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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Determination and climatology of diurnal cycle of atmospheric mixing layer height over Beijing 2013–2018: Lidar measurements and implication for airpollution" *by* Haofei Wang et al.

Anonymous Referee #1

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This manuscript analyses long-term measurements of mixed layer height (MLH) over Beijing. Authors describe and evaluate the techniques, derive climatological diurnal variation, and presents an application towards the estimation of fine particulate matter. Several comments and suggestions are offered for authors to consider while revising the manuscript for ACP.

Introduction section should provide more background, based on studies comparing mixed layer measurements, not limited to LIDAR but also from RADAR and other instruments. Some discussion has been made on the importance of MLH in context of

air pollution mixing and dispersion, which should be corroborated with relevant recent references (e.g. Singh et al., 2016; Mues et al., 2017).

Stronger correlations between LIDAR and Radiosonde are seen during afternoon but such correlations are absent in morning and evening. Besides poor correlation, values of MLH also do not match with radiosonde in morning and evening. There should be more deeper analysis and discussions on these aspects with references to previous studies.

The correlation analysis between MLH' and radiosonde should be shown for all three times in the supplement.

Section 3.1 describes mostly the variations as retrieved with limited new insights into boundary layer evolution. Additionally, several general statements are made e.g. "MLH' sometime agree well with SBL". Remove general statements and provide more specific discussions based on analysis.

Figure 8 shows significant reduction in MLH after sunrise, particularly during summer (l.245). This should be elaborated. How do the horizontal winds change during this time of minimum MLH? Have any other studies reported such variability in Beijing or elsewhere?

Interannual variation – It seems that some of the years have data limited to particular season (s). it will be appropriate to compare the years which have consistency in the seasonal coverage. Otherwise better to analyse a particular season among different years. In any case it is not clear what new is learnt by this analyses. There should be supporting analyses of temperature /winds and /or aerosol changes to explain observed inter-annual variations.

There are several variables defined MLH, MLH', MLH_RS etc. Try to use these variables consistently. For example in discussions MLH_RS is used but in Fig S3 -axis title -it is written as MLH.

Correlations are very weak r = 0.01 between radiosonde and lidar at 8LST (Fig S4) and data has significant scatter. Add some inter-comparison studies from literature to elaborate on this.

Computation of PM2.5 should be part of the main manuscript, instead of supplementary material.

Fig 7: show variability in RS data too.

Manuscript needs careful proofreading for language as various places. e.g. l.69: change “consistent” to “consistency” l.107: “MHL” to “MLH” l.118: check the sentence: “..where was located”, probably it should be “which was located” l.195: change “collapse” to “collapsed” and “develop” to “developed” l.203: “shown” to “shows”

References Mues, A., Rupakheti, M., Münkel, C., Lauer, A., Bozem, H., Hoor, P., Butler, T., and Lawrence, M. G.: Investigation of the mixing layer height derived from ceilometer measurements in the Kathmandu Valley and implications for local air quality, Atmos. Chem. Phys., 17, 8157–8176, https://doi.org/10.5194/acp-17-8157-2017, 2017.

Singh, N., Solanki, R., Ojha, N., Janssen, R. H. H., Pozzer, A., and Dhaka, S. K.: Boundary layer evolution over the central Himalayas from radio wind profiler and model simulations, Atmos. Chem. Phys., 16, 10559–10572, https://doi.org/10.5194/acp-16-10559-2016, 2016.

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