

The manuscript “Validation of cloud macrophysical properties from the ATLID Level 2a products A-TC, A-FM, A-CTH using airborne lidar observations during the HALO missions PERCUSSION, ASCCI and NAWDIC” by Krüger et. al. presents an independent validation of three ATLID single-sensor Level 2 products using a comprehensive multi-campaign dataset of airborne high spectral resolution lidar (HSRL) backscatter ratio (BSR) measurements. The results are relevant and useful for the EarthCARE community.

Overall, the manuscript is well written and suitable for publication in ACP, after some comments detailed below in my review.

General comments

The results are presented in Section 4 and discussed in Section 5. However, some parts of the discussion, especially in Section 5.1, repeat the results rather than providing further interpretation. Consider incorporating the relevant discussion directly into the corresponding results sections to improve clarity and readability.

L89-L112: The information provided in this part would fit better in Section 2.1, where the WALES lidar system is described. Consider moving the detailed description to that section while retaining only the relevant introductory information in the Introduction.

Specific comments

Figure 7: The authors present the correlation between WALES and A-CTH cloud-top altitudes. While the scatter plot visually indicates that most points cluster around the 1:1 line as written, I recommend including values to support this assessment. Statistics such as the mean bias, median bias, RMSE, and correlation coefficient would provide a better evaluation of the agreement between the two datasets.

Figure 10: Figure 10c: Could the authors also include the number of cloud tops detected by WALES for each cloud class and present the differences relative to the A-CTH different baselines? This comparison may help explain the discrepancies observed in Fig. 10b.

Typos, wording and requests for clarification

L103, L164: “water vapour”. Water vapor is used elsewhere through the manuscript. Please select one terminology.

L156 , L303: “depolarisation”, Depolarization is used elsewhere through the manuscript. Please select one terminology.

L161: “airborne field campaigns.” Is there any bibliography for these previous campaigns?

L214: “Liu et. al., 2004.” Please verify the year of the citation, as it appears to be 2024 in the reference list.

L243: 1 s.

L273: “consistent with the generally reduced cirrus altitudes expected at higher latitudes and during spring or winter conditions”. Please cite relevant studies.

Figures 3 and 4: Consider placing the panel labels (a), (b), etc. outside the plotting area, as done in most of the other figures, to improve consistency throughout the manuscript. In Figure 4, some panel labels also appear to be partially clipped.

L388: The date and campaign are missing. I suggest revising the sentence to: "A second case study is presented to illustrate an EarthCARE underflight on 31 March 2025 during the ASCCI campaign under extratropical conditions."

L395: Fig. 3

L397: "near the approx. constant tropopause ..." . Consider writing out approximately.

L440: "(factor of >2 increase)". I would recommend rewriting it for clarity

L466: Fig. 1.

L544: consider expressing the entire altitude range in the same units, e.g., "from approximately 0.2 to 9 km."

L585: Fig. 4

L616: comparable to Fig. 8.

L675: Fig. 3e

L747: Fig. 8

L814: ... below.

L867: Fig. 6

L918-L920: This reference is not cited in the manuscript text. Please check.

L966-L968: This reference is not cited in the manuscript text. Please check.

L1071-L1073: This reference is not cited in the manuscript text. Please check.

L1116-L1117: This reference is not cited in the manuscript text. Please check.