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Atmospheric Chemistry and Physics
Discussions

Interactive comment on "Chemical and stable carbon isotopic composition of $PM_{2.5}$ from on-road vehicle emissions in the PRD region and implication for vehicle emission control policy" *by* S. Dai et al.

S. Dai et al.

bixh@gig.ac.cn

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General comments: Air pollution and haze episodes in recent years are drawing more and more concerns all around the world, and vehicle emissions are believed to be responsible for the worsen of air quality. Representative emission factor of vehicles considering the fleet composition is thus very important for the reasonable estimation of contributions to ambient fine particles from on-road traffic. Detailed information on the characteristics of fine particles was obtained in this study by means of tunnel sampling.

The data set is useful and important for the air quality study in China, especially for the source apportionment of PM2.5. Generally speaking, the manuscript is well organized and clearly presented.

Response: We would like to thank the reviewer for his/her useful comments and recommendations to improve this manuscript.

Specific comments and suggestions: 1. p28889, the authors have described the sampling and the tunnel in quite detail. But more information should be included if possible. One is that if the Zhujiang Tunnel is equipped with or without ventilation devices? Second is the fleet composition in the Zhujiang Tunnel similar to the vehicle composition in Guangzhou as a total?

Response: The ventilation system of the tunnel was turned off during the sampling period, thus the dispersion of air pollutants in the tunnel was mainly brought from the piston effect arising from the traffic flow. The fleet composition in the Zhujiang Tunnel was not as the same as the vehicle composition in Guangzhou. Taken year 2013 as an example, the average proportions of DV, GV and LPGV in Zhujiang Tunnel were 13.7, 59.8 and 26.5% respectively, while those in Guangzhou were 7.12, 86.1, and 6.75% respectively (http://data.gzstats.gov.cn/gzStat1/chaxun/njsj.jsp)(Feng, 2014). Therefore, the fleet composition in this study cannot be regarded as representative for Guangzhou. However, the aim of this study is to compare the study conducted in the same tunnel in 2004, and to get a view of the effectiveness of the implementation of vehicle emission control policies from 2004 to 2013 in the PRD region. We have clarified them in the text. Please refer to Lines 102-104, 124-126 in the revised manuscript.

2. p28892, line 10, I think the uncertainties in the weighing process should be an important cause of the uncertainty in mass closure. Elements such as Si and S (not in form of sulfate) should not have contributions large enough to account for the discrepancy observed.

Response: We agreed with the comments. Combining with the second reviewer's suggestion, we have re-estimated the reconstructed PM mass: "PM2.5 mass was also obtained by summing OM, EC, geological component, sea salt, and major water soluble inorganic ions (NH4+, SO42-, NO3-). OC was multiplied by 1.4 to estimate mass of OM (He et al., 2008). The geological component of 35 mg vehicle-1 km-1 was estimated based on the Al emission data as present in Table 1. A typical road dust Al composition is 9% on average (Tiittanen et al., 1999). Sea salt of 9 mg vehicle-1 km-1 was estimated by Na assuming sea salt contains 32% of Na. Thus, the average PM2.5 reconstructed mass was 91.8% of the gravimetric value. This discrepancy can be attributed to the uncertainties in the weighing process, the estimation methods and uncalculated components." Please refer to Lines 205-213 in the revised manuscript.

3. p28897, the authors discussed the difference in alkane distribution between results of this study and the study in 2004 in the same tunnel. Actually, the difference is quite small (shift of Cmax from C23 to C24), and this difference could be explained by the shift of gas-particle partitioning as alkanes of <C26 are semi-volatile. I would suggest the authors to provide more information such as ambient temperature to confirm that the observed difference is meaningful, and to avoid the over explanation.

Response: The average ambient temperature in this study is 33.0 $\pm$ 2.3 C, while it is 31.8$\pm$1.0 C in the study of 2004 in the same tunnel. A significant T-test ($p = 0.14$) shows that the temperature in this study is not significantly different from that in the study of 2004. Thus the differences due to different Cmax between this study and the study in 2004 can not be regarded as a result of temperature differences. Furthermore, Cmax was found to be C24 in every test of this study, although the temperature ranged from 28.6 to 36.1 C. So we don't think that the ambient temperature in this study would make the shift of Cmax from C23 to C24. Please refer to Lines 351-357 in the revised manuscript.

4. p28898, the part of implication should be shortened and focus more on the application/implication of the current results. Repeat of the figures in Tables should be avoided.

Response: We have rewritten this section and focus on the application and implication of the results. Please refer to Lines 385-401, 410-414 in the revised manuscript. Additionally, we have moved Tables 1 and 2 to the Supplementary material, and revised the table number accordingly in the revised manuscript.

References:

Feng, Q., 2014. Research on emission mechanism of oxygenated volatile organic compounds in vehicle emissiom. Master Dissertation Research Paper, Jinan University.

He, L.Y., Hu, M., Zhang, Y.H., Huang, X.F., Yao, T.T., 2008. Fine particle emissions from on-road vehicles in the Zhujiang Tunnel, China. Environmental Science & Technology 42, 4461-4466.

Tiittanen, P., Timonen, K.L., Ruuskanen, J., Mirme, A., Pekkanen, J., 1999. Fine particulate air pollution, resuspended road dust and respiratory health among symptomatic children. European Respiratory Journal 13, 266-273.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/14/C12219/2015/acpd-14-C12219-2015-supplement.pdf

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 28885, 2014.