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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The SPARC water vapor assessment II: intercomparison of satellite and ground-based microwave measurements" *by* Gerald E. Nedoluha et al.

Anonymous Referee #2

Received and published: 22 August 2017

This manuscript is an important manuscript for the assessment of water vapor in the upper stratosphere and mesosphere. The authors compare several ground based microwave radiometer observations with a number of satellite retrievals from several different instruments. This paper has good scientific merit; however, the presentation quality needs to be improved. For that reason I recommend this paper for publication after major revisions to give the authors sufficient time to deal with the recommendations, which I describe in detail below.

Major comments

The paper shows water vapor data from 22 different retrievals from 8 instruments.

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Discussion paper

Combining all of these into single figures makes these very difficult to read. Furthermore, 13 of these retrievals are from the MIPAS instrument, i.e. different analyses of raw data from the same instrument. This heavily biases the appearance of the figures towards MIPAS and covers the data from other instruments, which have only one or two retrieval versions. One possible solution for this problem could be to discuss all MIPAS retrievals separately and show only one MIPAS retrieval in the comparison with the other instruments. This would significantly improve the clarity of the figures and the overview of all available instruments. Throughout the paper it has been very difficult to follow the discussion of individual instruments, when data are hidden in the cloud of all other instruments or difficult to distinguish from similar colors and symbols used for other instruments.

In the presentation of the time series there is no discussion of the changes in the GBMW instruments throughout the time series. There have been a number of changes in the instruments, but no discussion about the possible impact of these changes on the time series. Page 5, Lines 13ff indicate that the WVMS instruments have been replaced, but there is no indication, when this happened, if there has been some overlap period, when both instruments measured, of if there has been any effort to evaluate the impact of this change on the time series. I would assume that the other instruments have had changes throughout time as well. Some discussion should take place to that effect to convince the readers that a possible impact on the time series is much less than the differences seen in the comparisons with the other instruments and the trend estimates discussed in the paper.

Specific comments

Why did the authors choose to show the two most recent ACE-FTS retrievals? It would appear that the recent version 3.5 would be sufficient.

Have any of the surface instruments ever been compared to each other or is there a traveling standard that has been shipped to the different sites?

Page 5, Line 18: Why are these older measurements not used here?

Page 5, Line 24-25: Why is the smaller spectral width used in this paper, when a wider range is available? It would be nice if the authors could give a short statement on the impact of this decision on the analysis.

Page 5, Line 6: What does a measurement response of “<0.6” mean?

Page 9, Line 21: It could be helpful, if the authors showed a typical water vapor profile over the entire upper stratosphere to mesosphere range.

Page 10, Line 1: Why are the MIPAS V7 data excluded here? They are included in the later discussion.

Page 10, 1st paragraph: The MIPAS data shown in Figure 3 justify a stand-alone figure to discuss the MIPAS specific differences. Can the authors make a statement, which of the many MIPAS version is preferable? After all, they are all from the same instrument.

Page 10: The other instruments should be separated from Figure 3, since these are very difficult to identify.

Page 13, Line 26: I would accept “nearly indistinguishable” if the authors could clarify that the differences are significantly less than 2%. If not, they become relevant in comparison to the annual average difference above. Please clarify.

Page 15, Line 3: The sign of the drift is coincident with Hurst et al. (2016). How about the magnitude?

Page 15, Line 29: Why do you believe this is a sufficient model, i.e. without a QBO term as in equation 2?

Page 20, last paragraph: Can this be interpreted such that there has been no significant trend in water vapor at the 0.46 hPa level and that the longest time series limit possible trends to within +/- 0.1%/year? This is just for clarification and could probably be elaborated more in a sentence or two.

Technical comments

Figure 1 should indicate which MLS version and which HALOE version are being used.

Page 13, Line 7: I guess you mean "∼0.2 ppmv (∼3%) for an annual average difference", not "annual average".

Page 17, Line 7: The conjunction "whereas" seems somewhat misplaced, since the two phrases do not connect well. A part of the explanation seems to be missing.

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