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comment**

Interactive comment on "The conclusive impact of aerosols vertical structure on low-atmosphere stability and its critical role in aerosol–PBL interaction" *by* Tianning Su et al.

Anonymous Referee #1

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Aerosol-planetary boundary layer (PBL) interaction is proposed as an important mechanism to stabilize the atmosphere and exacerbate surface air pollution. Attempts to analyze aerosol-PBL interaction by using observation data are rare and worth encouraging. Thus, I recommend a minor revision before publication. The detail comments or suggestions are shown below:

1. My main concern about this study is how to get cause-effect from correlations. As we know, PBL has a strong impact on surface aerosol concentration and aerosol vertical profile (forward effect). Compared to that, the impact of aerosol on PBL (reverse effect) can be treated as a perturbation. Thus, it is hard to get the contribution of reverse

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[Discussion paper]

effect only. For example, Line 265 to 272. It is claimed that "In general, there are stronger correlations between PBLH and PM2.5 under inverse aerosols structure. ... This phenomenon indicates that the absorbing aerosol could play a more important role in the inverse aerosol structure.". Let's imagine that the decreasing and inverse profile are formed by specific PBL structure, we may get a similar relationship between PBL height and PM2.5 in Figure 5. Moreover, it is possible that the correlations are caused by some other factors, simultaneously, like the front process or precipitation.

2. I don't quite understand the role of Figure 6 and the corresponding part of the manuscript. It seems that Figure 6 does not support the topic directly and may be considered to be moved to SI.

3. More quantitative analysis is needed in the Results part. I can barely find the detail of quantitative discussion figures, especially in 3.3. I'm not sure if Figure 7 is a specific case, a statistic scenario or just a diagram? It seems there are too many diagrams in the manuscript.

4. It might be helpful to show some statistical information and meteorological condition information. For example, the occurrence/frequency of each aerosol vertical structure within PBL. Does it occur in specific seasons or weather conditions?

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