Reply to Dietrich Althausen's Discussion Comments:
The discussion comments are in black, and are followed by our answers in red.

Comment:
I am missing the reference of our recently published new calibration method for the water-vapor Raman lidar measurements "Calibration of Raman lidar water vapor profiles by means of AERONET photometer observations and GDAS meteorological data" (https://doi.org/10.5194/amt-11-2735-2018) and

Thank you for bringing this article to our attention. We originally did not mention calibration using a sun photometer as an external calibration technique, but we agree that it is a good idea to mention it along with the rest of the external calibration methods in the Introduction.

Comment:
I am missing the discussion of our paper "Comparison of Raman Lidar Observations of Water Vapor with COSMO-DE Forecasts during COPS 2007" (DOI: 10.1175/2011WAF2222448.1) where we took already into account the time-height-dependences of radiosonde data when comparing those data to Raman lidar data.

Thank you for sending this article. Our method is different from that given in the above reference in that we make use of trajectories which seem to have not been mentioned in your article. We would be happy to cite your paper along with the other articles using methods which take the time-height-dependence into account, such as that given by Leblanc et al. 2012. We believe that this class of methods is different from our technique because they do not take the movement of the radiosonde with respect to the air mass into account by using trajectories.

Comment:
Table 1: I'm wondering about the large variability (about 15-20 %) of the determined calibration constant and that it seems to have no unit . . .

Thank you for pointing out that we did not put the units of the calibration constant. We considered the calibration constant technically unitless since it is mass/mass, however, it is indeed in units of "g/kg" and could be included in the text.

The large drift of the calibration constant over 10 years is known to occur for RALMO (Simeonov, 2014) and is thought to be the result of the differential aging of the

photomultipliers which causes a large drift over time. The differential aging is due a culmination of factors such as the exposure of the water vapour channel to high count rates (20+ MHz) during the daytime, the lidar's uptime of 50% over 10 years, and the fact that the photomultipliers have never been changed or upgraded. When considering the operational nature of the instrument, it is not surprising that the calibration factor changes with time. The reference below discusses this drift in detail.

Simeonov, V., Fastig, S., Haefele, A. and Calpini, B.: Instrumental correction of the uneven PMT aging effect on the calibration constant of a water vapor Raman lidar, Proceeding SPIE, 9246, 1–9, doi:10.1117/12.2066802, 2014.