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Interactive comment on "Ground Based Lidar and Microwave Radiometry Synergy for High Vertical Resolution Absolute Humidity Profiling" *by* M. Barrera-Verdejo et al.

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This paper is a resubmission of the discussion paper entitled "Ground based lidar and microwave radiometry synergy for high vertically resolved thermodynamic profiling" by the same authors which has been rejected for publication (http://www.atmos-meas-tech-discuss.net/amt-2015-63/). I have acted as reviewer for this former publication (Anonymous Referee #2). My review of the original manuscripts can be found online and the review of the revised manuscript is provided as supplement to this review, since it was not published online. I do of course not expect any response to this former review!

The text is now very clear and reads well. The issue of the Raman lidar (RL) covari-

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Discussion paper

ance matrix is correctly presented. I regret a lot that the averaging kernels have been removed again, it would be very interesting for the community to see averaging kernels of a combined retrieval! I encourage the authors to include averaging kernels in the response to this review and to discuss the difficulties in their interpretation. I recommend the manuscript for publication in AMT after minor revisions.

Minor remarks

L 42: Include also R. J. Sica and A. Haefele, "Retrieval of water vapor mixing ratio from a multiple channel Raman-scatter lidar using an optimal estimation method," Appl. Opt. 55, 763-777 (2016)

L 49: This is demanding but demonstrators exist. Include:

Dinoev, T., Simeonov, V., Arshinov, Y., Bobrovnikov, S., Ristori, P., Calpini, B., Parlange, M., and van den Bergh, H.: Raman Lidar for Meteorological Observations, RALMO – Part 1: Instrument description, Atmos. Meas. Tech., 6, 1329-1346, doi:10.5194/amt-6-1329-2013, 2013.

Brocard, E., Philipona, R., Haefele, A., Romanens, G., Mueller, A., Ruffieux, D., Simeonov, V., and Calpini, B.: Raman Lidar for Meteorological Observations, RALMO – Part 2: Validation of water vapor measurements, Atmos. Meas. Tech., 6, 1347-1358, doi:10.5194/amt-6-1347-2013, 2013.

L 141: Say explicitly how much the standard deviation is.

L 330: Something is wrong with "as to be expected 2".

L 350: The vertical resolution tends to infinity because the diagonal elements of the averaging kernels tend to zero. Include this explanation.

L 354: Low resolution is bad, high resolution is good!

L 391: It seems the panels of Fig. 5b are not in the right order. Reading the caption I understand 1.96 for combined, 0.84 for MWR and 0.96 for RL. The authors should also

comment on the biases.

L 445: There is no a and b in Fig. 7.

L 548: This does not sound right. It seems you scaled the variance by a factor of 4 and hence the standard deviation scales by a factor of 2. I expect in the RL region the a posteriori uncertainty if fully determined by the RL uncertainty.

Fig. 4: Mark the upper boundary of the RL data.

Fig. 7: Why do the solid lines stop at 5.5 km?

Please also note the supplement to this comment:
http://www.atmos-meas-tech-discuss.net/amt-2016-46/amt-2016-46-RC4-supplement.pdf

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2016-46, 2016.