

# Interactive comment on “Comparison of HDO measurements from Envisat/MIPAS with observations by Odin/SMR and SCISAT/ACE-FTS” by S. Lossow et al.

Anonymous Referee #4

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## General Comments:

This paper shows an intercomparison of three sets of satellite measurements of HDO. The paper is, in general, well written and clear descriptions of the datasets and the method are provided. The results should be of interest to the community and the subject matter is suitable for publication in AMT.

I think the paper would be stronger if more information were provided on the differences between the H<sub>2</sub>O (main isotope) retrievals from the three instruments. The authors refer to comparisons of H<sub>2</sub>O, but no reference or quantitative information is provided. Since dD, is really the main quantity of interest here, the H<sub>2</sub>O retrievals are very important in this context.

Could the authors provide some rationale as to why there is no quantitative information provided here on dD or on the H<sub>2</sub>O?

In general, when the ratio is taken to calculate the delta values, some systematic errors common to both HDO and H<sub>2</sub>O might be expected to cancel. Could the authors comment on whether the same discrepancies in spectroscopic parameters between spectral regions be expected for H<sub>2</sub>O as for HDO?

Response (to the last two comments): Errors might cancel out, but they might be also amplified when HDO and H<sub>2</sub>O are combined to  $\delta D$ . With the current retrieval setup, i.e. with no inter-species constraint on HDO and H<sub>2</sub>O, the evaluation of both species individually is of greatest importance before addressing  $\delta D$  values. The presented validation of HDO is a first step towards a consistent analysis of  $\delta D$  derived from the observations of the three instruments. Therefore we have by purpose left out  $\delta D$  here. Similar discrepancies in the spectroscopic parameters as for HDO can be expected for H<sub>2</sub>O. The line broadening parameter of the 488.5 GHz H<sub>2</sub>O emission line used in the SMR retrieval has an uncertainty of 30% in the worst case scenario, about the same value as for the 490.4 GHz HDO line.

I would have liked to have seen some more discussion about the influence of sampling/cloud. The authors do note that the MIPAS and ACE-FTS results are likely to show more of a clear-sky bias than the Odin-SMR results, due to the wavelengths involved. However, I

didn't see much discussion of the MIPAS/ACE-FTS differences at the lower altitudes. Could the large discrepancies between MIPAS and ACE-FTS at the lower altitudes be partly due to differences in the nature of the quality control/cloud screening applied to the two datasets?

Response: Definitely! Up to 15 km the deviations between MIPAS and ACE-FTS are larger in the tropical region than the extra-tropics, where less cloud influence exists. As described in the manuscript the MIPAS observations are actively evaluated using a cloud index to detect cloud influence. In the ACE-FTS retrieval no cloud detection is performed. The measurements are only truncated if an opaque cloud in the line of sight causes the pointing sensor (that stares at the Sun) to fail. So the basic nature of the MIPAS and ACE-FTS measurements causes already differences in the clear sky bias that both instruments have.

### **Specific Comments:**

Page 1691: If I understand correctly, the ACE-FTS retrieval is linear and allows for negative values, while the MIPAS retrievals are in log(VMR) and would therefore not allow negative values to occur. Could this perhaps be part of the reason for the positive bias in MIPAS with respect to ACE-FTS throughout most of the stratosphere?

Response: None of the retrievals uses a log-scheme. As we discuss in the revised version a small part of the wet bias of MIPAS can be explained by the different spectroscopic databases used in the MIPAS (HITRAN-2000 including updates) and ACE-FTS (HITRAN-2004) retrievals. However there are some spectral regions employed that are unique to the HDO retrieval of MIPAS ( $1250\text{ cm}^{-1}$  to  $1400\text{ cm}^{-1}$ ) and ACE-FTS ( $2612\text{ cm}^{-1}$  to  $2672\text{ cm}^{-1}$ ). Inconsistencies in the spectroscopy there could be also a potential explanation.

Page 1691: "totally unphysical" -How was it decided that these points were unphysical? What were the criteria?

Response: With "totally unphysical" we denoted data points that were far outside the expected range of volume mixing ratios for HDO. For the visual inspection the entire data set was plotted and those data points removed that were prominently outside of the bulk of data. Typically these erroneous data points were parts of profiles with very strong oscillations, so the entire profile was removed.

Page 1701, line 10: "The ACE-FTS profile less structured...."

Response: Corrected.