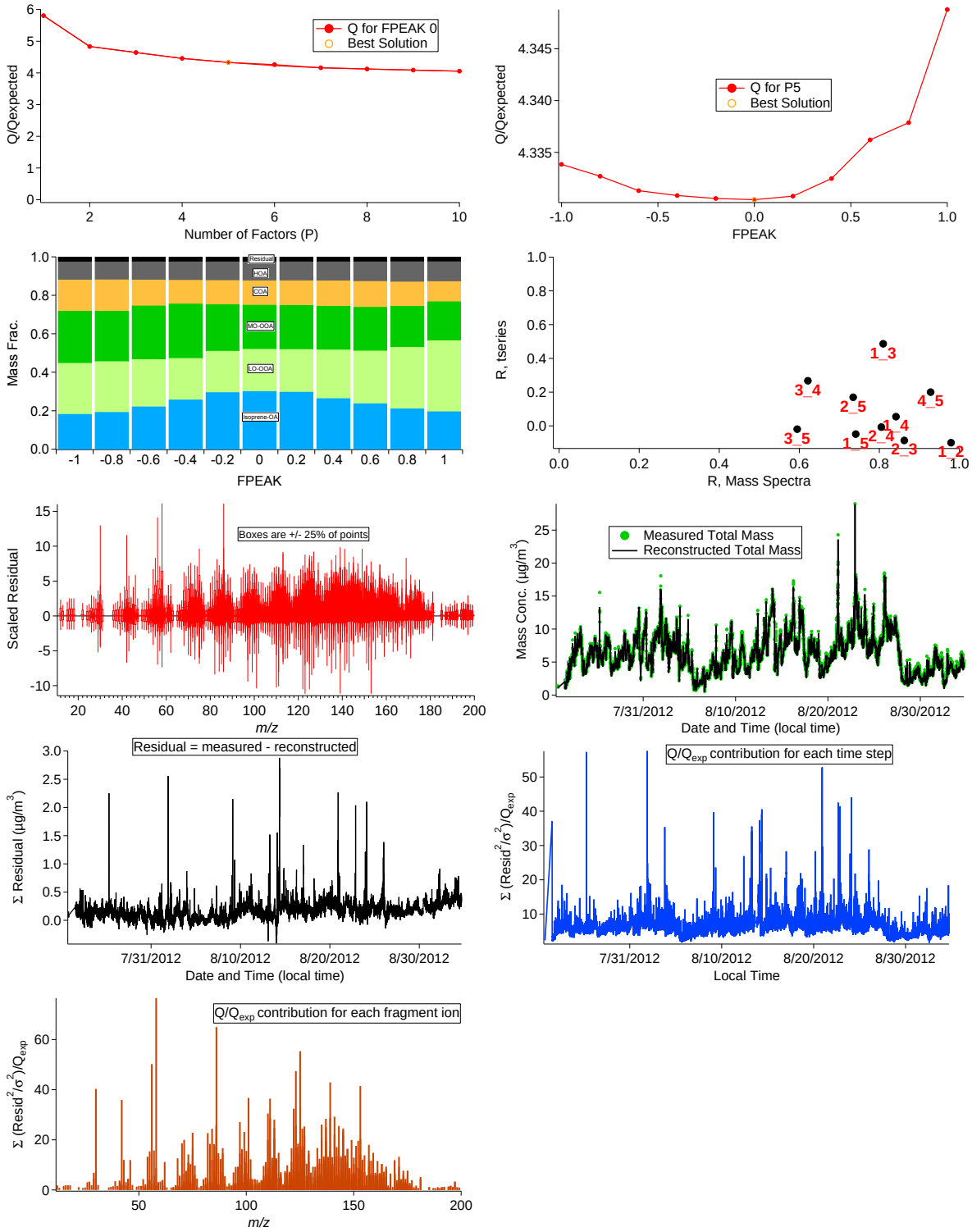

Σ (Resid²/σ²)/Q_exp
Date and Time (CDT)
Q/Q_exp contribution for each time step


Σ (Resid²/σ²)/Q_exp
m/z
Q/Q_exp contribution for each fragment ion

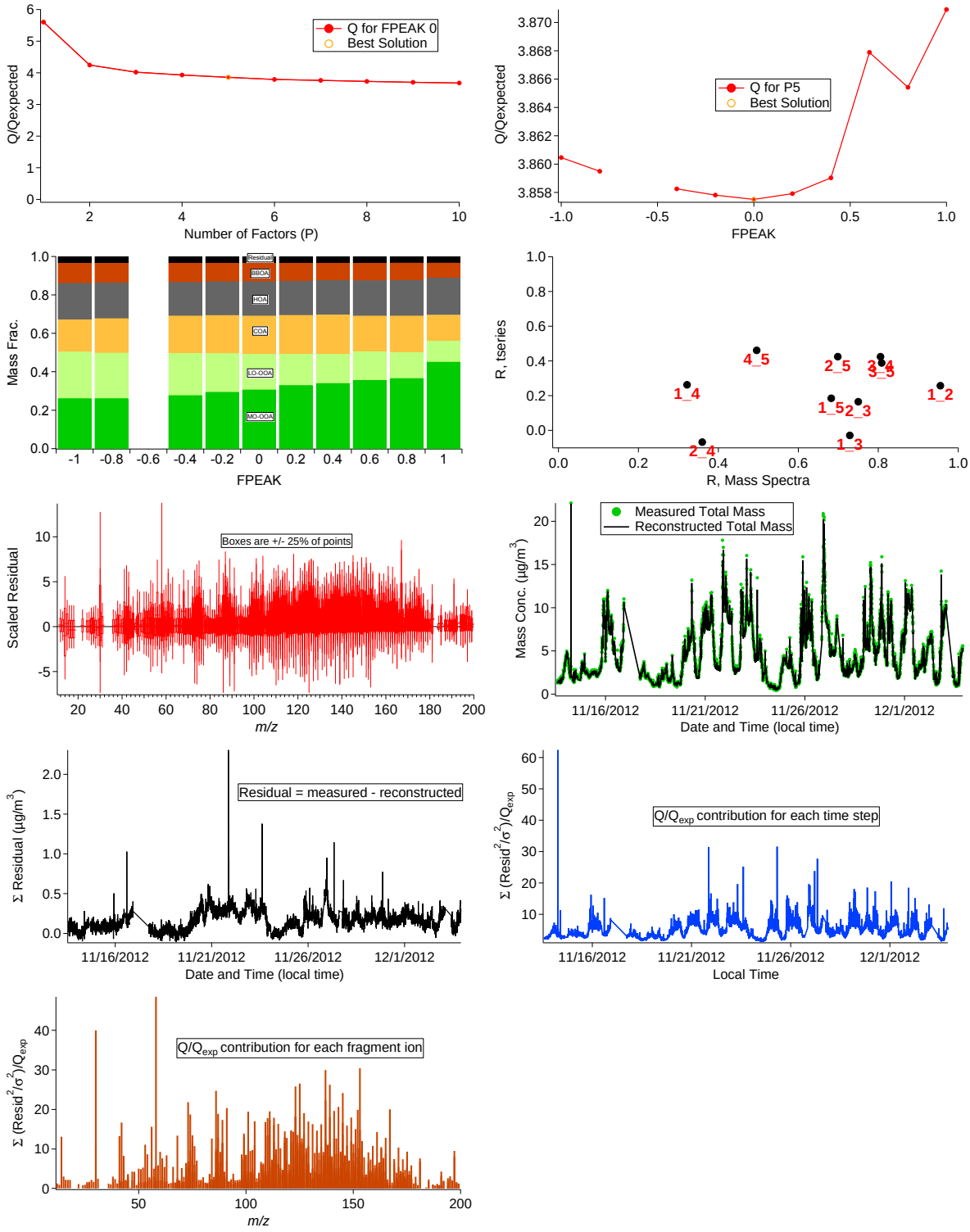
c) YRK_July


Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P3
Best Solution
FPEAK
Residual
MO-OOA
LO-OOA
Isoprene-OA
Mass Frac.
FPEAK
1_3
2_3
1_2
R, tseries
R, Mass Spectra
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (μg/m3)
Date and Time (local time)
Residual = measured - reconstructed
Σ Residual (μg/m3)
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

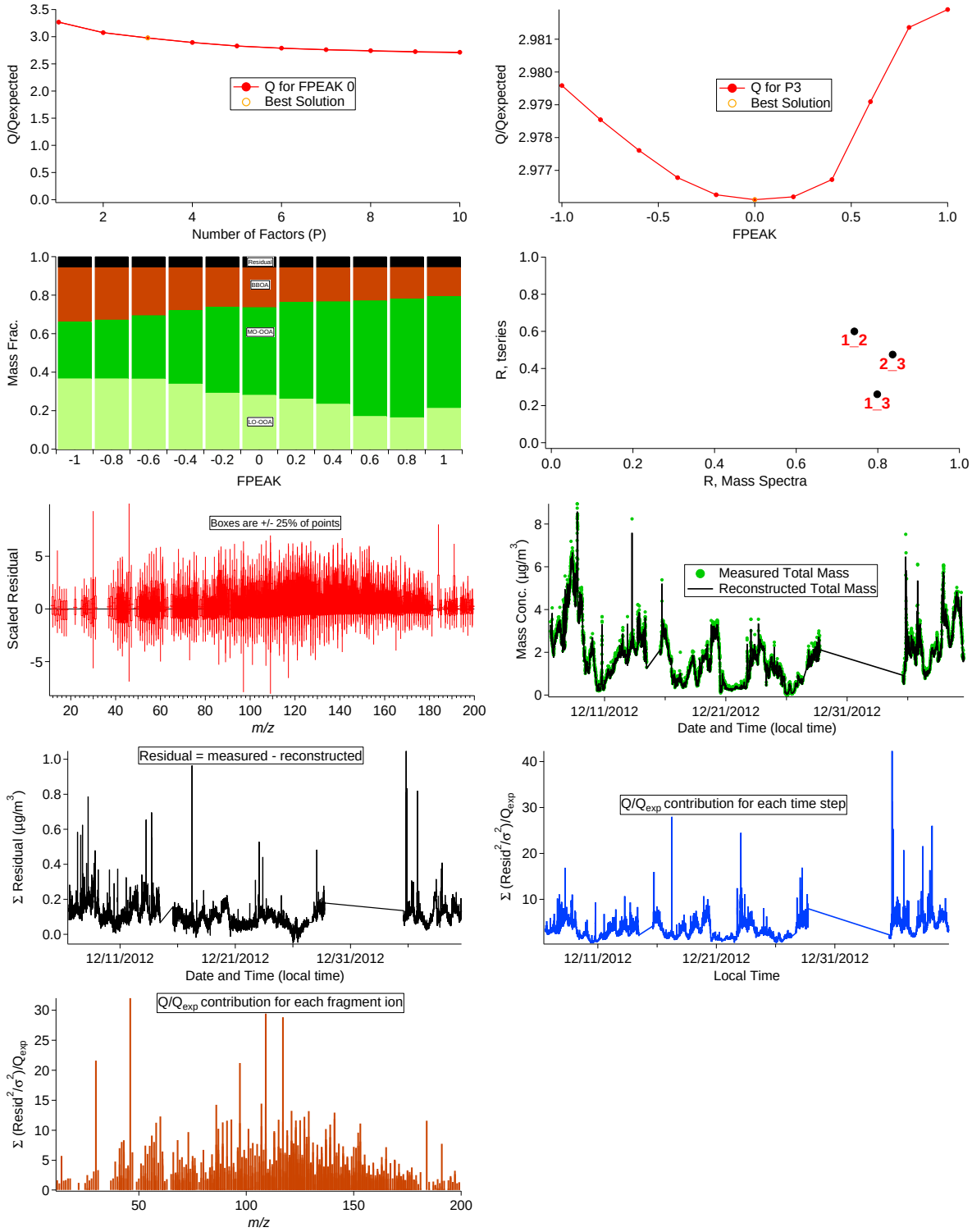
d) GT_Aug


Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P5
Best Solution
FPEAK
Residual
HOA
COA
MO-OOA
LO-OOA
Isoprene-OA
Mass Frac.
FPEAK
R, tseries
R, Mass Spectra
1_3
3_4
2_5
4_5
1_4
3_5
1_5
2_4
2_3
1_2
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (µg/m3)
Date and Time (local time)
Residual = measured - reconstructed
Σ Residual (µg/m3)
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

e) JST_Nov


Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P5
Best Solution
FPEAK
Residual
BBOA
HOA
COA
LO-OOA
MO-OOA
Mass Frac.
FPEAK
R, tseries
R, Mass Spectra
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (µg/m3)
Date and Time (local time)
Residual = measured - reconstructed
Σ Residual (µg/m3)
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

f) YRK_Dec


Q/Qexpected
Number of Factors (P)
Q for FPEAK 0
Best Solution
Q/Qexpected
FPEAK
Q for P3
Best Solution
Mass Frac.
FPEAK
Residual
BBOA
MO-OOA
LO-OOA
R, tseries
R, Mass Spectra
1_2
2_3
1_3
Scaled Residual
m/z
Boxes are +/- 25% of points
Mass Conc. (µg/m3)
Date and Time (local time)
Measured Total Mass
Reconstructed Total Mass
Σ Residual (µg/m3)
Residual = measured - reconstructed
Date and Time (local time)
Σ (Resid2/σ2)/Qexp
Q/Qexp contribution for each time step
Local Time
Σ (Resid2/σ2)/Qexp
Q/Qexp contribution for each fragment ion
m/z

g) RS_Jan

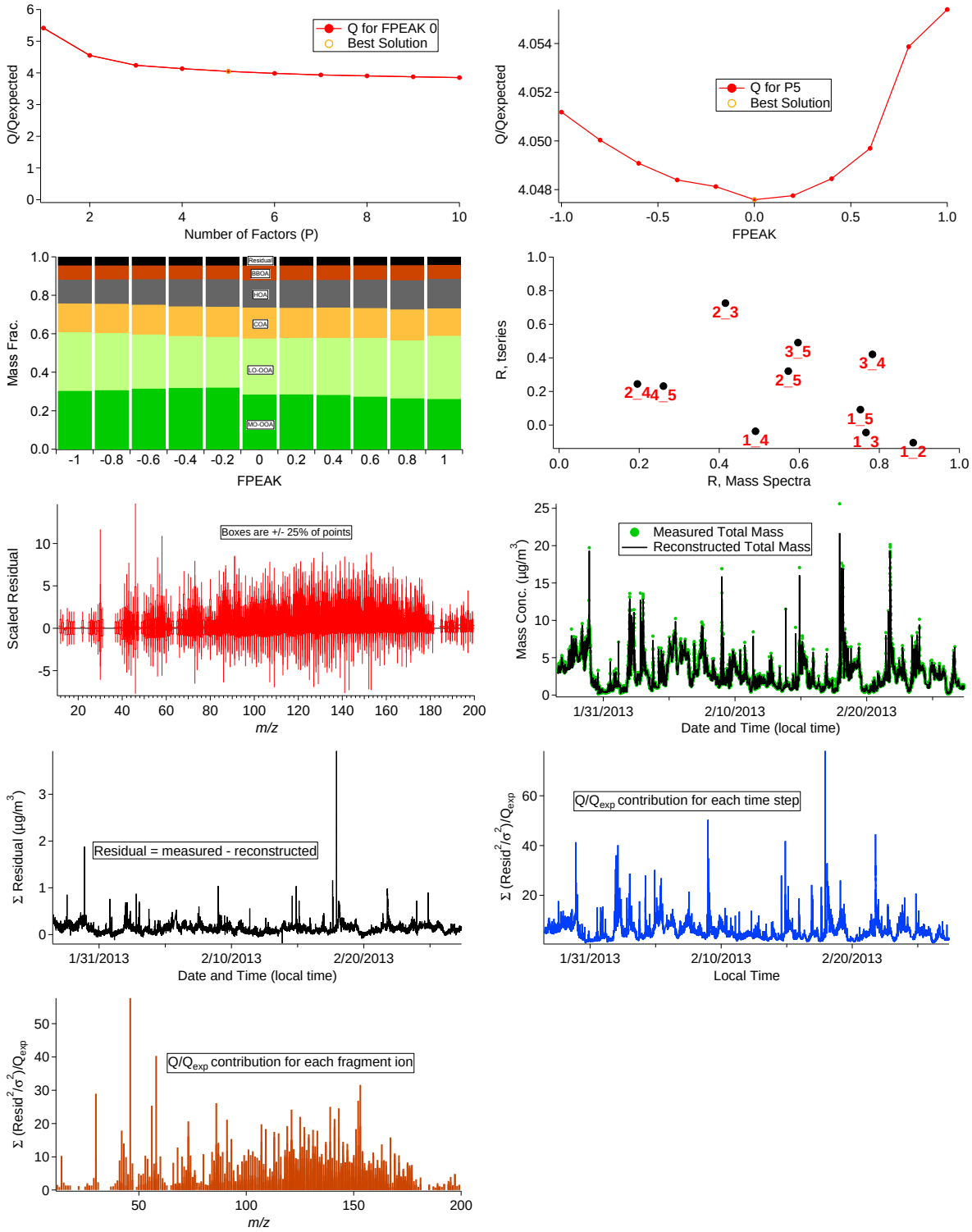
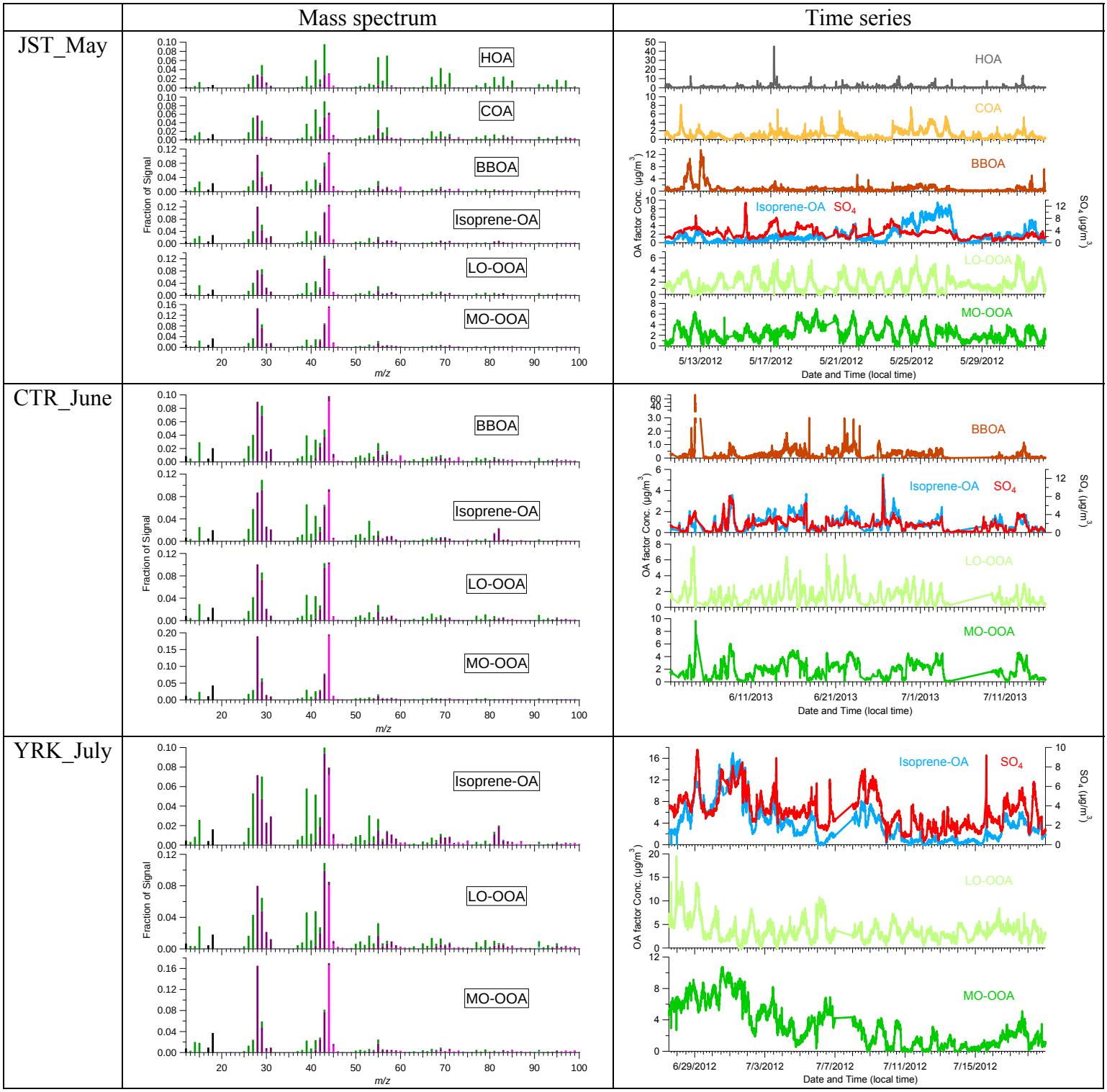

Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P5
Best Solution
FPEAK
Residual
BBOA
HOA
COA
LO-OOA
MO-OOA
Mass Frac.
FPEAK
R, tseries
R, Mass Spectra
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (µg/m3)
Date and Time (local time)
Residual = measured - reconstructed
Σ Residual (µg/m3)
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

Fig. S2.


Mass spectrum
Time series
JST_May
CTR_June
YRK_July
HOA
COA
BBOA
Isoprene-OA
LO-OOA
MO-OOA
Fraction of Signal
m/z
OA factor Conc. (μg/m3)
SO4 (μg/m3)
SO4
Date and Time (local time)
5/13/2012
5/17/2012
5/21/2012
5/25/2012
5/29/2012
6/11/2013
6/21/2013
7/1/2013
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6/29/2012
7/3/2012
7/7/2012
7/11/2012
7/15/2012

Fig. S2. Continued

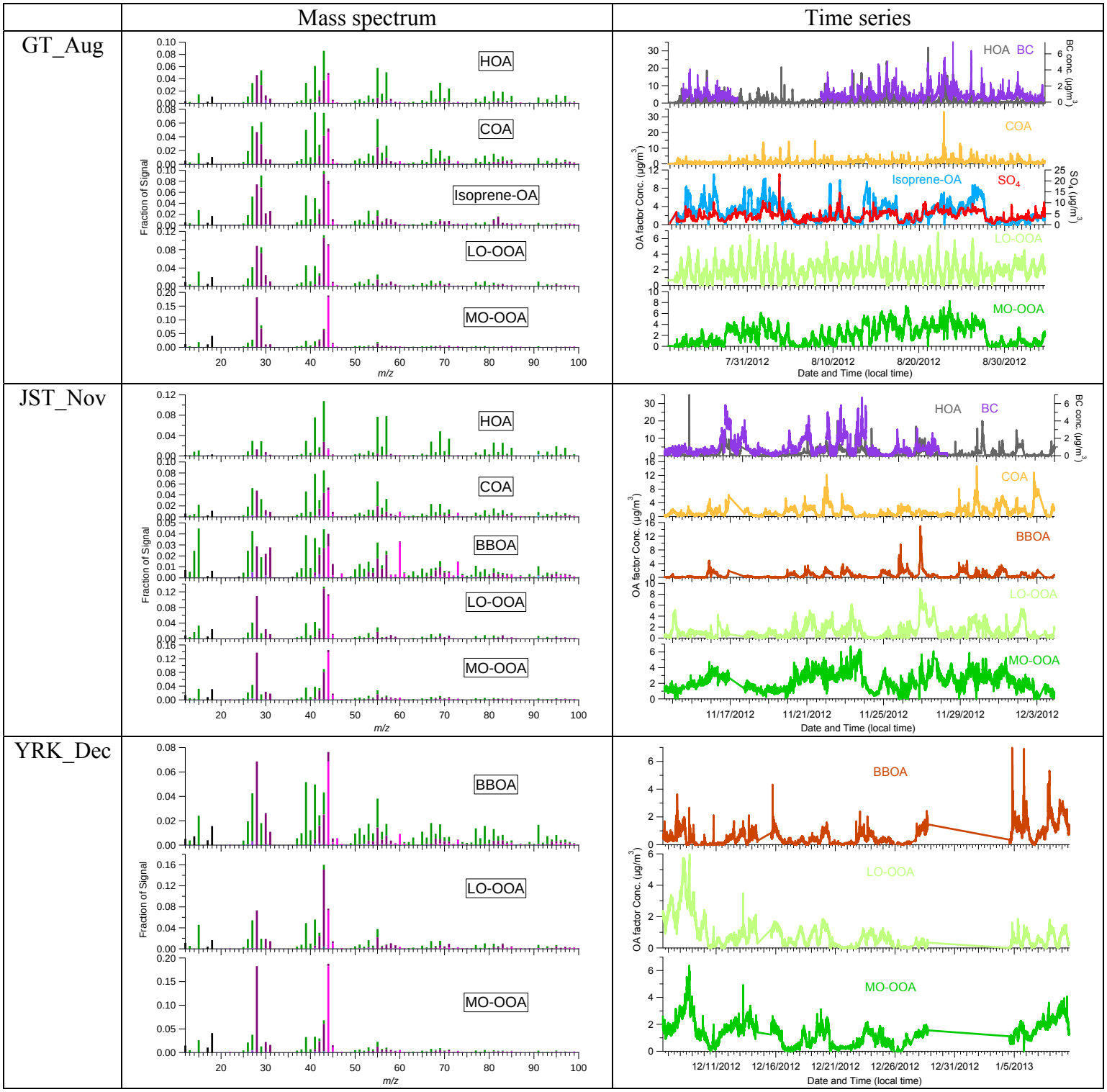


Fig. S2. Continued

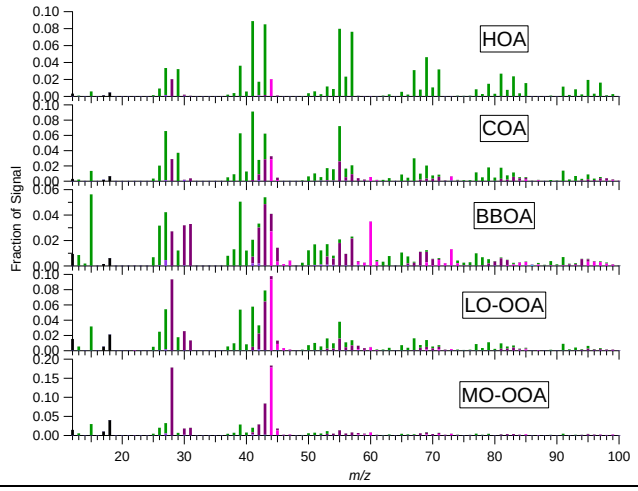
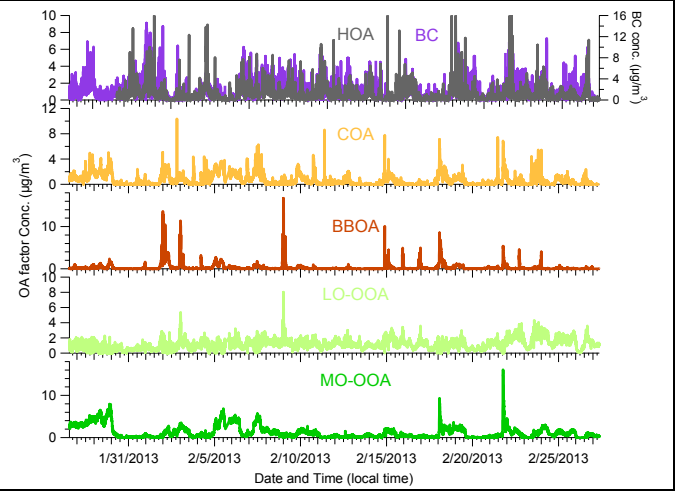
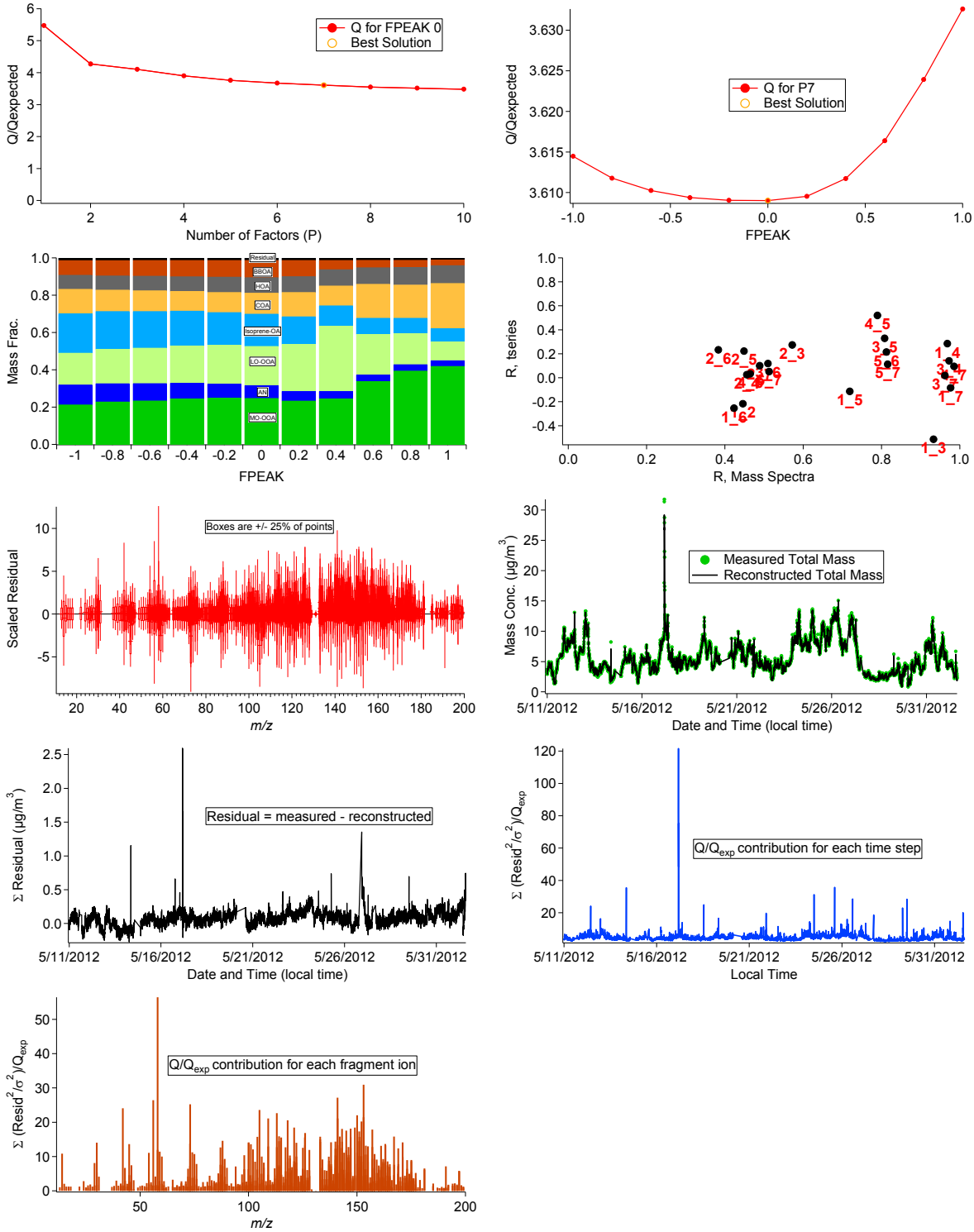
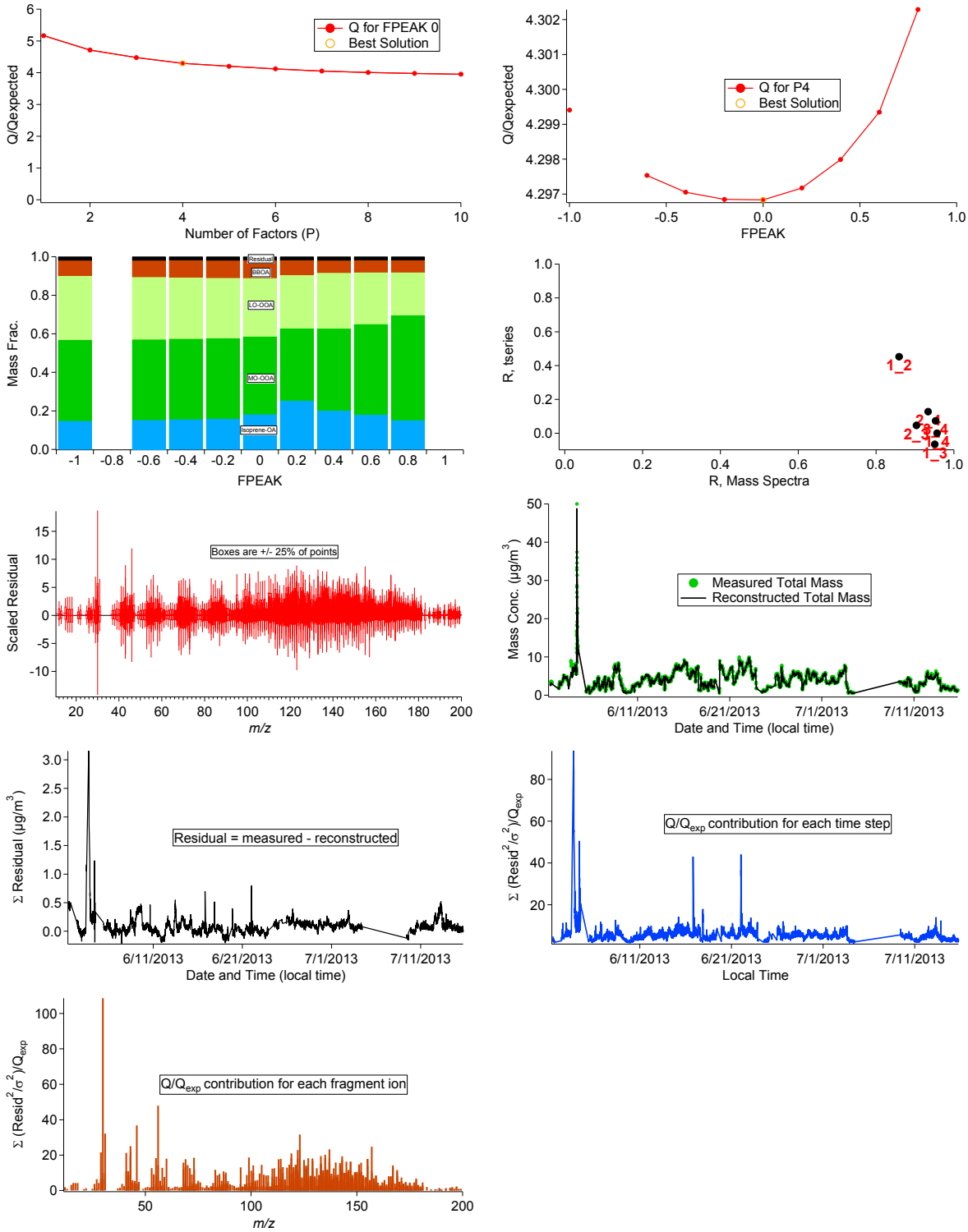
	Mass spectrum	Time series
RS_Jan		

Fig. S3.

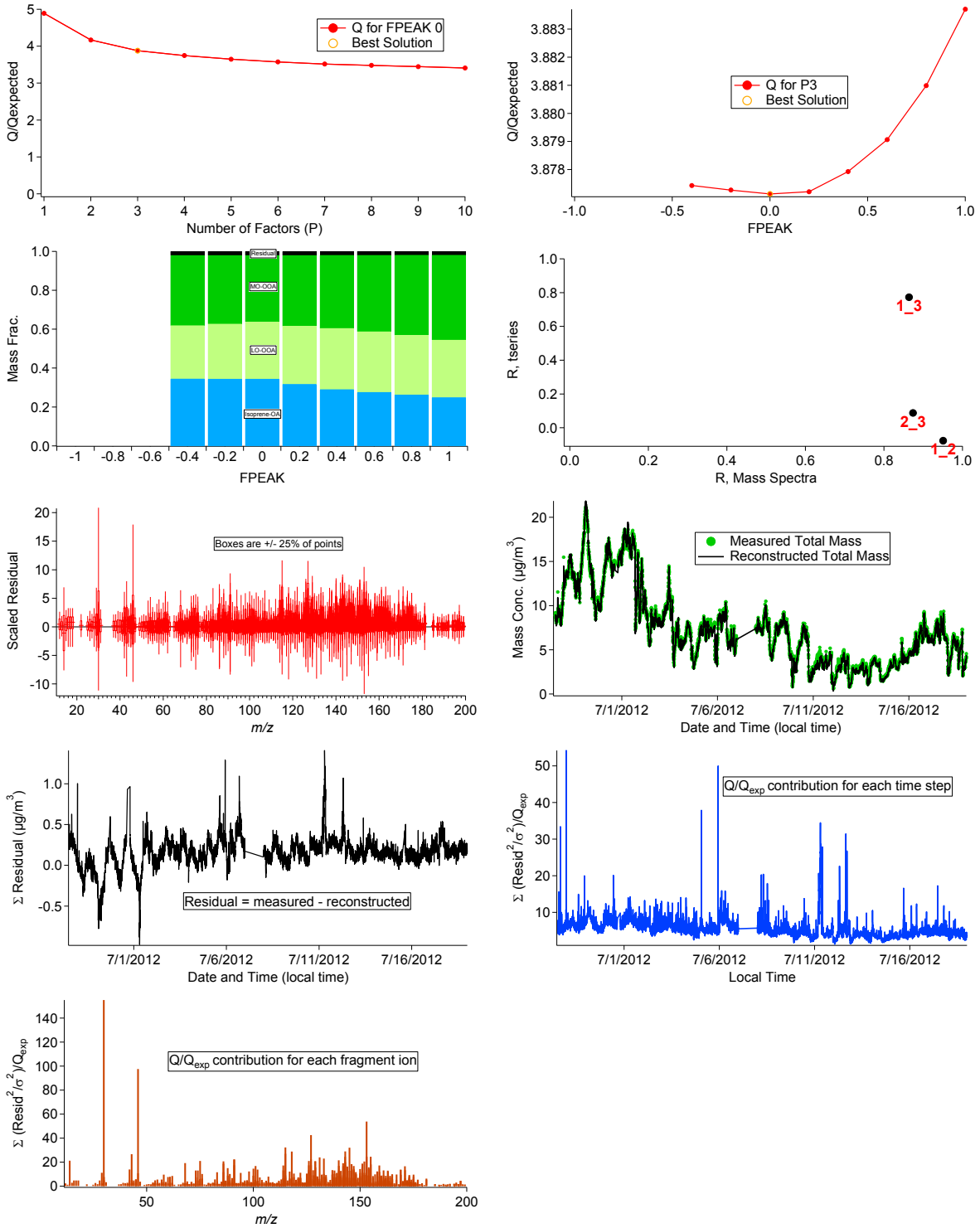
(a) JST_May



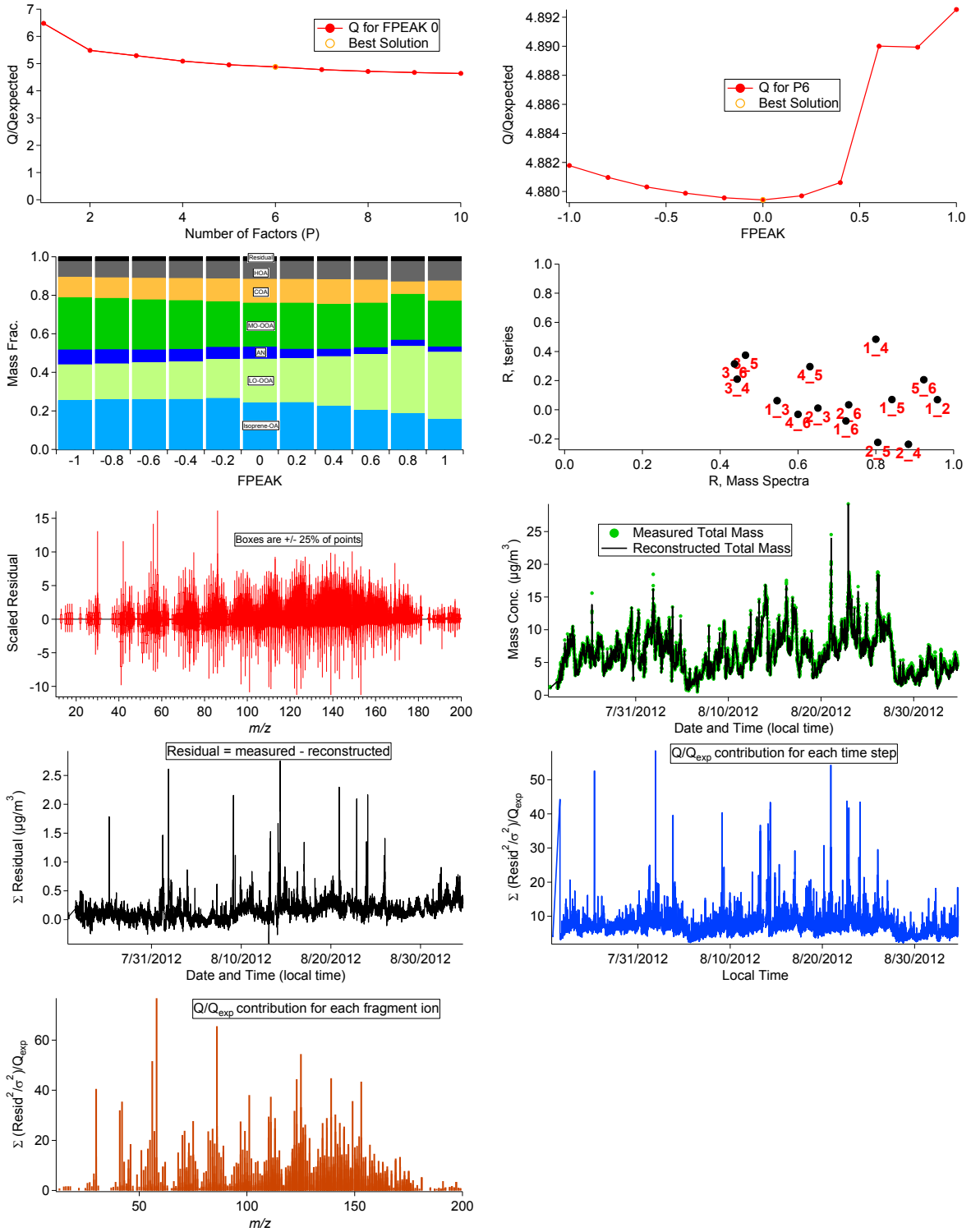
(b) CTR_June


Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P4
Best Solution
FPEAK
Residual
BBOA
LO-OOA
MO-OOA
Isoprene-OA
Mass Frac.
FPEAK
R, tseries
R, Mass Spectra
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (µg/m3)
Date and Time (local time)
Residual = measured - reconstructed
Σ Residual (µg/m3)
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

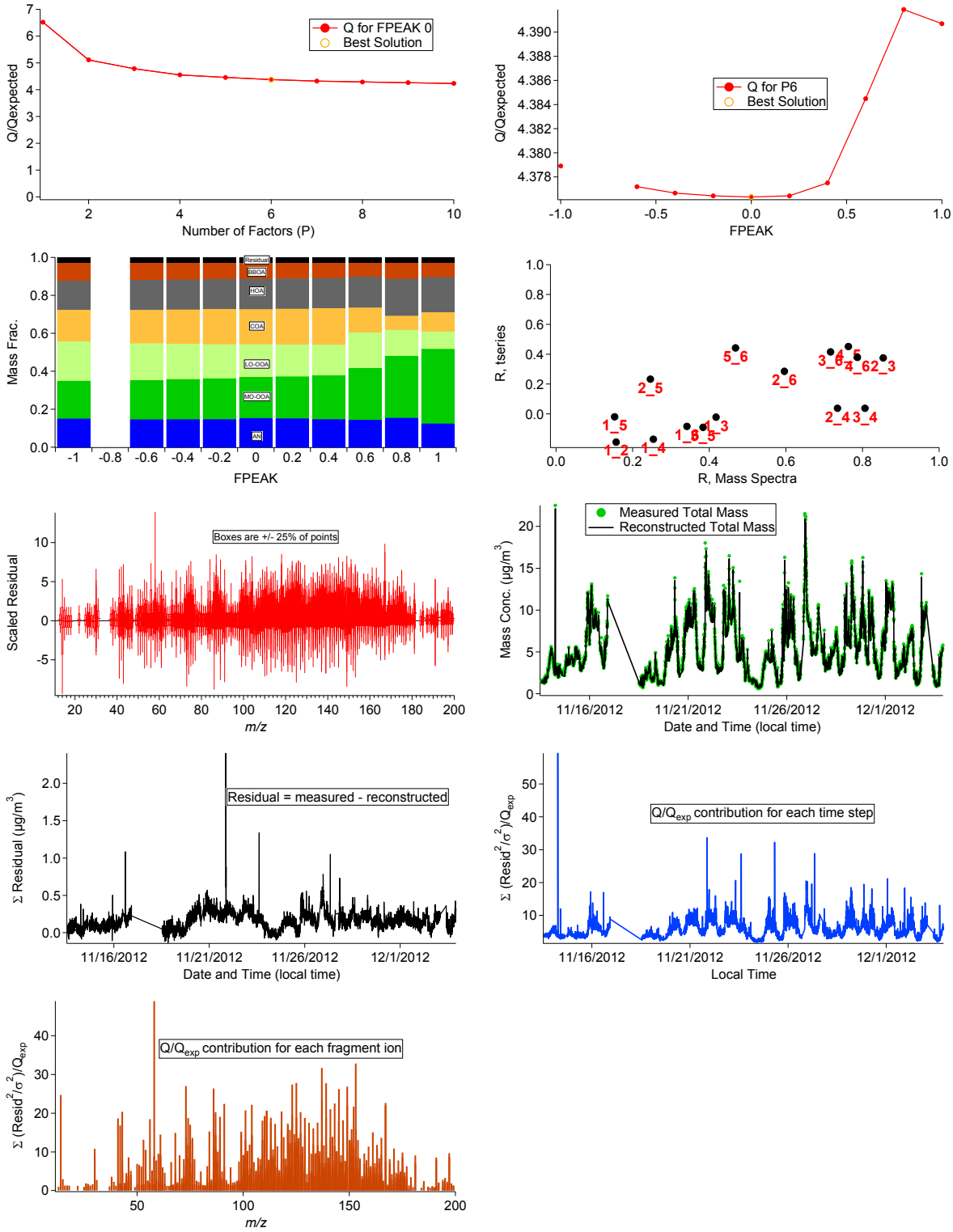
(c) YRK_July


Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P3
Best Solution
FPEAK
Residual
MO-OOA
LO-OOA
Isoprene-OA
Mass Frac.
FPEAK
R, tseries
R, Mass Spectra
1_3
2_3
1_2
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (μg/m3)
Date and Time (local time)
Σ Residual (μg/m3)
Residual = measured - reconstructed
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

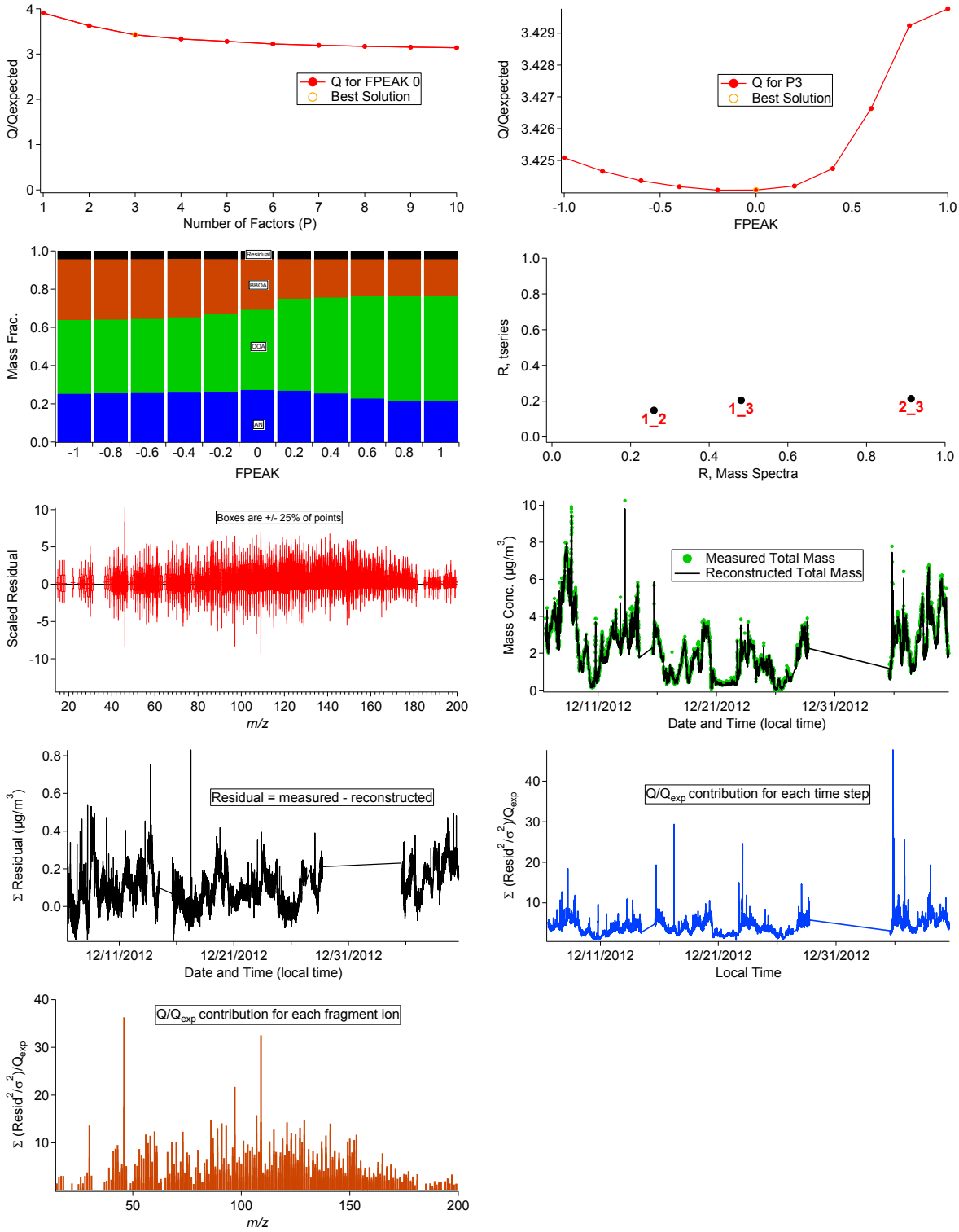
(d) GT_Aug


Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P6
Best Solution
FPEAK
Residual
HOA
COA
MO-OOA
AN
LO-OOA
Isoprene-OA
Mass Frac.
FPEAK
R, tseries
R, Mass Spectra
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (μg/m3)
Date and Time (local time)
Residual = measured - reconstructed
Σ Residual (μg/m3)
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

(e) JST_Nov


Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P6
Best Solution
FPEAK
Residual
BBOA
HOA
COA
LO-OOA
MO-OOA
AMS
Mass Frac.
FPEAK
R, tseries
R, Mass Spectra
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (µg/m3)
Date and Time (local time)
Residual = measured - reconstructed
Σ Residual (µg/m3)
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

(f) YRK_Dec


Q/Qexpected
Number of Factors (P)
Q for FPEAK 0
Best Solution
Q/Qexpected
FPEAK
Q for P3
Best Solution
Mass Frac.
FPEAK
Residual
BBOA
OOA
AN
R, tseries
R, Mass Spectra
1_2
1_3
2_3
Scaled Residual
m/z
Boxes are +/- 25% of points
Mass Conc. (µg/m3)
Date and Time (local time)
Measured Total Mass
Reconstructed Total Mass
Σ Residual (µg/m3)
Residual = measured - reconstructed
Date and Time (local time)
Σ (Resid2/σ2)/Qexp
Q/Qexp contribution for each time step
Local Time
Σ (Resid2/σ2)/Qexp
Q/Qexp contribution for each fragment ion
m/z

(g) RS_Jan

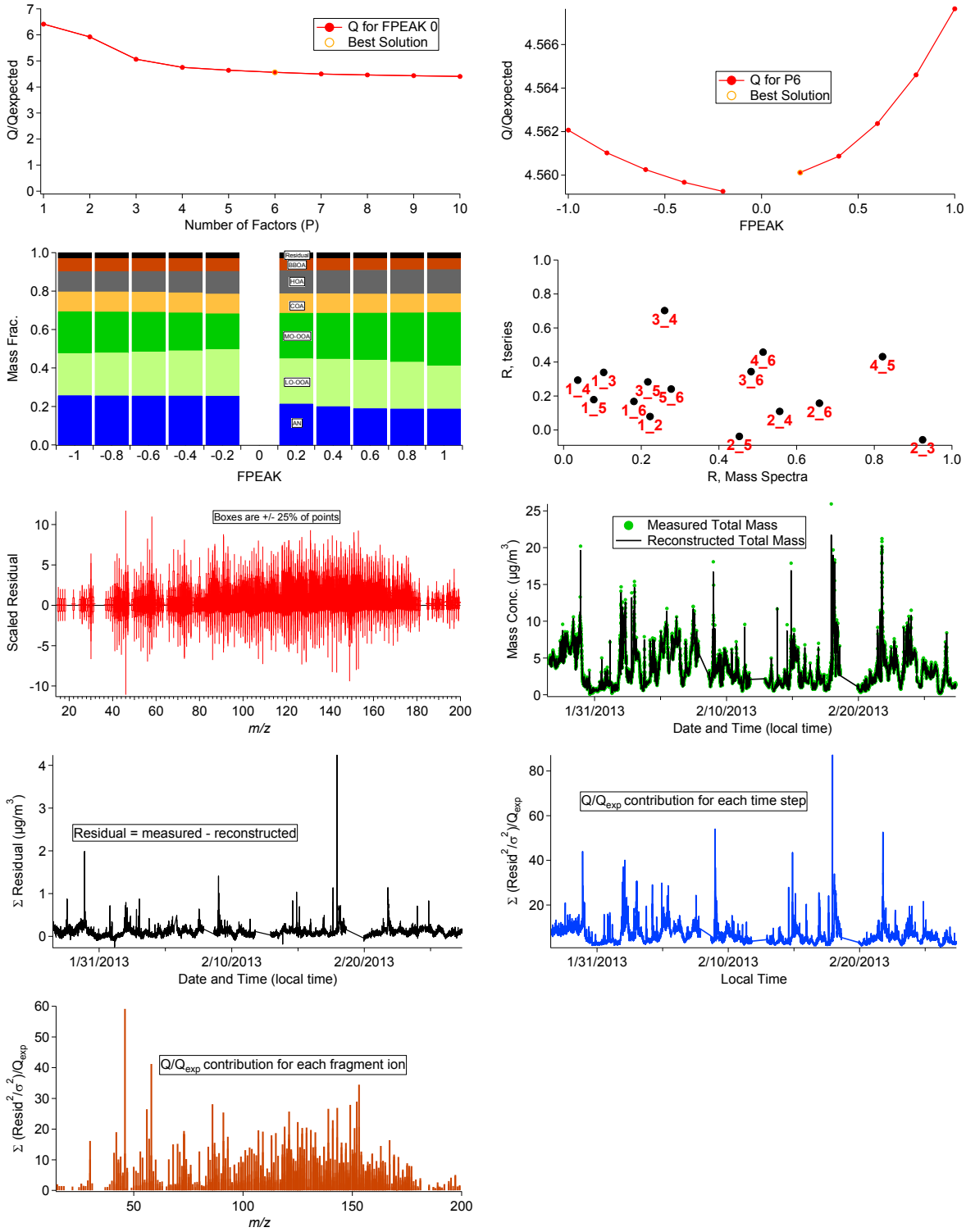

Q for FPEAK 0
Best Solution
Q/Qexpected
Number of Factors (P)
Q for P6
Best Solution
FPEAK
Mass Frac.
Residual
BBOA
HOA
COA
MO-OOA
LO-OOA
AN
FPEAK
R, tseries
R, Mass Spectra
Boxes are +/- 25% of points
Scaled Residual
m/z
Measured Total Mass
Reconstructed Total Mass
Mass Conc. (µg/m3)
Date and Time (local time)
Residual = measured - reconstructed
Σ Residual (µg/m3)
Date and Time (local time)
Q/Qexp contribution for each time step
Σ (Resid2/σ2)/Qexp
Local Time
Q/Qexp contribution for each fragment ion
Σ (Resid2/σ2)/Qexp
m/z

Fig. S4.

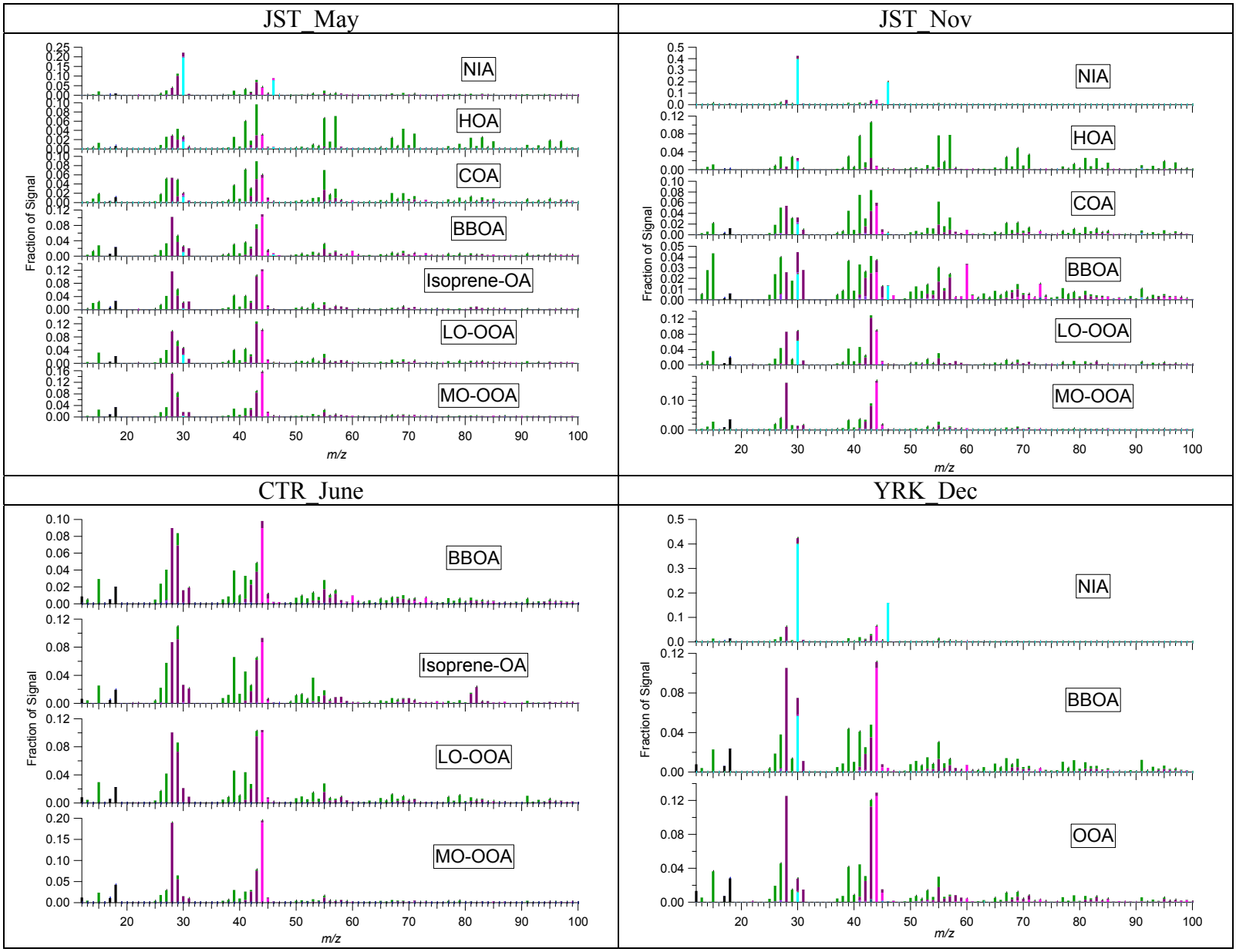

JST_May
NIA
HOA
COA
BBOA
Isoprene-OA
LO-OOA
MO-OOA
Fraction of Signal
m/z
JST_Nov
NIA
HOA
COA
BBOA
LO-OOA
MO-OOA
Fraction of Signal
m/z
CTR_June
BBOA
Isoprene-OA
LO-OOA
MO-OOA
Fraction of Signal
m/z
YRK_Dec
NIA
BBOA
OOA
Fraction of Signal
m/z

Fig. S4 continued

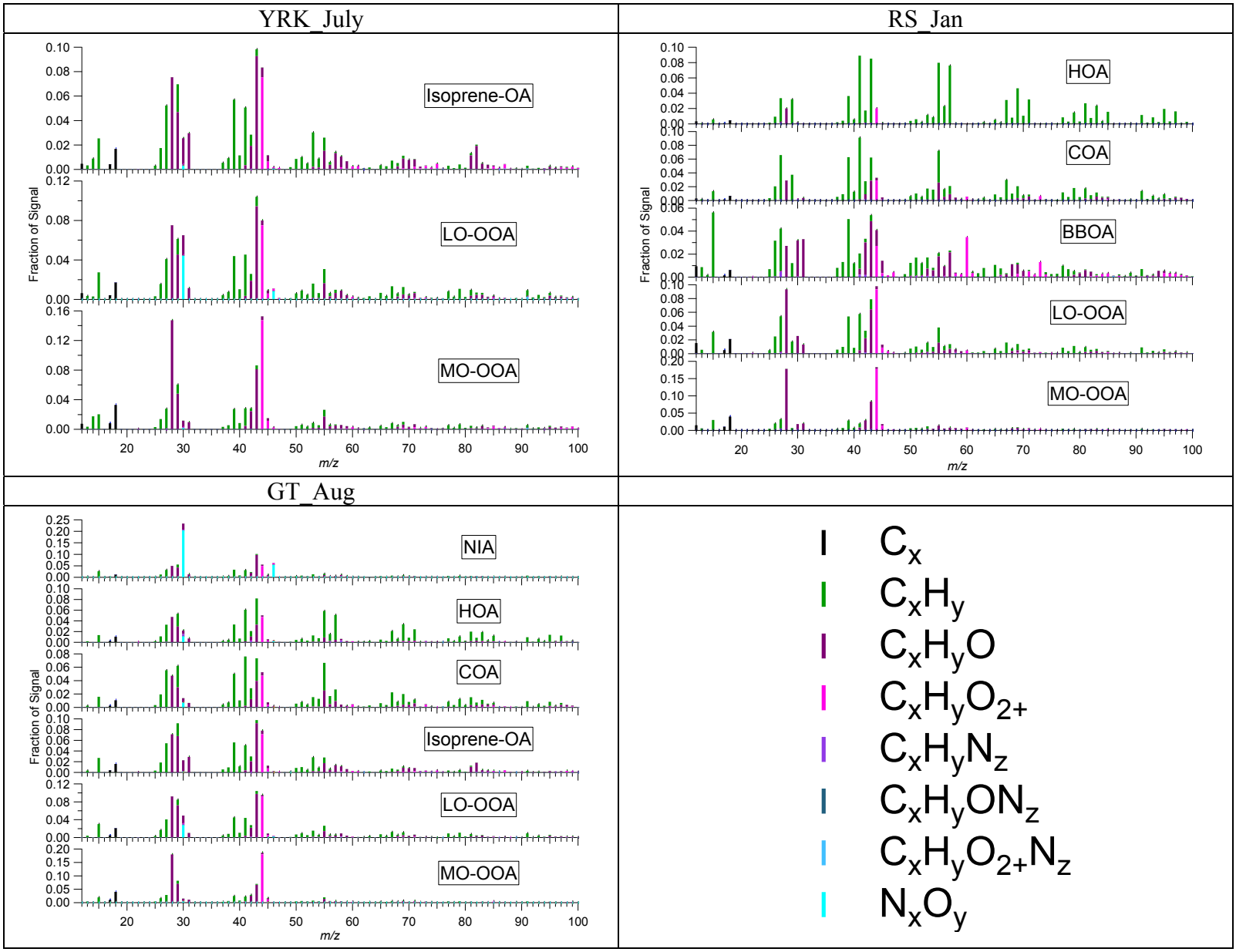


Fig. S5.

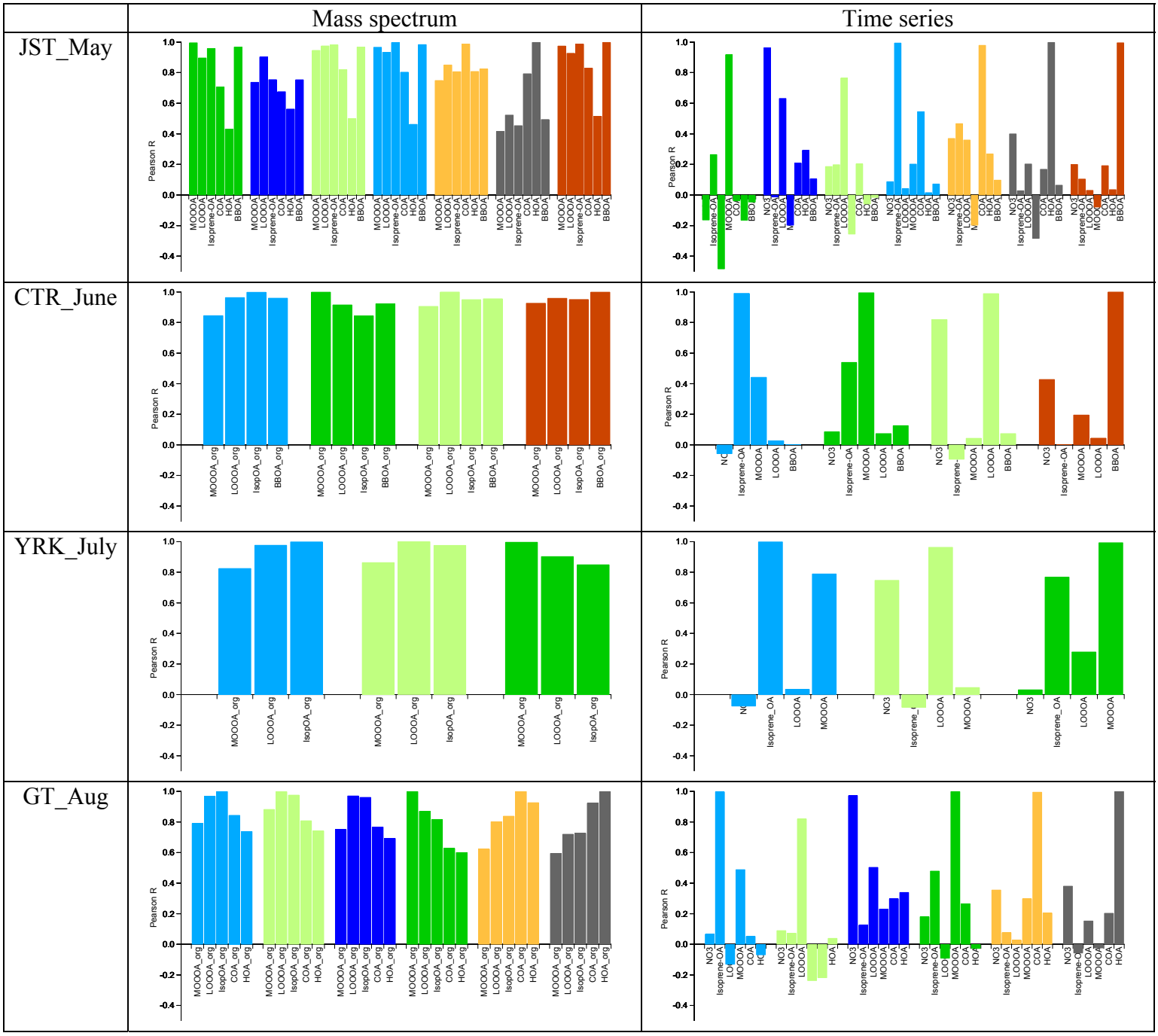

Mass spectrum
Time series
JST_May
CTR_June
YRK_July
GT_Aug
Pearson R

Fig. S5. Continued

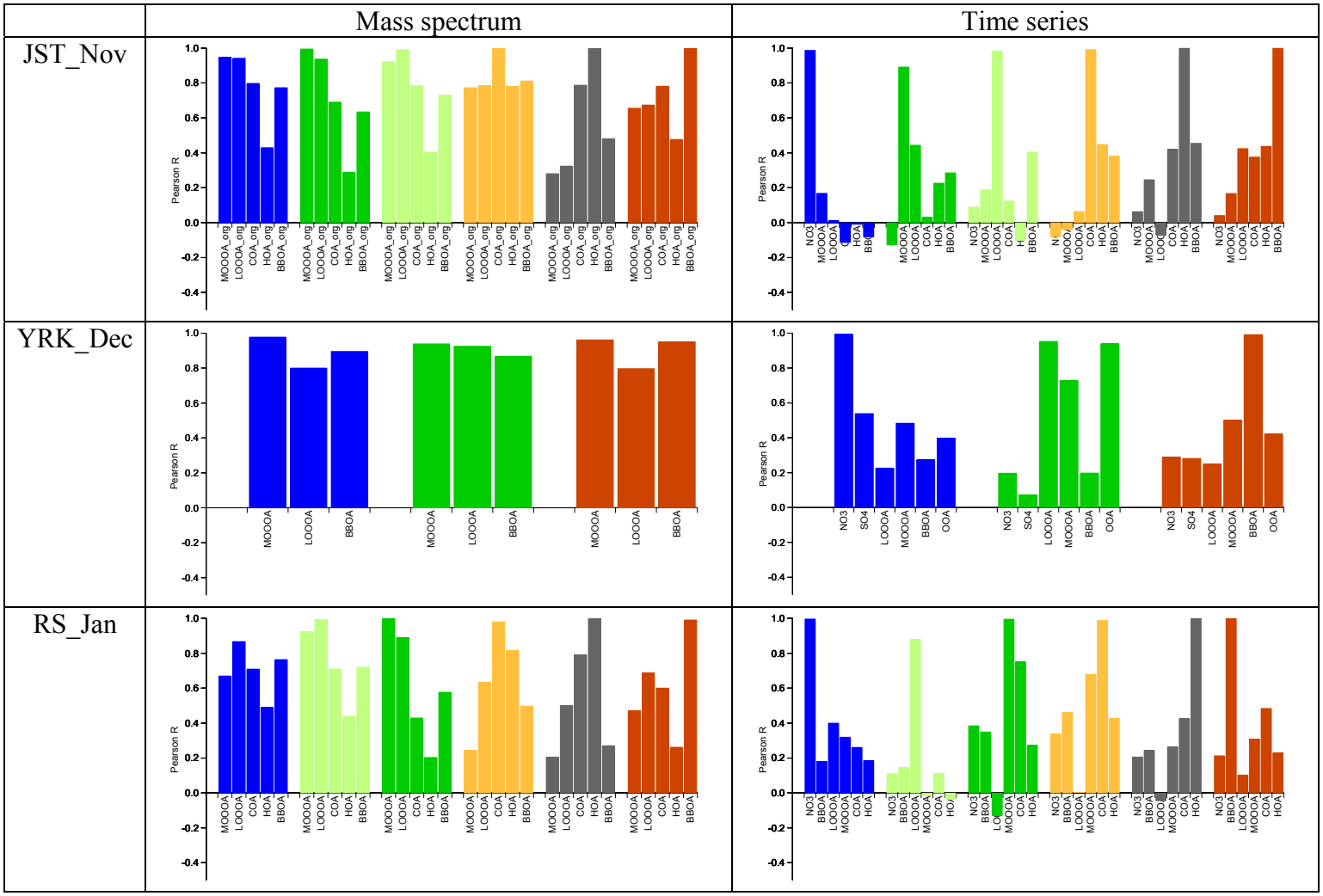


Fig. S6.

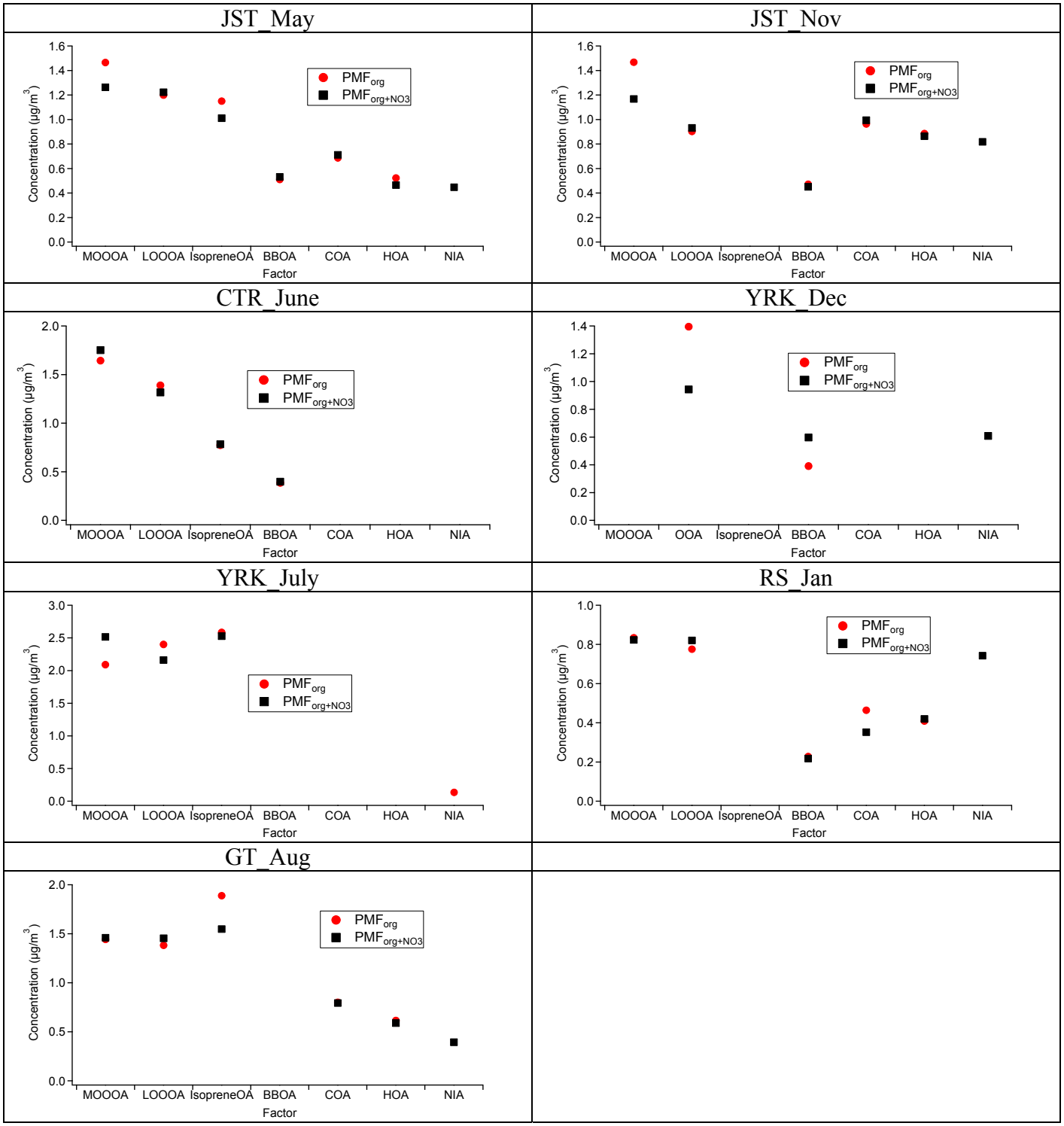

JST_May
JST_Nov
CTR_June
YRK_Dec
YRK_July
RS_Jan
GT_Aug
PMForg
PMForg+NO3
Concentration (μg/m3)
Factor
MOOOA
LOOOA
IsopreneOA
BBOA
COA
HOA
NIA
OOA

Fig. S7.

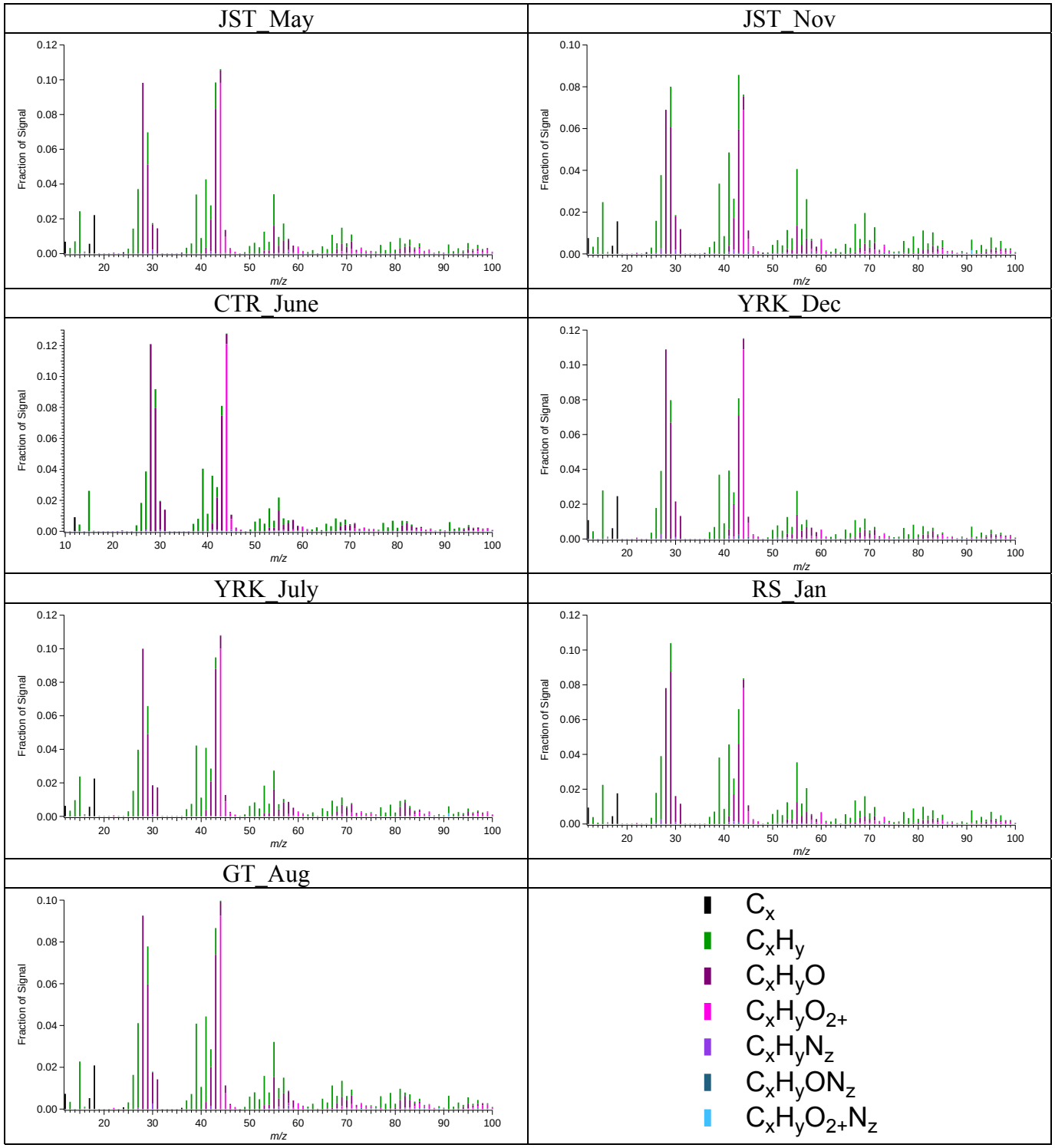

JST_May
JST_Nov
CTR_June
YRK_Dec
YRK_July
RS_Jan
GT_Aug
Fraction of Signal
m/z
C_x
C_xH_y
C_xH_yO
$C_xH_yO_{2+}$
$C_xH_yN_z$
$C_xH_yON_z$
$C_xH_yO_{2+}N_z$

Fig. S8.

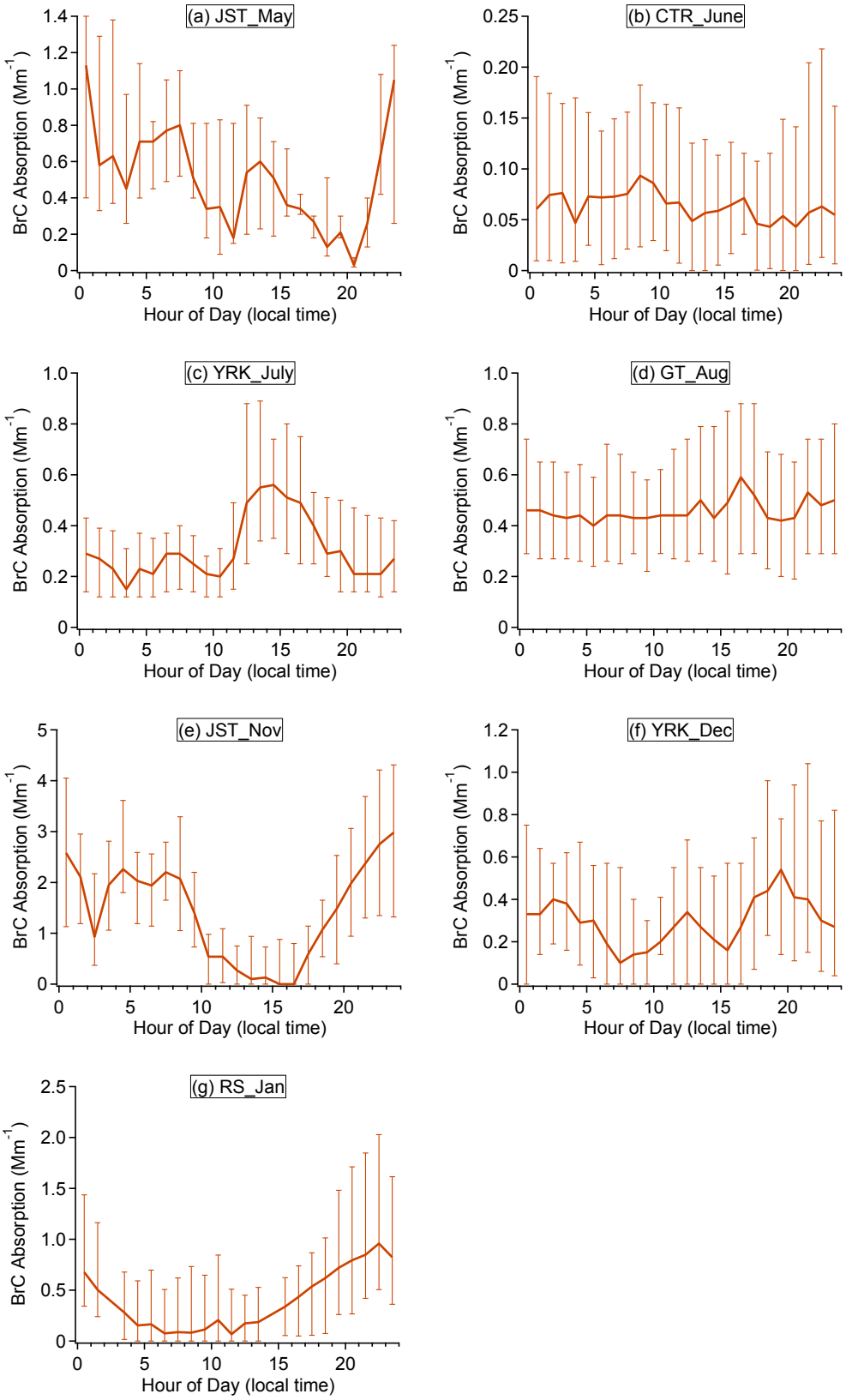

(a) JST_May
(b) CTR_June
(c) YRK_July
(d) GT_Aug
(e) JST_Nov
(f) YRK_Dec
(g) RS_Jan
BrC Absorption (Mm^{-1})
Hour of Day (local time)

Fig. S9.

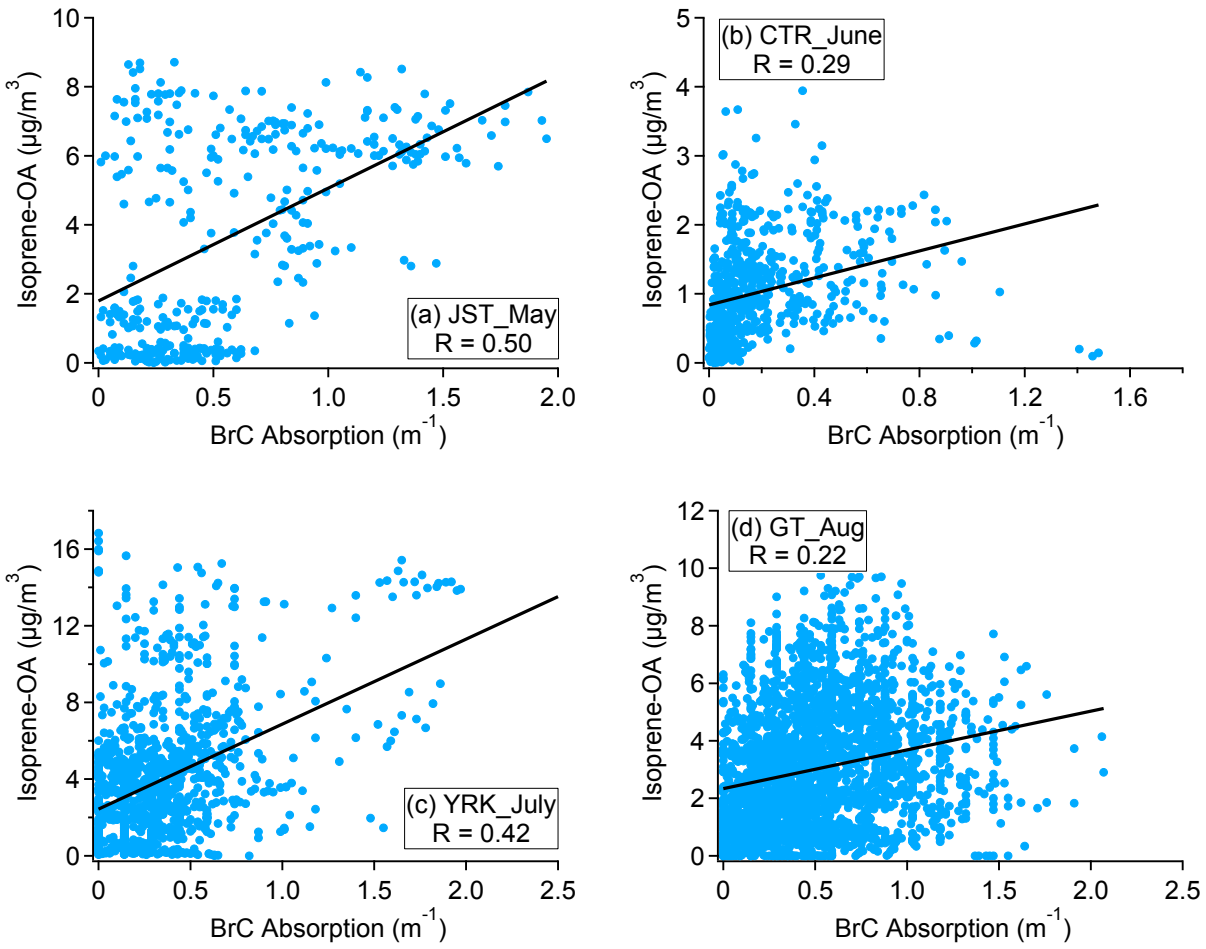

(a) JST_May
R = 0.50
(b) CTR_June
R = 0.29
(c) YRK_July
R = 0.42
(d) GT_Aug
R = 0.22
Isoprene-OA (μg/m3)
BrC Absorption (m-1)

Fig. S10.

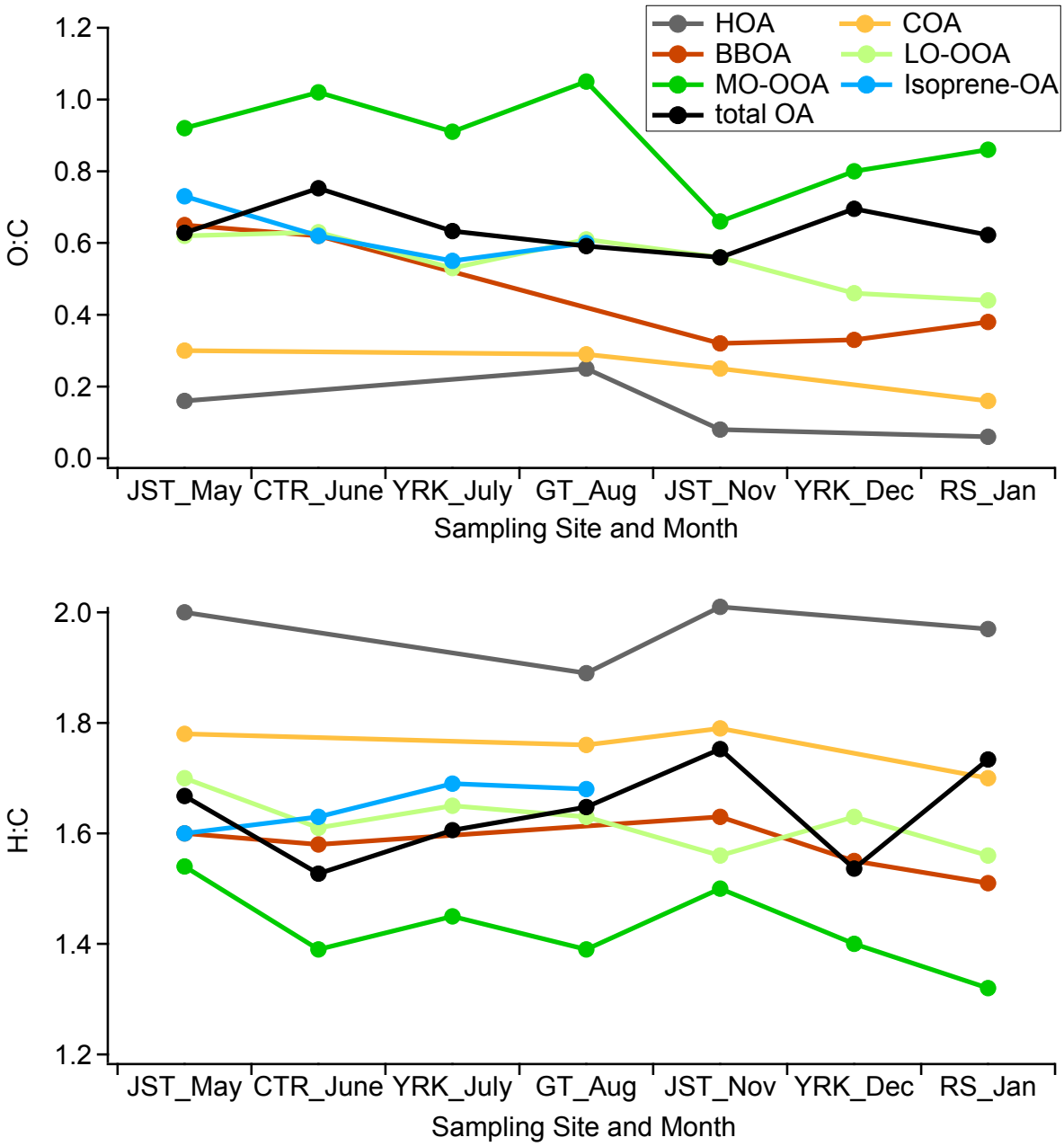

HOA
COA
BBOA
LO-OOA
MO-OOA
Isoprene-OA
total OA
O:C
1.2
1.0
0.8
0.6
0.4
0.2
0.0
JST_May
CTR_June
YRK_July
GT_Aug
JST_Nov
YRK_Dec
RS_Jan
Sampling Site and Month
H:C
2.0
1.8
1.6
1.4
1.2
JST_May
CTR_June
YRK_July
GT_Aug
JST_Nov
YRK_Dec
RS_Jan
Sampling Site and Month

Fig. S11.

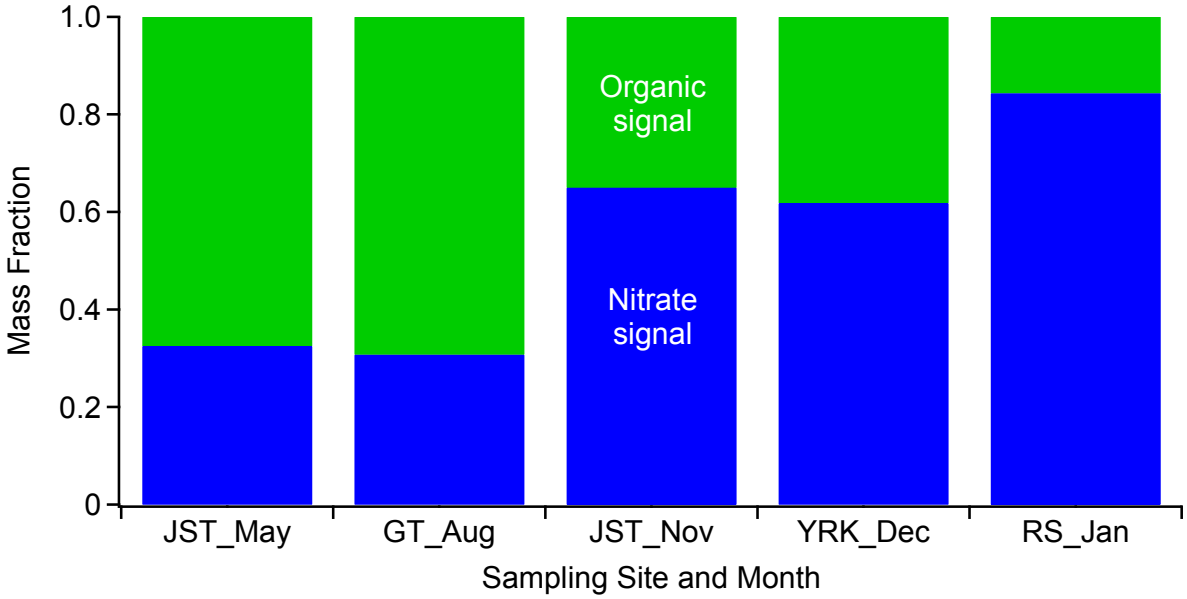

1.0
0.8
0.6
0.4
0.2
0
Mass Fraction
Organic signal
Nitrate signal
JST_May
GT_Aug
JST_Nov
YRK_Dec
RS_Jan
Sampling Site and Month

Fig. S12.

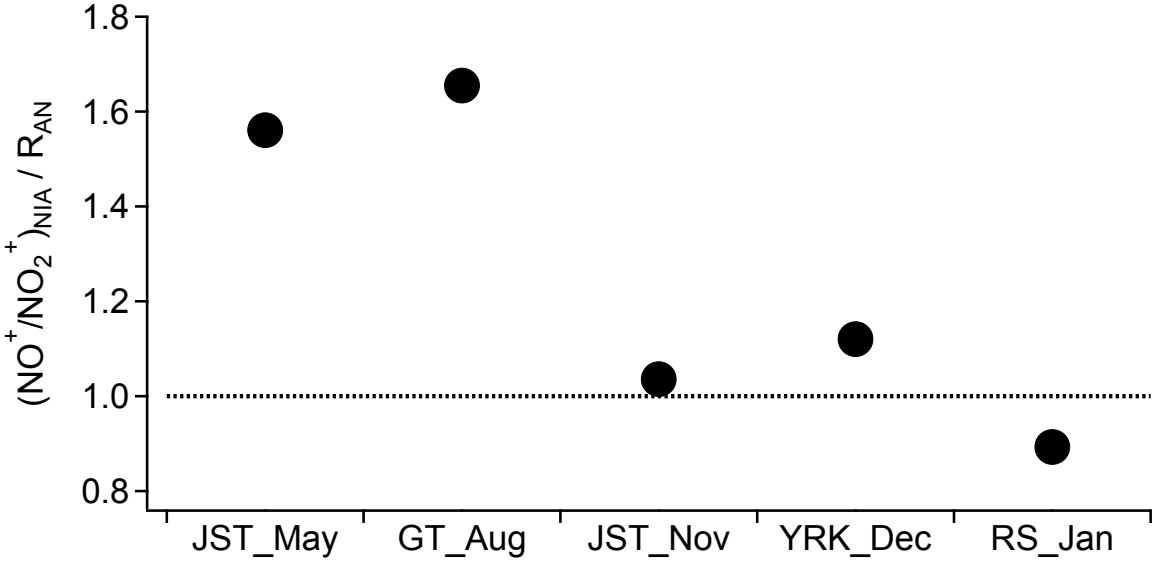

1.8
1.6
1.4
1.2
1.0
0.8
$(NO^+/NO_2^+)_{NIA} / R_{AN}$
JST_May
GT_Aug
JST_Nov
YRK_Dec
RS_Jan

Fig. S13.

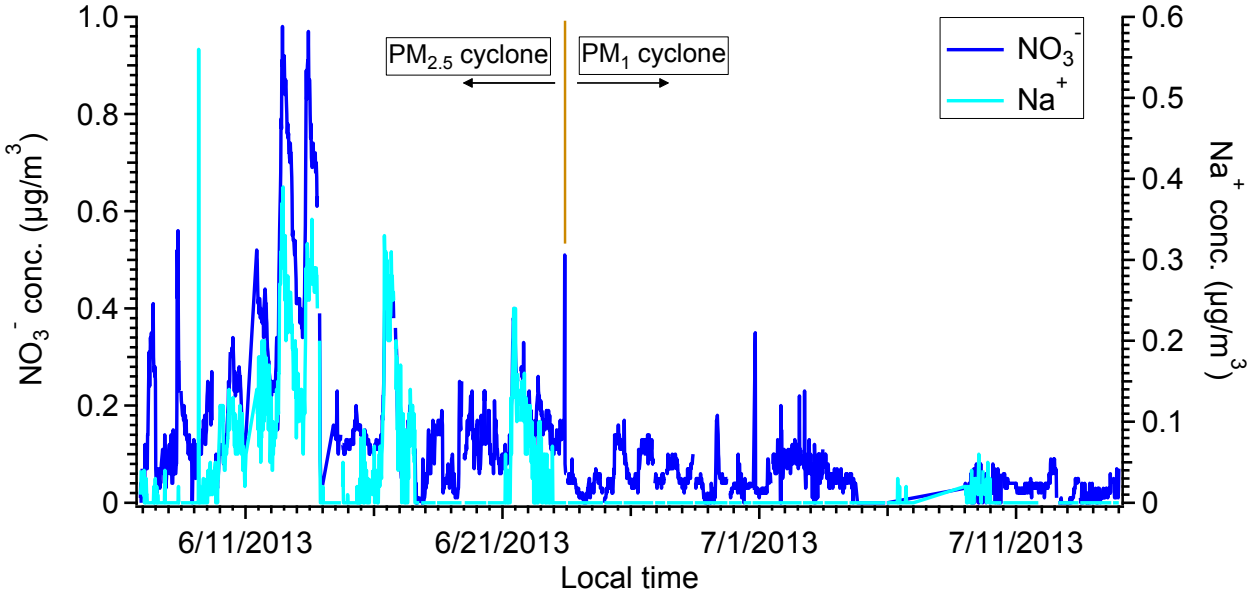

PM2.5 cyclone
PM1 cyclone
NO3-
Na+
NO3- conc. (μg/m3)
Na+ conc. (μg/m3)
1.0
0.8
0.6
0.4
0.2
0
0.6
0.5
0.4
0.3
0.2
0.1
0
6/11/2013
6/21/2013
7/1/2013
7/11/2013
Local time

Fig. S14.

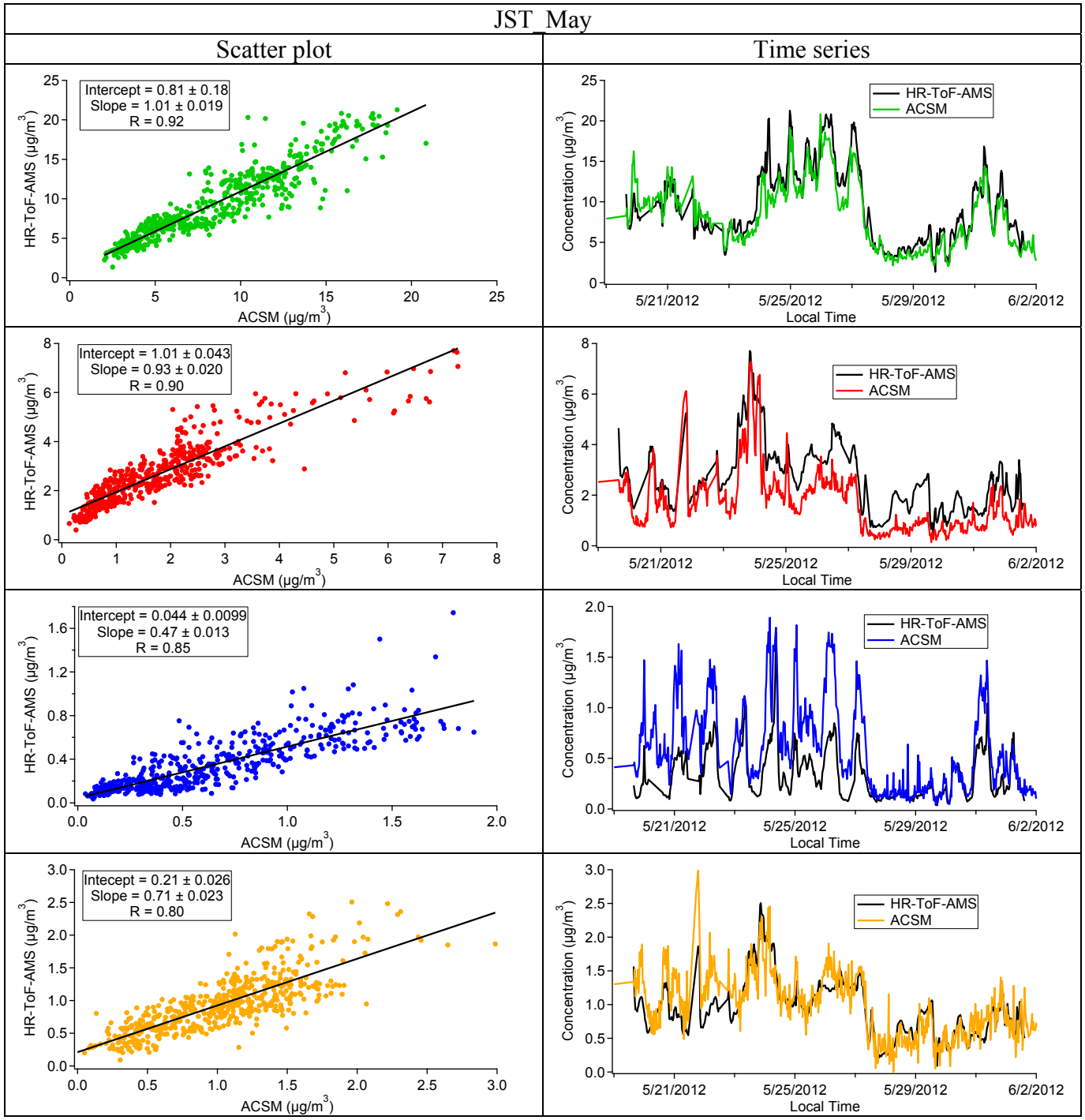

JST_May
Scatter plot
Time series
Intercept = 0.81 ± 0.18
Slope = 1.01 ± 0.019
R = 0.92
Intercept = 1.01 ± 0.043
Slope = 0.93 ± 0.020
R = 0.90
Intercept = 0.044 ± 0.0099
Slope = 0.47 ± 0.013
R = 0.85
Intecept = 0.21 ± 0.026
Slope = 0.71 ± 0.023
R = 0.80
HR-ToF-AMS (μg/m3)
ACSM (μg/m3)
Concentration (μg/m3)
HR-ToF-AMS
ACSM
5/21/2012
5/25/2012
5/29/2012
6/2/2012
Local Time

Fig. S14. Continued

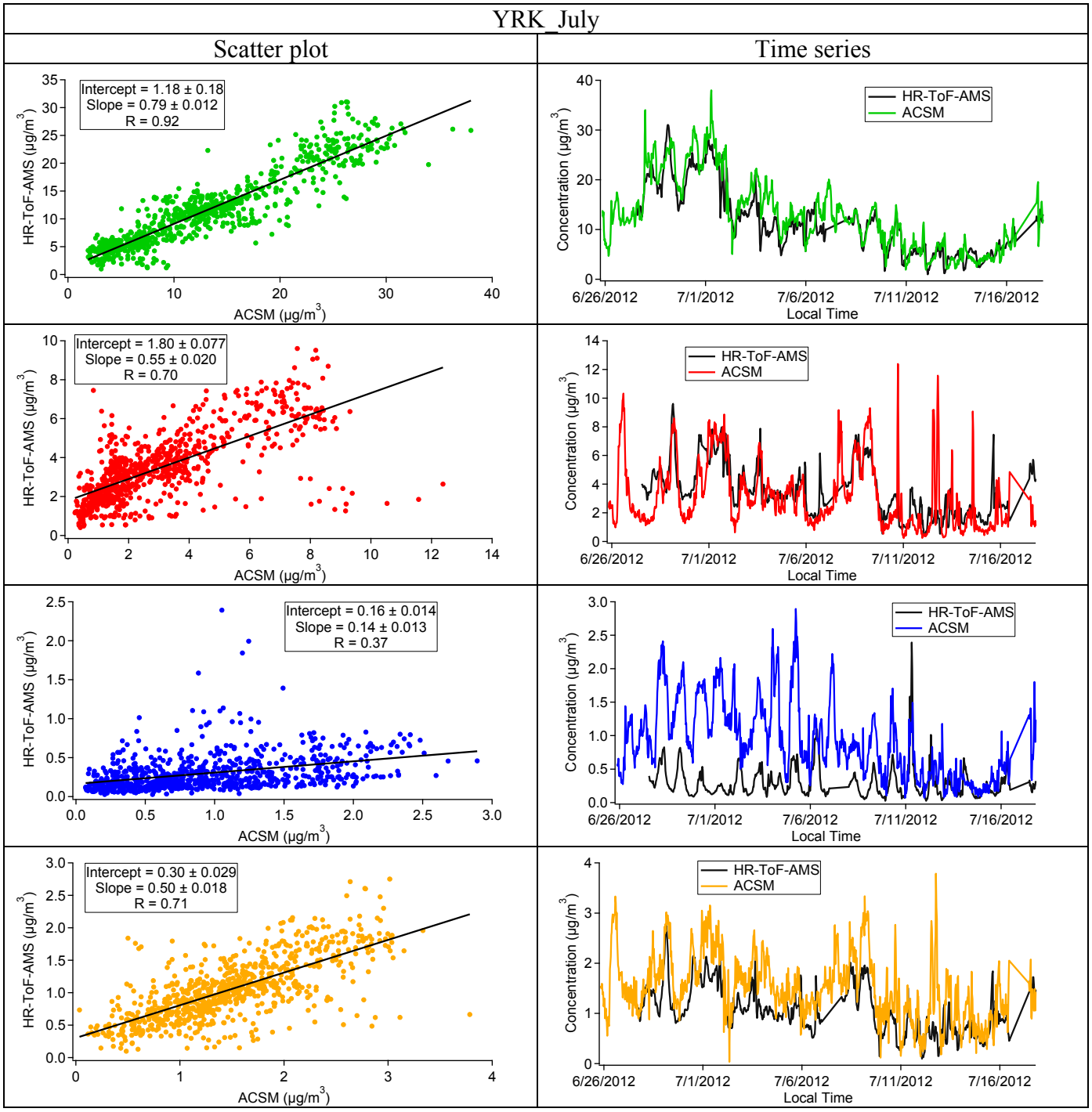


Fig. S14. Continued

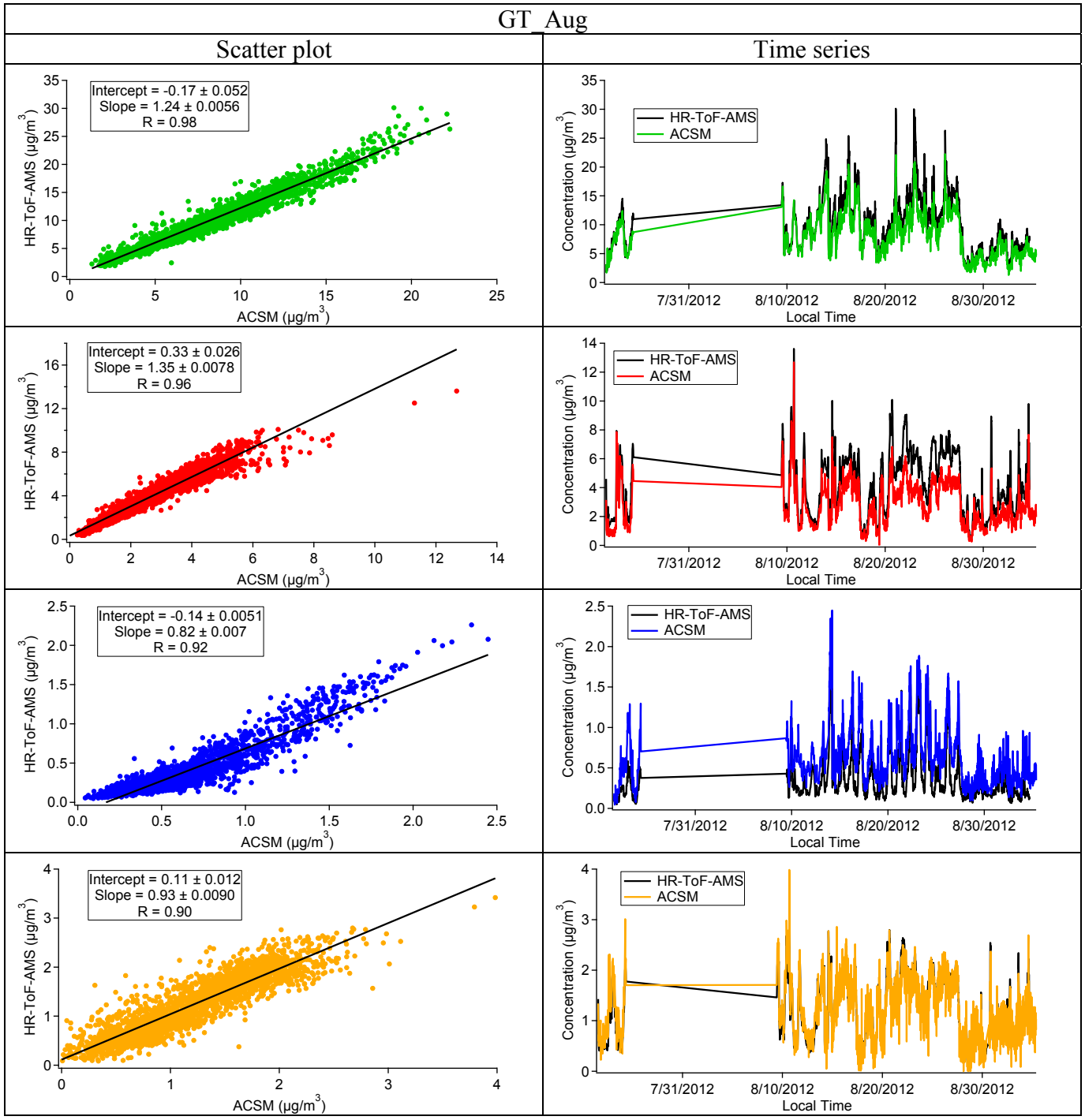


Fig. S14. Continued

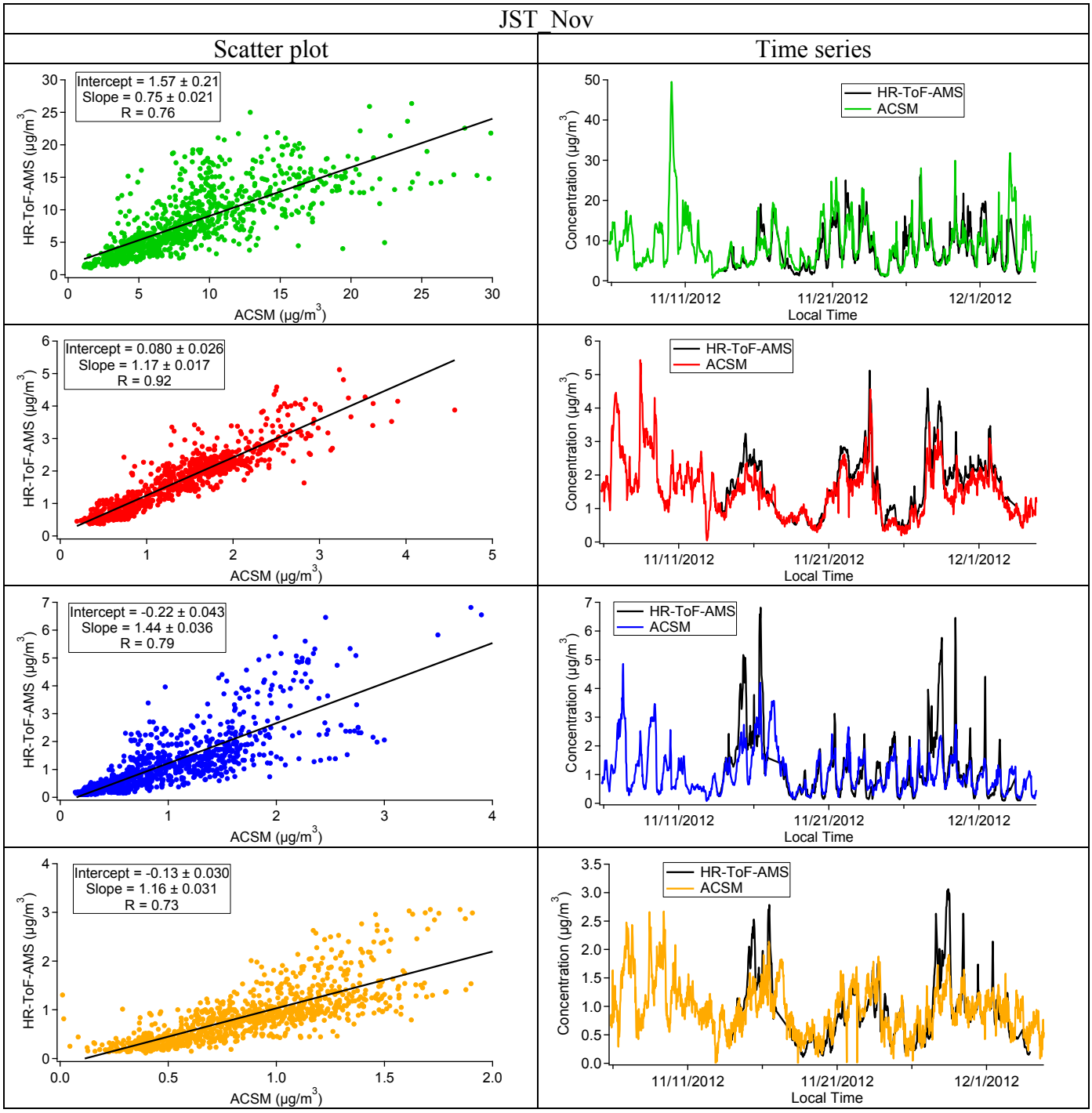


Fig. S14. Continued

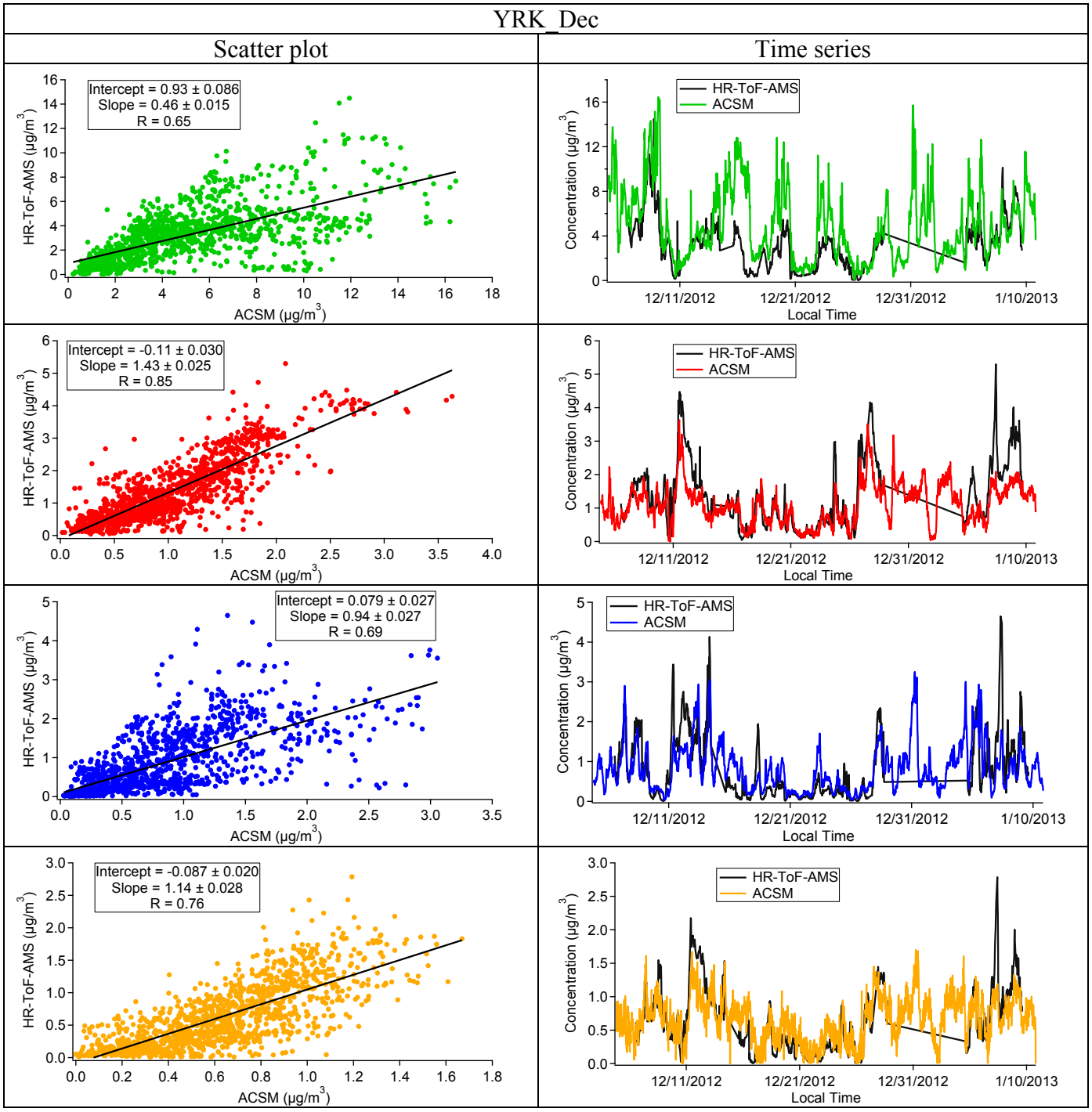


Fig. S14. Continued

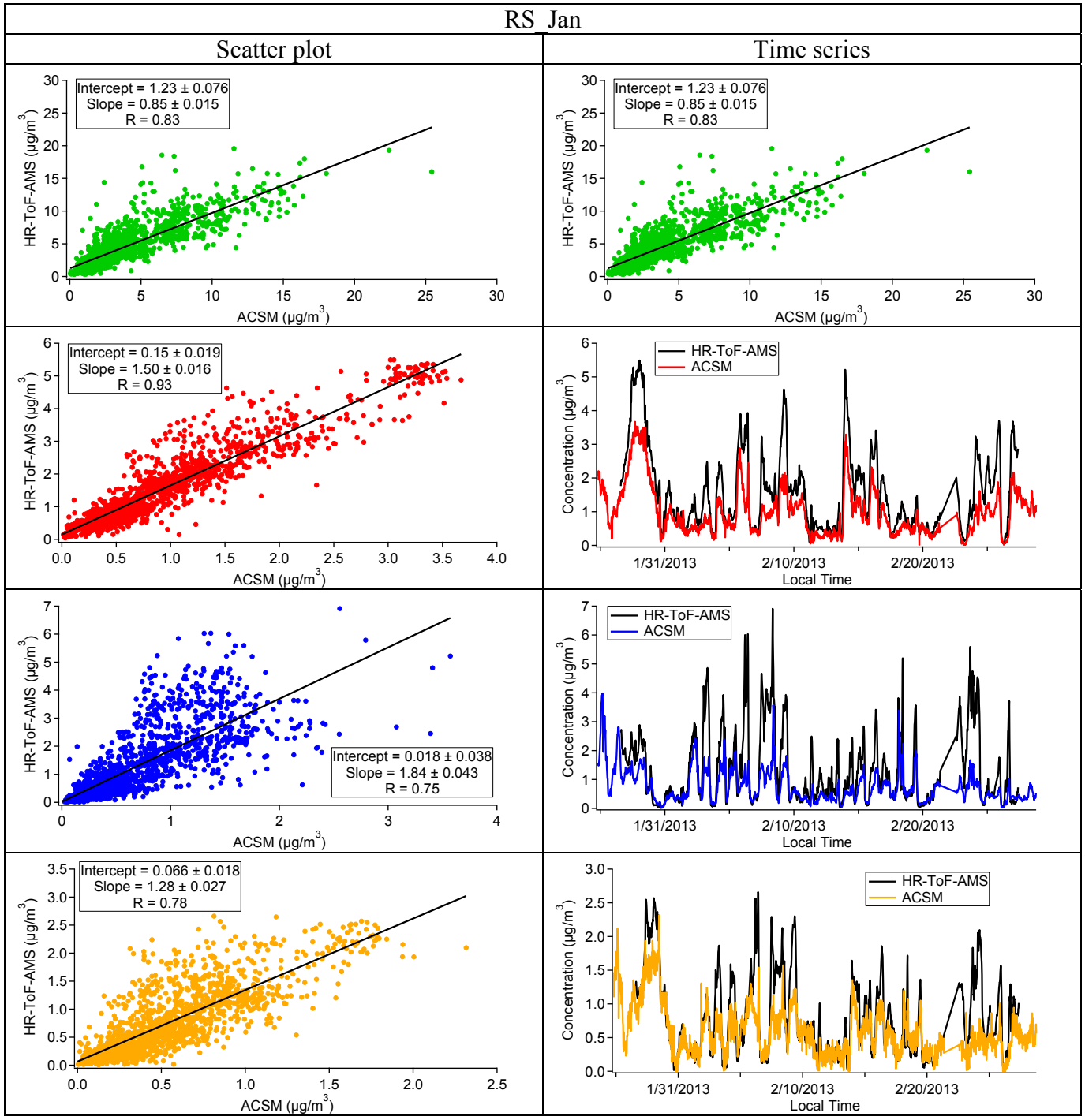


Fig. S15.

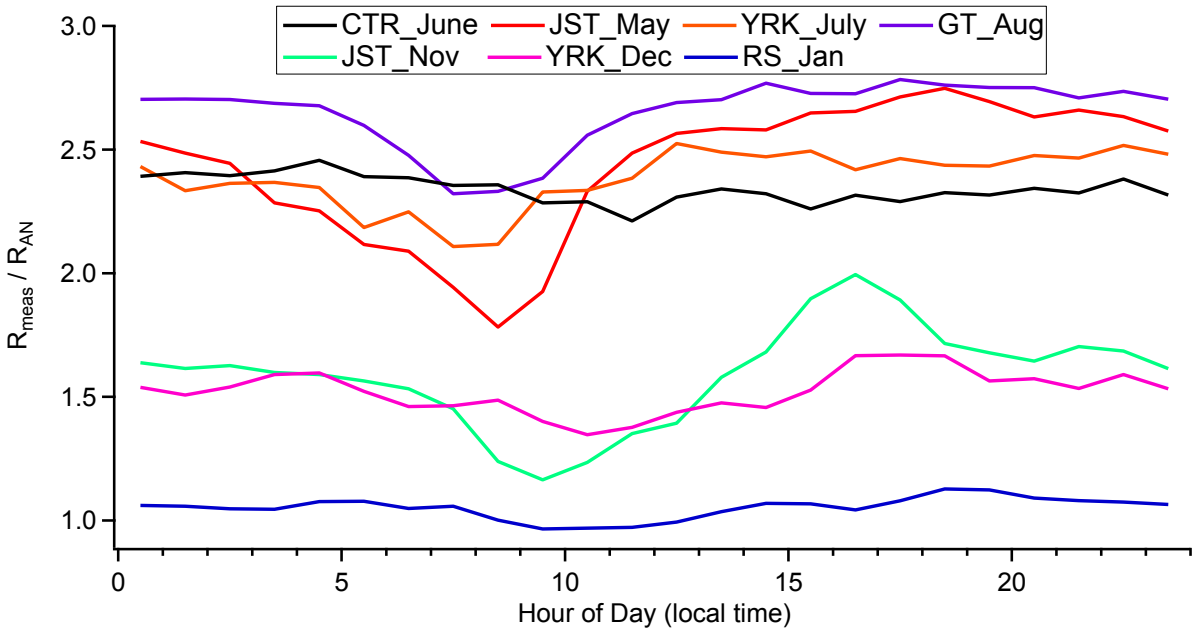

CTR_June
JST_May
YRK_July
GT_Aug
JST_Nov
YRK_Dec
RS_Jan
3.0
2.5
2.0
1.5
1.0
R_{meas} / R_{AN}
0
5
10
15
20
Hour of Day (local time)

Fig. S16.

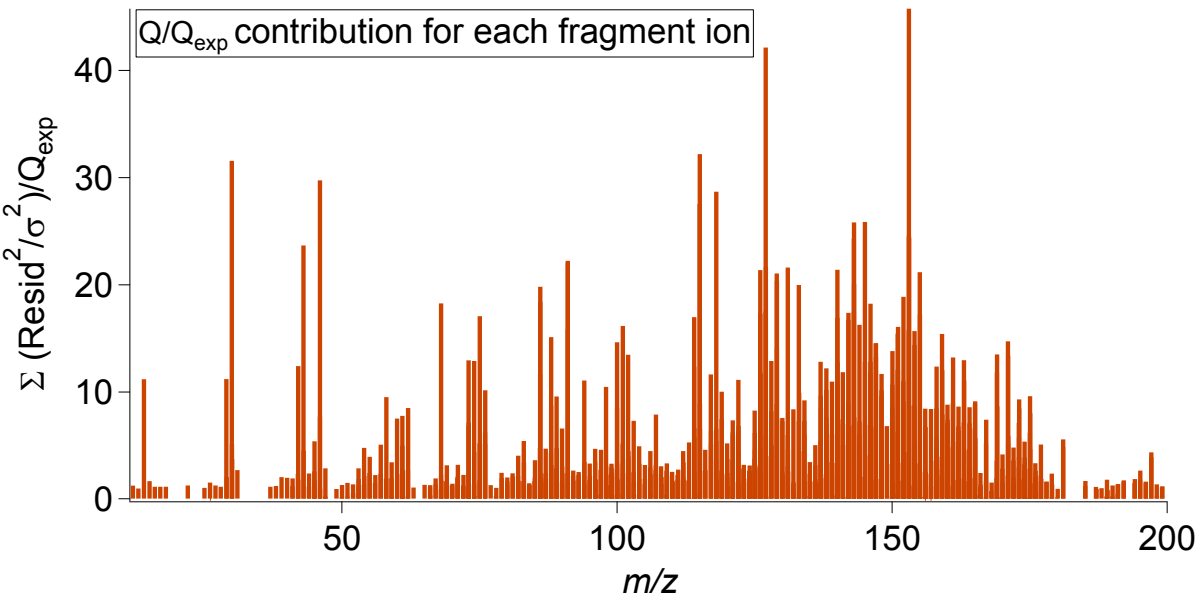

Q/Q$_{exp}$ contribution for each fragment ion
Σ (Resid^2/σ^2)/Q$_{exp}$
0
10
20
30
40
50
100
150
200
m/z

Fig. S17.

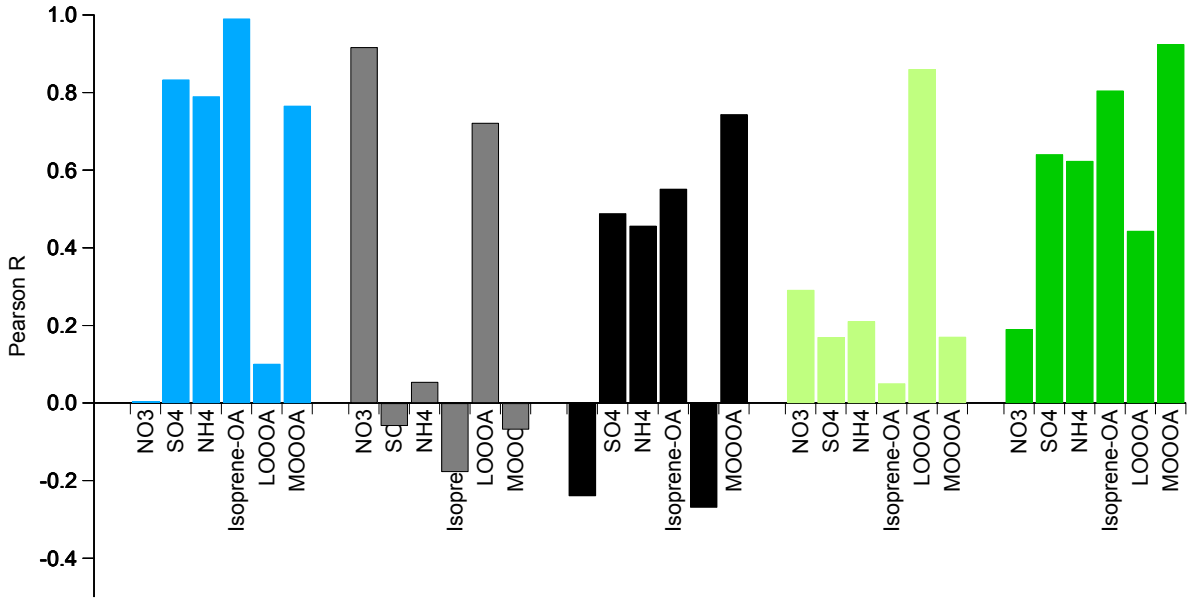

Pearson R
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
NO3
SO4
NH4
Isoprene-OA
LOOOA
MOOOA
NO3
SO
NH4
Isopre
LOOOA
MOOO
SO4
NH4
Isoprene-OA
MOOOA
NO3
SO4
NH4
Isoprene-OA
LOOOA
MOOOA
NO3
SO4
NH4
Isoprene-OA
LOOOA
MOOOA

Fig. S18.

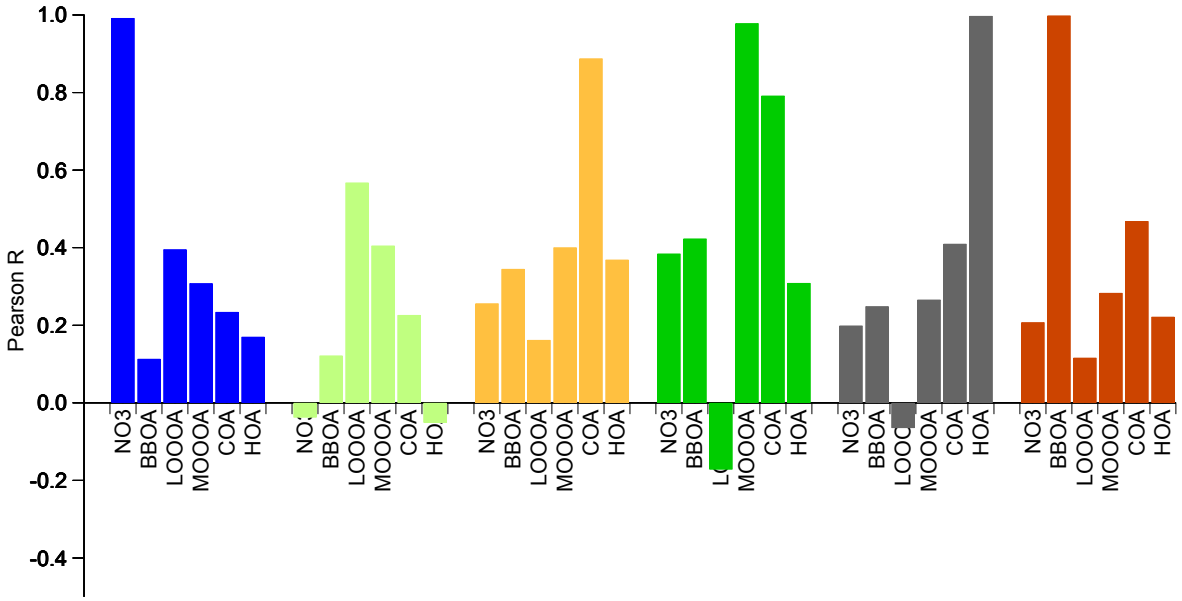
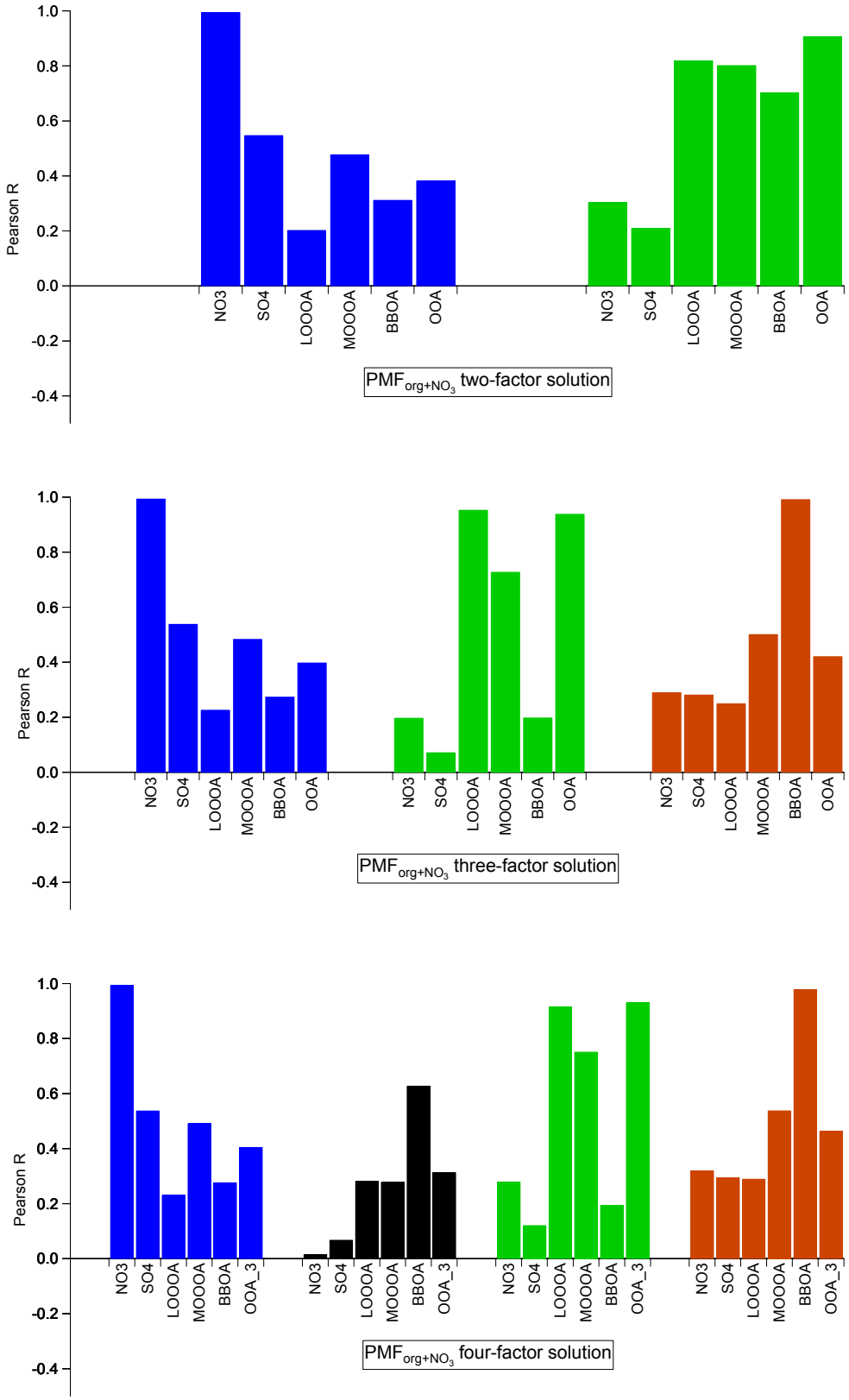


Fig. S19.


Pearson R
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
NO3
SO4
LOOOA
MOOOA
BBOA
OOA
OOA_3
PMF$_{org+NO_3}$ two-factor solution
PMF$_{org+NO_3}$ three-factor solution
PMF$_{org+NO_3}$ four-factor solution

Reference

Ulbrich, I. M., Canagaratna, M. R., Zhang, Q., Worsnop, D. R., and Jimenez, J. L.: Interpretation of organic components from Positive Matrix Factorization of aerosol mass spectrometric data, Atmos. Chem. Phys., 9, 2891-2918, 10.5194/acp-9-2891-2009, 2009.