

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

Anonymous Referee #2

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The manuscript amt-2016-46 by Barrera-Verdejo et al. presents a method to combine water vapor measurements from two ground-based instruments, a Raman lidar (RL) and a microwave radiometer (MWR).

Sensor synergy is particularly important as it helps overcoming the limitations of currently available remote sensing instruments (such as RL and MWR) towards the fulfillment of the user requirements set by WMO for meteorology and climate applications. Atmospheric humidity is one such an essential variable that currently miss to meet the WMO requirements, specially for vertical resolution.

The proposed method shows the potential of RL and MWR synergy for increasing humidity profiling, both in terms of accuracy and vertical resolution, with respect to the

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observations from the two separate instruments. In addition, the manuscript evaluates the effects caused by incorrect estimate of the instrument specification, such as the RL overlap function and measurement uncertainties.

I believe the manuscript is worth publication. I only have the few minor comments below, which I believe would improve the manuscript, if properly addressed.

- L291: The authors choose to use as input to the Optimal Estimation Method (OEM) a mix of retrievals (RL absolute humidity) and direct observations (MWR Tb). I'm not against this approach, but I suggest the authors explain the reason behind this choice in Section 3.3

- L313: Maybe this is stated before, but it would be worth reminding here: how was the prior knowledge estimated?

- L396: there are few cases in which the joint IWV differs more than MWR only from GPS. Particularly one point at 22 kg/m² while GPS is 14 kg/m², where it seems that the joint retrieval has followed the lidar IWV. Could you comment on the nature of these few cases?

- Figure 2: The caption miss to explain what the horizontal blue lines mean. I guess these indicate the estimated retrieval error, but it should be explained.

- Figure 4: It would be useful to see the same time-height cross section as seen from the two separated instruments (preferably with the native retrievals) to appreciate visually the added value of synergy.

- Figure 5: Panel a: It says clear-sky data only are presented, but I don't see any gaps for cloudy-sky periods. Gaps were shrunk or is it a 25-day clear-sky period? Not clear. Please explain in the caption. Panel b: I guess the first and last panels should be switched. Or alternatively the caption should say from right to left.

Typos:

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- L50: calibrated.This
- L62: where there lidar data
- L89-91: section -> Section (or the other way around, just pick one)
- L258: way to due lack
- L263: can to lead
- L285: "in different heights" -> "at different heights"
- L330: be expected 2.
- L381: therefor
- L406: simplies -> simplifies?
- L478: than -> as
- L526: regular -> initial
- L545: Therefor

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