Atmos. Chem. Phys. Discuss., 10, C7378–C7381, 2010
www.atmos-chem-phys-discuss.net/10/C7378/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Formic acid above the Jungfraujoch during 1985–2007: observed variability, seasonality, but no long-term background evolution" *by* R. Zander et al.

R. Zander et al.

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Received and published: 10 September 2010

Dear Rudy,

I am impressed on the high-quality long-term time series of HCOOH over Jungfraujoch. I would like to bring to your attention that HCOOH global distributions have been inferred from MIPAS-Envisat data for the years 2002 to 2008 and have been published recently (see: Grutter, M., N. Glatthor, G. P. Stiller, H. Fischer, U. Grabowski, M. Höpfner, S. Kellmann, A. Linden, and T. von Clarmann (2010), Global distribution and variability

of formic acid as observed by MIPAS-ENVISAT, J. Geophys. Res., 115, D10303, doi:10.1029/2009JD012980;http://www.agu.org/pubs/crossref/2010/2009JD012980.shtml).

It might be interesting to you to see that MIPAS observes the seasonal cycle of HCOOH

in the Northern hemisphere as well; maximum values are found at about June with ∼100 pptv at 8 km altitude, minimum values at about December with ∼50 pptv at 8 km, both decreasing rapidly with altitude (we have used the same spectroscopic data as you for the MIPAS retrievals).

I thought you might wish to refer to the MIPAS observations in the revised version of your paper. The MIPAS data are publicly available at http://www.imk-asf.kit.edu/english/308.php and are at your disposal for further comparisons.

Kind regards,

Gabi Stiller

1 Reply to above comments.

[AC] The above referenced paper was published during the finalization of our manuscript, and we thank Gabriele Stiller for having brought it to our attention during the discussion process. Indeed, related HCOOH findings at Northern mid-latitudes fit well in relevant inter-comparisons reported in our Appendix 1. Consequently, the following elements will be inserted in our Discussion manuscript:

P. 14774, L. 22: after Gonzáles Abad et al., 2009, we shall add the reference 'Grutter et al., 2010'.

L. 25 will be rewritten as: . . . 'Here, however (and as was done in the last two referenced investigations), we adopted a new, improved set of spectroscopic parameters. . . '

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P. 14790, L.16: after Gonzáles Abad et al., 2009, we shall add the reference 'Grutter et al., 2010'.

Between P. 14797, L. 24 and P. 14798, L. 1, we shall insert the following text:

'We conclude this Appendix with a relevant HCOOH-related research published by Grutter et al. (2010) which deals with the global distribution and variability of formic acid in the upper troposphere. The HCOOH concentration profiles between 8 and 16 km altitude were derived from Earth's limb infrared emission spectra recorded between September 2002 and July 2008 with the MIPAS-ENVISAT (Michelson Interferometer for Passive Atmospheric Sounding-Environment Satellite) instrument (Fischer et al., 2008). As in the present work, Grutter et al. (2010) used the same HCOOH ν_6 Q-branch feature near 1105 cm^{-1}, as well as the new set of spectroscopic line parameters from Perrin and Vander Auwera (2007). Of relevance here is a subset of findings derived by Grutter et al. (2010; see their Figs. 2, 4 and 6) at 8 km altitude and longitudinally integrated over the 20-60^o North latitude zone, namely (i) their reported seasonal pattern, with largest HCOOH concentrations (typically 100-110 pptv) between May and August and minimum values (around 45 pptv) during Nov.-Dec.-Jan., which agrees very well in time with our mean findings (see Fig. 3); (ii) their related maximum to minimum ratio of 2, which contrasts with the ratio 4 found here (see Fig. 3 and Table 2); this difference very likely results from the predominance of HCOOH emissions at the ground and progressive dilution, deposition and lifetime increase during the convective transport to higher altitude; (iii) the lack of a significant diurnal variation in the MIPAS observations over the 8 to 16 km altitude range at Northern latitudes, while our Fig. 4 and Table 3 provide evidence for an overall maximum HCOOH loading around mid-day as compared to sunrise and sunset; here also, the altitude of the observations versus the distance from the main ground sources and the HCOOH lifetime variation (hours in the boundary layer and days in the upper troposphere) can account for these observed differences. Finally, the slope of the mean MIPAS profiles at Northern mid-latitudes confirms the soundness of our adopted altitude-dependent HCOOH a priori

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profile characterized in Sec. 2. c.'

P. 14799, L. 31: We shall inserted the following reference:

'Fischer, H., et al., MIPAS : An instrument for atmospheric and climate research, Atm. Chem. Phys., 8, 2151-2188, (2008).'

P. 14800, L. 22: We shall insert the following reference:

'Grutter, M., Glatthor, N., Stiller, G. P., Fischer, H., Grabowski, U., Höpfner, M., Kellmann, S., Linden, A., and von Clarmann, T, Global distribution and variability of formic acid as observed by MIPAS-ENVISAT, J. Geophys. Res., 115, D10303, doi:10.1029/2009JD012980, (2010).'

P. 14810, Table 4: The following MIPAS-related contributions will be inserted in Table 4:

MIPAS-ENVISAT subset: 20-60˚N longitude-integrated; Sept.2002-July 2008	Space-based IR limb emission 8 km	M-J-J-A max.: 105 **(160)** N-D-J min.: 45 **(42)**	Grutter et al., 2010.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 14771, 2010.