

***Interactive comment on “Global distributions of C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>2</sub>, HCN, and PAN retrieved from MIPAS reduced spectral resolution measurements” by A. Wiegele et al.***

**Anonymous Referee #1**

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Wiegele et al. present follow-up work on Envisat MIPAS retrievals for C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>2</sub>, HCN, and PAN for the reduced spectral resolution mode of the instrument (in operation since Jan 2005). They discuss modifications of the existing Karlsruhe retrieval schemes with respect to the high spectral resolution mode of the instrument (in operation from Jun 2002 to Mar 2004) and the corresponding impact on spatial resolution and retrieval errors. They present in detail the retrieval results for a single orbit as well as monthly means for Oct 2007. The paper is in the scope of AMT. It should be published after the following comments are properly addressed by the authors.

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**General Comments**

1) This paper does not present any new measurement technique or retrieval concept. It presents some new data obtained by minor modifications of the existing and published retrieval schemes in Karlsruhe. However, a spectral degradation from 0.025/cm to 0.0625/cm and some change of the spatial sampling pattern do not seem to be such a big deal? It should be clearly pointed out in the abstract and the introduction that this is follow-up work. Or provide better motivation. What was the challenge?

2) The introduction should include at least one paragraph on the scientific motivation of the paper. From my point of view this is required even in a journal like AMT, since scientific questions are of concern when a new retrieval dataset is produced. For example, the choice of the regularization or smoothing constraint made by the retrieval expert has impact on the noise-resolution trade-off of the result. Why was the smoothing constraint set to a particular value? Do the results fit the needs of the scientific users of the dataset?

3) The introduction as well as the rest of the paper should provide more references to external work, e.g. by providing information on other retrievals of the analyzed species based on measurements made by other sensors. The presentation is too strictly focussed on work done in Karlsruhe.

4) In the results section of the paper it should be pointed out which fraction of the MIPAS data was processed with the new scheme. Just the sample orbits and Oct 2007 or are there more data available? A scientific user of the data would certainly like to know that.

**Specific Comments**

p. 5390, l. 1: The abstract should include one sentence that an example orbit as well as monthly means for October 2007 are discussed in the paper.

p. 5390, l. 13: Place reference (Fisher et al.) behind 'MIPAS instrument', add reference

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to Envisat satellite.

p. 5390, l. 15: 'a high number of species' is unspecific. Please clarify.

p. 5390, l. 25: 'which is one of different MIPAS-Envisat processors' What do you mean by that? Missing word?

p. 5391, l. 2: Provide information on inclination and local times of orbit.

p. 5391, l. 13: In this paragraph information and references to cloud filtering are missing. However, this is an important issue for UT/LS retrievals.

p. 5392, l. 12: How often do you encounter convergence failures? Is this an important issue? Do you provide quality flags to allow the scientific user of the data to identify possibly obscure results?

p. 5392, l. 20: Why do you extend the retrievals up to 52km altitude? For C<sub>2</sub>H<sub>6</sub>, C<sub>2</sub>H<sub>2</sub>, and PAN the AVKs shown in the paper drop to nearly zero at 30km. Isn't that inefficient in terms of CPU-time?

p. 5392, l. 20: You should add a sentence that the lowermost tangent altitude varies due to cloud filtering. Since these are UT/LS retrievals it would be interesting to know what fraction of tropospheric data is lost due to cloud filtering. Which measures were taken to reduce this number as far as possible?

p. 5392, l. 26: What is the reason for the negative side wiggle of the 5km AVK at 10km? Optically thick conditions? Did you check the kernel functions (Jacobi matrix)? Which influence has this undesired feature on the retrieval results? Is there a typical decrease in the profiles at the lowermost altitudes?

p. 5392, l. 28: Here, as well as in the subsections for the other species you included the information on vertical resolution in the text, only. It would be much more convenient if this information is also available in Table 4, it already provides information on horizontal resolution.

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p. 5393, l. 7: Is the estimate of the horizontal resolution of the retrievals based on analyzing just a single, horizontal line of the 2-D averaging kernel matrix (i.e. the one referring to the altitude of the 2-D grid point) or is the full 2-D field taken into account. The 2-D AVKs may have a complex shape and analyzing just a single row of the 2-D field may underestimate the horizontal resolution. It would also be interesting to know if the 1-D estimate of vertical resolution fits to the results of the 2-D analysis.

p. 5393, l. 13: Got a bit confused about the statement 'is attributed to parameter uncertainties discussed below'. I guess it refers to the ozone uncertainties mentioned in the next paragraph?

p. 5393, l. 16: It is mentioned that propagation of ozone uncertainties causes a significant retrieval error at altitudes above 15km. I was wondering if a joint-fit rather than a pre-fit may improve the results in this case? I noticed that the joint-fit approach was selected for the other species to avoid just this problem.

p. 5393, l. 24: Is the modification of the microwindows based on a complete re-run of the optimal selection procedure or was it an ad-hoc choice?

p. 5394, l. 3: The stronger side-wiggles of the AVKs may indicate that the vertical smoothing constraint is too weak. How was the constraint chosen? Based on a parameter study?

p. 5394, l. 9: 'by a few times' is unspecific. Please clarify.

p. 5394, l. 13: 'at high mixing ratios' is unspecific. Please clarify.

p. 5395, l. 8: 'outmatches ... significantly' is unspecific. Please clarify.

p. 5396, l. 12: On how many profiles are the monthly means for Oct 2007 based? Do they include data for every day or just for selected days in that month?

p. 5397, l. 1: I did not find the information where on Earth the example orbit is located. Maybe provide the reader with a map or the longitudes of the Equator crossing?

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- p. 5397, l. 8: It may be confusing if it is mentioned first that C<sub>2</sub>H<sub>6</sub> is mainly produced by biomass burning (or anthropogenic activity) and then the maximum concentration in Oct 2007 is found over the southern Atlantic Ocean. Add a sentence if this is due to advection.
- p. 5397, l. 15: For the other species you present not just a comparison with MIPAS HR measurements, but also initial comparison with other datasets or climatologies. Would be nice if the same is possible for C<sub>2</sub>H<sub>6</sub>.
- p. 5399, l. 16: The reason for the N/S difference of PAN is not explained.
- p. 5400, l. 8: 'Plumes of different compositions and different mixing ratio enhancements can be found.' This is a very generic sentence and not really useful, I think. Maybe expand a bit in terms of scientific motivation for the paper. Is the analysis of plumes a major topic for the new data set? Since the conclusion section seems rather short at the moment, maybe repeat the retrieval characteristics (noise, resolution) once more, if there is nothing else to add?
- p. 5404, Tab. 1: What is the rationale to select if information on interfering species is determined by 'pre-fit' or 'joint-fit'?
- p. 5406, Tab. 3: Maybe explain a bit better that 'LOS' refers to vertical pointing errors. Does 'ILS' refer to the ILS width or other uncertainties as well? 'gain' should be explained better as well (radiometric calibration error). In the table you can use '\gg' instead of '>>' in LaTeX.
- p. 5406, Tab. 3: Did you analyze the retrieval errors due to uncertainties of spectroscopic data? I would have guessed that these are quite important errors, assuming that the spectroscopic parameters may not be well known?
- p. 5409, Fig. 1: This type of plot typically includes an additional curve showing the area of the averaging kernels as a function of altitude. It would be helpful to include it here to infer the altitude range where the retrievals are sensitive to measurement information.

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This aspect should also be discussed in the text of the paper.

- p. 5410, Fig. 2: I see zero radiance rather than 'gaps' in the plot?
- p. 5417, Fig. 9: What do '+' and 'x' in the plot indicate? Add additional x-axis labels showing the longitudes of the measurements or provide data on Equator crossing at least.
- p. 5418, Fig. 10: What kind of smoothing method or algorithm was used to produce these map plots? Was the data preprocessed with a box mean? Which box sizes? It looks a bit, as if outliers are present in the results, e.g. the red triangle at (50N, 90E)? You should add the information that missing data (white areas) is due to cloud filtering.

#### Technical Corrections

- p. 5390, l. 2: spell out MIPAS
- p. 5390, l. 13: spell out ESA
- p. 5390, l. 19: spectra\_l
- p. 5391, l. 6: suggest '...the lowermost nominal tangent altitude is...' (singular)
- p. 5391, l. 11: suggest 'about' instead of 'close to'
- p. 5391, l. 15: suggest to use dots '.' instead of ';' (very long sentence)
- p. 5391, l. 23: spell out HITRAN, should be 'HITRAN04' instead of 'Hitran04'
- p. 5394, l. 2: remove 'and'
- p. 5397, l. 19: 'Similar to the pollutant' (singular)
- p. 5398, l. 13: close to the tropopause
- p. 5398, l. 16: spell out ATMOS
- p. 5398, l. 24: event\_s (plural)

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p. 5399, l. 2: \_the\_ peroxyacetyl (?)

p. 5399, l. 11: suggest 'polar regions' instead of 'northwards'

p. 5399, l. 13: suggest to replace by 'e.g. \_over\_ the Atlantic Ocean at 12km \_altitude\_'

p. 5400, l. 17: level-1 \_data\_

p. 5407, Fig. 3: should be 'Tab.' and not 'Fig.'

p. 5408, Fig. 4: should be 'Tab.' and not 'Fig.'

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