

Interactive comment on “Tropospheric water vapour above Switzerland over the last 12 years” by J. Morland et al.

Anonymous Referee #3

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The paper investigate the possibility of using a water vapour radiometer, TROWARA, in Bern for climatological purposes. This radiometer has been operating, with a few interruptions, since 1994. Since there have been some modifications and problems with the instrument during this period, the authors use a method to homogenise the data. The corrected data set is then used to calculate monthly climatologies, diurnal climatologies, and trends over the studied period. The results are compared with results from radiosondes, GPS, ECMWF, and a solar photometer.

The paper is interesting to read and is relatively well written.

General comments

Both ECMWF and radiosondes are integrated up to the 200 hPa level. Why not go

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higher? Both the radiometer, solar photometer and GPS measures through the whole atmosphere. At least mention the reason for not going higher (e.g. unreliable humidity data above).

Page 7247-7248, equations 1 and 2: The corrections applied to that data is the mean of the correction estimated by four different methods. In doing this, it is assumed that the accuracy of the four methods is the same. This is not obvious, one method could be more accurate than the other. It could be interesting to see the effect on e.g. the trends if only one of the methods was used for the homogenisation. In general I think it would be interesting to have some kind of study on how possible errors in the homogenisation process could affect the results presented later in the paper.

When investigating e.g. the monthly climatologies, there are biases resulting from the fact that some instruments cannot measure for all weather conditions. It might be more interesting to limit the investigations to the times when there are data available from all instruments, or at least to the times when there are data from TROWARA (since that paper mainly evaluates the data from this instrument).

Section 4.2: As the authors discuss, estimating the mean temperature T_m from surface temperature measurements may give errors in the diurnal cycle since T_m has a lower diurnal variability than the surface temperature. Thus the authors use a damped surface temperature. A more accurate method probably is to estimate T_m from ECMWF data. Of course, this only gives a resolution of 6 hours, but it could be interesting to investigate if this way of estimating T_m will give a diurnal signature closer to that of TROWARA.

It could be interesting to investigate the diurnal cycle for different seasons, since it can be very different in summer compared to winter.

Specific comments:

No radiometer data during rain is used since these are unreliable.. How is these

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periods detected? Is data from a rain gauge used, or are all data where the estimated liquid water content is high (e.g. $> X$ mm) removed? This should be stated in the paper.

Page 7249, equation 5: This equation seems to be the equation for retrieving the IWV from the paper by Ingold and Mätzler (2000), although the constant term is given as -0.5059 in this equation while it is -2.0059 in Ingold and Mätzler (2000). Which value is the correct one?

Page 7557, line 9-19: It seems like the movement of TROWARA indoors (which stabilised the temperature) is a likely reason for the different differences in mid-day/midnight trends between TROWARA and radiosondes. Would it be possible to in the homogenisation process to estimate an offset which was not constant but had a diurnal variation?

Page 7257, line 15: Would it not be more appropriate to compare the TROWARA trend for 2003-2008 with the radiosonde trend for the same period, not 1996-2007?

Technical comments:

Page 7248, 16: I think it would be good if the typical temperatures of the hot and cold load were given here. Below the cold load is given as 24 K, but the hot load temperature is not given.

Page 7249, line 10: An artificial increase in BT_31 will, according to equation 5, always lead to a artificial decrease in IWV. Thus remove "under most atmospheric conditions";.

Page 7255, equation 8: I do not find the parameter T explained anywhere. I would assume it is the length of a year, but for clarity I think it should be explained in the text.

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