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Atmospheric Measurement Techniques Discussions

Interactive comment on "Tropospheric water vapour and relative humidity profiles from lidar and microwave radiometry" *by* F. Navas-Guzmán et al.

Anonymous Referee #2

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The paper entitled "Tropospheric water vapourur profiles from lidar and microwave radiometry" by F. Navas-Guzmán, J. Fernández-Gálvez, M.J. Granados-Muñoz, J.L. Guerrero-Rascado, J.A. Bravo-Aranda, and L. Alados-Arboledas describes a method to derive profiles of relative humidity from water-vapor-to-dry-air mixing ratio profiles (obtained by Raman lidar) and from temperature profiles (obtained by a microwave radiometer).

The paper is of scientific significance, a new idea of relative humidity profiling is described. The scientific approaches and applied methods are valid. The presentation of the results can be improved.

Specific comments:

The title of the paper should be improved. It implies that the radiometer measurements delivered humidity profiles.

line 95: operating -> operated

lines 150-155: redundant information 'Granada is surrounded by mountains'

line 158: I suggest a new structure of the paper. Insert a new subsection "3.1 Retrieval of mixing ratio with Raman lidar". Shift sections 4 and 5 to subsections 3.2 and 3.3, respectively.

line 160: remove one 'used'

equations (1) and (2) can be written as a single equation with index i; i = H2O or N2

line 192: magnitudes -> quantities ?

line 200: The statement "Equation 3 assumes identical overlap factors and range-independent Raman backscatter cross sections for the two signal." should be discussed. The authors should estimate the uncertainties related to deviations from these assumptions. Refer e.g., to the corresponding papers by David Whiteman.

equation(5) The sign in the integral term should be minus : exp{- integral[a(r,N2)-a(r,H2O)]dr}

lines 225-228: The exponential term can not be neglected. The signal ratio needs to be corrected at least for the different molecular transmissions. Only different transmissions due to aerosols might be neglected. The statement in the reference (Mattis et al. 2002) is "The difference between the atmospheric transmissions at 407 nm and at 387 nm is caused mainly by Rayleigh scattering and can easily be corrected for by use of standard-atmospheric profiles of temperature and pressure or, if available, actual radiosonde data. ... Differences in transmission at the two Raman wavelengths as a result of wavelength dependent particle extinction are negligible for clear-air condi-

tions."

line 230: "4 Raman lidar water vapour calibration" -> "3.2 Raman lidar mixing ratio calibration"

line 280: Why are data below 1.5 km not used for the calibration? Is it because of overlap problems?

line 353: The section title should be "3.3 Retrieval of relative humidity using Raman lidar and temperature from microwave radiometer"

line 375: The paper by Hänel is not about rotational Raman lidar technique. It has a completely different topic. Instead, references to the lidar systems of MeteoSwiss Payerne, MPI Hamburg, and DWD Lindenberg should be provided.

table 2: The deviations between lidar and radiosonde data could be better illustrated in figures. How does the deviations depend on distance between lidar and sonde? Distances could be estimated from trajectories.

lines 434, 445, 449: Temperature differences should be provided in Kelvin.

figure 3: It seems that there is a mismatch in the legend of 3b or 3c. Mixing ratios are very similar in the altitude range between 3 and 3.5km. If the temperature from radiosonde (black) is larger, the resulting relative humidity (black) should be smaller. Probably, the black curve in figure 3b is from MR (less vertical structures) and the blue curve could be from radiosonde. Please, check your data again and modify the discussion accordingly.

general: The authors should not mix different altitude measures. Use only agl or only asl.

lines 472-478: Are those measurements useful for hygroscopic growth studies? Discuss the required accuracy of humidity measurements of hygroscopic growth studies related to the uncertainties of the presented method.

line 509: years -> year

line 522: What was the altitude range of these layers? 500m layers between 1 and 4 km?

figure 7: porcentage -> percentage

line 597: Bosenberg -> Bösenberg

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 10481, 2013.