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Interactive comment on "Opposite Long-term Trends in Aerosols between Lower and Higher Altitudes: A Testimony to the Aerosol-PBL Feedback" *by* Zipeng Dong et al.

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Aerosol-PBL feedback has been found to play very important roles in enhancing surface air pollution in many regions. Existing studies, especially some latest modeling works, revealed the mechanism and key processes of this kind of feedback. From an obvious opposite long-term trends in aerosol between lower PBL and upper PBL, this study provides additional observational testimony from satellite retrievals to show how important this feedback is in China. In general, this paper was well-written and the main results certainly will help improve the current understanding of air pollutant in China and many other regions.

Based on comprehensive data analysis and validation using various data (e.g. satellite and ground-based remote sensing data, ground based in-situ measurements etc.),

this study provides solid evidence to show the opposite trends in aerosols between lower and upper PBL in Guanzhong Plain and other regions in China. The method of topography-based calculation of vertical trend AOD is very unique. However, understanding a direct linkage between the opposite trend in upper and lower altitudes with the aerosol-PBL feedback needs more clarifications.

1) For a reader who is not familiar with the aerosol-PBL feedback, maybe it is difficult to directly link the two points. The feedback scheme has been already well-established in previous studies, especially modeling works. The key point of this paper is to show how this process is important for specific regions and different part of China from a perspective of long-term trend. It will be better that the authors give more descriptions on the aerosol-PBL feedback in the introduction part based on existing studies. In the introduction part, it also could be directly pointed out that the aerosol-PBL feedback will cause enhanced lower PBL pollution and decreased upper PBL pollution, as that showing in Fig.1b of Ding et al. (2016).

2) A decrease of AOD at an altitude about 1km might also been influenced by cloud or mountain fog, in which the in-cloud removal/deposition could also cause a decreased upper altitude negative trend. How did the model deal with the cloud cover issue under high cloud cover condition? Did the authors exclude the days with thick cloud while categorizing days into relatively clean, moderate pollution, and severe pollution scenarios? It will be better to clarify these points in the paper.

3) The overall structure of the presentation could be a little bit changed. For example, Fig. 1-5 present results from Guangzhou Plain except Fig. 3, which shows results in the entire China (similar to Fig. 8), and was discussed in the second paragraph of Sec. 3.1. How about discussing the Guanzhong Plain results in the first half of the main results part and the results for entire or different regions of China in the latter half? I think it will improve the readability. For Fig. 3 and Fig. 8, the region definition (i.e. range of longtidue and latitude) of data for the plot should be included.

4) In terms of the calculation of heating rate, it highly depends on light-absorbing property of aerosols. Thus the SSA input data is vital, which ought to be provided in the main text. Additionally, the aerosol-boundary layer feedback play more important role in winter extreme pollution event. How about results during winter?

5) Both of MODIS and MISR retrievals display substantial upper-level decline in AOD trends. For the near-surface increasing AOD, MISR shows much smaller change. What are the causes for these differences?

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