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Interactive comment on "Retrievals of heavy ozone with MIPAS" *by* Bastiaan Jonkheid et al.

Anonymous Referee #1

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The paper by Jonkheid et al. presents the retrieval of Ozone isotopomers from MIPAS instrument. This is an interesting subject presented in a well written and concise manuscript. The results seem to be robust and should constitute a valuable contribution to AMT after consideration of the following comments.

In general, the paper would benefit from a more detailed description of the error and sensitivity of the retrieval. Also it is not clear to me how such measurements could be used to investigate the role of O3 in atmospheric chemistry. It is my understanding that it is not the purpose of the paper to expand on this subject, but a few lines, references, would strengthen the interest of developing such products.

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Discussion paper

Specific comments

Interest of such products

The authors state that observations of O_3 isotopomers are “useful tracer for the role of O_3 in atmospheric chemistry” (P1,L20). Is it possible to be more explicit on their use, is there any former work using such observations?

Later on, it is suggested that ozone formation and photolysis enrich delta values. I guess then, delta observations could help to constrain these processes. Is there any uncertainty associated to these processes?

Uncertainty analysis 3.1

The error analysis in is actual form is a very general description of the error analysis and more information would be needed to have a clearer picture on the robustness of the results.

- What are the parameter uncertainties used in the error calculation (a table would be appropriate)? For example, we can not appreciate any potential underestimation of the uncertainties associated to HITRAN (P6, L23) since theses uncertainties are not given.
- A clearer decomposition in random and systematic error would also be useful. Especially since the different impacts of these errors is discussed later on.
- Is there a reason why there is no description of the smoothing error? At least a discussion on the sensitivity of the retrieval is needed. For the moment, the discussion is limited to the information that there are 6 DFS between 25 and 50 km.

- Figures of the averaging kernels would greatly help to actually realize that the different species have very similar vertical resolution (also for all latitudinal bands). Is there any sensitivity below 25 km? That would be useful information for the following of the manuscript.
- P7,L12: " the fact that the standard deviations are much larger than the estimated accuracy suggests that this is due to zonal variability in these latitude bands". It could also be due to an underestimation of the error. Or differences in sensitivity? Note that it is the random error here it is about and not the accuracy.
- In the Polar (S) panel, the error estimation appears to be the lowest, but in the error estimation corresponding to this latitudinal band, the error is the largest. Is it because more profiles have been used? Could you add the information on the number of profiles. Also if you attribute the standard deviations to natural variability, you need to explain the depletion observed for example in Mid-latitude.
- "In all latitude bands, the standard deviations tend to increase at altitudes <25 km and >50 km, as do retrieval parameter uncertainties in Figure 1." What is the meaning of this sentence? What is the confidence level in the retrieved values below 25 km and above 45 km? It is needed to precise whether or not at theses altitudes, the retrieval reflects real variations of O3 isotopomers.
- The lack of discussion on error sources also reflect in the explanation concerning the depletion observed in s-50O3 (P7,L32) as you suggest that the "depletion to be a retrieval artefact possibly due to a spectroscopic bias". I would expect the error associated with a spectroscopic bias to be systematic and constant over time and space (as it is stipulated in the conclusions), so why this is just happening here? Moreover in the abstract the systematic uncertainty is estimated to 1-2 % but the observed depletion actually seems larger than this estimation.

Comparison with previously published data 3.3

This section in its actual form is a bit difficult to follow for someone not familiar with all the existing O3 measurements. A description of the other dataset is missing. A short description of the others published data, their sampling, sensitivity and error characteristics would facilitate the reading. Why do the different instruments present such different standard deviations? Is it inherent to their errors? I guess the different datasets cover different time period, could that be an eventual cause of the spread observed in some cases?

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