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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Heavy ozone enrichments from MIPAS limb emission spectra" *by* C. Piccolo et al.

Anonymous Referee #1

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General remarks: The paper entitled "Heavy ozone entichments from MIPAS limb emission spectra" is methodically sound and presents interesting results.

Thus I recomment publication in ACP after consideration of the following specific and technical issues:

Specific remarks:

p 25128 l 19: It might be useful to add a caveat on the reliability of the MIPAS $^{50}O_3$ data compared to the in situ measurements here.

p 25129 l 15: This statement can only be understood by readers who know that HITRAN line intensities of isotopologues actually are line intensities divided by isotopic relative abundance. For non-spectroscopists not familiar with this HITRAN convention,

the meaning of this statement may remain unclear. Some more words on this would be useful.

p 25133 l 25: Isn't there a reference or MORSE available?

p 25134 l 19–23: This is a bit vague and I suggest to delete this.

p 25136 l 9: Is $\pm$10% uncertainty enough to also cover possible spectroscopic uncertainties arising because the lines interfering with the heavy ozone microwindows and those included in the microwindows used for the preceding standard ozone retrieval may be from different bands?

p 25136 l 9: This reads as if there are no off-diagonal elements in the initial $\vec{S}_a$ matrix, and the choice of 100% for the other isotopic variants seems to be an ad hoc choice. This certainly will have virtually no impact on the final results because after a few iterations $\vec{S}_{i-1}$ will be dominated by the information content of the preceding retrievals. However, the terms 'optimal estimation' and 'sequential estimation' are, to my knowledge, reserved to retrievals with Bayesian justification of the priori information. I suggest a less strong wording, e.g. 'optimal estimation algebra' instead of 'optimal estimation'. To avoid to be misunderstood: I have no reservations against the method chosen, it's just about making terminology unambiguous.

Section 3.2: I miss local thermodynamic disequilibrium as an error source in some of the plots. Has it been considered and is just not shown because it causes small errors only, or has it not been considered? If weak isotopic lines are interfered by strong lines of the main isotope or other species, local thermodynamic disequilibrium of the latter could be an issue. This may be particularly true for CO_2 lines in the laser band.

p 25144 l 3: Are the MIPAS results robust enough to challenge the Thiemens and Heidenreich data? Or could any systematic errors, particularly not well specified uncertainties in spectroscopic data lead to an artefact in the enrichment ratios? The discrepancy is worrying and should be discussed more thoroughly.

By the way: When I first read this, I understood that it was the spread, not then enrichments themselves which contradict the Thiemens and Heidenreich results. I suggest to reword this.

Technical issues:

p 25128 l 19: contraddictions → contradictions

p 25137 l 4: is the comma after 'so' correct? I have had some problem to figure out the grammar of this sentence.

p 25144 l 7: contraddction → contradiction

p 25144 l 21: 'contradictions' is the plural appropriate?

Fig. 1: labels and axes captions are quite small and hard to read. There are some symbols outside of the panel.

Fig. 2: There are some symbols outside of the panel.

Fig. 4: The plots are quite small and hard to read. The term 'Kalman' in the plots is not incorrect but misleading, since in the figure caption and in the text this is always called 'sequential estimate'.

Fig. 5: The plots, and particularly the numbers at the colour scale, are very small and hard to read.

Fig. 8: The plots are quite small.

Fig. 9: The polts are quite small.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 25127, 2009.