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Atmospheric Measurement Techniques
Discussions

Interactive comment on "What is the benefit of ceilometers for aerosol remote sensing? An answer from EARLINET" *by* M. Wiegner et al.

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Introduction

Thanks to the reviewer #2 for his/her comments and useful suggestions – they helped us to improve the paper. We repeat the points raised by the reviewer and add our comments in italics.

Point by point replies

[...] Thus, I think that the paper is acceptable for the publication in AMT after minor revision. The minor comments are given below.

Specific comments:

1. P2499, L7: I do not think that the vertical distribution of air density is not a smooth function when strong inversion is present.

   → *We assume that the question is "I do not think . . . density is a smooth function . . .". In general the air density decreases with height (strictly monotonic). In case of (strong) temperature inversions the decrease is even stronger. Of course the gradient of the air density is not the same for the entire range of the troposphere, however, there are no irregularities as they are known from aerosol layers or clouds. That's what we have called a "smooth" function. Thus, mixing up with aerosol features is impossible. To make this clearer we have replaced "smooth function" by "monotonic function" in the manuscript.*

2. P2499, L13: Add "particle" before optical property.

   → *Done.*

3. P2506, L27: Please explain night time problem briefly.

   → *The "night time problem" means that sun photometer do not work during night so they cannot provide information on the aerosol optical depth. The implementation of lunar or star photometers might help as they do not need the sun as source. To better explain this we have modified the sentence to "The potential of star or lunar photometers (Barreto, 2013) has not yet been exploited to substitute the missing sun photometer measurements at night".*

4. P2508, Eq. (15): What is the colon before the equal sign?

   → *Corrected; same comment was provided by reviewer #1.*

5. P2509, L1: I cannot find the slight increase in the deviation with increasing z_{ovl}. Please specify the altitude range. In addition, please explain why the increases is found only for the lower lidar ratio.

   → *According to a suggestion of reviewer #1 we have exchanged the figure (ratio instead of difference), adapted and rephrased the whole paragraph. As before it can be seen that in the clear case the different z_{ovl} have hardly an influence and can be neglected. The "slight increase" of the error of β_p with z_{ovl} in the turbid case and for an underestimate of S_p is in fact irrelevant for any practical applications (remind the inherent assumptions!). Thus we do not comment on this in the manuscript anymore. The "unexpected" behavior (statement in the original version of the manuscript, now deleted) is a mathematical consequence of the dependencies of β_p-retrieval on S_p, z_{ovl} and the magnitude of $\alpha_p(z)$. Note, that it could be even more complicated: while the β_p-profile in the overlap region typically increases towards the surface, different situations might also happen.*

6. P2510, L25: Please cite the reference of US standard atmosphere.

   → *Reference has been added: Anderson et al. (1986).*

7. P2514, L12: Please explain possible reasons for the large variability in the overlap function between 0.1 and 0.5 km in Fig. 7.

   → *A perfect horizontal homogeneity of the aerosol distribution a few meters above ground cannot be expected. We found several cases when local "plumes" of aerosols pop up and were transported with the wind. The cases that we used to determine the overlap function were the best available; note that our first attempts in Munich all failed due to small scale sources as e.g.*

streets (see next paragraph of the manuscript). Furthermore, the ceilometer signals become increasingly noisy with range, so that the normalization of the signals becomes difficult. In view of this experience we were really happy with the results shown in Fig. 7, in the beginning we had expected an even larger variability. And in Fig. 8 it is demonstrated that the corresponding overlap correction function obviously is a very good description as the agreement between the two ceilometers is perfect.
To describe this situation we have slightly modified the sentence in this way: "To ensure that only “as homogeneous as possible” atmospheric situations are considered, . . . ". We are aware that a distribution is either homogeneous or not, but by putting the text in quotation marks it should be clear what is meant.

8. P2515, L21: no ! not.

   → *Corrected; same comment was provided by reviewer #1.*

9. P2518, L9: Add the reference of the hybrid algorithm if available.

   → *This paper is in preparation and foreseen to be submitted in the second half of 2014.*

10. P2519, L1: Tough ! Though.

    → *Typo corrected.*

11. P2527, L32: J. Tech. ! J. Atmos. Ocean. Technol.

    → *Corrected.*

12. P2532, Fig. 3: Add the explanation for the two solid lines (Are they different z_{ovl}?).

    → *We have exchange this figure following a suggestion of reviewer #1 (see also reply to 5. comment): instead of the difference, now the ratio is plotted. In this context we have also added an explanation of the different z_{ovl} in the caption of the figure (the assumption of the reviewer was correct.).*

13. P2537, Fig. 8: Add the unit of height.

    → *Done.*

14. P2538, Fig. 9: Please check the unit of height (m. a. g.).

    → *Done.*

15. P2539, Fig. 10 Same as 13).

    → *Done.*

16. P2540, Fig. 11: Add the notation of the vertical axis.

    → *Done.*

17. P2541, Fig. 12: Same as 15).

    → *Done.*
