

Authors reply to reviewer's comments:

Dear Anonymous Referees,

Thanks for your careful review of the manuscript. We read the reviewer's comments carefully, and have responded and taken all of the reviewer's comments into consideration and revised the manuscript accordingly. My detailed responses are as follows:

**The authors have carefully considered all comments raised by referees and the manuscript has much improved. The only thing that I am not fully confident that the free convection assumption is applicable over majority of observations at CAMS site (there is probably a typo in the response letter where the range of conditions  $-0.15 < (z-z_d)/L < 0$  is called very unstable; this corresponds to conditions from near-neutral to moderately unstable). However, the authors have quantified the uncertainty related to this assumption and I am ok with the response.**

Response:

We made a typo in the response letter. The range of conditions  $(z-z_d)/L < -0.15$  is called very unstable, which is in accordance with our previous paper (Yuan et al. 2016).

1. **Line 67, replace “much high” with just “high”**

Response: We modified the manuscript as suggestion.

2. **L 77-78, do not repeat “and the boundary layer is taken as a box”.**

Response: We modified the manuscript as suggestion and deleted the words.

3. **L. 108, better use “are not representative of wider area”, L. 109, would it make sense “larger spatial representation” instead of accurate? Measurement accuracy is a different concept but here we talk mostly about spatial representativeness.**

Response: We modified the manuscript as suggestion.

4. **L. 112 “atmospheric surface layer similarity theory” (or Monin-Obukhov...)**

Response: We modified the manuscript as suggestion

5. **L. 114 replace repetition “light propagation theory and...” with “the same principles”**

Response: We modified the manuscript as suggestion

6. **L. 136: “PM2.5 dominated by wind” is loose wording. Perhaps “PM2.5 high concentration levels are caused...”**

Response: We modified the manuscript as suggestion

7. **L. 138: What rising process? Probably you mean elevation of PM2.5 concentrations. The same in L. 144 (for the rising...)**

Response: We mean elevation of PM2.5 concentrations and modified the manuscript as suggestion

8. **L. 149 what are “vertical aerosols”? improve**

Response: “vertical aerosols” means “aerosol particles by vertical transport”. We modify the sentence.

9. **L. 152 how near-ground cooling effect is caused by atmospheric circulation and vertical mixing? Perhaps you mean lack of vertical mixing?**

Response: Yes, a near-ground cooling effect results in the lack of vertical mixing in the near-surface layer. We modified the manuscript as suggestion.

10. **L. 155 instead of “mostly” better “predominantly”?**

Response: We modified the manuscript as suggestion.

11. **L. 167, Instead of “argument” use “principles”**

Response: We modified the manuscript as suggestion

12. **L. 198, it is not clear from text if the choice of coefficients was based on the experimental data of this study or some other. Also, better “based on minimal difference”?**

Response: We modified the manuscript as suggestion. The choice of coefficients was based on the experimental data of this study.

13. **L. 244, “relatively small variations in particle size”: particle distributions are usually over very wide range of sizes; do you mean here small variations in size distributions?**

Response: Yes, we mean here small variations in size distributions

14. **Line 388, instead of “supplementation” use “gap-filling”**

Response: We modified the manuscript as suggestion.

15. **L. 389, verb is missing in the first part of sentence, add “exist”?**

Response: We modified the manuscript as suggestion.

16. **L. 390, more clear “impact of the deviation of the shape of spectrum from...”?**

Response: We modified the manuscript as suggestion.

17. **L. 406, this is not truly scatter diagram because bin-averaging has been performed. Call it relationship plot or similar.**

Response: We modified the manuscript as suggestion.

18. **L. 408: use “The fitted line”**

Response: We modified the manuscript as suggestion.

19. **L. 420:  $R_{MN}$**

Response: We modified the manuscript as suggestion.

20. **L. 432: Better “Moderately strong” because the wind speed values were still fairly moderate**

Response: We modified the manuscript as suggestion.

21. **L. 433: better “has diurnal variation, which is related”**

Response: We modified the manuscript as suggestion.

22. **L. 488: I would skip the badly worded sentence. And in general 15% relative error is fairly small considering large uncertainties of aerosol fluxes in general.**

Response: We modified the manuscript as suggestion and deleted the sentence..

23. **L. 453: This is badly worded sentence. The Monin-Obukhov has a significant error... in terms of what? It is not the theory that has error but its applicability under these conditions. Revise this sentence.**

Response: L. 453 in original manuscript is modified as, “applicability of the Monin-Oubhov similarity theory under stable condition causes a significant error for  $T^*$  or  $u^*$ ,”

24. **I would suggest to move the whole paragraph (L. 451-462) into methods section (e.g. after line 281)**

Response: We modified the manuscript as suggestion.

25. **L. 483, explain what was the difference or remove “except that there is a slight difference”**

Response: We modified the manuscript as suggestion and remove the sentence.

26. **L. 589: “from the ground”: maybe better “from near-ground emission sources” because pollution source below the observation level (including buildings) contribute to emissions.**

Response: We modified the manuscript as suggestion.

We also modified some typo errors. Please see the marked document.

Finally, the authors thank the two referees for their constructive comments that help us to improve the manuscript greatly.