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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Subtropical trace gas profiles determined by ground-based FTIR spectroscopy at Izaña (28° N, 16° W): Five-year record, error analysis, and comparison with 3-D CTMs" *by* M. Schneider et al.

Anonymous Referee #1

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General Overview

This paper is discusses measurements made at the NDSC site in Izana. The data is from a high resolution FTIR, analysed with a state-of-the-art inversion algorithm software (PROFFIT), and subsequently compared with two 3-D chemical transport models (SLIMCAT, KASIMA). The data is of high quality, while the analysis method and treatment of errors is both thorough and complete. The section on the sensitivity analysis is of particular interest for the rest of the ground-based IR community. The discussion

comparing the model outputs with known bias in the retrieval methods is also quite detailed.

Specific Comments

1) Why did the authors choose the O3 microwindow at 780 cm-1? The reason for the question concerns the smoothing error issue for O3, and the known surface bias for largely stratospheric gases. The use of the window at 1002-1005 cm-1 has been reported in the literature by Pugatchev et al in the mid 1990's and more recently by Barret et al in 2003. The window removes a large proportion of the smoothing error in the troposphere.

2) What is the nature of the additional constraints mentioned in table 1? The reason for asking refers to the data presented in column 3, "fixed to a-priori". HCl has similar issues with its surface concentration as O3 and HF (and also at the highest elevations), yet the table implies that no constraints were used. Further, the must also be constraints surely for both N2O and CH4 above about 60 km?

3) Error analysis: error estimates are significantly affected by the choice of the uncertainties of the a-priori (Sa) and assumed S/N (Se). While the referee can largely confirm in the case of O3 the smoothing error estimates in table 2 for O3 assuming the % variabilities from figure 1, the measurement error (noise) of 7.1% for the column below 12.4 km seems low. Again an equivalent calculation by the referee for an assumed S/N of 250 gives this figure closer to 20%. The authors may wish to check this number for two reasons; a) it is not consistent with the comments just made, and b) a S/N of 250 seems low given that in this region with NDSC filter covering the 700-1400 cm-1 should yield rms noise of order 700:1 or better. Is the noise in the Izana spectra really only 250:1 at 780 cm-1?

4) Page 5: discussion of the degrees of freedom for signal. The quantity is highly dependent on Sa, Se, and also to some extent of the sza and resolution. It is assumed that the numbers quoted here are for the mean sza for example? The dof for O3 is

ACPD

4, S2595–S2598, 2004

Interactive Comment

more like 4.5 at 65 degrees (given the stated Sa an Se) so I am assuming that the sza's must be very high (ie $<$ 20 degrees)?

5) Page 10; there is a discussion about the chemically active species O3 and HCl. One pronounced difference is SLIMCAT's reasonable reproduction of the HCl stratospheric column but the referee does not see an explanation for the obvious overestimate of the HCl column by the KASIMA model. Would the authors care to comment on this?

Technical Corrections

The general level of grammar of many sentences needs correcting. The following are some examples which may help.

1) Start the very first sentence with "Within the framework Ĕ" Introduction: " of knowledge still disables the models to, e.g., simulate theĔ" replace with, "of knowledge still beyond the models ability to, e.g., simulate theĔ"

2) The following sentence "In the tropics where, through the upwelling branch of the large-scale circulation (Brewer, 1949; Dobson, 1956), the majority of transport from the troposphere into the stratosphere occurs, the conversion of anthropogenic gases into reactive compounds are very efficient through enhanced photochemistry." This is clumpsy and would read much better thus "In the tropics, where the majority of transport from the troposphere into the stratosphere occurs through the upwelling branch of the large-scale circulation (Brewer, 1949; Dobson, 1956), the conversion of anthropogenic gases into reactive compounds are very efficient through enhanced photochemistry."

3) A few sentences later, "Ĕabsorption spectroscopy allows to determine a large varietyĔ" should read "Ĕabsorption spectroscopy allows one to determine a large varietyĔ"

4) And a bit later "Ĕ Bruker 120M FTIR spectrometer is run at theĔ " change to "Ĕ Bruker 120M FTIR spectrometer has been operated at theĔ"

5) Page 3, 3rd line, change "file are in consistency" to "files are consistent"

ACPD

4, S2595–S2598, 2004

6) Page 10, second paragraph, 1st sentence; “sophisticated” should be “complicated”

7) Page 10, second to last sentence does not make sense at all.

8) Section 4.3: Change the first sentence to read “Over the whole period both SLIMCAT and KASIMA overestimate stratospheric N2O and CH4 while underestimating O3, HCl, and HF.”

9) And the next sentence woul read better this way “An examination of the the temporal evolution of their differences to the measurements, indicates that KASIMA simulation of the vertical transport is too strong, resulting in strongly increasing altitudes of tracer Ě”

Finally, examine a number of sentences that overuse the phrase “in particular”. In most cases the phrase can be removed making the sentence read more clearly.

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 5261, 2004.