

Interactive comment on “An empirical method to correct for temperature dependent variations in the overlap function of CHM15k ceilometers” by M. Hervo et al.

Anonymous Referee #1

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General comments:

The paper describes an overlap correction method for ceilometers that bases on the simple assumption of a homogenous boundary layer combined with a known a-priori overlap function. A sophisticated quality check is described that identifies the homogenous layers and is shown in an appropriate example. A temperature dependence of the overlap correction was found and a linear model could be applied to account for this dependence. Thus, an ensemble of overlap correction functions can be generated and used for a range of occurring temperature variations inside the instrument. The implementation of this methods for automatic retrieval makes it particularly useful for networks of similar instruments, such as the recently implement ceilometer networks.

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The paper is written clearly and concise. Some English grammar may be corrected for. I recommend the paper for acceptance with minor corrections.

Specific comments and technical corrections sorted by page and line:

p. 2 and p. 3. L, 19-23: Please explain the Sasano et al. (1979) method briefly to the reader.

p. 3, l. 26: “(previously Jenoptik)” can be misunderstood - by readers not so familiar with the history of the CMH15k ceilometers: Not the Company Lufft was former called Jenoptik, but Jenoptik is another company that has manufactured the ceilometer before. Please clarify.

p. 4, l 26-28 and p. 5, Eq. (2): $O(r,t)$ and $o(r,t)$ may be confusing.

p. 5, l. all equations: Very small letters! Difficult to read.

p. 5, l. Eq. (3): Did you also take the number of laser pulses, l_p , into account?

From the definition in the netcdf files:

`beta_raw: long_name = 'normalized range corrected signal`

`(signal_raw / l_p - b) / (c * o(r) * p_cal) * r * r'`

p. 5, l. 14: Please define the lidar ratio as extinction-to-backscatter coefficient ratio.

p. 5, l. 16 and for Eq. (6) and (7): Please define molecular and particle backscatter coefficients as `beta_m` and `beta_p` and the respective extinction coefficients as `alpha_m` and `alpha_p`.

p. 6, l. 2: `sr` not `Sr`.

p. 6, l. 4 -5: An illustration of the “straight-line-approximation” of term `A1` and the right hand side of Eq. 7 could improve the immediate/intuitive understanding of this fact.

p. 6, l. 7: An illustrative example of this fit would be helpful to visualize this procedure.

p. 6, l. 9-10 and Eq. (9): How does this correction function looks like? Can you give an example?

p. 7, l. 12-13 and Fig. 1: There are surprisingly few areas for the fitting procedure. Is this enough to obtain a proper correction function? Of course, it shows off in the overlap function plots, but anyhow it seems little information for a strong correction. Please outline, why this is working so well! May be a short review of the Sasano et al. (1979) method (already in the introduction) would help to elucidate this.

p. 7, l. 20-21: Why is the elimination of the artefact-line above 250 m not visible from the overlap function? Because it is the difference between the manufacturers and corrected overlap function. This fact could be illustrated in Figure 2 as well.

p. 9, l. 4 and 5: relative difference ... of what?

p. 9, l. 8: 153 daily corrections - > daily overlap function corrections.

p. 9, l. 13-17: Does this mean that in the end the overlap function has the same shape, but does only vary by internal temperature and will thus be chosen after the measured internal temperatures and not be calculated again? Or will actual overlap functions be calculated continuously and added to the existing ensemble?

p. 10, l. 4: please refer to Appendix for S. Note, that in the lidar community S is often used for the lidar ratio.

p. 10, l. 10-21: and Fig 7: For clarity please relate /or replace 'daily correction' to 'overlap correction' and 'model correction' to 'temperature correction'.

p. 10, l. 29: Why is the spike at 360 m, if the artefact in the data is at 250 m?

p. 11, l. 1 and 3: detections ... of what? Be more precise!

p. 11, l. 21: A straight line or a linear dependence?

p. 11, l. 30: It was assumed... On what premises? Why is this plausible?

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p. 12, l. 1: Finish this sentence after 'instrument'. And start the next one a: This is the other. . . .

p. 12, l. 6: Two dots at the end of a sentence. 'year.'

p. 13, l. 3: Shortly denote the parameters as R_x , $\kappa_1 - \kappa_{11}$, in the text here, so that the reader also can follow without studying Table 2.

p. 13, l. 9: if -> whether

p. 13, l. 16: Explain R_{\max} , max before you use it: move line 16 before line 14.

p. 13, l. 33: Give explanation of S also in the text on p. 10 (see remark above).

p. 14, l. 3-9: Long sentences, please shorten.

p. 14, l. 19 and 24: Sobel operator is not common to me. Short explanation (edge-detector, high-pass-filter) or at least a reference.

p. 15, l. 21, 22, 24: Please note in the text that these κ_x are explained in Table 2!

p. 16, l. 28: S-G filter: reference?

English: 'has been, have been. . .' is often used where simple perfect is more adequate: Rather use 'was' and 'were' at several instances.

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