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Atmospheric Measurement Techniques Discussions

Interactive comment on "Relationship Analysis of $PM_{2.5}$ and BLH using Aerosol and Turbulence Detection Lidar" *by* Chong Wang et al.

Anonymous Referee #1

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This manuscript presents continuous measurements of PBL structure using a newly-developed compact lidar system combined both direct detection lidar and coherent Doppler win lidar, and demonstrates that the PBL height can be accurately retreated by the measurements and the residual BL and stable BL can be distinguished using different signals from the instrument. The relationships between the PM2.5 concentration and the PBL height were also analyzed. The authors found a strong negative correlation between PM2.5 and PBL height before the precipitation event and a much weaker negative correlation after the precipitation.

The manuscript is well organized and written in general. The instrument is demonstrated as very useful in boundary layer research. The quality of the observations is very impressive. The results and analyses are clear and persuasive. Some of the con-

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clusions need to be rephrased under certain contexts. After the following points are addressed, the manuscript is recommended to be published on AMT.

1. Page 1, line 17. Suggest removing “Negative”.

2. It is not an ideal location for the weather site to be on the top of a building. The building impacts the temperature, humidity, wind speed and direction. Cautions should be used when analyzing the weather data from such a site.

3. Page 4, line 22. The variance of vertical velocity should just represent the vertical component of the turbulent kinetic energy.

4. Page 5. Model-simulated PBL height in a relatively coarse grid spacing cannot be used to cross-check the observation even though the reanalysis data have assimilated lots of observations. Sounding is probably a better source for observation cross-check. I would recommend the authors to show the 12-hourly sounding data in the city and compare them with the lidar observed PBL structure.

5. Page 6. How strong was the precipitation event? The authors are recommended to provide quantified value of the precipitation either from the met station observation or model-based estimate. The strength of the precipitation impacts the PM2.5 concentration after the event. Usually strong rainfall will scavenge most of the PM2.5 particles while drizzle or light rain can moisten the PBL and facilitate wet growth of smaller aerosols that reach PM2.5.

6. Page 7, line 32. As mentioned in previous comment, there may not be unknown sources but just the wet growth of the existing small particles.

7. Page 14, figure 3. I would recommend the authors to identify RL and SBL tops and if possible, together with the RL bottom at the same time based on the data. These fine structures are extremely useful for model validation and parameterization development.

8. Page 16, figure 5e. These relationships are indeed the result of both cloud effect and precipitation impacts not just precipitation causing the differences. A modeling study is

needed to untangle these two effects and quantify the contributions to the changes of the relationships.

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