Atmos. Meas. Tech. Discuss., 7, C907–C909, 2014
www.atmos-meas-tech-discuss.net/7/C907/2014/

Atmospheric Measurement Techniques
Discussions

Interactive comment on "Potential of airborne lidar measurements for cirrus cloud studies" *by* S. Groß et al.

Anonymous Referee #3

Received and published: 14 May 2014

Review of 'Potential of airborne lidar measurements for cirrus cloud studies', by S. Gross et al., submitted to AMTD for publication in AMT.

Summary Using a new airborne platform, HALO, Gross et al. perform DIAL lidar measurements of high-altitude cirrus with a nadir lidar. They observe lidar backscatter and water vapour mixing ratio during a November 2010 case study and use ECMWF analysis temperature to derive relative humidity over ice. Furthermore, results from a second aircraft flying in-situ provide temperature and water vapour mixing ratio within the cloud. Such observations of in-cloud water vapour measurements are uncommon yet required to characterise the environment in which cirrus exist. The authors have performed a comprehensive and interesting case study and I recommend that they publish in AMT following their consideration of the following points.

Minor Comments

1) You discuss the optimal distance being 2km above cirrus cloud (tops?) (line 30) yet your case study says HALO's flying only 1km above the clouds (P3 line 11). Perhaps this is why you have overloaded signal in Figure 3a above 12km altitude. Some mention of this should be made in the discussion of Figure 3.

2 Section 3.1 Some details of the ECWMF analysis are required. Are you flying in one analysis grid-cell? What space / time resolution is ECWMF? More details on how you constructed the cloud ice water content from the ECMWF gridded data (Figure 3a) should also be provided. You should probably change P7 line 1 to read 'water content indicates that…'.

3) Page 7, line 7. Optical depths (OD) using lidar are sometimes calculated differently by different research groups. Some brief detail about how you calculate OD would be useful. Also worth noting the cloud is rather optically thick (for lidar anyway).

4) From my understanding, Figure 3 shows the cirrus time-series as measured by the multiple 'racetrack' ovals which the aircraft flies in Figure 2b (please note how many of these ovals you are studying in Fig 3 and subsequently). So is it possible that you are at times measuring the same air mass (which looking at Figure 2a moves approx eastward) at later times as it moves through your aircraft flight? Is this why in Figure 3a the ECMWF IWC shows a semi-repetitive nature every $\sim$10min?

5) P8 line 13. Comment on your use of the word 'smaller' to discuss temperature fluctuations (implying this is smaller relative to mixing ratio fluctuations). Unless you are comparing their percentage fluctuations, you cannot say/imply that temperature fluctuations are smaller than mixing ratio fluctuations. Please reword, e.g. simply state that 'The temperature fluctuations have a minor…'. It might be useful to include the formula which you used to calculate RHi in this section.

6) Figure 5. Uncertainties in all observed and derived parameters need to be plotted,

and then propagated through to the RHi (bottom figure). You may wish to plot representative uncertainties instead of the uncertainty at each time, but they are certainly needed on Figure 5 to determine whether the RHi are consistent within uncertainties using each different technique.

7) Figure 1 (aircraft photograph) and Table 1 (technical features) can be removed as they do not add anything to your research paper. Table 1 seems especially irrelevant here, although it might be suitable for an overview paper.

8) Figure 10. Overplot the backscatter ratio=4 line to indicate your cloud threshold boundary.

Technical Corrections

P2, line 14: ‘and therefore of the’

P2 line 26: ‘enables us to’

P4 line 7 ‘access for commercial’

P4 line 13 “data beneath”

P6 line 21 ‘jetstream’

P9 line 9 ’12 UTS ascents over Munich’

P10 line 25. Do you mean low ‘temporal’ variability?

P11 line 21 ‘Figure 10’

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 4033, 2014.