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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Interrelations between surface, boundary layer, and columnar aerosol properties over a continental urban site" *by* Dongxiang Wang et al.

Anonymous Referee #1

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This manuscript presents a statistical analysis of optical products derived from lidar data and its interrelation with boundary layer height and aerosol optical depth at an urban site in central europe. Overall, the manuscript is clear and data is well presented. Some of the interrelations described have statistical significance, while others do not seems to have relation. The manuscript appears scientifically sound to merit publication. However, in its current form, it requires some revisions.

A main concern in this study is the comparison with AOD. It is stated that a percentage of the total AOD (obtained from CIMEL and/or MFR7 at some specific wavelengths) is within the boundary layer (calculated integrating the extinction profile from the ground

to the ABLH at different wavelengths). This is not very precise since, a priori, you do not know if the integration of the entire profile (from ground to let say... 20 km) matches the total AOD from the independent instruments (CIMEL and/or MFR7). Al least this is not stated in the manuscript and it is a comparison worth having for, at least those 33 cases. Also, wavelengths should be the same. Since AE is available, using the Angstrom law the AOD at 355 nm and AOD at 532 nm can be calculated from CIMEL and MFR7. The wavelength dependence of the AOD is important, and the comparison should be made at the same wavelength. Also, the CIMEL is at some distance from the lidar. Is it at the same altitude approximately?

There are other comments and I'll enumerate indicating page (P) and line (L) or Figure. Some of them just typos, but others are important changes to be considered:

- A list of acronyms would be good. There are a lot of acronyms within the manuscript starting on the abstract and sometimes is hard to follow. Also revise the acronyms used in figure axis, sometimes they do not match the text.

- Please avoid the use of exclamations within the manuscript.

- P4L6: The Tropos website should be http://polly.tropos.de/ instead of www.polly.tropos.de/.

- P4L16-17: I do not understand the incomplete overlap issue sentence. What does it mean?

- P5L5: A map of the different locations would be good. The CIMEL is 25 km away from the lidar, the air quality monitoring site is also at a different location. It would be good to have a sense of the locations visually.

- P6L29: Why the water vapor mixing ratio profiles are extrapolated from 100 m?

- P7L8: It is clear that the LR is wavelength dependent. What is the wavelength of the LR described for aerosol typing?

- P7L13: Values in range of 4-8 is correct?

- P9L8: is it possible to have marine aerosol at the surface in Warsaw? It is a continental location hundreds of kilometers away from the sea.

- P10L9: The numbers given for MFR7 are not the same shown on Table 2.

- P10L15: Having only 33 profiles, it is easy to see if there is free troposphere aerosol by looking directly at the profiles. Also, according to the very first comment, if the AOD is calculated for the entire profile (integrating the entire profile) a percentage of AOD outside the boundary layer could be given. The statement indicating that AOD_ABL is 3-4 times lower than the AOD_CL could change if the AOD considerations from above are taking into account.

- P10L22-25: Consider the same comment regarding the AOD calculations and wavelength of AOD for this statement.

- P11L13: The reference Stachlewska at al. 2017 is not clear. There are 2 references for the same year. They should be called 2017a and 2017b in the manuscript and reference list.

- Table 2: This Table should chance if the wavelength change from CIMEL and MFR7 to lidar wavelength is taking into account.

- Figure 2: This Figure should change if AOD consideration from above are taking into account as well. On the Figure caption 2016 is a LEAP year (not lap).

- Figure 4: For consistency, the Y label should be AOD_ABL instead of just AOD.

- Figure 5: The horizontal lines on the first row graphs are not explained.

- Figure 6: The correlation between AE and FCMR is not explained well in the manuscript and conclusions. There should be a clear correlation since larger values of AE means predominance of smaller particles (fine mode dominates)

- Figure 7: Same as Figure 4.

- Figure 8: Same as Figure 4.

- Figure 9: For consistency with the text, the Y axis label should be RH_0

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