

Response to the Comments

Colour code:

comments of the reviewer

response by the authors

proposed changes in the manuscript

General comment:

This is an excellent study that shows that the discrepancy between MIPAS and ACE- FTS measurements of the δD tape recorder can be explained by the effect of seasonal changes in the lower altitude where MIPAS retrievals are possible. The apparent discrepancy in the δD between the two measurements was quite large, and improving our understanding δD can help to clarify the contribution of convectively lofted ice to stratospheric water vapor. The study highlights the importance of fully understanding and characterizing the various factors that can affect a satellite retrieval, and shows that such a recharacterization can fundamentally alter the physical interpretation of the results.

Comment #1:

The last sentence of the Abstract does somewhat oversimplify the result. The authors do not show that “MIPAS confirms a δD tape recorder signal with an amplitude of about 25 per mille in the lowermost stratosphere.” What the authors show (Figure 14) is that when the EMAC simulation (which itself shows a δD amplitude of 25 per mille, consistent with the ACE-FTS measurements) is convolved with the MIPAS averaging kernels, then the convolved EMAC simulation gives a result consistent with the MIPAS measurement. A more appropriate phrasing of this entire sentence would therefore be “Considering these MIPAS characteristics largely removes any discrepancies between the MIPAS and ACE-FTS data sets and shows that the MIPAS data is consistent

with a δD tape recorder signal with an amplitude of about 25 per mille in the lowermost stratosphere.”

Response #1:

We absolutely agree with that. The text has been changed accordingly.

Comment #2:

Figure 7 – I understand that it's easier to see the lines separately with the pressure scale going up, but I really would recommend plotting this with high pressure at the bottom just to avoid confusion.

Response #2:

The pressure axis is now descending and the corresponding text has been changed.

Comment #3:

Page 9 line 22 – “Overall, the test yields both improvements and deteriorations of the comparison results,” This is a very awkward phrase. “Overall, the test shows that in some cases agreement improves while in others it becomes worse, . . .” might be better.

Response #3:

Thanks for the suggestion. It has been included.

Comment #4:

Page 12 line 20 - the resolution mismatch is only a “residual effect”. I'm not sure what “residual effect” means. I would drop this sentence.

Response #4:

As already written in our answer to the technical review comments, the change of the H₂O constraint already reduced the differences in the vertical resolution between the H₂O and the HDO. In that sense the remaining mismatch is only a residual effect. We have adapted the text as follows:

The H₂O retrieval has been specifically developed for the joint HDO retrieval (Steinwagner et al., 2007), differing from the nominal H₂O retrieval approach. The main reason behind that were actually the differences in vertical resolution between the HDO and H₂O data, with the latter exhibiting a better resolution. To reduce the vertical resolution of the H₂O data the constraint necessary for a stable retrieval was adjusted. This led, overall, to a better agreement of the vertical resolution of the two species. As such the remaining resolution mismatch can be considered as a “residual effect”.

Comment #5:

Page 14 line 7 = “Both is” should be “Both are”

Response #5:

Thank you for spotting this.

References:

Steinwagner, J., M. Milz, T. von Clarmann, N. Glatthor, U. Grabowski, M. Höpfner, G. P. Stiller and T. Röckmann, “HDO measurements with MIPAS”, *Atmospheric Chemistry & Physics*, 7, 2601 – 2615, doi:10.5194/acp-7-2601-2007, 2007.