Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-1089-RC1, 2020

Atmospheric Chemistry and Physics Discussions

Interactive comment on "A Raman Lidar Tropospheric Water Vapour Climatology and Height-Resolved Trend Analysis over Payerne Switzerland" *by* Shannon Hicks-Jalali

Anonymous Referee #2

Received and published: 7 February 2020

The present work makes an important effort to build a water vapor climatology using Raman lidar measurements. Authors exploit a more than ten years database recorded at Payerne, Switzerland and very carefully distract the uncertainty, in order to estimate the natural variability in each month and atmospheric layer as long as the corresponding trends. A very detailed approach has been applied to compare the retrievals with radiosonde data.

There is the structural problem for a lidar based climatology, that there are huge gaps in the timeseries and the results are biased towards specific atmospheric conditions, which combined with the lack of long lidar time series, results in the absence of such

works in the literature. This high quality work deals with these matters and it is sufficient clear to the reader how this study should be interpreted.

Basic comment.

Major disadvantage for a climatology study is the limitation to the nighttime and cloudless conditions. What I miss in the conclusions is who from the scientific community can use and benefit from such a climatology of nighttime water vapor.

P2l17-18 . To my understanding, the variation could be a lot more than 100%, depending on meteorological conditions. I suggest to add a reference for this number, or restate the sentence in a more general way.

P3 l8-9. "published Raman wv lidars" - "publications on Raman wv lidars"... Also, Goldsmith et al., 1994 is not in the last decade.

P3 l25. I think it should be highlighted that this trend is inside the uncertainty range.

P4 l22-25 It is important to make at least a short summary here (few sentences) for the method used for the retrieval, because it is crucial for understanding the rest of the manuscript.

P4. L18 I think, it should be added a summary and discussion about the stability of calibration and any issues rising from it.

P4 l 29. The abbreviation OEM is nowhere defined and it is not well known. Also, it should be explained this approach , why it was selected and any drawbacks that it causes.

P5 17 This fact should be explained and provide some reference.

P5 l22 Should the 30 min be continuous? If not, could natural variability add noise, when it could be hours apart?

P5l35 It seems that the OEM output is one profile per night. But it is nowhere clearly

stated. Is it possibly to discuss the variations expected if treated differently, on a clear winter night that could last 15 hours?

P7 l 23 It is not clear what a “cost threshold of 3.5” is.

P8 l5 Are these the uncertainties discussed in the next page? If so, I suggest moving this plot and paragraph, after the definition of the uncertainties.

P8 l7 The fact that the highest uncertainties are associated with the very low concentrations in the upper troposphere should be discussed here and probably add some examples or a plot of absolute range of specific humidity uncertainty at different levels.

P10. L9. I think it is more reasonable to integrate the radiosonde starting from 100m (or the height that lidar measurements are trustworthy) , and compare this modified PWV, if the full profiles of the radiosonde are available. By this approach the results are directly comparable and not affected by any bias for the near surface area.

Figure 5. Only the days with lidar profiles are used. But as discussed earlier, it could be that the lidar profile is constructed from measurements hours away from the radiosonde, during cloudy nights. I suggest to investigate if using only profiles with data close to radiosonde timestamp could lower the biases.

Figure 6 It is not easy to claim that the natural variability at 230-250hpa is 80-90%, where the absolute values suggest is almost no humidity and the uncertainties are very high.

P12 l3. The high variability in the 600-400hpa region is one of the most interesting findings of the study. Figure 7 adds a lot of credibility to this pattern. I was wondering if a similar Temperature variation plot could provide more information for this behavior.

Îd’able 1 It is not clear how the trend %/C° is calculated for RALMO.

Table 2, specify that these trends are derived from RALMO.

Summary and Conclusions sections are overlapping. I suggest to merge in one sec-

tion.

P20 l12, EOS climatology refers to what region?

Congratulations on the very interesting work

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