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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Optical and hygroscopic properties of black carbon influenced by particle microphysics at the top of anthropogenically polluted boundary layer" *by* Shuo Ding et al.

Anonymous Referee #2

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Review of "Optical and hygroscopic properties of black carbon influenced by particle microphysics at the top of anthropogenically polluted boundary layer" by Ding et al.

This work presents the physical properties of particles containing black carbon measured during two short measurement campaigns (winter and summer 2019) on a mountain site in China. This site allows measurement at top of planetary boundary layer (PBL). For the full data set, the authors found and classified three types of PBL (according to back trajectories) from polluted regions to cleaner (and long range transportation) regions. The paper focuses mainly on comparing the black carbon containing particle physical properties of these three air masses, during winter and summer. The paper

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reports the influence of coating on hygroscopic and optical properties of these particles. The data presented in the figures are easy and pleasant to read. The sentences are sometime long and therefore not easy to follow (for me), but after several reading I could understand all of them. Although the data set is short, it is enough to cover two distinct periods (winter vs summer) and provide a first hint of temporal variation of the PBL physical properties. I would recommend this paper for publication, after the following comments are clarified.

The paper would benefit to have more references and discussion about previous study. For example, in paragraph 38-48 the authors cite different studies on BC in the same regions, highlighting what was not measured. However, it would be beneficial for the paper, to also mention briefly, what are the main finding from these studies. Either here or in the discussion part.

line 6: "This study presents continuous measurements of detailed BC properties.." it would be fair to state that it presents x weeks of data during winter and y weeks of data during summer.

line 12: "we found enhanced BC mass absorption cross section (MACBC) for polluted PBL (up to 13 m2g-1 at λ=550nm), and summer had a higher MACBC than winter by 5%." for claritity of the sentence I suggest to change by for example: "...550nm), and that the PBL MACBC is higher by 5% during summer compare to winter.

line 158: "Consistent with the combined back-trajectory and emission analysis above, C1 had the highest BC for both seasons (1.0 $\pm$ 0.5 and 0.4$\pm$0.2 μg m-3 for winter and summer, respectively) and PM mass (23.8 $\pm$ 10.3 and 13.4$\pm$9.5 μg m-3). The concentration of BC mass was enhanced by a factor of 2.8 (1.7) higher than that in C2 for winter (summer), with winter having mass concentration frequently exceeding 1 μg m-3 The concentration of BC mass was enhanced by a factor of 2.8 (1.7) higher than that in C2 for winter (summer), with winter having mass concentration frequently exceeding 1 μg m-3."

This paragraph is difficult to follow. It would be easier if there is connection between sentences. For example here, it could written as follow:

"Consistent with the combined back-trajectory and emission analysis above, C1 had for both seasons the highest BC (1.0 $\pm$ 0.5 and 0.4$\pm$0.2 μg m-3 for winter and summer, respectively) and highest PM mass (23.8 $\pm$ 10.3 and 13.4$\pm$9.5 μg m-3). Compare to C1, for C2, the concentration of BC mass was enhanced by a factor of 2.8 (1.7) higher for winter (summer), with winter having mass concentration frequently exceeding 1 μg m-3. The concentration of BC mass was enhanced by a factor of 2.8 (1.7) higher than that in C2 for winter (summer), with winter having mass concentration frequently exceeding 1 μg m-3."

line 161: "It clearly shows" what (it) clearly show?

Fig1: in fig 1a, the sea could be also color, in blue for example. For non-local scientist, it would be easier to have a first idea of the region when the sea is also colored (the grey line for border between country or sea is not obvious for interpretation of the map).
Fig1: Maybe a picture of the station been added as well?

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