Atmos. Meas. Tech. Discuss., 4, C2124–C2129, 2011
www.atmos-meas-tech-discuss.net/4/C2124/2011/


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.

**A. Wiegele et al.**

andreas.wiegele@kit.edu

Received and published: 18 November 2011

We would like to thank the reviewer for his careful and detailed comments. In the following, the original comment is inserted in *italic face* and our reply is typeset in normal face.

*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 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).*

The focus of our paper is the careful characterization of a new data set. Both the retrieval setup as well as the diagnostic data differ from those of MIPAS full spectral resolution retrievals. Selection of microwindows, regularization, joint-fit vs. prefit of interfering species have been optimized for the reduced spectral resolution measurements, and data characteristics are different. Also, data characterization exceeds what currently is standard (horizontal information smearing). We trust that a paper on a new data product along with data characterization which helps the data user to better understand the data product is suitable for publication in AMT. We will include further analyses on longer timeseries etc as far as this helps to better understand the data. Any analysis aiming at better understanding the atmosphere (lifetime analyses etc) we think is beyond the scope of an AMT paper but belongs to an ACP paper. With a more technical AMT paper available, a subsequent ACP paper can focus much more on the atmospheric science related aspects without a large load of technical information which then can just be referenced.

GENERAL COMMENTS

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

We are aware of this change of terminology but we do not support it. While "reduced spectral resolution" is an unambiguous generic term which describes what we actually have, the term "optimized resolution" raises more question than it answers: optimized



AMTD

4, C2124–C2129, 2011



according to which criteria? Which optimization scheme? How can it be called optimized facing the fact that several species can no longer be retrieved from these spectra which could be retrieved from MIPAS full spectral resolution spectra. Sorry, we consider the new misleading terminology rather propaganda than scientific language.

*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 100 km). In general, I would suggest simply removing references to horizontal resolution.*

We agree that the quantity reported should not be called horizontal resolution, because the resolution can never be better than the sampling. However we insist that this quantity is an important part of the data characterization, because horizontal smearing of information is one of the major disadvantages of limb sounding (compensated by specific advantages, of course). We consider limb retrievals without reporting this quantity as not fully characterized and will additionally include information on the information displacement relative to the nominal geolocation of the limb scan.

*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*



AMTD
4, C2124–C2129, 2011





*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.*

We agree that any regularization which constrains the retrieval more than just fighting the null space will cause a residual. We further agree that spectral error contributions which are uncorrelated with the Jacobian of the target will cause no retrieval error but will show up as a residual. However we consider the distinction between types (a) and (b) as not very meaningful because except for line intensity errors we always have a mixed type. Even random noise is often partly correlated with the Jacobian, otherwise it could not cause a retrieval error. We will reword the related paragraph in order to avoid any misunderstaning on this issue.

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

This is a good point. This will be discussed in more detail in the revised version.

*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.*

We agree that parameter errors can mask information. This is why we carefully report error diagnostics. Our error estimates enable the data user to judge if an observed structure is significant.



AMTD

4, C2124–C2129, 2011

*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?*

This is a good point. We will investigate this but we are not too optimistic because the emission inventories of various fire events and industrial emission can vary considerably. While certainly interesting in its own right, such an analysis might not be suitable to judge how realistic the results are.

SPECIFIC/MINOR COMMENTS

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

The reported NESR values refer to apodized spectra, because all spectra shown (and used for the retrievals) are apodized spectra. We do not understand why comparison of residuals calculated from apodized spectra with the unapodized NESR should be more relevant.

*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 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.*

The reported RMS values refer to the single spectrum shown and will be included in the figure caption.



AMTD

4, C2124–C2129, 2011



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

We will provide more accurate numbers and change the wording to 'roughly 1400 profiles are measured in about 14.4 orbits.' The time needed for measuring a geolocation is little less than 61s.

All further specific and minor comments have been implemented. Thanks a lot for spotting them!

---

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