Atmospheric
Chemistry
and Physics
Discussions

Interactive comment on "Vertically-resolved Characteristics of Air Pollution during Two Severe Winter Haze Episodes in Urban Beijing, China" *by* Qingqing Wang et al.

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I agree with the two anonymous reviewers that this is an interesting and well written paper. This concerns not only the "chemical" aspects mentioned but also the determination of the mixing layer height (MLH): it is estimated from extinction coefficient profiles (aethalometer onboard of a vertically moving container) and attenuated backscatter profiles (Vaisala CL51 ceilometer). Though both parameters are different they offer an excellent opportunity for intercomparisons, as both are related to aerosol optical properties. Consequently, the authors briefly cover this topic and conclude that the MLH tends to be overestimated when using the ceilometer.

I suggest to discuss this interesting application of the data in more depth:

- From the reference Tang et al. (2016) it can be inferred that the authors use BL-VIEW. It has been shown by Geiß et al. (2017, Atmos. Meas. Tech.), that depending on the different options the retrieved MLH can be different. Thus, it would be interesting to include a few additional information on how the authors determine the MLH. By the way: Geiß et al. also found that the different versions of BL-VIEW tend to (slightly) overestimate the MLH.

  The quantitative criteria underlying the determination of the "transition height" from b_{ext} should be outlined as well (or be stated, that it is from visual inspection).

- A figure showing all coincident MLH-retrievals would be interesting. Fig. 11 – only shown in the conclusions – seems to provide this. I assume that "5", "6" etc. along with the MLH-curve correspond to Table S1? As the number of cases is relatively low (because quite often the MLH is larger than 260 m) this is not obvious and thus should be clearly emphasized. Maybe, the figure should be moved to the results-section. Fig. 7e is less suitable to demonstrate the differences as it does not cover the full set of measurements, and the reader might be confused from the two different vertical scales.

- It is known that an overlap correction function is applied to ceilometer measurements, well below 260 m in case of the CL51. Consequently comparisons with the independent extinction coefficient measurements could be a promising approach to check the plausibility of this correction, whenever adequate atmospheric conditions occur (e.g., no rapid changes of the aerosol distribution). Though a strict validation might be difficult and beyond the scope of this paper, it could be briefly discussed in section 4 whether or not this would be a possible extension of this study.

- A "definition" of "severe haze episodes" in terms of aerosol optical depth would

be interesting: In case of very large AOD the ceilometer might not fully penetrate the mixing layer. From the extinction coefficient profiles (aethalometer) it seems that the AOD is however clearly below 1 (and thus not critical). Do conditions occur in Beijing when this is not true?

Technical comments:

- Page 5, line 32: include brackets around "2 $\times$ mean".

- Page 6, line 20: when referring to V3 and V24 etc. it would be useful to mention Table S1 again, where the nomenclature is (more or less) explained.

- Define the light green and the dark green curve in Fig. 7e.

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