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Atmospheric Measurement Techniques Discussions

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

Bastiaan Jonkheid et al.

jonkheid@gmail.com

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1 Interest of such products

- O_3 affects the isotopic composition of other atmospheric species, and this is one of the reasons why the ozone isotope effect is studied. It is beyond the scope of the current paper to go into much detail here, but several affected species (CO_2, CO and N_2O) are referenced in the revised version.
- The uncertainties of the processes behind the isotopic enrichment of O_3 are difficult to quantify in terms of enrichments occurring in the atmosphere. The fractionation of the formation reaction rate coefficient, with its dependence on pressure and temperature, is quite well known, but this does not translate directly to an enrichment value. Conversely, while there are some data on the photolytic effect, there is only poor agreement between laboratory measurements and theoretical

calculations. The observational evidence for photolytic enrichment is tentative. In the revised manuscript, values are given for the magnitude of both effects, and their uncertainties are described in qualitative terms.

2 Uncertainty analysis 3.1

- In the revised manuscript, the uncertainties in the retrieval parameters are shown in the new Table 2. While there are too many relevant $^{50}O_3$ lines in the HITRAN database to list them all in the paper, note that all have the uncertainty flag "0" (meaning a relative uncertainty >1 or unreported) for line position, intensity and air-pressure induced line shift. This is also stated explicitly.
- The discussion of the uncertainties is changed in the revised version to give a clearer distinction between random and systematic error sources. Most notably, Figure 3 (Figure 2 in the original manuscript) is changed so that the total uncertainty is shown, instead of the component due to retrieval parameters.
- The most significant vertical variation of all relevant isotopemers is assumed to be captured in the a priori profiles, and the profiles retrieved here show only slowly varying variations on the prior data. For this reason, the smoothing error is not considered to be an important source of uncertainty; this is stated in the revised version.
- A new figure was added to the manuscript showing the averaging kernels of the relevant isotopomers (Figure 2).
- The discussion of the uncertainties is changed in the revised version. In the northern and tropical latitude bands, the enstimated precision fits quite well with the observed standard deviation; in the southern latitude bands, it is noted that the observed variation is larger than the estimated precision.

- The number of retrievals used to obtain the means and standard deviations in each latitude band is now displayed in the figure. The negative enrichments needed to explain the large spread in the observed profiles are noted explicitly.
- The passage is rephrased in the revised manuscript. The spread in the observed profiles is now compared directly to the estimated precision, which makes it easier to see if the variation is naturally occurring or inherent in the retrieval process.
- A spectroscopic bias resulting in a constant shift would indeed make sense. A positive shift of a few percent would remove the negative enrichments found here, this is noted in the revised manuscript.

3 Comparison this previously published data 3.3

- The description of the other datasets has been moved from the introduction to its own Section 3.3.1. The description of the measurement techniques, the error characteristics (where available) and the resulting profiles is expanded in the revised manuscript.

  Please also note the supplement to this comment:
  http://www.atmos-meas-tech-discuss.net/amt-2016-144/amt-2016-144-AC1-supplement.pdf

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