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Atmospheric Chemistry and Physics Discussions

Interactive comment on "$PM_2.5$ pollution in a megacity of southwest China: source apportionment and implication" *by* J. Tao et al.

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This study intended to focus on the characteristic of compounds and sources of PM2.5 in Chengdu, China. The ISORROPIA-II thermodynamic equilibrium model and positive matrix factorization (PMF) model were employed for discussion. The results reported are values and the discussion is comprehensive. Thus, a minor revision is recommended before published.

Response: We appreciate for the positive comments and constructive suggestions by this reviewer. Accordingly, we have revised our manuscript and made a point-by-point response as follows; please refer to them.

1) The QA/QC of the sampling and chemical analysis should be described more clearly.

Response: We have described more details in terms of the QA/QC; please refer to the methodology section.

2) Page 5156, Line 6. "These suggestions are in agreement with the fact that residents in Chengdu used to utilize waste wood as energy source to generate heat in cold winter" It is better to present some reference.

Response: (should be P5160). We have added two references (Yan et al., 206; Edwards et al., 2003), as follows. However, we also revised the sentence to "These suggestions are in agreement with the fact that residents in Sichuan Basin used to utilize woods as energy source to generate heat in cold winter (Edwards et al., 2004; Yan et al., 2006)."

Yan, X., Ohara, T., and Akimoto H.: Bottom-up estimate of biomass burning in mainland China. Atmos. Environ., 40, 5262–5273, 2006.

Edwards, R. D., Smith, K. R., Zhang, J., Ma,Y.: Implications of changes in household stoves and fuel use in China. Energy Policy 32, 395–411, 2004.

3) Page 5163, line 25. "These results suggest that biomass burning and soil dust had contrasting trends in contributing to PM2.5, with more OM contributions in autumn and winter and more dust contributions in spring and summer." The author should make further discussion to obtain this conclusion.

Response: Thanks for this comments. We revised the discussion with new statements as below. Figures 2a and 2b have shown relatively higher OC/EC ratios (2.9 and 2.6, respectively) and better correlations (R2 = 0.73 and 0.90, respectively) between biomass burning tracer LG and OC in autumn and winter, demonstrating more OM contributed from biomass burning in autumn and winter. Because PM2.5 concentrations were lower in summer than those in autumn and winter, the contribution of FS to PM2.5 was relatively higher in summer than those in autumn and winter. These results suggest that biomass burning and soil dust had contrasting trends in contributing to

PM2.5, with more OM contributions in autumn and winter and more dust contributions in spring and summer, which well consistent with the results of PMF (Table 4).

4) Page 5164, Line 1. “Based on the PMF modeling results, six main source factors were identified” How do you make the number of the factors? Additionally, the Fpeak and Q values should be presented.

Response: We have added the information (as below) in the methodology of the PMF model. To determine the appropriate number of source factors, a reasonable practice is to test different numbers of identifiable sources commonly used and to consider the major potential sources documented by the local Environmental Protection Bureau. In this study, we have tested five, six, seven and even eight different sources in the PMF analysis. Then, PMF was run several times with different Fpeak values to determine the range within which the objective function Q values remains relatively constant (Fig. S2). In the six-factor model, a value of Fpeak = -0.1, provided the most physically reasonable source profiles.

(please see supplementary figure) Fig. S2. Q values varying as a function of Fpeak for PM2.5 data set in Chengdu.

5) Page 5164, Line 25. “The second source is coal combustion, characterized by high EC, Zn, Cu, Sn, Sb, Tl and Pb concentrations (Fig. 6b). This source represented a mean contribution of 20$\pm$12

Response: In fact, two industrial sources have been identified in the present study, that is, Iron and steel industrial, and Mo-related industrial. For example, 48

6) Page 5169, Line 9. “The sixth source factor is soil dust, which is characterized by elevated Al, Fe, Mg, Ca, Sr, Ti, V and Zr.” Ca is the marker for cement dust, so, it might be a potential source category. Make a discussion.

Response: We have added the following discussion and concluded that this Ca is mostly from soil dust rather than cement dust: “A few previous studies have found that

Ca could be originated from anthropogenic activities in China and thus argued that Ca could serve as a marker for cement and construction dust (Zhang et al., 2005; Liu et al., 2005). However, the chemical profile of this identified source shows that Ca content is only 7.2

Liu, X., Zhu, J., Van Espen, P., Adams, F., Xiao, R., Dong, S., and Li, Y.: Single particle characterization of spring andsummer aerosols in Beijing: Formation of composite sulfate of calcium andpotassium. Atmos. Environ., 39, 6909–6918, 2005.

Zhang, D., Shi, G., Iwasaka, Y., Hu, M. and Zang, J.: Anthropogenic calcium particles observed in Beijing and Qingdao, China. Water Air Soil Pollut.: Focus 5, 261–276, 2005.

Zhang, X. Y., Gong, S. L., Shen, Z. X., Mei, F. M., Xi, X. X., Liu, L. C., Zhou, Z. J., Wang, D., Wang, Y. Q., and Cheng, Y.: Characterization of soil dust aerosol in China and its transport and distribution during 2001 ACE-Asia: 1. Network observations. J. Geophys. Res., 108(D9), 4261, doi:10.1029/2002JD002632, 2003.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/14/C3601/2014/acpd-14-C3601-2014-supplement.pdf

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Interactive comment on Atmos. Chem. Phys. Discuss., 14, 5147, 2014.

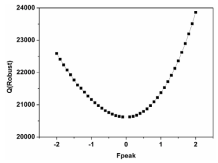

Fig. S2. Q values varying as a function of Fpeak for $PM_{2.5}$ data set in Chengdu.

Fig. 1. Q values varying as a function of Fpeak for PM2.5 data set in Chengdu.