

## ***Interactive comment on “AMALi – the Airborne Mobile Aerosol Lidar for Arctic research” by I. S. Stachlewska et al.***

### **Anonymous Referee #1**

Received and published: 30 September 2009

General comments: The paper gives a very detailed technical description of the airborne lidar AMALi. A lot of aspects are mentioned that are interesting not only for the lidar community. However, the data evaluation section contains mainly textbook knowledge and should be shortened. The measurement examples shown illustrate the lidar capabilities, although error bars should be provided for conviction. A direct comparison between ground based and airborne measurements would be desirable.

The paper is clearly written in good English language and can be recommended for publication with minor revisions.

Specific comments:

page 18748: The outcome of the campaigns AMALi participated in could be given in a

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less itemized way, i.e. a paragraph describing not only the subject but also the achieved results.

page 18751: Can you give the percentage of polarization of the emitted light? 99.xx% ?

page 18752: What SNR is sufficient?

page 18753/18754: The eye-safety chapter is very detailed and may be shortened.

page 18755: Why is the UV beam diameter only 1 mm? 6 mm are specified for this laser at all wavelengths.

Receiver subsystem: Why is it not necessary to use an aperture that is completely rotationally symmetric with AMALi? In contrast to other lidar systems or what did the authors wanted to express here?

page 18756: This is a difficult sentence - please try to disentangle: The mirror surface accuracy is high with figure (defines mirror roughness) of  $1/10$  wave peak to valley at 632.8nm over 99% of the 10 clear aperture and slope (defines mirror shape) of  $1/8$  waves per inch at 90%.

page 18757: What is a "double plain mirror"?

For the polarizing beam splitter cube and IF no companies are mentioned, whereas the companies selling the laser, the waveplate, and the primary mirror are explicitly given.

page 18758: Laptop, data acquisition, and PMT companies explicitly are mentioned.

page 18760: Here, for the first time, the acceptable value of the SNR is given! Please also give a number on the previous page and further back.

The whole description of the data display of the acquired data is very detailed and may be convenient during the lidar operation but is of much less interest for the reader. Please shorten. Thus, also Figures 5 and 6 are dispensable. Too many screens are shown on too little space. However, the last paragraph on page 18761 is indeed of

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interest and one of the screens of Figure 6 could be used to illustrate the ability of the quick-looks to detect invisible cirrus.

The whole chapters 3 and partly 4 and 5.1 contain mostly textbook matter which is not new and is thus not suitable for publication in a scientific article.

Instead, rather give an overview over the products AMALi can deliver under the different configurations and sum them up in table together with their limitations. This would also reduce this quite long paper.

Solely special data evaluation variations of the Klett\_Fernald-Sarasano method may needed to be explained in more detail to the reader, i.e. the iterative method described in 4.2.2., and, if necessary, supplementary parts from the other subsections. If 4.2.2. is used, the Newton-Raphson method needs a few more clarifying words.

page 18775: Why is "Noise in the signals and/or the detection efficiencies of both instruments are of no concern"? Error bars for both lidar profiles would substantiate this statement.

page 18777: The accuracy of the backscatter coefficient is assumed here? Why not calculated? Why is the backscatter coefficient denoted with  $\sigma_{\text{BSC}}$  and not with  $\beta$  here?

Do any ground based lidar profiles from KARL exist for comparison with the shown example? Are there other cases where ground based and airborne lidar profiles could be compared?

A discussion of the AMALi capabilities compared to other airborne aerosol lidars is missing.

Technical corrections:

page 18755: Two abbreviations used for ultraviolet: "UV" and "UVA"

page 18758: parallel (not parallelly)

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page 18760: Each second one display screen... can be misunderstood: Each second, a screen displays...

Figure 3: Too small, too many details. Please provide larger images.

Figure 4: Nothing new, can be left out.

Figure 5 and 6: Only show one example of a screen.

Figure 7: Please add error bars to the profiles.

Figure 8: In case a ground based profile exists, it could be included here for comparison.

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Interactive comment on Atmos. Chem. Phys. Discuss., 9, 18745, 2009.

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