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Atmospheric Measurement Techniques Discussions

Interactive comment on "Raman Lidar for Meteorological Observations, RALMO – Part 2: Validation of water vapor measurements" *by* E. Brocard et al.

Anonymous Referee #2

Received and published: 23 November 2012

General comments to amt-2012-138:

The paper describes the validation of the water vapor operational Raman lidar recently installed at the MeteoSwiss Regional Center of Payerne. Twelve months of lidar data have been analyzed and validated through comparisons with collocates sensors. The results between Lidar-rds vertical profile intercomparisons during daytime and nightime (agreement within 3% up to 3 km and between 5% and 10% up to 8 km, respectively) as well as the IWC comparisons with radiosonde, microwave radiometer and gps attest the quality of the water vapor measurements performed by the system. The employment

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of an operational Raman lidar to provide continuous, reliable and accurate water vapor profiles is of scientific interest. Thus I recommend the publication of the manuscript after some improvements of the discussion and of the text, according with the following observations.

Specific comments:

Introduction.

I agree with the first reviewer: the introduction lacks of a discussion about the state of art of operational water vapor profiling in the troposphere. During the last years many efforts inside the lidar community have been done to have Raman or Dial lidar systems able to routinely monitor atmospheric water vapor. This topic as well as some results of interrelated instrument intercomparisons should be addressed with the appropriate references.

P6917 lines 17-19:

Please renumber the sections (section 3 is absent) and add some details on the description of each part of the paper.

Section 2.

P6918 line 7:

Add the diameter of the four telescopes.

Section 3.

P6918 lines 22-23:

You say: 'for normal conditions at Payerne the effect of differential extinction due to aerosols is small and is neglected'. Even if, as written in the companion paper, 'error in water vapor concentration due to aerosol extinction is below 10% even for hazy conditions (Whiteman et al. 1992, 2001)', this term could significantly affect the inter-

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comparison results. Arguments need to be provided to justify this assumption.

P6919 lines 2-8:

Calibration methodology needs to be more described (adding a plot if necessary) and discussed. In particular do you use the same calibration coefficient for nighttime and daytime? What about the PMT efficiency during these two different measurement conditions? Please clarify these arguments.

P6919 line 17:

Delete the repetitive sentence 'in order to maintain a statistical error lower than 10%'.

Section 4.

P6921 line 5ff:

The presence of the outliers in Fig. 3 could affect the calculated mean monthly bias. Do you find the same trends using the median instead of the mean? If you separate daytime from nighttime measurements do you find different trends?

P6921 lines 23-25:

I do not understand the meaning of the whole sentence ('Therefore, the characterization...as a monthly average'). Please rephrase it.

P6923 lines 1-2:

Please consider that 'limiting conditions' may include also presence of aerosol layers (see the comment P6918 lines 22-23).

Section 5.1.

P6925 lines 17-23:

Please discuss more extensively the effect of the different space-time collocation that is certainly relevant when comparing profiles from lidar and rds. In particular, the paper of

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Dionisi et al. (JAOT, 2010), which describes a methodology to calibrate a Raman lidar through non-collocated radiosoundings, shows that the main source of calibration coefficient variability (approximately 10%) appears to be caused by the different sampling between lidar and rds. This term is significant also in case of collocated instruments, because the rds drifts with the wind. This work should be cited. Furthermore, although it is beyond the aim of the paper, an evaluation of this term could be provided by plotting, for some atmospheric layers, the dependence of the relative difference between lidar and rds in function of their reciprocal distance.

Section 5.2.

The results between daytime and nighttime should be completed with the calculation of the median to verify that the outliers do not affect the statistics. Furthermore, as suggested by the first referee, also the analysis under specific conditions (at least dry and humid) should be added to better characterize the differences between lidar and rds measurements.

P6926 line 9ff:

The left plot of figure 7-8 does not provide significant elements in the discussion and should be eliminated. Figure 8 should be cut at 6 km.

P6927 lines 6-9:

Please add more details on the correlation procedure (vertical range, number of points used, etc.).

Section 6.1.

P6929 lines 5-7:

One of the critical issues of a Raman lidar is to minimize the different system performances between daytime, where PMTs are subjected to the strong solar short-wave radiation, and nighttime. Although the methodology of the profile retrieval is well de-

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scribed in the companion paper (and it should be cited here), I suggest to add more information about the use of AD channel (how do you scale the AD signal to PhC signal?) and maybe to move this description to Section 5.2. Please also specify if you use the same AD-PhC merged profile for night and day and at which altitude the two channels are merged.

P6929 lines 9-12:

Please be more specific about the behavior of SRS-C34 and RS92 during night and day (add some results).

P6929 lines 21-25:

Please specify the error sources and add references.

Figures.

P6940 Fig. 3:

Please add, If relevant, median-derived trends and separate trends for daytime and nighttime conditions.

P6944-45 Figs 7 and 8:

Please consider modifying the figures as proposed in comment P6926 line 9ff. Furthermore the caption is a bit confusing: replace 'Top' with left and Bottom' with right and index the subplots.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 6915, 2012.

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