

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

Anonymous Referee #1

Received and published: 14 May 2014

Review of manuscript “Potential of airborne lidar measurements for cirrus cloud studies” submitted to Atmospheric Measurement Techniques.

General Comments:

This manuscript presents a new airborne lidar that uses DIAL technology to measure vertical profiles of water vapor mixing ratio. The capabilities of the so-called WALES system are demonstrated through observations inside and outside of cirrus clouds. The water vapor measurements are compared with in situ measurements obtained by a second airborne platform that flew 1.5–2 km below the WALES instrument, which flew onboard the HALO aircraft. The relative humidity with respect to ice (RH_i) is computed using both the in situ aircraft data and also using the WALES measurement combined

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with ECMWF model output. The authors present a thorough analysis of a cirrus case study to demonstrate the capabilities of the WALES. The manuscript is well written, organized and the figures are appropriate and support the findings. This manuscript primarily demonstrates new measurement capabilities, which is suitable for publication in AMT. Suggest publishing with minor changes as listed below.

Specific Comments:

- 1) Sec. 2.3 last sentence – do you have an estimate of uncertainty in the efficiency of the Rosemount inlet particle separation? Do you know the size range that is included/excluded using this inlet?
- 2) P. 4042 line 4: While the mean difference in the water vapor between WARAN and ECMWF is small (~1 ppmv), the standard deviation is very different between the two. Suggest mentioning that here and referencing Table 3 here rather than in the next paragraph.
- 3) P. 4042 line 12–13. “...smaller temperature fluctuations have a minor...” Suggest quantifying and stating specifically the change in RH_i due to temperature variability. i.e. RH_i varies by X with a 1 K temperature variability (since you show later in Fig. 6 a 1 K offset between aircraft and model/radiosonde temperature).
- 4) P. 4042, line 27: “...differ only by about 10%...” A 10% uncertainty in RH_i is pretty large for ice nucleation studies. Heterogeneous nucleation occurs in about a 10–15% RH_i range, so 10% error would significantly impact any conclusions. Suggest modifying your sentence to reflect this and removing “only by” from this sentence.
- 5) Fig. 3 caption: What is meant by “signal overload”? Do you mean the detector is saturated? Please clarify.
- 6) Fig. 8: Is there any way to quantify or discuss the uncertainty of the water vapor measurement (and hence RH_i) in cirrus clouds vs. outside cirrus clouds. I am wondering what if any contamination of the lidar signal by ice crystals might have on the

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retrieval of water vapor inside clouds.

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