

## ***Interactive comment on “Mixing layer height on the North China Plain and meteorological evidence of serious air pollution in southern Hebei” by Xiaowan Zhu et al.***

### **Anonymous Referee #1**

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This paper characterizes mixing layer height (MLH) over the major cities in the North China Plain based on the two-year surface observations. The relationship between MLH and regional air pollution is explored using concurrent PM, MLH, surface radiation, and meteorological parameters in the same cities. Overall, the paper is well written and the finding about the low MLH in southern Hebei is valuable to develop an efficient air pollution mitigation strategy in North China. I suggest the paper should be accepted by ACP after the authors address my comments below.

1) It is not clear what is the difference between the MLH discussed here and the traditional defined planetary boundary layer height (PBLH). It would be interesting to see if

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the MLH obtained from surface can be intercompared with PBLH from soundings like Guo J. et al. (2016).

2) L266, the authors attribute the lower summertime MLH in QHD to the higher frequency of sea breeze. However, the underlying physical mechanism is not fully explained. Intuitively, the active sea breezes should come with more unstable atmosphere over the land. Figure 5 about prevailing wind directions in different seasons is referred, but it is still unclear to me how this figure supports the hypothesis above. Some detailed discussions are needed to better describe the formation and characteristics of the sea breeze in the coastal regions.

3) L372, to overcome the lack of radio sounding in SJZ, how about directly using the reanalysis data? The quality of reanalysis can be evaluated by radiosound at XT.

4) Section 4.1, could absorbing aerosols be another factor to explain the reason of the low MLH in southern Hebei? Observations have revealed that the ambient aerosols can become highly absorptive in the urban conditions in China [Peng J. et al., 2016, PNAS]. The strong solar absorption near the top of PBL can increase the atmospheric stability and convective inhibition energy [Wang Y. et al., 2013, AE; Li Z. et al., 2016, Rev. Geos.]. Those possible influences from the feedback of air pollution should be discussed and quantified if possible.

5) L437, what makes the RH at SJZ is higher than that in BJ and TJ? SJZ is more inland than those two cities.

6) L432-445, some basics of new particle formation in urban condition should be thoroughly reviewed. Please refer to Zhang, R. 2010, Science and 2015, Rev. Chem.

7) Fig. 8. Define  $V_c$  in the figure caption.

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