

Interactive comment on “A generalised background correction algorithm for a Halo Doppler lidar and its application to data from Finland” by A. J. Manninen et al.

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The authors are grateful for the comments and questions. They address very important aspects and help to clarify and address many important points.

Question 1) Perhaps the most important issue: What is the general aspect of the problem? Are you only correcting errors in the Doppler lidars data acquisition software (which would be actually the task of the manufacturer) or are there general benefits for atmospheric research? -Could, e.g., the proposed cloud mask be used in combination with other instruments to improve cloud detection in general?

Answer to question 1) The true causes for the artefacts present in the Halo Doppler lidar background are not yet clear. Before the causes and correction for the artefacts are found, the background needs to be corrected in post-processing. Although, even after the manufacturer has found a solution, there remains vast amount of data already collected, which will greatly benefit from use the background correction algorithm discussed in this article. -Added this to Sect. 3.1

Certainly, the cloud mask could be used in combination with other instrumentation. The main goal of the proposed cloud mask is to screen all of the atmospheric signal so that only the background signal remains. However, it is possible to adapt it to mask only clouds, and thus to be used in cloud detection. -Added this to Sect. 5

Question 2) One thing does not become completely clear from beginning: Does the correction method reduce the time or height resolution of the dataset? Is, e.g., Doppler velocity still available on the original time and height grid after the correction has been applied?

Answer to question 2) The background correction algorithm discussed in this paper does not decrease the time or height resolution of the dataset. -Added this to Sect. 1

Question 3) Some technical notes about the provided software: -Please specify with what version of Matlab the program can be run. -Could You provide also a short atmospheric measurement and a ready-to-run example program that invokes the correction method? That would greatly enhance the usability of the software.

Answer to question 3) The program, which comes as an supplement with this paper, is compatible with Matlab version r2014b or newer. The compatibility with older Matlab versions is likely, but has not been verified.

Unfortunately, the size of the data files prevents providing a measurement file together with the algorithm as Supplement. However, we are most happy to help in implementing the algorithm and we are looking into providing a link to such example.

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Question 4) Please specify - Is the noise-jump a general feature of Doppler lidars? -Are there any plans to incorporate the solution into the standard software of the instrument? -In the paper, there is little insight into the origin of the bias. Is it temperature dependent? Looks like a thermal oscillation over time? -What does the manufacturer say to this error? -Is there a statement of the manufacturer about the noise problem?

Answer to question 4) The specific noise jump here is not necessarily a general feature, but monitoring the background is a necessary step. Many early Doppler lidar versions displayed transient (non-linear with range) change in the signal due to instabilities in the amplifier, which the internal instrument background check attempts to remove. -Added this to Sect. 3.1

The Halo Doppler lidars, as many other remote sensing instruments, provide near real time measurements despite tremendous amount of processing. The required temporal resolution of the continuous measurement outputs depend on the user. The background correction algorithm requires data between at least two instrumental background determinations in order to reliably calculate the median shape of the background between the two adjacent background determinations. As the background determinations are carried out approximately in one hour cycles, it can be argued that the temporal resolution for the continuous measurement outputs would decrease significantly and would exceed the requirements of some of the users, if the background correction would be incorporated into the standard instrument software. Thus the correction should be carried out in post-processing and hopefully in the future the manufacturer will remedy the causes for the background artefacts altogether. -Added this to Sect. 5

As mentioned earlier, the true causes for the artefacts present in the Halo Doppler lidar background are not yet fully clear. Not thought to be temperature dependant. The temperature is monitored and e.g. instrument in Sodankylä had minimal temperature fluctuation (winter) but still exhibited these artefacts. Addressed in the Description of the background artefact section.

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The manufacturer says it is “great to have spotted the issue and are working to get the cause of the artefacts to be removed.”

Line-by-line critics:

Formulas (1) and (2): These relations can not be considered to be common knowledge. How can these formulas be derived? (A citation should be sufficient).

Answer) Added citations O’Connor et al., 2010, Rye and Hardesty 1993.

p. 11140 I.5: “from studying the variation in velocities”: This is too general. Please explain what kind of “velocities” we are looking at.

Answer) Added “radial velocities”. Note, there are techniques for retrieving turbulent information both vertical and from scanning.

p. 11141 I.13 “represent a cost-effective solution”. There is a certain issue here: If You really want to mention “cost-effective”, then You have to put it into context. An ultrasound anemometer can also measure wind and is even more cost effective. Do not concentrate on the financial aspect so much, better put forward the advantages of Doppler lidars against other wind-measuring instruments!

Answer) “Cost-effective” removed

p. 11142 I.6. “The instrument is configured to cover a range from 90 to 9600m with 30m resolution”: Better would be: “In the context of this work the instrument has been configured to cover...” (or similar)

Answer) I.6 changed to “Here, we have configured. . .”

p.11144 I.5: Please be careful with the word "trivial". The time of a background measurement might be known, but it still has to be checked if a jump in SNR has actually happened.

Answer) “trivial” replaced with much more simple.

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p.11143 l.4 "Since software version 10" is a little bit general... What if there are any changes in future software versions? If the error discussed in this paper is so limiting ("this threshold places a severe restriction on data availability") should it not immediately be implemented in the next software version?

Answer) It is important to find the true causes for the background artefacts. Before they are found, the provided background determination text files are valuable in correcting the background in post-processing.

p.11144 l.25: What is Cook's distance? Please insert the Citation (Cook, 1982) already here.

Answer) Citation of (Cook, 1977) added.

p.11152 l.8. One "=" too much

Answer) The extra "=" removed.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 11139, 2015.

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