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## Comment on acp-2021-558

Anonymous Referee #1

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Referee comment on "The vertical aerosol type distribution above Israel – 2 years of lidar observations at the coastal city of Haifa" by Birgit Heese et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-558-RC1>, 2021

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Review of the manuscript 'The vertical aerosol type distribution above Israel - 2 years of lidar observations at the coastal city of Haifa' by Heese et al.

The manuscript provides analysis of a two-year period of lidar measurements in Haifa. Lidar measurements in the Eastern Mediterranean are rare and the PollyXT lidar provide a large set of lidar optical properties for characterizing the general aerosol distribution as well as for aerosol typing. For the analysis of the data well-established and well-described methods were used, and the results of this paper provide valuable contribution to better understand the general aerosol situation and variability in the Eastern Mediterranean. However, the paper should be carefully revised before final publication. The suggestions mainly consider the structure of the paper to increase its readability and comprehensibility.

General comments:

- A restructuring of the paper should be considered to first give a clear introduction to the general topic and the specific situation and needs in the eastern Mediterranean / Haifa region, followed by a description of the methodology (including all used methods used in this study e.g. the aerosol typing scheme), and then a clear presentation of the results.
- A comparison to the general aerosol situation from other measurements and to other lidar sites in the eastern Mediterranean is missing. This would in general enrich the content of this study to a more general overview.
- A height dependent consideration of the different aerosol types is missing. Do the pure or dominating aerosol types / aerosol situations mainly occur in the PBL or in the lofted layers?

Specific comments:

- Figure 3 and 4: The different lidar optical properties could be discussed in a more integrated manner. The volume depolarization ratio is only mentioned for the second layer
- Figure 4: In the description of PollyXT lidar you are mentioning near range channels to perform measurements close to the lidar. Those measurement are missing in this analysis. Have they been used at all during this study? And how did you derive the results in the PBL?
- Figure 4: It would be very interesting to also include the Angstroem Exponent of extinction.
- What is the resolution of the lidar ratio? Did you use the same resolution for extinction coefficient and backscatter coefficient to derive it?
- Case study: How do the OEM derived aerosol types (e.g. FSNA in the PBL) agree with the large contribution of water derived from the trajectory analysis? I guess from the trajectory analysis one would expect a larger contribution of marine aerosols. The different results should be better connected and discussed with one another.
- Why do you only use 397 profiles of the 474 profiles with a statistically significant result? The distribution of these profiles over the year (i.e. to the different seasons) should already been mentioned at this point. Although, I recognized that it is mentioned later in the manuscript.
- Figure 8: The volume contribution might be a bit misleading. Furthermore, for the large particles one would expect that they dominate the volume contribution, right? But that must not necessarily mean that they dominate the occurrence frequency. A better presentation or description of the results would be needed. Furthermore, I was wandering if a presentation of the relative frequency would not be clearer, as it would diminish the different sample frequency.
- Figure 10: This information would give a good extension to the information shown in Figure 8 and the authors should consider to move this figure and give an extended description of the results there.
- The content of the summary chapter is more like a discussion of the results. Maybe it should be considered to rename this section as 'discussion' and extend it, following the suggestions mentioned in the general comments.
- The sentences are occasionally a bit long, e.g. in the Abstract.