

Atmos. Meas. Tech. Discuss., referee comment RC1  
<https://doi.org/10.5194/amt-2021-229-RC1>, 2021  
© Author(s) 2021. This work is distributed under  
the Creative Commons Attribution 4.0 License.

## **Comment on amt-2021-229**

Anonymous Referee #1

---

Referee comment on "Differential absorption lidar measurements of water vapor by the High Altitude Lidar Observatory (HALO): retrieval framework and first results" by Brian J. Carroll et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-229-RC1>, 2021

---

Review for "Differential absorption lidar measurements of water vapor by the High Altitude Lidar Observatory (HALO): Retrieval Framework and validation" by Brian J. Carrol et al.

This paper describes the retrieval strategy for water vapor profiles using the HALO lidar instrument. Data from HALO and validation of the data is presented.

Overall, this paper, as part of a series of planned papers, provides a detailed overview of the HALO instrument which can measure any two of the three including water vapor, methane, and aerosol backscatter using the DIAL and high spectral resolution lidar measurement techniques. This series of papers will be important touchstones for the HALO instrument which has the potential to play an important role in atmospheric science field campaigns.

Detailed Comments:



Line 240: How was the random error plot generated i.e. what random errors are included here.

Line 264: If detection is limited to 15 m due to the electronics, how can you get a 1.5 m resolution?

Line 284: Having the instrument paper would be a useful compliment to this paper. I am not sure about the reference here to an as yet unpublished paper. Could you say more about the status of this instrument paper?

Line 314: Please add a reference for self-broadening calculations.

Line 379: How do the choice of the OD threshold values affect the retrieval? Will non-experts in lidar be able to do this manual inspection and can this be automated?

Line 413: Do you have any evidence that using the surface reflection over land or the reflection for cloud tops can be used to retrieve the water vapor mixing ratio in the lowest range bin? With what accuracy can you expect to retrieve water vapor in the lowest range bin over land or cloud top?

Line 436: How do errors in the assumed temperature profile affect the accuracy of the Doppler correction factor and overall water vapor retrieval?

Line 475: When reporting the accuracy of the water vapor retrieval near the surface of less than 15% -- was this only over water? If so please state.

Unfortunately, the issue with the dropsonde results in the validation consisting of one profile comparison with the DLH profile that resulted from a spiral descent of the aircraft. The comparison of the first range bin of the HALO with the DHL and the comparison of the precipitable water vapor show good agreement, but comparison with the DHL and HALO have a 400 m offset, comparison with the pwv from satellite based measurements will result in a dry bias for the HALO instrument since it misses the pwv above the aircraft, and comparison of the satellite profiles and HALO are qualitative at best due to the spatial resolution of the passive sensor. This results in a non ideal set of measurements for validation. While this paper is still publishable and, I feel, should be published, I hope to see follow on validation efforts based on sonde profiles.