

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 #2

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General Comments:

The paper describes the comparison of measurements of monodeuterated water vapour, HDO, by three different satellite borne instruments, MIPAS (on board Envisat), ACE-FTS, and SMR. Comparisons are performed on a profile-to-profile basis as well as using zonal mean bins for different seasons and individual months. In the stratosphere MIPAS and ACE-FTS agree quite well while SMR shows a persistent low bias with respect to HDO volume mixing ratios, which can be explained by uncertainties in the spectroscopic data used for the retrieval.

The comparison is of high scientific quality and is clearly structured, well documented and presented. I was pleased by the introduction part giving a good overview over the origin and distribution of HDO, its role as an indicator for transport processes in the atmosphere, and previous observations. It should be published in AMT. Before publication, there are some minor comments which should be addressed.

Specific Comments:

Page 1680, Line 8-10: The decreasing temperatures reduce the water vapour pressure... It is clear what you mean, but decreasing temperature only reduces the water vapour saturation pressure and thus, as a consequence, the water vapour amount. Rewording could improve this sentence.

Response: Of course. The word “saturation” has been added to the sentence.

Page 1686, line 13-15: I do not clearly understand the averaging described here: “30 day mean around the first and the mid-day around a given month”. Do I understand correctly that two adjacent points in the time-series are not independent but related due to the fact that roughly 50 % of the averaged period are covered by both averaging periods? So this could be seen as a kind of moving average? This could be described in a clear way.

Response: Correct, it is a running average on a slightly irregular grid. The text has been reworded in that direction.

Page 1692 l7 ff: The calculation of the bias B is performed for each altitude grid point. This is not clear from the beginning and the explanation comes at the end of the section (Page 1693, line 8). For a better understanding of the calculations described here, this fact should be mentioned earlier to avoid confusion about the switch from vectors to scalars.

Response: The paragraph describing the bias determination now starts right away with “At a given altitude ...”.

Page 1697: What is the intention of the linear regression (intercept and slope) and the correlation between the individual data-sets? A short explanation or reference to Figures 5 and 6 would help to understand the intention.

Response: It is used as a quantitative measure of the consistency of the latitudinal cross sections derived from two observations. The corresponding sentence that was supposed to express that has been reworked. We did not add any references to Fig. 5 and 6 to the section where the mathematical framework is described. Instead we added references to the equations in the section where the figures are described.

Page 1697/1698: When describing the results in Figures 3 and 4, a short comment on the data gaps (e.g. for ACE-FTS) could help to understand the figures.

Response: A sentence was added.

Page 1699: I assume that the fit from Equ. (10) was used for the regression line. A cross reference to Equ. (10) could help to follow the outline.

Response: Done.

Page 1700/1701 and discussion (Section 4): The discussion tropical comparisons is very interesting. When reading the explanations for the individual months, the question arose to which extend profiles at the lower end of the SMR altitude range and close to the TTL are affected by problems arising from the discretisation and limited vertical resolution of the profiles. E.g. the vertical displacement of the local extrema related to the tropical-tape-recorder. To which extend is the expected ascend of the local extrema from February to April masked by discretisation and limited resolution. This could be mentioned here and discussed in Section 4.

Response: All three observations have a limited vertical resolution, so the effects of discretisation are implicitly included. Averaging over a larger set of data certainly improves the situation a bit. The vertical displacement of the local extrema of the tropical “tape recorder” signal is very likely masked by the limited vertical resolution on short time scales.

The discussion of the august profiles mentions the sharp peaks for MIPAS and SMR mean profiles at 18 km and 19 km, respectively. To which extend can these artifacts be introduced by cutting the individual profiles at the lower edge (cloud filter, averaging kernel criterion etc)? Two adjacent altitudes can represent quite different subsets of the data-sets leading to such discontinuities. It could be interesting and helpful to see how many profiles for the individual heights were available for the instruments. Can it be excluded that these sharp features are introduced by such effects?

Response: There is no indication that the sharp features are caused by different subsets of data. The number of profiles contributing to the mean at the altitudes around this feature are rather constant for both instruments. In addition in the revised version of the manuscript more data was included to derive the monthly mean profiles (SMR x 2, MIPAS x 6) without changing the feature in a significant way.

Both aspects are partly described in the discussion section but in a quite general way. These could be addressed more clearly.

Technical Comments:

Page 1638, Line 3/4, ff: Acronyms and citation could be separated for clarity.

Response: We left it as is. The references that come with the instrument acronyms provide an instrument/mission overview rather than any specific HDO related results. Such references in turn are separated.

Page 1687, line 7: "Odin is a Swedish-led..." - insert "a". line 24: "...SMR is one of two instruments on board..." - insert "s" at "instrument".

Response: Corrected.

Page 1688, line 25: is there a reference for the retrieval version?

Response: There is no dedicated reference for the retrieval version 2.1 in general nor a specific reference to retrieval version 2.1 HDO results. Urban et al. (2007) give an overview of the Odin/SMR observations of water vapour and its isotopes, however retrieved with an older version.

Page 1690, line 17: "This index is the ratio between..." - insert "the" before ratio.

Response: Corrected.

Page 1696, line 21: Use comma to improve readability of this sentence.

Response: Corrected.

Page 1703, line 14: "... that might an influence too." - something is missing in this sentence (e.g. verb?). - "...influence, too."

Response: The structure of the discussion section has been changed and the corresponding sentence does not exist any longer in this form.

line 20: "... resolution resolution..." remove one "resolution"

Response: Corrected.