Dear Atmospheric Chemistry and Physics Editor:

After reading the comments from the reviewer, we have carefully revised our manuscript. Our responses to the comments are itemized below.

Anything for our paper, please feel free to contact me via cwu@geo.ecnu.edu.cn, or ghwang@geo.ecnu.edu.cn.

All the best

Can Wu
On behalf of Prof. Gehui Wang
December 25, 2019

Reviewer(s)' Comments to Author:

Reviewer 2
Comments:
This paper reports on the light absorption of organic aerosol components (BrC) in an urban setting with significant biomass burning emissions in China. Both the experimental methods and the data analyses approaches are largely identical to other studies and are not novel. This paper's contribution is that it adds more data points to the characterization of BrC in various locations. Possibly the most interesting finding is strong evidence for the secondary formation of BrC in summer. Overall, I have only minor comments, with the exception that 1) the authors could do a better job of citing original sources, and 2) the paper could use some editing throughout. The paper is appropriate for ACP and in my view acceptable after consideration of the following issues.
Reply: We thank the reviewer's valuable comments. We have carefully revised our manuscript according to your advice. See details below.

Comments:
1) Line 160 to 161. In calculating the MAC what is the concentration of the carbon? That is, clarify what is the WSOC and MSOC concentration. I assume they are mass of carbon per volume of air, not per volume of liquid extract. Also, what about conversion of carbon mass to organic aerosol mass. Finally, it seems that since this is all liquid based analysis, can this data be applied to atmospheric aerosols? If the authors think so, justify how this is done (see the comment below on the 1.3 factor, this should be noted here in the text).
Reply: As for calculating the MAC values, the WSOC and OC are the mass concentrations of carbon per volume of air (ugC/m^3), respectively. We didn't convert the carbon mass to

organic aerosol mass, because it would not give any extra information and numerous studies were processed in a similar way (Liu et al., 2013;Kirillova et al., 2014). Although the liquid extraction method may underestimate the light-absorption of brown carbon, it is an extensive research technique for BrC at present with many advantages, e.g., without interference of black carbon, wavelength continuity, and so on. To a certain extent, the results can explain the BrC light-absorption, and it may correct based on the data by Mie theory predicted to better quantify the BrC absorption in the future studies.

Comments:

2) It would clarify things if the authors used the units of ugC/m^3 for WSOC and OC throughout, instead of ug/m^3.

Reply: Suggestion taken. We have replaced the unit for WSOC and OC throughout the revised manuscript.

Comments:

3) Line 198 and beyond. The use of the term matters is a poor choice. Eg, edit : as ubiquitous matters in the atmosphere. Also in a few lines down the term matters is again used.

Reply: Thank for the comments, we changed the “matters” into “compounds,”.

Comments:

4) Edit line 201, due to owning: : :?

Reply: Suggestion taken. We have modified it in the revised manuscript.

Comments:

5) Line 314 to 317. The value of Mei-predicted (based on size resolved data) and bulk light absorption factor of 1.3 is interesting. Since this work is simply repeating what other studies have done, please compare this 1.3 factor to the factor reported in these other studies (these papers are already cited). Also, the statement that using liquid based Abs or MACs to estimate aerosol optical effects will result in an underestimation is obvious and not new. It seems more important that the authors should state that in this study, to convert the liquid based data reported here to estimated aerosol properties, a factor of 1.3 must be applied, at least for the water-soluble data.

Reply: Suggestion taken, we had one sentence to state this issue, see page 15, line 318-321.

Comments:

6) In Figure 5, explain the regular up and down pattern in PAHs, OPAHs and nitrophenols. The pattern also seems to be evident in some other plotted factors, such as Abs: : : This looks like a measurement artifact and not real. Please provide some evidence it is real or possible explanation for the cause.

Reply: The regular up and down pattern in PAHs and related compounds is real, which was mainly caused by the lower PBL height and higher emissions at night; the high concentrations were for the nighttime samples and the low concentrations were for the

daytime samples. Here we give more evidences to show that the variation pattern is real. As seen in Fig. 1(a), PAHs showed a robust linear correlation with EC, suggesting that the pattern of PAHs should be similar with EC (Figure 1(b)). This can be interpreted by the change of boundary layer and intense biomass burning at nigh, which reveals a real variation tendency of PAHs during the sampling period. Moreover, as shown in Figure 1c, the triplicate results of the recovery experiments for the target compounds (i.e., PAHs) are very stable with a relative standard deviation (RSD) less than 5%, further demonstrating the data reported here are real. Therefore, we believe that our results presented by this work are accurate and reasonable.

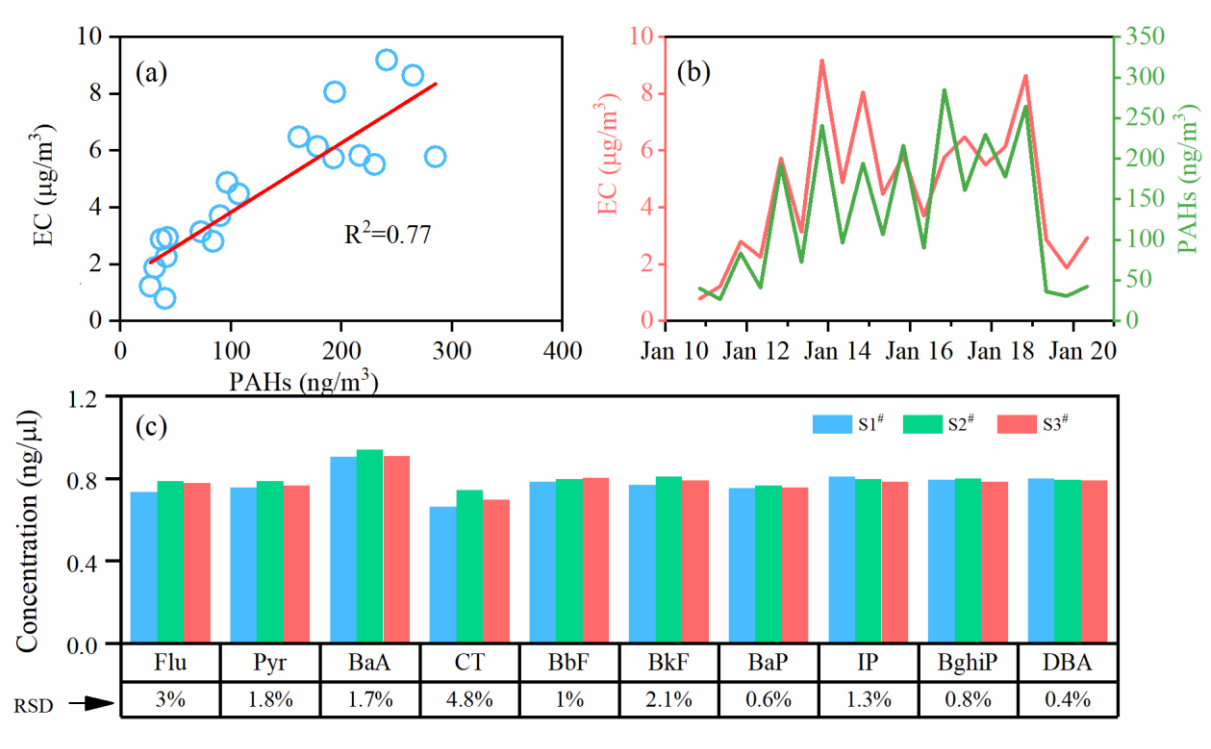

Figure 1. **(a)** The relationship of EC and PAHs during the haze period of January 12th to19th. **(b)** Temporal variations of EC and PAHs during the haze period of January 12th to19th. **(c)** The data for standard PAHs experiments of repeatability and recovery. (RSD: relative standard deviation, the concentration of standards is 0.8 ng/μl)

References

Kirillova, E. N., Andersson, A., Tiwari, S., Srivastava, A. K., Bisht, D. S., and Gustafsson, Ö.: Water-soluble organic carbon aerosols during a full New Delhi winter: Isotope-based source apportionment and optical properties, Journal of Geophysical Research: Atmospheres, 119, 3476-3485, 10.1002/2013jd020041, 2014.

Liu, J., Bergin, M., Guo, H., King, L., Kotra, N., Edgerton, E., and Weber, R. J.: Size-resolved measurements of brown carbon in water and methanol extracts and estimates of their contribution to ambient fine-particle light absorption, Atmospheric Chemistry and Physics, 13, 12389-12404, 10.5194/acp-13-12389-2013, 2013.