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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Amplification of light absorption of black carbon associated with air pollution" *by* Yuxuan Zhang et al.

Anonymous Referee #1

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In this study, the authors examined light absorption of black carbon (BC) under clean and polluted conditions based on observations. They found that we found that the aging degree and light absorption capability of BC containing particles increased by 26-73% and 13-44% respectively, due to more coating materials on the BC surface. This work is interesting and merits publication after following comments addressed.

General Comments:

The authors reported a large amount of BC was originated from sources outside Beijing based on effective emission intensity. It is true in this analysis. But the authors need to caution that they were comparing the contributions from a small region (Beijing) and a large region (outside Beijing or adjacent regions). In addition, the authors evaluated the contribution of local photochemical production by the changes of O3 concentrations

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in the atmosphere. They found that the O3 concentrations showed a different temporal trend. It only means weak photochemical production of O3 due to high aerosol concentrations blocking sunlight. It does not mean the local aging of BC is weak because high concentrations of aerosols may compensate the adverse conditions for BC aging. Anyway, the authors should provide uncertainty values for the numbers.

Specific comments:

Page 1 Line 14: It 'is' well known.

Page 2 Line 22: What is the 'lens effect'?

Page 7 Line 27: Missing ')'.

Page 8 Line 21: How many samples are there for different PM1 conditions?

Page 9 Line 27: It should be 'Figure 4'. The unit of EEI is 't/grid/year' shown in the figure. What does the 't' stand for?

Page 9 Line 30: 'account for' what? Does that mean the rest of the contribution is from Beijing's own emissions or emissions from other non-adjacent regions? As I understand, there are three emission source regions, emissions from Beijing, adjacent regions, and other regions. Please clarify.

Page 10 Line 1: Does EEItotal include the contribution from Beijing's own emissions?

Page 10 Line 3: I am confused that EEItotal increased by a factor of 4.6, but after that, the authors said BC from adjacent area. Should it be EEIadjacent? In addition, I think it needs a supplement to the conclusion that the increased BC is due to transport of polluted air mass, not the adverse local meteorology. It is true for a very small region, based on the analysis of this study, because the authors were comparing the contributions from a small region and a large region. Also, polluted events always occur over a larger region, even spread the whole eastern China. They are definitely caused by adverse meteorology. The more transport of pollutants into Beijing is probably a

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consequence of increased pollutants due to adverse meteorology in other regions. For example, Yang et al. (2017) analyzed the source-receptor relationship of BC in China and found that, during polluted days in winter, the increases in BC over the North China Plain (including Beijing) is dominated by its local emissions instead of regions outside North China Plain. The weakening of winds can explain it.

Page 11 Line 1: What does the normalized EEI mean? Is it a percent value or some index?

Page 11 Line 19: I see the author calculated DRF by scaling the average DRF (0.32 W m-2) of externally mixed BC with an average MAC of 7.5 m2 g-1 from various climate models (Bond et al., 2013). Is the DRF value global average with a fixed BC climatology? The author should make it clear, or the readers may think the value is the DRF over Beijing during the analyzed clean and polluted days.

Page 12 Line 15: Delete 'by'.

Page 13 Line 19: It was defined as transport-controlled 'period'.

References

Yang, Y., Wang, H., Smith, S. J., Ma, P.-L., and Rasch, P. J.: Source attribution of black carbon and its direct radiative forcing in China, Atmos. Chem. Phys., 17, 4319-4336, https://doi.org/10.5194/acp-17-4319-2017, 2017.

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