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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Retrieval of global upper tropospheric and stratospheric formaldehyde(H_2CO) distributions from high-resolution MIPAS-Envisat spectra" *by* T. Steck et al.

Anonymous Referee #1

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General comments

The paper demonstrates the capabilities of MIPAS to detect and retrieve formaldehyde profiles in the upper troposphere and stratosphere, with 2 to 4.5 degrees of freedom. The retrieval is performed in the spectral range 900 to 1850 cm-1, in which the most prominent band of formaldehyde is centered around 1750 cm-1. The emission lines are however very weak compared to the spectral noise in that region; therefore the uncertainty on single spectra retrievals is dominated by the noise error. However, averaging over a large number of spectra in a zonal band and for a period of time of the order

of some months reduces the noise error enough to discern latitudinal / vertical cross sections in the formaldehyde distribution. These are discussed and compared to other satellite (Odin-SMR and ACE-FTS) observations and to REPROBUS model evaluations. The paper is well written, clear and concise. Figures, Tables and references are appropriate. New data for formaldehyde are presented, they open interesting perspectives. The discussions of the retrieval and associated results are clear and complete. My major concern regards the section on validation - see specific comments below.

Specific comments

- Section 2, Line 17: How do the so-called new spectroscopic data of Perrin et al. (2003) and Sharpe et al., (2004) compare to the HITRAN2004 data ? Are these new spectroscopic data already available in the HITRAN updates ? - Section 5.1, pg. 13635, line 3: why does the breakup of the southern polar vortex induce larger concentrations of formaldehyde in the southern hemisphere, compared to the northern hemisphere ? Some more explanation is desirable. - Section 5.2 lines 15-16: again, it would be good to clarify the explanation for the higher nighttime values of formaldehyde in the southern polar vortex. - Section 5.2, line 13: If I understand the authors correctly, they recognize themselves that the zonal mean day- plus nighttime values presented in Figure 7 are slightly shifted towards daytime values because these are more abundant in the ensemble of data. Why then not eliminate some daytime observations from the ensemble (where nighttime measurements are missing) in order to have a balanced presentation of the mean ? - Section 6: I am not convinced about the interest of Section 6 as it is presented here for three reasons: (1) the comparisons relate to different time periods and geographical areas of observations, and (2), the cited values are never accompanied by their uncertainties so any agreement / disagreement is difficult to judge, (3) the tables present comparisons at different altitudes, even if we know that the vertical resolution of the observations is too low to distinguish these altitudes.

In particular: Where was the ACE-FTS biomass burning plume of October 8, 2005 located? Table 2: why not compare the partial column values in the range 10 to 21

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km altitude which corresponds to 1 DOF for the MIPAS retrieval ? Table 3: (1) Similar remark as to vertical resolution as made with Table 2. (2) Was it not possible to find data for Odin-SMR and REPROBUS in similar periods as for the MIPAS data set ? (3) What can we learn from Table 3 if the compared periods (seasons, years) are different and if we have no idea about the interannual variability (at least the interannual variability should be discussed). Also, to interpret the significance of the differences, one should know what the estimated uncertainties on the data are. The averaging that has been performed on the MIPAS data for the period Sept. 2003 to Dec. 1, 2003 and for the latitudinal bands given in Table 3 has reduced the noise error seriously (by a factor of more than 30) which means, looking at figure 4, that the spectroscopic error is becoming the dominant (systematic) error source; the dominant random error sources are LOS and shift. So we are talking about errors of the order of 5 to more than 20 ppptv? Can you discuss somewhat better the significance and interpretation of the values found in Tables 2 and 3 ?

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 13627, 2007.