

Interactive comment on “Methane spectroscopy in the near infrared and its implication on atmospheric retrievals” by C. Frankenberg et al.

C. Frankenberg et al.

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We would like to thank the reviewer for his positive comments and suggestions. In the following, we will reply to his comments step by step.

Major comments

Reviewer comment (RC): One major weakness is that the manuscript does not report the N₂-broadened half widths or pressure shifts for the 2ν₃ P-branch. The authors do not mention why they have chosen to ignore the P-branch, although they cite previous atmospheric retrievals that used the 2ν₃ P-branch. Since the authors already have the necessary highquality spectra, I would suggest that they include the complete 2ν₃ band

in their analysis.

Author comment (AC): The paper was initially tailored specifically to SCIAMACHY measurements which only cover the Q and R-branch of the $2\nu_3$ band. However, we see the point that including the P-branch would make the paper more *complete*, especially since it is often used for ground based FTIR retrievals. We therefore took the effort to include the P-branch in the analysis as well even though it meant some restructuring of the text and inclusion of new as well as changes to existing figures.

Minor comments

RC: Define acronyms when they are first introduced (FTIR, SCIAMACHY, etc).

AC: Done

RC: Units should be consistently presented as wavenumbers, nanometers, or micrometers. It becomes confusing to keep track of the different methane bands when they are referred to in several different wavelength units.

AC: We now stick, where possible, to wavenumbers throughout the text

RC: How was the pressure measured and calibrated?

AC: We added the sentence: The pressure in the absorption vessel was measured with two independent capacitive pressure transducers of 500mbar and 1000mbar maximum range (MKS Baratron).

RC: The authors determine the absolute methane concentration by fitting the R0 and R1 lines using published linestrengths from Margolis [1988]. Is the stated accuracy of 1% a random or systematic error? How well known are the R0 and R1 linestrengths?

AC: We meant that, assuming the linestrengths from Margolis [1998] as the truth, we can determine the total methane column in the cell with an accuracy of about 1%. However, if the linestrengths of Margolis will be revised by other studies also our dataset

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has to be adjusted accordingly. The systematic error in linestrengths can therefore easily be 1-2%.

RC: Is there a theoretical explanation for different $|m|$ dependence?

AC: In general the dependence is largely an empirical observation based on measured values, although for many molecule types, the theoretically predicted values are seen to follow patterns with m . Plotting against m is a common way in spectroscopic literature which we adopted even though for methane in fact the sets of energy levels for the 3 branches are all different degeneracies. We therefore skipped the phrase "As expected, ..."

RC: The exponent of the temperature dependence of broadening as been reset to 0.85 for all lines." This is an important detail. How well known is the temperature dependence? Do the authors have spectra at different temperatures that would allow them to make an improved estimate of this parameter?

AC: We modified a sentence to "Temperature dependence of pressure broadening is so far unknown for most transitions and therefore requires further research". Even though we performed also lower temperature measurements (243 K), we were not confident enough to determine the T-dependence accurately especially because no 900 hPa measurements at low T were performed.

RC: This paragraph contains some vague statements, such as: "Hardly any seasonal variation in methane can be seen any more." "[...] observed an additional biasing factor for SCIAMACHY retrievals that is taken into account in this study." The paragraph is missing a meaningful discussion of the remaining sources of retrieval error for the 2 ν 3 methane linelist.

AC: The main reason for the vagueness of this paragraph was probably an unclear reference to a manuscript in preparation. As this manuscript is now in print in GRL, we could modify the paragraph to make statements clearer.

RC: This paper would benefit from a more specific title...

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AC: Right, we changed the title to *Pressure broadening in the $2\nu_3$ band of methane and its implication on atmospheric retrievals*

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 10021, 2008.

ACPD

8, S5497–S5500, 2008

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