Supporting Information for

Characteristics and Formation Mechanism of Sulfate and Nitrate in Size-segregated Atmospheric Particles from Urban Guangzhou, China

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Table S1. Sampling durations, number of samples and weather conditions over four seasons.

	Sampling time	Sampling types （Numbers of sets）	Numbers of raining days
Spring	March 15–29, 2014	C (11)	2
	April 10–15, 2014	P (12)	1
Summer	June 16–July 14, 2013	C (30)	13
		P (4)	2
Autumn	September 15–October 16, 2013	C (29)	3
		P (7)	0
Winter	December 13–17, 2013	C 10)	4
	December 20, 2013–January 20, 2014	P (27)	1

C, clean days; P, polluted days

Table S2. Correlation coefficients with nine water-soluble inorganic ions from size-segregated aerosols in different seasons

Size-segregated aerosol		Correlation coefficients						
		Na^+	**NH_4^+**	**K^+**	**Mg^{2+}**	**Ca^{2+}**	**Cl^-**	**PO_4^{3-}**
< 0.49 μm	SO_4^{2-} over all seasons	0.22*	0.83**	0.75**	0.3**	0.34**	0.07	0.3**
	NO_3^- in summer and autumn	0.74**	0.16	0.54**	0.72**	0.69**	0.65**	0.75**
	NO_3^- in spring and winter	0.41**	0.75**	0.69**	0.57**	0.56**	0.28*	0.41
0.49-0.95 μm	SO_4^{2-} over all seasons	-0.03	0.87**	0.79**	0.57**	0.31**	0.37**	0.12
	NO_3^- in summer and autumn	0.23	0.53**	0.61**	0.21	0.27*	0.27*	0.11
	NO_3^- in spring and winter	0.06	0.84**	0.78**	0.54**	0.28*	0.58**	0
0.95-1.5 μm	SO_4^{2-} over all seasons	-0.08	0.93**	0.87**	0.57**	0.45**	0.48**	0.08
	NO_3^- in summer and autumn	0.34**	0.36**	0.47**	0.36**	0.48**	0.31**	0.11
	NO_3^- in spring and winter	-0.09	0.83**	0.86**	0.56**	0.40**	0.63**	-0.09
1.5-3.0 μm	SO_4^{2-} over all seasons	-0.05	0.92**	0.58**	0.48**	0.61**	0.24**	0.08
	NO_3^- over all seasons	0.13	0.76**	0.56**	0.64**	0.80**	0.46**	-0.02
3.0-7.2 um	SO_4^{2-} over all seasons	0.52**	0.81**	0.69**	0.80**	0.79**	0.57**	0.06
	NO_3^- over all seasons	0.44**	0.78**	0.67**	0.79**	0.88**	0.42**	-0.05
7.2-10 um	SO_4^{2-} over all seasons	0.53**	0.32**	0.48**	0.63**	0.63**	0.49**	0.20*
	NO_3^- over all seasons	0.20*	0.38**	0.36**	0.70**	0.80**	0.17	0.06

** $p < 0.01$. * $p < 0.05$

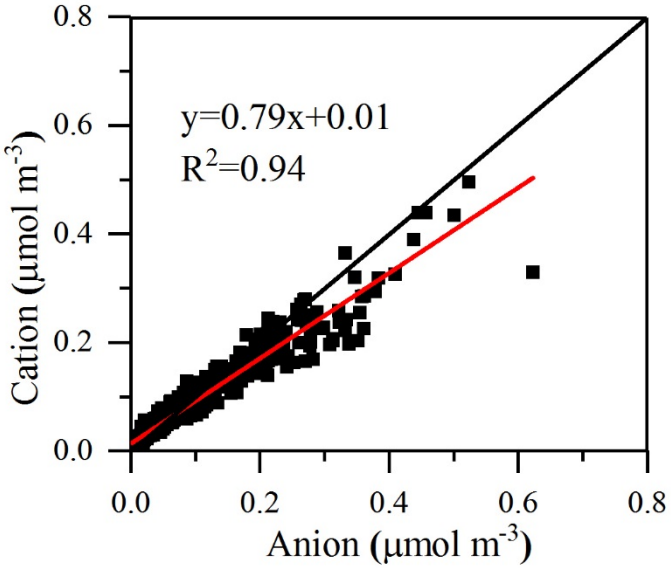

Fig S1. Charge balance between cations and anions in size-segregated atmospheric particles.

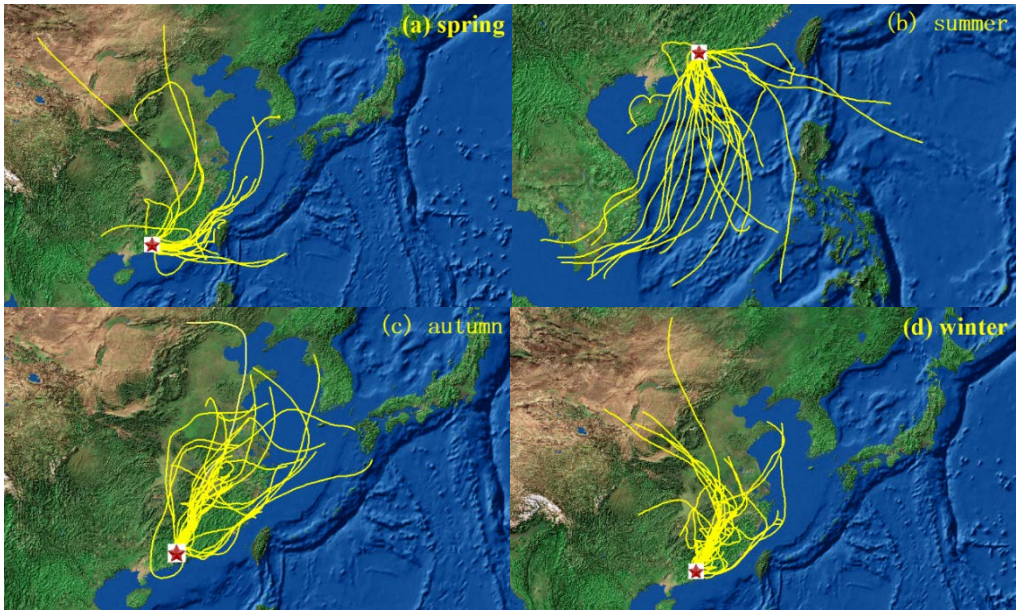

Fig S2. HYSPLIT back trajectories (72 h) for air masses at 500 m during the whole sampling period

We use PMF analysis to indicate the influence of possible sources on the observed sulfate and nitrate in fine and coarse particles, respectively. In this study, eight species were used as input in the EPA PMF 5.0 model (Gugamsetty et al., 2012; Polissar et al., 1998). Three factors were finally resolved from the model and the results were shown in Figs. 3-5.

The model could separate the influences of potential sources on the observed sulfate and nitrate in coarse particles. Three factors were finally resolved, with the resulted Qrobust (1411.1) and Qtrue (1421.0) close to Qtheory (130×9=1170). The predicted nitrate and sulfate could explain more than 60% of nitrate and sulfate in coarse particles. As shown in Figs. S3 and S4, the three main influence factors were likely dust, sea-salt and ammonium.

However, the model cannot well separate the influences of potential sources on the observed sulfate and nitrate in fine particles. This might be explained by the limited species (or specific markers) inputted in the model, which makes the identification ambiguous (Fig. S5).

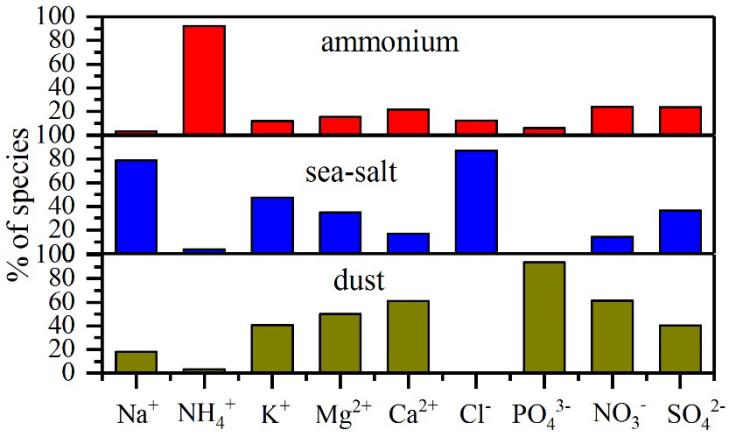

Fig. S3. Three source profiles (% of the species) resolved from PMF model analysis in coarse particles.

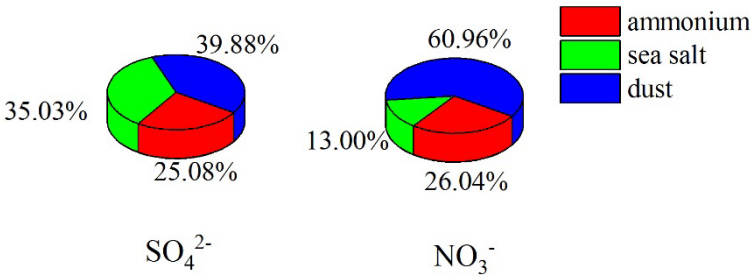

Fig. S4. Contributions of identified sources to modelled SO_4^{2-} and NO_3^- in coarse particles.

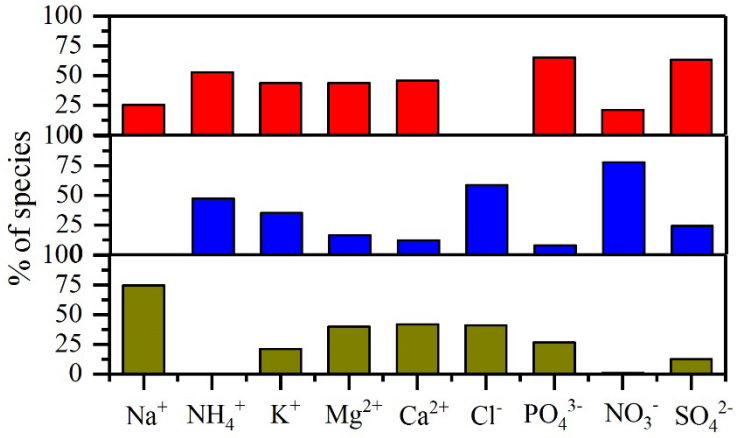

Fig. S5. Three source profiles (% of the species) resolved from PMF model analysis in fine particles.

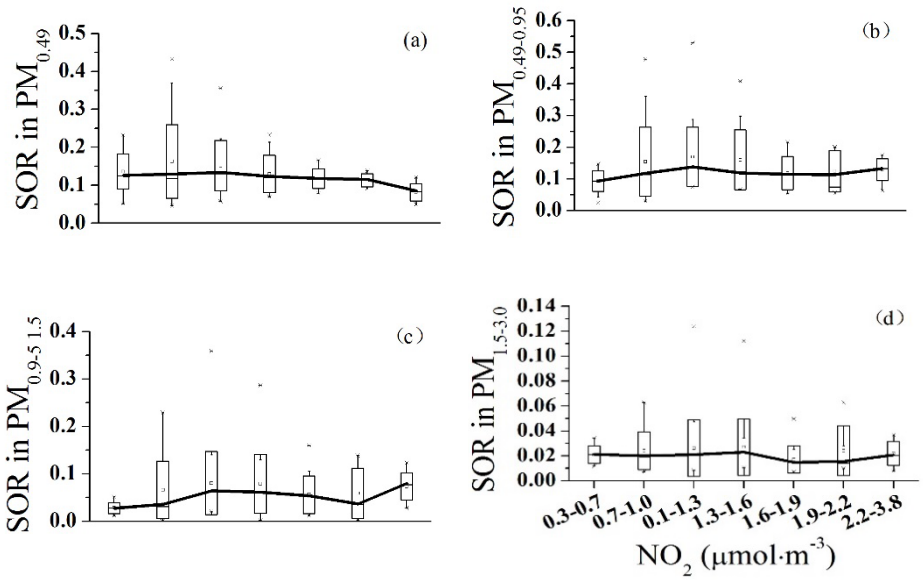

Fig S6. Relationships of SOR versus NO_2 at < 0.49 μm, 0.49-0.95 μm, 0.95-1.5μm and 1.5-3.0 μm, respectively.

References

Gugamsetty, B., Wei, H., Liu, C.-N., Awasthi, A., Hsu, S.-C., Tsai, C.-J., Roam, G.-D., Wu, Y.-C., Chen, C.-F. (2012). Source characterization and apportionment of PM_{10}, $PM_{2.5}$ and $PM_{0.1}$ by Using Positive Matrix Factorization. Aerosol Air Qual. Res. 12: 476-491.

Polissar, A. V., Hopke, P. K., Paatero, P. (1998). Atmospheric aerosol over Alaska - 2. Elemental composition and sources. J. Geophys. Res. 103: 19045-19057.