

Atmos. Chem. Phys. Discuss., referee comment RC1  
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## Comment on acp-2021-170

Anonymous Referee #1

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Referee comment on "Reduced light absorption of black carbon (BC) and its influence on BC-boundary-layer interactions during "APEC Blue"" by Meng Gao et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-170-RC1>, 2021

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Black carbon (BC) is one of the major air pollutions severely threatening public health despite of its relatively low contribution to total PM mass, not only due to its toxicity but also its nature of light absorption. Because of this, BC is able to alter boundary layer stability and structure, which further influence the ventilation of pollutants. Previous studies have demonstrated the importance of this BC light absorption effect in surface layer pollution in many China megacities. This study use APEC Blue period as a natural lab to further quantify this impact using a fully coupled model. The scope fit well with ACP. The manuscript is well written, the results are scientific interesting and politically meaningful supported by sound methodology. I feel this work is suitable for publication after addressing a few minor concerns.

### Minor concerns:

1) Calculation of aerosol optical properties has been well described for the external mixture and internal homogeneous mixture (volume-weighted average). I feel the calculation details of core-shell mixture should also be elaborated, given core-shell is the main mixture style discussed in this paper. Please also provide the information of how complex reflective index is defined for each component, especially for organics.

2) There are many ways/definitions of boundary layer top. How boundary layer top is

defined and hence its height is estimated?

3) line 283. Do you mean reduce PBLH by 8.2m on average?

4) There is some nice discussion about the PBL-PM<sub>2.5</sub>-O<sub>3</sub> interactions. I think some chemical reasons also influence ozone. Such as, reduce of PM<sub>2.5</sub> could enhance the surface layer photolysis therefore increase ozone especially for heave polluted area/periods, and the co-reduction of NO<sub>x</sub> and the regime of NO<sub>x</sub> (Chen et al., 2021).

5) Just curious that in Fig. 5h, why reduction of emission could lead to a strong enhance of pollutants in the northwest? Is there some interactions between PM and dynamic lead to the re-distribution of pollutants? This may be out of the scope of this study, therefore do not expect authors' full answer here. Some discussion would be appreciated and may be an interesting topic for future study.

### **References:**

Chen, Y., Beig, G., Archer-Nicholls, S., Drysdale, W., Acton, J., Lowe, D., Nelson, B. S., Lee, J. D., Ran, L., Wang, Y., Wu, Z., Sahu, S. K., Sokhi, R. S., Singh, V., Gadi, R., Hewitt, C. N., Nemitz, E., Archibald, A., McFiggins, G., and Wild, O.: Avoiding high ozone pollution in Delhi, India, *Faraday Discussions*, 10.1039/D0FD00079E, 2021.