Atmos. Chem. Phys. Discuss., 5, S3119–S3121, 2005
www.atmos-chem-phys.org/acpd/5/S3119/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global carbon monoxide vertical distributions from spaceborne high-resolution FTIR nadir measurements" *by* B. Barret et al.

B. Barret et al.

Received and published: 11 October 2005

We would like to thank the referee for his careful review of our manuscript and for his suggestions to improve the paper. Thereafter, we provide positive answers to the referee's comments with a description of the changes made in the manuscript when necessary.

Specific comments:

We have added comments and references about the CO profile retrievals from AIRS and from TES that are demonstrated now. No CO profiles have been reported to be retrieved from SCIAMACHY.

The “a priori” is used as a mathematical constraint and the a priori variability is set to large values without correlations for limb observations which provide an independent measured spectrum at each tangent altitude. For nadir measurements, the vertical distribution is retrieved from a single integrated measurement and the information comes from the broadening of the absorption lines and from their relative intensities. In this case, the vertical resolution is poor and, in order to provide a good regularization of the retrieval, the “a priori” has to represent the best statistical knowledge of the state as we stated in the paper.

Line shapes are Voigt profiles. They are actually modified for CO2 by chi factors to account for non-impact effects as described in Perrin and Hartmann (1989). This is now stated in the manuscript (section 2.2) and the reference has been added. The modulation efficiency term "a" is therefore not accounting for the non-Lorentz behavior of CO2 lines and may be applied to CO lines to correct for the deviation of the instrumental line shape from its nominal form.

In the paper, we stated that “an analysis of the RMS of the differences between the fitted and the measured spectra revealed strong variations in the level of noise, with a positive correlation between the signal and the noise levels” . We meant a correlation for the all set of spectra and not a correlation between the spectral points inside each spectrum as the referee misunderstood. This correlation between noise and signal is probably due to the presence of photon noise.

We assume a fixed surface emissivity and we fit the surface temperature. Surface temperature is therefore used to represent actual temperature/emissivity variations as the referee stated. Day-time reflected solar radiation from the surface is assumed to be negligible in this part of the infrared. The validity of this assumption was confirmed by the fact that we found no differences in the ability of the forward model to reproduce day-time and night-time observations and no day/night variations in the retrieved CO profiles.

ACPD

5, S3119–S3121, 2005

The DOFS depends on the assumed a priori covariance but also on the measurement covariance used for the retrieval. For each retrieval, the DOFS is a measure of the number of independent pieces of information that are retrieved from the measurement for a given set of covariance matrices. It is therefore justified to compare the DOFS obtained for different instruments assuming that those retrievals are optimized for each instrument.

The “IMG lower tropospheric mixing ratios” correspond to the mixing ratios retrieved at 1.2 km. This precision has been added into the text. We agree with the referee that the shape of the CO vertical profile should lead to some biases between the IMG lower tropospheric mixing ratios and the CMDL surface mixing ratios. Nevertheless, we think that there are different situations that may lead to different biases: a.In the northern hemisphere at middle latitudes, CO is released in the atmosphere near the surface resulting in a strong vertical negative CO gradient. As expected from this situation, CMDL in-situ CO vmr are slightly higher than the IMG lower tropospheric CO (Table 1). b.In the tropics, probably because of convection and advection of the CO produced by biomass burning, the IMG lower tropospheric values are higher than the CMDL surface values. c.In the southern hemisphere, because of the absence of sources, the CO vertical gradient is low and the agreement between CMDL and IMG is the highest.

All the technical corrections have been taken into account in the revised manuscript.

Reference: M. Y. Perrin and J. M. Hartmann, Temperature-dependent measurements and modeling of absorption by CO2-N2 mixtures in the far line-wings of the 4.3ìm CO2 band, J. Quant. Spectrosc. Radiat. Transfer, 42, 311-317, 1989.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 4599, 2005.