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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Growth rates of stratospheric HCFC-22" *by* D. P. Moore and J. J. Remedios

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We thank the Oxford MIPAS group for their comments and have addressed each point they have raised.

reply to comments:

1) You quote Kleinert et al for a MIPAS NESR value of 50 nW, but in her paper (Fig. 2) she shows values of 20-30nW around 900 cm^{-1}. In any case, since you are presumably using apodised spectra an even lower noise value would be appropriate, so overall you seem to be overestimating the impact of instrument noise by about a factor 4.

This is true that the MIPAS NESR is lower than the pre-flight requirements. The 50 nW 'guide' we use may indeed overestimate the measured NESR by a factor of

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up to 1.75. We have now modified the text in page 10519, line 22 to read "At 21 km, however, the observed inflight MIPAS–E noise equivalent spectral radiance (NESR) of 20-30 nW/(cm^2 sr cm^{-1}) (Klenert et al. 2007) is important with only the peak of the 829.05 cm^{-1} Q-branch visible above this NESR level. As such, the 829.05 cm^{-1} Q-branch may still be visible in 21 km spectra and provide some useful HCFC-22 concentration information. We see that the 828.95 to 829.15 cm^{-1} region..."

The noise value plotted in figure 2 was actually calculated based on an NESR value of 30 nW (i.e. the value used in the measurement covariance matrix) following on from discussions at the MIPAS-E Quality working group meetings. As such, we do not need to recalculate this for figure 2. We have also altered the NESR value we plot in figure 1, to 30 nW.

2) In your figure 2 error analysis you say in the text (p10522 line 3), that you use one sigma climatological uncertainties for the contaminants. But earlier you say that you use the offline l2 offline products for the major contaminant species, so why the climatological uncertainties to characterise these errors.

Thank you for pointing this out. We made a mistake in the text as the actual random model parameter error shown (including pressure, temperature and also water vapour and ozone) in figure 2 is calculated from a sigma estimate derived from the MIPAS-E level 2 data from the four months used in the analysis. The text has been changed accordingly. Climatological uncertainties were used for those not retrieved in level 2.

3) Also, in the plot, you seem to have a surprisingly low sensitivity to 1 K temperature errors (less than 1% above the 200 mb surface). Since the Planck function varies by several % per degree K at these wavelengths/temperatures I would have expected at least a similar level of sensitivity to a 1 K error, i.e. several %.

We were a little surprised ourselves when we analysed the results that the temperature error was so low at 200 mb. We have now looked our analysis again, firstly from a practical retrieval perspective, for one of the orbits from January 2003 (04480). From

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the 31 cloud-free/converged profiles that we derive from this orbit we do find that the mean profile retrieved using level 2 data differs from the mean profile retrieved using level 2 data with the whole temperature profile perturbed by 1K by 2-2.5%.

We have found that the problem lay with the way that we handled the uncertainty on T. Due to a coding error, this value was not handled correctly and in effect was a value <1 K. The code has been altered and we find that a 1 K temperature error is calculated to propagate into a 1-3% vmr error, depending on altitude/latitude. We have updated figure 2 accordingly.

4) You say that systematic errors are dominated by spectroscopic uncertainties (p10522, line 20) but it is unclear whether this means contamination from other gases, the uncertainties in the spectroscopic database for these contaminant gases or the 3.5% uncertainty in the spectroscopy of HCFC-22 itself. If its the latter - and this is presumably just a scaling factor applied to the strength of the whole HCFC-22 band - then you would expect this to translate directly into a 3.5% uncertainty in the retrieved VMR values.

It is the 3.5% uncertainty in the HCFC-22 spectroscopy itself. It is true that this is a scaling factor applied to the strength of the whole HCFC-22 band and yes, as you state, this does translate directly into a 3.5% uncertainty in the retrieved vmr values.

To make this clearer in the text we have changed the line to "Systematic uncertainties are dominated by the spectroscopic measurement uncertainties of HCFC-22 (3.5%) propagating into the retrieved vmrs."

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