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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the spatial variability of the regional aerosol distribution as determined from ceilometers" *by* Matthias Wiegner et al.

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Thank you for reading our manuscript, and your comment and question.

Your question

Your question, whether it is possible to intercompare not only the integrated backscatter of the whole mixing layer but also the particle backscatter coefficient of layers (what you call "selected heights"), can be answered with "maybe".

Actually we were thinking about the investigation of elevated layers, e.g. Saharan dust layers, but postponed that for several reasons: (1) the paper is already long, (2) a reliable automatically identification of such layers requires a significant amount of extra work that would have delayed the writing of the paper by an unpredictable (as we know

from "real life") period of time, and (3) we feel that it would be worthwhile to devote a separate paper for this topic (if successful), so that it would be more "visible". In this context an investigation as you suggest would potentially fit. However, the investigation of this topic is likely more time consuming than expected at first glance and thus beyond the scope of our present paper (note, that we have already presented the mean particle backscatter coefficient of the mixing layer in the present paper). It certainly will depend on the vertical resolution of the selected layers, e.g. problems of the interpretation may arise if the layers include the top of the mixing layer, i.e., parts of the mixing layer and of the free troposphere must be averaged. The temporal resolution of the backscatter coefficient profiles (retrieved from the ceilometers) is – depending on the algorithm – up to one hour and maybe must be extended to improve the accuracy of the inversion method; this has to be investigated. In the free troposphere the signal-to-noise ratio of ceilometer signals is typically insufficient for a quantitative intercomparison, or this range is virtually aerosol-free (below the detection limit). Note, that we are using ceilometers, not advanced high power lidars, so a quantitative retrieval above say 5 km is typically impossible. Close to the surface the incomplete overlap prohibits the exploitation of that range. So it can be expected that only a small vertical range can be used for such an intercomparison. We had made the same experience when we tried to validate the water vapor correction in case of Vaisala and Campbell ceilometers, see Wiegner et al. (2019) [https://doi.org/10.5194/amt-12-471-2019]. The remaining vertical range is considerably smaller than the range discussed in your paper "Will a perfect model...", and the interesting range (below 200 m according to your paper) is not included.

So, for the time being it cannot be anticipated whether such an intercomparison results in something of value, and it make no sense to promise something that might turn out to be unrealistic: thus, not a clear "yes" to your question. However, in the framework of our ongoing activities to extend the COBOLT-software we will keep this topic in mind, in particular, as the distance between some of our ceilometers is indeed small, offering unique opportunities.

Your comment

We agree with your comment concerning the missing references of studies on the representativeness of scales relevant for e.g. satellite data. Only one has been included in the current version of our manuscript. In the revised version we will include more citations and discuss their relevance for our study.

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