Supplementary Material:

Mixing state of individual submicron carbon-containing particles and their seasonal variation in urban Guangzhou, China

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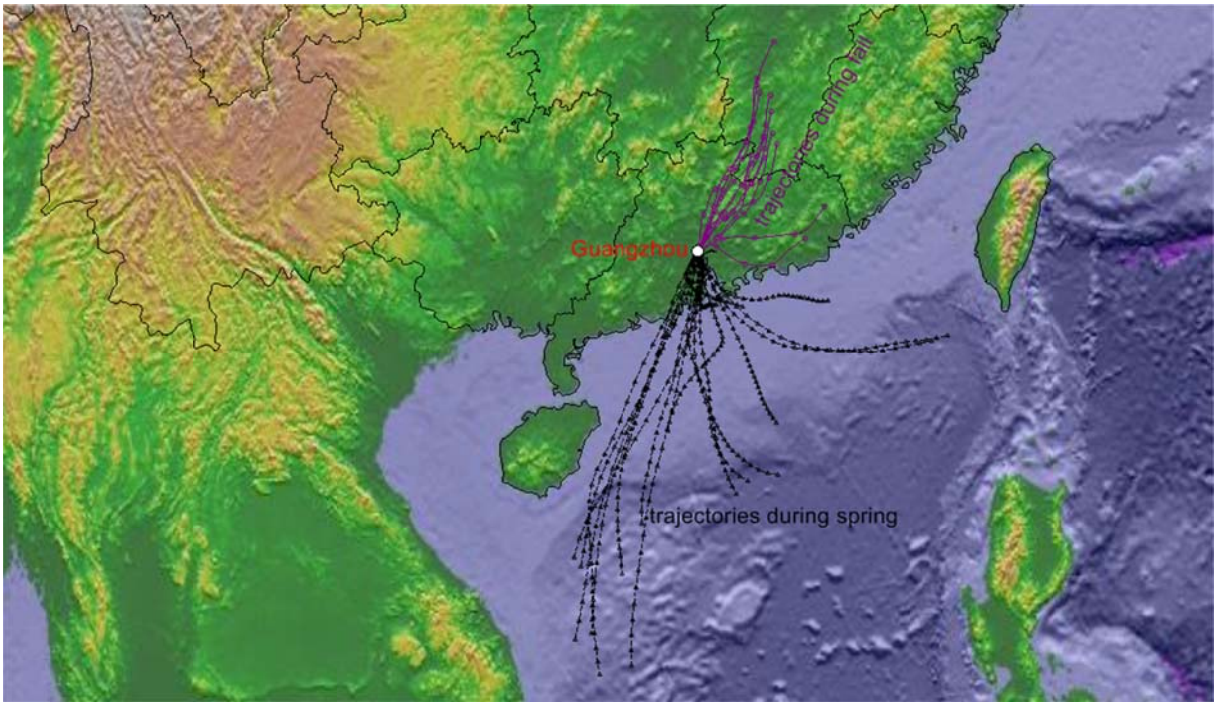

Fig. S1. Daily backward air-mass trajectories reaching urban Guangzhou site ending at 500 m above sea level and 0: 00 (local time) during spring and fall sampling periods.

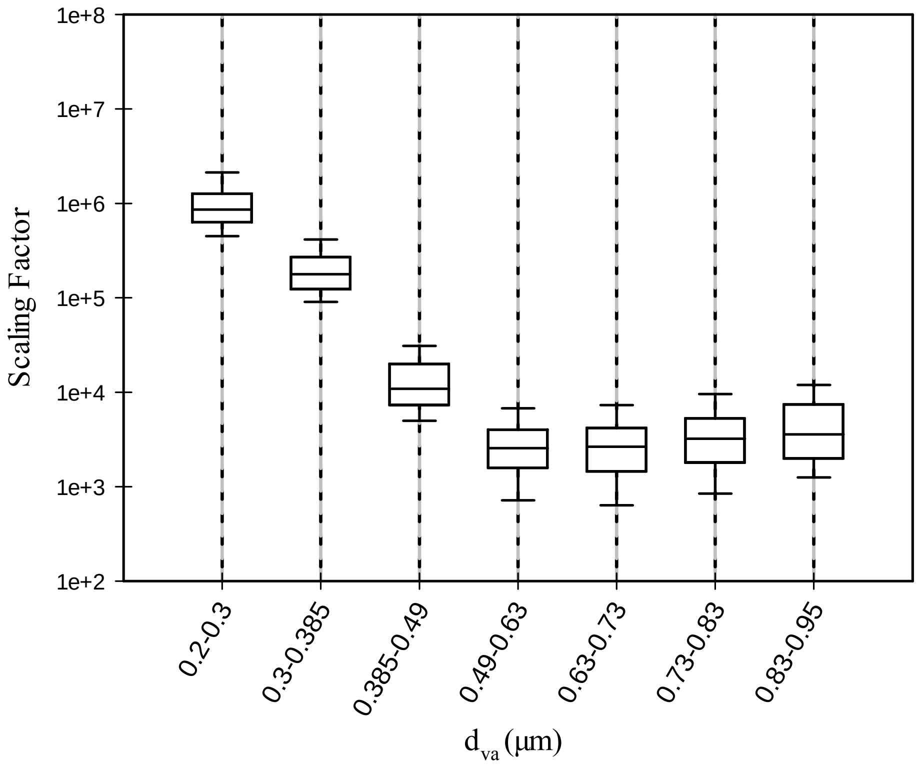

Fig. S2. Box-whisker plots of SPAMS scaling factor using SMPS + C for Spring period 2010 in Guangzhou. The median (line in the box), quartile (box), 10% and 90% percentile (whiskers) were shown. The size-dependence pattern of the scaling factor is similar to those described in earlier studies with single particle mass spectrometry (Healy et al., 2012; Jeong et al., 2011).

Scaling procedure for SPAMS data: firstly, the conversion of d_m to d_{va} was performed according to the methodology described by (DeCarlo et al., 2004):

$$d_{va} = \rho_p/\rho_0 \times d_{ve} /\chi$$

where ρ_p is the particle density, ρ_0 is standard density (1 g cm^{-3}), d_{ve} is particle volume equivalent diameter, and χ is the dynamic shape factor (assumed to be 1). All particles were assumed to be spherical with no internal voids, thus d_m is equal to d_{ve}.

A single density value of 1.7 g cm^{-3} (Cheng et al., 2006) was chosen to convert the d_m to d_{va}. Certain error might also be introduced based on the usage of an assumed density for scaling process, while previous work has attained satisfactory results (Healy et al., 2012; Reinard et al., 2007). Secondly, the particle size range from SPAMS was divided into seven size bins (0.2-0.3, 0.3-0.39, 0.39-0.49, 0.49-0.63, 0.63-0.73, 0.73-0.83 and 0.83-0.95 μm), corresponding to seven size bins from SMPS + C created by merging adjacent pairs of size bins, approximately covering a d_m size range of 124-521 nm (mid-point). Thirdly, scaling factor was calculated for each size bin through dividing the size-segregated hourly average number concentration from SMPS + C by the simultaneously observed hourly total SPAMS particle number count in the corresponding size bin (Rehbein et al., 2012). The hourly scaling factors in each size range were utilized in scaling the number concentration of particles by directly multiplying SPAMS counts of each single particle type of the exactly same size range in that hour.

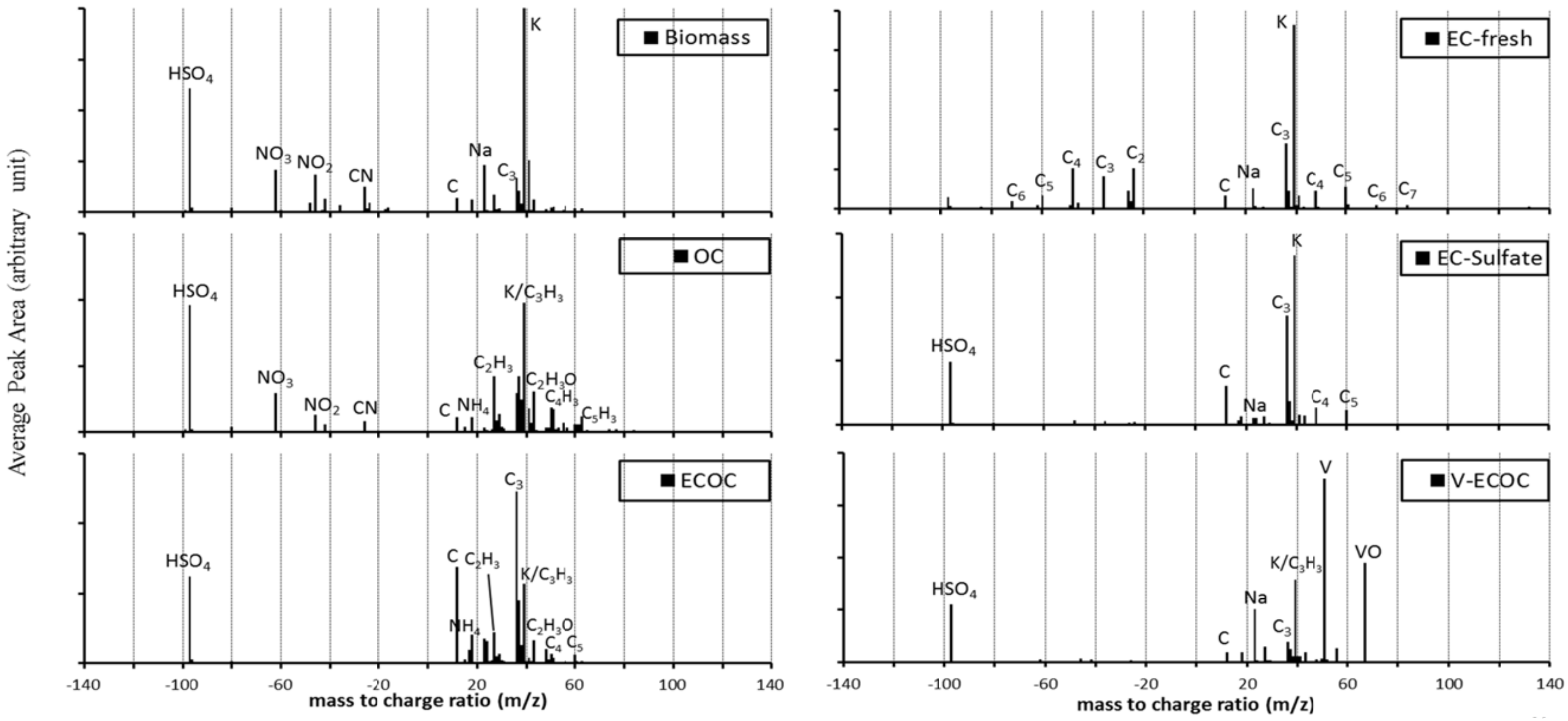

Fig. S3. Averaged positive and negative mass spectra for the 6 single particle carbon-containing classes observed during the fall sampling period.

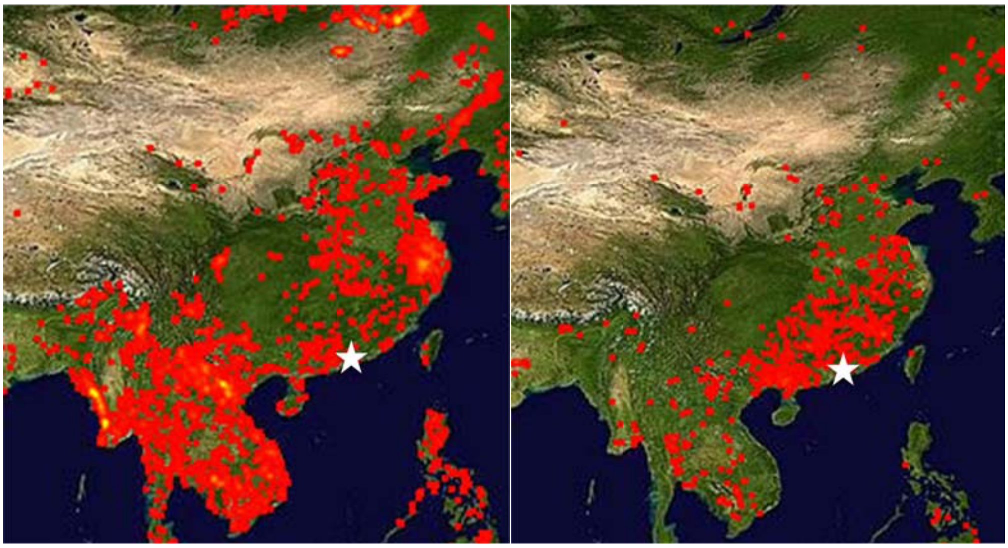

Fig. S4. Fire maps from MODIS on board the Terra and Aqua satellites during 2010/05/01-2010/05/10 (left), and 2010/11/07-2010/11/16 (right). The fire map accumulates the locations of the fires over a 10-day period. Each colored dot indicates a location where MODIS detected at least one fire during the compositing period. The star marker signifys the location of sampling site.

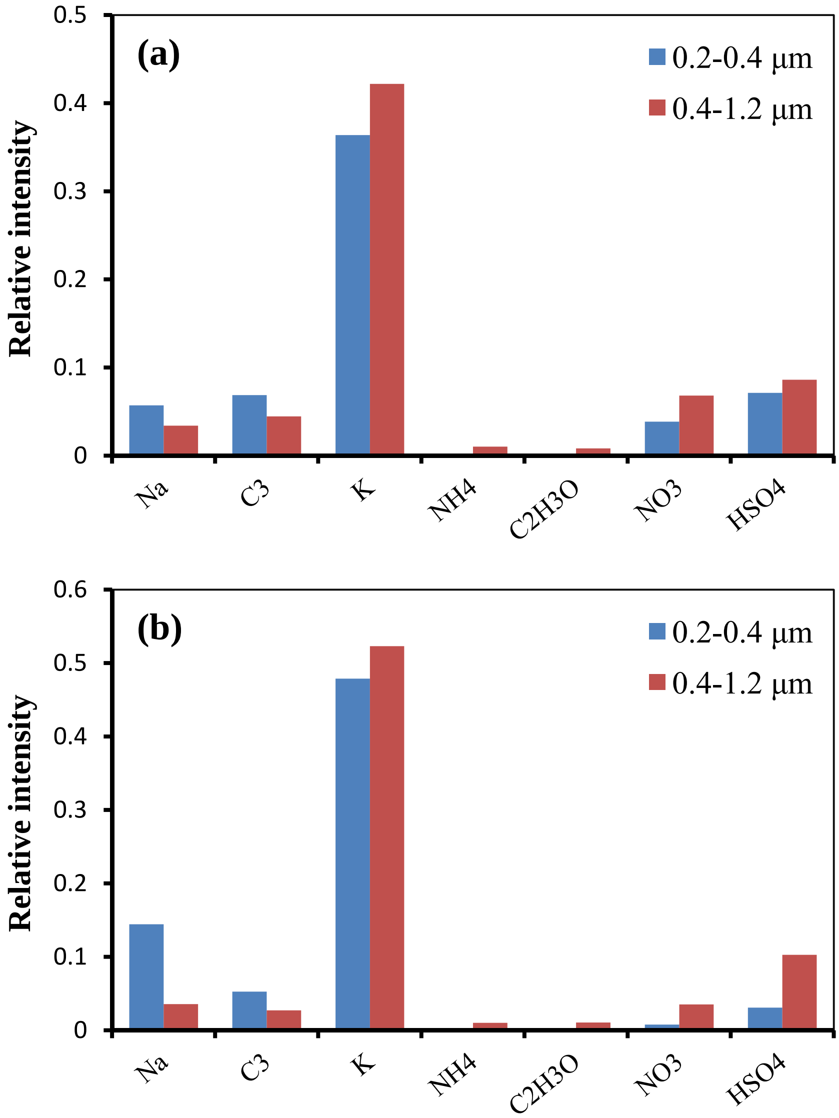

Fig. S5. Comparion of relative intensity for different species in smaller (0.2-0.4 μm) and larger (0.4-1.2 μm) Biomass particles during spring (a) and fall period (b), respectively.

References

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