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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Mass absorption efficiency of elemental carbon and water-soluble organic carbon in Beijing, China" *by* Y. Cheng et al.

Anonymous Referee #1

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This manuscript describes the measurements of the mass absorption efficiency (MAE) of elemental carbon in Beijing using a thermal-optical carbon analyzer. Previous published MAE values of North America, Europe and Asia were converted to the equivalent MAE using a converting approach. Finally, water-soluble organic carbon extracted from the filter samples collected in Beijing was quantified using TOC analyzer, and the absorption spectra of the liquid extracts were also measured with a UV-Vis spectrophotometer and long-path absorption cell. Based on these data, the authors concluded: i) The daily variation of MAE in Beijing coincided with the OC abundance due to the enhancement by coating with OA (especially SOA); ii) The equivalent MAE is much lower in the regions heavily impacted by biomass burning; iii) the seasonal pattern of MAE

in Beijing could be due to the difference in the precursors of SOA, of which was coupled with the previous data (Cheng et al., 2011). These experiments are potentially of interest to the ACP readership because carbonaceous aerosols exert great influence on climate by changing the energy transfer through the atmosphere, and potentially affect public health as carriers of toxic chemicals. Carbonaceous aerosol emissions in China are estimated to account for around one-fourth of global anthropogenic carbonaceous aerosols. Therefore, the study focused on MAE of carbonaceous aerosols in Beijing will appeal to a wide general readership and be of exceptional interest to the atmospheric specialist.

Unfortunately, however, the manuscript provides no solid evidences for these conclusions. The authors severely criticized that "the artifacts were associated with the filter-based method due to the aerosol-filter interactions shadowing of the incident light with increasing filter loading, and aerosol scattering effects." (Page 4, in the introduction section); therefore, the main aim of this manuscript is to gain high-qualified data using a thermal-optical carbon analyzer, and to update the previously published MAE values using a converting approach in order to compare these data in different fields including North America, Europe, and Asia. However, it seemed that the efforts of authors resulted in failure. The author also emphasized that the data may be affected by the artifacts resulting from the redistribution of liquid-like organic particles, or during the filter-based absorption measurements. The reliability of the data presented in this manuscript need to be further proved.

Besides, the equivalent MAE of the first group and the second one were between 4-11 m2/g and 2-9 m2/g, respectively, as shown in Table 1; the authors thus concluded that the much lower MAE in the regions of Asia compared to North America and Europe could be due to be heavily impacted by biomass burning. Apparently, two data scopes overlapped largely, and this result was lamely inferred.

The manuscript was not well organized. The authors listed three sub-topics in the first section of Results and Discussion. They were "MAE" values of EC in Beijing", "Effects

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of the measurement methods", and "Effects of biomass burning and brown carbon". In my opinion, "Effects of the measurement methods" should be combined into the section of Experiment. The present manuscript did not meet the requirement of a scientific paper, which could be seen apparently in the Abstract, Conclusion and Implications sections. For example, the sentence of "WSOC in Beijing has been demonstrated to be strongly linked to SOA" in Abstract is not suitable; the description about the research method (line 488-492) should not be placed in the Implications section. By the way, the conclusion is so long, and it should combine the Implications section into one unit.

Specific comments

Line 76: what is "Rabs" ? It is "babs"?

Line 105-107: In my opinion, light-absorbing organic aerosol is tentatively named "brown carbon" and may be associated with high molecular weight humic-like substances (HULIS) from biomass burning or soil deflation. HULIS not only leads to the efficient absorption of solar radiation in the UV and visible range, but also exhibits much stronger wavelength dependence at shorter wavelengths than EC. The work by Alexander and Hoffer has proved this point. "Tar balls" and soot could be precursors of HULIS, but "Tar balls" from biomass are not the important "brown carbon".

Line 126: The map of sampling site should be shown. It will help give the readers a direct information.

Line 228-231: The corresponding literatures should be cited.

Line 342-380: in the section of 3.13, the data about Beijing was not involved into this discussion, which deviated from the topic of "Mass absorption efficiency of elemental carbon and water-soluble organic carbon in Beijing, China".

Line 414-416: The corresponding literatures should be cited.

Line 482: In the section of Implications, more information about radiative forcing and climate change should be discussed coupled with the present data.

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Captions of Table and Figure were not normative. Please overwrite it.

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