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Atmospheric Measurement Techniques Discussions

Interactive comment on "Global distributions of C_2H_6, C_2H_2, HCN, and PAN retrieved from MIPAS reduced spectral resolution measurements" *by* A. Wiegele et al.

Anonymous Referee #2

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SUMMARY

The paper describes the procedure for retrieving profiles of various species linked to upper-troposphere transport and chemistry from the lower spectral resolution spectra obtained by MIPAS since 2005. As well as standard retrieval diagnostics, some sample results are presented which look reasonable.

Earlier publications have already described such retrievals from the higher resolution MIPAS spectra obtained before 2005. Since these results have been obtained essentially using the same software with apparently only minor modifications, to justify a

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further publication I would have expected on this occasion some further analysis of the data; for example: correlation plots between the species associated with biomass burning, perhaps with some estimates of chemical lifetimes and comparisons with model results for specific events, analyses of longer time series (not just a single month).

GENERAL COMMENTS

1) Nowadays the 'preferred' terminology is 'optimised' rather than 'reduced' resolution (also 'full' rather than 'high' resolution for the earlier measurements).

2) Horizontal averaging kernels: since this is a one-dimensional retrieval I don't know that horizontal averaging kernels are particularly meaningful. Some of the numbers in Table 4 are of the order of 200km whereas the actual profile spacing is >400 km, which can be a bit confusing, and there is also the issue of whether the profile locations are defined at some reference lat,lon coordinate or at the locus of the tangent points in the elevation scan (the difference being up $\sim$100 km). In general, I would suggest simply removing references to horizontal resolution.

3) Comparison of NESR and RMS residuals (see also specific comments for p5393 below). The assumption is that the discrepancy is due to the larger terms arising from the error analyses in Table 3. However a distinction should be made between a) parameters which contribute an error in the retrieved value itself, which tend to be the errors with spectral signatures well-correlated with the Jacobian spectrum of the target molecule), and b) parameters which contribute mostly to the RMS of the residual spectrum without necessarily contributing a significant error to the target molecule, which tend to be the errors with spectral signatures uncorrelated with the target molecule Jacobian spectrum. Table 3 lists those of type (a) while the RMS difference depends mainly on those of type (b). A further contribution to the RMS differences will come from the regularisation itself, but this is not quantified.

4) There are a number of comparisons made with the earlier MIPAS retrievals or other measurements but without any conclusions. Are these differences merely attributable

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to the natural variability of, for example, biomass burning events or do they indicate some underlying bias between the measurements?

5) The conclusions (and averaging kernel analyses) point to some ability to resolve vertical structure but is there any evidence that such profiles are meaningful? A theoretical vertical resolution is not necessarily obtainable in practice if there are oscillations induced in the profiles by other factors such as parameter errors.

6) The conclusions (and error analyses) also suggest an accuracy for the retrieved values, but again these are just predictions. Is there, for example, any quantitative analysis that can be obtained by measuring the self-consistency of the results for the different species?

SPECIFIC/MINOR COMMENTS

p5391, l2: "sunsynchronous"

p5391, l5: altitude should reach 5km at poles, not 6km, and upper altitudes vary from 77-70 km (according to v4.3 of the Mission Planning document).

p5391, l11: nearer 14 orbits per day than 15 ($\sim$100 minutes per orbit), and with one profile every 65s this gives a maximum of around 1330 profiles per day, not 1500.

p5392, l21: suggest "see Tab.2" or just "Tab.2", not "cf Tab.2" since you are not actually "comparing" your range with the details given in Table 2.

p5392, l25-26: the "awkward" feature is fairly common in averaging kernels where the vertical resolution is pushed to its limits. But I suggest replacing "awkward" with "undesirable" and "side wiggle" with "oscillation" (and elsewhere).

p5393, l11 (and elsewhere): are these NESR figures for the apodised or unapodised spectra. I assume unapodised is more relevant when comparing with residuals.

p5393, l12 (and elsewhere): is this RMS value an average over all altitudes, or just the single spectrum plotted in Fig.2? The former is not particularly meaninngful since it will

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be highly altitude dependent, and if the latter it should be incorporated into the figure or figure caption itself. Incidentally, on the figures themselves I think it would be useful to see the full residual spectra not just those in the microwindows, but that is a personal preference.

p5393, l13: "discussed"

p5396, l1: "approximately"

p5396, l3: "exhibits"

p5396, l18: "anthropogenic" rather than "anthropogenically". In any case, isn't most biomass burning also "anthropogenic" in the sense of being man-made?

p5397, l15: "anthropogenic"

p5397, l19: "Similar to the ..."

p5398, l12: "Mixing ratios ... exhibit mixing ratios ..." ?

p5398, l24: "events"

p5400, l14: "characteristics"

p5406, Table 3 caption: suggest replacing "most contributing" with "largest contributing"

p5407, Table 3 continued: caption reads "Fig.3"

p5408, Table 4: caption reads "Fig.4"

p5417, Fig 9: what do the symbols at 10km altitude represent?

p5418, Fig 10: "chosen"

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 5389, 2011.