# 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 #1
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**General Comments:**

The paper describes a new comparison of three stratospheric HDO data sets from different satellite instruments. The methods used are clearly described; proper credit is given to related work. Except for some minor technical corrections listed below the overall presentation of the paper is good. The paper fits well within the scope of AMT and may be published after some mainly minor corrections addressed below.

I have only one general comment to the paper:

In the paper, differences between the three data sets are largest at lower altitudes (below 20 km). The error bars in Fig. 5 indicate, that the errors are also larger at lower altitudes. How large are the errors at altitudes below 18 km? Could this explain the larger deviations and/or the reduced correlations? Could some of the deviations be explained by bad statistics? Maybe errors/statistics depend on latitude and/or season? In the paper it should be made clear if the observed deviations are statistically significant.

Response: The errors shown in Fig. 5 are the same as shown in Fig. 3 and 4. For MIPAS the standard errors are small even below 18 km and therefore not visible in these figures. For ACE-FTS there are some larger errors in some latitude bands at 12 km, where very few measurements exist. For SMR the largest errors occur in the altitude range between 15 km and 20 km, the lowest altitude range HDO retrievals are possible. In the calculation of the correlation coefficient we did not include the errors, as we simply want to prove that the expected high correlation between the latitudinal cross sections observed by different instruments is present. As already evident from Fig. 3 there are significant deviations in the observed latitudinal distributions and thus low correlation coefficients can be expected. It is just another way to quantify the observed deviations.

**Specific Comments:**

1. p. 1681, eq. (2): Where does the factor 2 before [H2O] come from? I would expect [D]/[H] ≈ [HDO]/[$H_2O$].

Response: The factor comes from the fact that $H_2O$ contributes two H atoms to the hydrogen budget, while HDO only contributes one D atom to the deuterium budget.

Equation 2 and the related text have been expanded for a better explanation of the derived approximation for $R_{sample}$.

2. p. 1684/1685, 1st paragraph of section 2.1: Can the data set in principle be continued based on the MIPAS reduced spectral resolution measurements after March 2004?

   Response: Yes, the data set can be continued with the reduced resolution measurements, which started in January 2005. These data retrievals are currently in the planning stage.

3. p. 1686, line 17: “No smoothing has been applied to the data.”: Fig. 1 shows contour plots; to generate these usually some surface is fitted to the data (maybe internally by the plotting routine). This may also imply some smoothing.

Response: The sentence appears to be rather misleading and has therefore been removed.

4. p. 1691, last sentence of 1st paragraph: “Finally the data sets were inspected visually to remove data points with totally unphysical HDO abundances that remained after the previous filtering steps.” What is meant with “totally unphysical”? What were the criteria to remove data? Are the reasons clear why these “totally unphysical” results occurred?

Response: Data points are denoted “totally unphysical” when they are far outside the expected range of volume mixing ratios and can potentially influence the results of the bias determination. Quite often profiles with such data points show strong oscillations, likely due to problems with the level-1b data; either in terms of quality or the spectral fit in the retrieval.

5. p. 1704, line 12: Which HITRAN version is used? Please add a reference.

Response: Information about the spectroscopic databases used in the HDO retrievals of the individual instruments have been added to the text. The MIPAS retrievals use a special compilation by Flaud et al. (2003), which for the minor water vapour isotopologues employs spectroscopic parameter from the updated version of HITRAN-2000 (Rothman et al., 2003). The ACE-FTS retrievals use HITRAN-2004 (Rothman et al., 2005), while the SMR retrievals utilise spectroscopic parameter from the Verdandi database (Eriksson, 1999). A sensitivity study has been performed to assess the impact of the different spectroscopic databases used in the MIPAS and ACE-FTS retrievals on the comparison results between these two instruments. However the effect is very small and does not influence the comparison result in a significant way.

**Technical Corrections:**

1. p. 1684, line 10: “a into” → “into a”

Response: Corrected.

2. p. 1689, line 23: “with the a” → “with a”

Response: Corrected.

3. p. 1692, eq. (6): Probably, “bi =” has to be removed, otherwise there is an inconsistency in notation with eq. (5).

Response: The text regarding Eq. (5) and (6) has been rewritten to make clearer that $b_i$ denotes in general the deviation between each individual pair of coincident data, which can either be in absolute terms or in relative terms.

4. p. 1701, line 11: “The ACE-FTS profile less” → “The ACE-FTS profile is less”

Response: Corrected.

5. p. 1703, line 14: “that might an influence” → “that might have an influence”

Response: Corrected.

References:

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