Supplementary information

SOC comparisons of traditional and modified ER tracer method

The SOC concentrations were calculated by following two traditional EC tracer method:

(1) Using those ratios derived from emission inventories of OC and EC (Gray et al., 1986). The inventory $(OC/EC)_{pri}$ in Guangdong Province is about 2.18.

(2) Using the ratios between ambient OC and EC when primary source emissions dominate and the secondary organic aerosol formations are expected to be low (Turpin and Huntzicker, 1995). The $(OC/EC)_{pri}$ of 1.1 in the primary emission days was adopted here.

The SOC concentrations in normal days can be obtained by the equation 3 in the paer (The OC background concentrations was also neglected here). In general, the SOC time series variation by different EC tracer method was in good agreement (Fig. S1).

The average SOC concentrations calculated by $(OC/EC)_{pri}$ from inventory was about 0.7 $\mu g/m^3$, which was much lower than the one (2.0 $\mu g/m^3$) obtained by the modified EC tracer method. There were many zero value points (40% of the total points) in SOC time series obtained by inventory-based calculation method. The $(OC/EC)_{pri}$ (2.18) given by inventory was even higher than the regression slope (2.0, Fig. S3) calculated by the whole OC/EC data set in normal days. The high $(OC/EC)_{pri}$ got by inventory validate the drawback of inventory EC tracer method that the uncertainties of $(OC/EC)_{pri}$ derived from emission inventories are very large and can not reflect the specific atmospheric conditions. The scatter plot between SOC (inventory method) and OOA was displayed in Fig. S2(a). The regression slope was about 0.2 that is lower than the 0.31 obtained by the modified EC tracer method. The r^2 between SOC and OOA was a little lower, about 0.41.

The average SOC concentration obtained by using $(OC/EC)_{pri}$ from the slope (1.1) in primary emissions days was about 2.2 $\mu g/m^3$, which was higher than the value 2.0 $\mu g/m^3$ reported in the manuscript. Higher regression slope (0.39) between SOC and

OOA was obtained than the ratio of the modified EC tracer method, as shown in Fig. 2S. The r^2 (0.66) between SOC and OOA was higher the one (0.58) obtained by modified EC tracer method. It is mainly due to there are more zero values of SOC data in the modified EC tracer method than the former one. It is noticed that the OC background was not deducted when applied the $(OC/EC)_{pri}$ 1.1 to SOC calculation. However, the scatter plot in primary emission influence days showed that there are large OC background. Considering the high background OC concentrations and distinct emission patterns, using $(OC/EC)_{pri}$ from the regression slope (1.1) in primary emission day is not suitable for $(OC/EC)_{pri}$ normal days.

Overall, it is convenient for the modified EC tracer method to calculate the SOC concentrations for its simply application to the dataset in the normal days. However, there are still improvement should be done to the modified EC tracer method, e.g. more specific data set selection (day and night in the manuscript) and the proper r^2 range to calculate $(OC/EC)_{pri}$ (minimum r^2 in the manuscript). Comparision between modified EC tracer method and other SOC calculation method in other environments should be further investigated.

Reference

Gray, H. A., Cass, G. R., Huntzicker, J. J., Heyerdahl, E. K., and Rau, J. A.: Characteristics of Atmospheric Organic and Elemental Carbon Particle Concentrations in Los-Angeles, Environ Sci Technol, 20, 580-589, 1986.

Turpin, B. J., and Huntzicker, J. J.: Identification of Secondary Organic Aerosol Episodes and Quantitation of Primary and Secondary Organic Aerosol Concentrations during Scaqs, Atmos Environ, 29, 3527-3544, 1995.

Figures

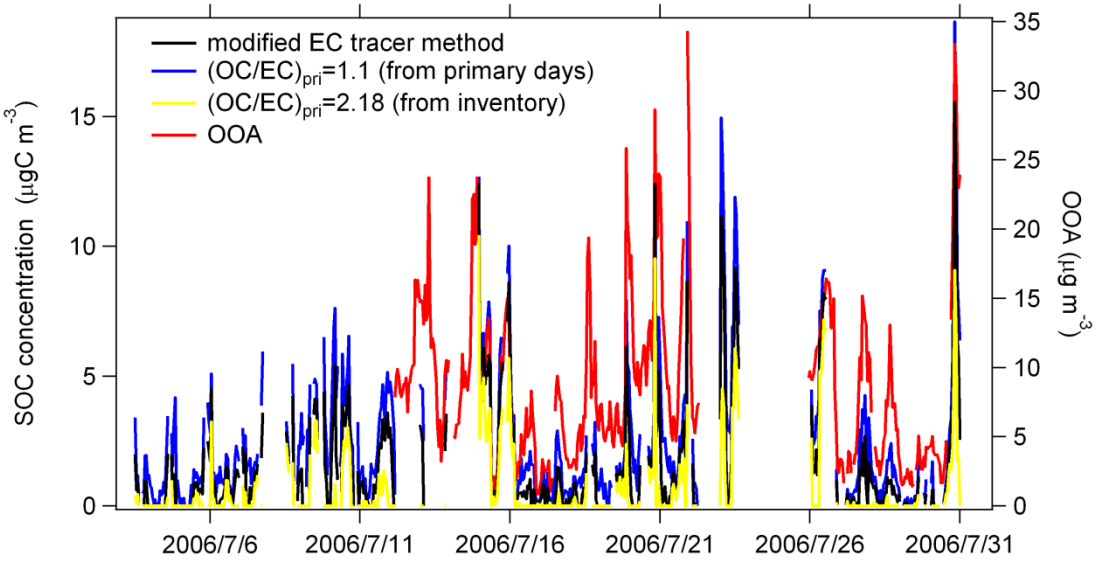

Fig. S1. The time series of SOC (Calculated by three EC tracer methods) and OOA concentrations.

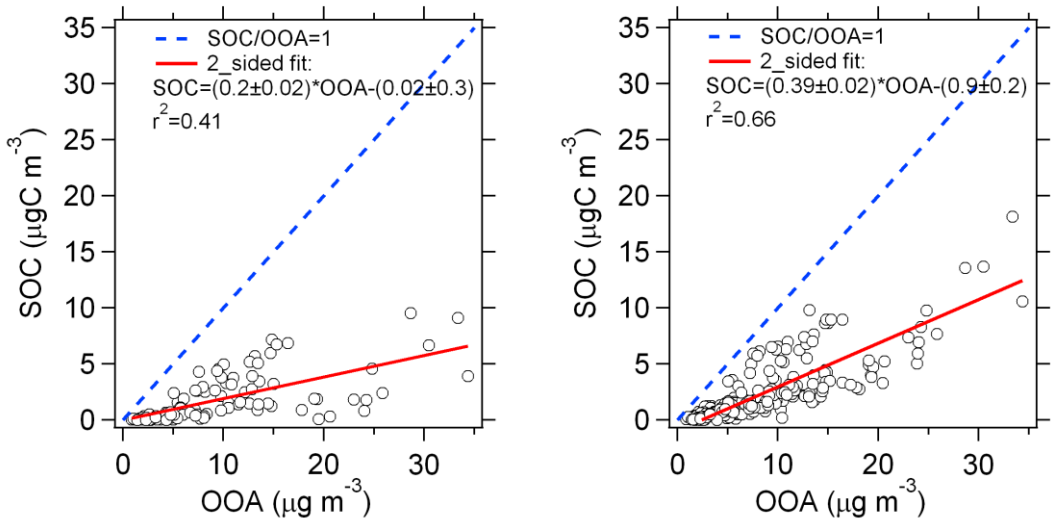

Fig. S2. The scatter plots of SOC ((a) calculated by the inventory $(OC/EC)_{pri}$, 2.18; (b) calculated by the $(OC/EC)_{pri}$ in primary emission day, 1.1) vs OOA.

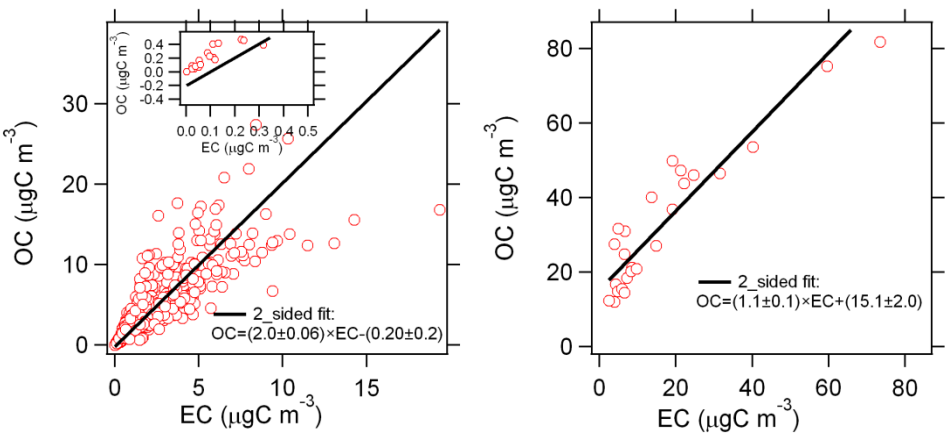

Fig. S3. The scatter plot of OC and EC in normal days and primary emission influence days