

## ***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.***

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Received and published: 23 August 2017

The climatology of MLH at four sites over NCP were investigated using long-term measurements. However, lots of statements in the manuscript and part of conclusions were not well supported. Thus, a major revision is suggested.

1) LINE 214-215, the definitions of rainy, sandstorm and windy conditions should be given. 2) LINE 317-318, “the TJ station was supposed to be an inland site”, the TJ site is quite close to the Bohai sea, which should be considered as a coastal station. 3) LINE 319-324, the definition of sea-breeze used in this study should be given. The sea-breeze cannot be identified merely by the near-surface wind speed and direction.

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How to identify the sea-breeze from background wind? How to calculate the occurrence frequency of sea-breeze at TJ and QHD? 4) LINE 326-335, more evidences should be given to support the statement that the movement of sea-breeze suppress the MLH at QHD site in summer. The TJ site also locates in the coastal regions, why the diurnal patterns and seasonal variations of MLH are quite different? 5) LINE 362-364, the buoyancy fluxes are determined by the surface sensible heat fluxes, not the net radiations. The statements here are inaccurate. 6) LINE 371-375, before using the sounding data of XT as a replacement of SJZ, the data consistency must be examined and presented, since there are  $\sim 90$  km between these two sites. At least, the general characteristics of MLH at SJZ at 08:00 and 20:00 LT should be well reflected by the sounding data at XT. The data consistency also should be check between the LT site and QHD site. 7) As shown in Fig. 7, the profiles at XT are almost the same in different season and different moment, which is different from the profiles of other sites. The prevailing wind speed and direction are different in different season, why the profiles are almost the same? The error-bar of the profiles should also be given. In spring and summer, at 20:00 LT there are lots of fluctuations in the profiles at LT, why? Do the terrains play a role in the profiles in different regions? 8) LINE 390-392, the authors merely presented the profiles at 20:00 LT, which cannot support the statement “during the whole night”. More evidences should be given. 9) LINE 404-405, please give evidences to support the statement “the front usually does not reach southern Hebei”. 10) LINE 406-408, please give evidences to support the statement “the lessened effects of the front system and strong turbulent exchange will lead to less wind shear contrast in the vertical direction between southern Hebei and the northern NCP.” 11) LINE 410-419, the authors attribute the high PM concentration in SJZ to the low MLH. It is inaccurate, the different anthropogenic emissions of pollutants in SJZ and BJ should be considered. 12) LINE 420-422, although the RH can affect the visibility, it cannot significantly affect the aerosol concentration. Is there any direct physical connections between the high RH conditions and high aerosol concentration? 13) LINE 426-427, “temperature is the main factor in new particle formation,” any evidences to

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support this statement in NCP. 14) LINE 437-440, the RH in SJZ is higher than that in TJ (closer to sea), why? 15) Section 4.2.1, the authors attribute the higher PM in SJZ to new particle formation, which is quite complex and cannot be understood merely by the surface temperature and RH. And the direct emissions of pollutants should be considered. 16) LINE 470-473, “it was considered reasonable to regard the sounding data of WS as a climatological constant”, during a day, the WS within ML would change due to the momentum exchanges between the ML and free troposphere. The WS cannot be considered as a constant. As illustrated in Fig. S2, there are differences in profiles at 08:00 and 20:00 LT. The error-bar of wind speed should be given.

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-295>, 2017.

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