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Interactive comment on “HDO measurements with MIPAS” *by* J. Steinwagner et al.

J. Steinwagner et al.

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Below are the answers to Anu Duhia’s short comment on behalf of all co-authors.

SC 1
Abstract, line 5: "delta D" assumes that people know what this means.

AC
The following sentence will be added to the abstract: “Variations in the deuterium content of water are expressed in the common δ notation, where δD is the deviation of the deuterium/hydrogen ratio in a sample from a standard isotope ratio.”

SC 2
p934 line 5: there seem to be a lot of different definitions of MIPAS resolution, varying

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from 0.025cm^{-1} sampling, 0.035cm^{-1} unapodized and, here, 0.05cm^{-1} apodized. The 0.025 and 0.035 figures are well-documented and functions of the instrument and spectra distributed by ESA, but I don't know where the 0.05cm^{-1} figure comes from. Doesn't it depend on the type of apodisation, if any, that the user (you) have applied?

AC

it To clarify this, the following information will be added to the text: ..."0.05 cm^{-1} (apodized with Norton-Beer ”strong” apodization function)"

SC 3

p934 line 10: this 17 sweeps only applies to the nominal mode scan pattern for the "full resolution" mission. There are many different scan patterns.

AC

The following additional information will be added to this sentence in the text: "...in the original nominal measurement mode..."

SC 4

p935 line 19: Does the Milz et al paper (incidentally, there is no journal listed for this in the references) refer to the IMK-derived H_2O? If so, you should at least acknowledge that there is also a more generally-available ESA product also.

AC

The Milz et al. reference will be corrected and the following reference will be included:

Raspollini, P., Belotti, C., Burgess, A., Carli, B., Carlotti, M., Ceccherini, S., Dinelli, B. M., Dudhia, A., Flaud, J.-M., Funke, B., H(̈o)pfner, M., Lopez-Puertas, M., Payne,

V., Piccolo, C., Remedios, J. J., Ridolfi, M., Spang, R.: MIPAS level 2 operational analysis,Atmospheric Chemistry and Physics, Vol. 6, pp 5605-5630, 18-12-2006, SRef:1680-7324/acp/2006-6-5605.

SC 5
p936 lines 1-4: it's unclear what you are doing with the contaminant species here. When you say 'taken from the previous MIPAS retrievals' do you mean retrievals from the previous scan, or previously retrieved profiles from the current scan (if so, whose? yours or ESA's?). If it is the second case, how can retrieving HNO_3, CH_4 and N_2O jointly with H_2O and HDO lead to a better representation of these products than just modelling the standard retrieved values? Presumably your H_2O/HDO microwindows have been chosen to minimise the interference from these species so you will only end up with less accurate modelling of their contributions.

AC
We mean "from previous analysis of the measurement under investigation". The purpose of this joint fit is to avoid being too sensitive against inconsistencies of the spectroscopic data in different spectral regions.

SC 6
p936 line 13: 11km isn't one of the standard tangent altitudes. 12km?

AC
12 km was meant. This will be corrected in the final Version.

SC 7
We have lots of questions about your error assumptions!
(a) p938 3rd bullet: treating temperature errors as correlated with altitude is strange. If these are meant to represent the random uncertainties in retrieved temperature then

the errors are likely to be uncorrelated with altitude.

AC
Our software uses perturbation spectra which are calculated by multiplying the Jacobians with the delta-T value (1K) at each tangent height. The noise error for T is of the order of 0.5 K, thus a value of 1 K can be assumed to also cover the systematic error part which needs not to alternate per altitude step. We therefore consider our error estimation quite conservative and the values appear justified to us.

(b) p938 3rd bullet: what is ’line of sight’ uncertainty. You describe it as an instrument characterisation error, but I think you mean that it is the tangent point pressure error from the pT retrieval.

AC
This error is meant to include the relative los-uncertainty between adjacent tangent altitudes and therefore is considered an instrument characterization.

(c) Fig.1: These plots have a parameter error, noise error and total random error. We assume that some, but not all, of the various parameter errors described in section 4.2 have been reclassified from "parameter error" to "random error", but you should make it clearer.

AC
On p940 line 9 the term “total random error” is explained. Parameter errors can be of systematic or random nature. Which error is considered random and which error is considered systematic is stated at the respective bullets on p938.

(d) p938 4th bullet: what is the difference between a "line strength" uncertainty and a "line intensity" uncertainty? You have assumed that the H_2O and HDO uncertainties are uncorrelated, but aren't they likely to have been measured by the same people at the same time? In which case your assumption that the spectroscopic errors for the two species are uncorrelated is likely to be over-pessimistic when it comes to calculating the error in the ratio HDO/H_2O.

AC

Since we cannot fully exclude the possibility that the measurements where made under identical conditions we will add a statement in the final version indicating that our assumptions may be over pessimistic.

(e) p939 line 3: I'm a bit surprised to see SO_2 uncertainty as a significant error source, especially since its concentration has been rather low throughout the MIPAS mission. Is this because you've used the original pre-launch estimate of variability for SO_2 which would have been based on the possibility of a major volcanic eruption such as Pinatubo. In retrospect, of course, we know that there has been no such eruption so the actual contribution of SO_2 uncertainty should be reduced by at least an order of magnitude.

AC

Correct. We will add a statement, saying that the error contribution of SO_2 *in this situation is over pessimistic.*

(8) Section 5: While the maths looks correct, there must be a better way of explaining it. It would help if you defined J before using it (Eq 13) and I didn't find Eq (15) helpful.

AC

We consider the Equations and their order as correct.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 931, 2007.

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