

Interactive comment on “Analysis of global water vapour trends from satellite measurements in the visible spectral range” by S. Mieruch et al.

Anonymous Referee #1

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The paper presents a very interesting study on global trends in the atmospheric water vapor column derived from satellite observations in the visible spectral range. It is in general well written and the results are overall presented in a good way. My major concerns are on the merging of the two data sets and on the influence of clouds.

A) The influence of clouds on the trend must be discussed in more detail. In particular it should be discussed which measures were taken to assure that the derived trends are not significantly affected by trends in cloud cover.

B) It is not totally clear to me why it is not possible to use the year of overlap between both sensors to merge the two data sets without allowing a step function. I think the introduction of the step function introduces a large uncertainty to the determination of

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the trends.

I also recommend to shorten the introductions substantially. I see no specific need or justification for the extensive introduction; the presented results do not support many of the stated aspects. I also suggest to remove the discussion on the 4 scenarios. At least it should be discussed on which time scales these changes are to expected and also on which time scales the vegetation would irreversibly react to these changes. Probably, the 11 years of data are too short to support any meaningful interpretation of the H₂O trends with respect to these scenarios. After addressing these points (major changes) and the additional points listed below, I suggest publication in Atmos. Chem. Phys.

Specific points::

Introduction:

In the discussion of the dependence of the H₂O column on climate change, the role of transport should be mentioned. Local H₂O concentration fields are only partly related to the local surface temperature (and surface type).

It should be also mentioned in which aspects the different satellite observations of the H₂O VCD have their advantages and limitations. Especially the advantages of the presented data set should be discussed.

Page 3, first line: Is 'Australian Bureau of Meteorology' the appropriate reference for the greenhouse effect?

Page 3, second paragraph: I think the increase of H₂O for a warmer climate should not referred to as 'small'. I can be a very substantial increase, especially in the tropics, where temperatures are high. I suggest to discuss here the Clausius-Clappeyron dependency and give some rates of increase of the H₂O concentration per temperature change for different temperatures.

Page 5, line 8. Why mention the surface elevation here? I will not affect the trend

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analyses.

Data analysis:

In addition to the general description of the effect of clouds on the H₂O analysis, it should also be discussed how clouds - in combination with the different spatial resolution of the two sensors, might cause systematic differences between the two sensors: The relative frequency of cloud free pixels and partially cloud covered pixels depends systematically on the size of the ground pixels. Maybe this effect is partly responsible for the observed steps. It might be instructive to compare the global distribution of the step function should be compared to the global distribution of clouds

The combination of GOME and SCIAMACHY data

Page 7, first paragraph in section 3: I don't understand why the first of January is chosen for the change. Moreover, I think instead of choosing one explicit day for the change, the whole year of overlap should be used for merging the data.

Page 8, first line: Why has a larger amplitude be expected? For monthly mean values, the higher spatial variability of the SCIAMACHY data should not be that important?!

Page 8, line 12: the effect of clouds and how cloud effects are treated in the retrieval should have been mentioned earlier.

Page 8, last paragraph in section 3: This information should already be given in the introduction.

Methods:

Page 9, equation 1: Why is the subscript 't' needed in C_t? It should be constant.

Results:

Page 13, last sentence in first paragraph in 5.1: This sentence makes not a big sense to me. If I am interested in the 'magnitude of the H₂O content in a specific site' I would

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rather look on the map with the global distribution of the H₂O VCD.

Section 5.1: I suggest to show the global distribution of the 'level shift'. It would be in particular interesting to compare it to the global distribution of other parameters, e.g. the cloud cover.

Page 17, third paragraph: How do the trends derived for only the GOME period compare to those of Wagner et al., 2006?

Conclusions and discussion

Page 20, fourth last line: I suggest to skip the sentence: 'However, long term oscillations'

Figures:

Fig. 2: I suggest to skip this figure. At least some time information should be put on the x-axis.

Fig. 3 It would be very instructive to add the H₂O anomalies for the same region.

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