Atmos. Chem. Phys. Discuss., 15, C4828–C4832, 2015
www.atmos-chem-phys-discuss.net/15/C4828/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global HCFC-22 measurements with MIPAS: retrieval, validation, climatologies and trends" *by* M. Chirkov et al.

Anonymous Referee #2

Received and published: 13 July 2015

The paper by Chirkov et al. provides important information about HCFC-22 (CHClF2) data in the whole stratosphere and upper troposphere, as derived from MIPAS (Michelson Interferometer for Passive Atmospheric Soundings) global observations performed in the "reduced resolution mode" over a little more than 7 years, starting in January 2005. Several aspects are covered, from a brief description of the retrieval to the determination of the global distribution of HCFC-22 and the changes in its concentration with time and altitude over the available years.

Potentially, this is an important contribution for a "Montreal Protocol species" which is poorly sampled in the upper atmosphere, with global measurements only available from ACE-FTS since the loss of the Envisat satellite three years ago. The paper fits well with the scope of Atmospheric Chemistry and Physics but includes several annoying

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

imperfections which should have been corrected by the authors or spotted by the editor before submission or online publication. I would therefore recommend publication after some significant reorganization and rewording, also considering the suggested changes outlined or detailed below.

General comments

- The current title includes the words “climatologies” and “trends”. This clearly corresponds to two overstatements in a row for a data set covering 7 years or so. To avoid any misunderstanding, I recommend changing the title to something like “HCFC-22 measurements with MIPAS: retrieval, validation, global distribution and its evolution over 2005-2012”.

- This data set is very important for the scientific community. Beside the discussions, the current presentation is essentially restricted to a suite of (sometimes small!) color plots which will be of limited use to the interested reader. I would therefore strongly suggest to include the most important information in an electronic supplement, as done e.g. in Kellmann et al., ACP, 12, 2012. This supplement should at least include the underlying data used to build the color plots (starting Figure 10) and the time series of Fig. 16, allowing direct numerical comparison with model outputs, computation of “trends”. . .

- Figure 12 presents interesting results showing similarities with material published recently for other stratospheric tracers, i.e. in Nedoluha et al. (doi:10.5194/acp-15-6817-2015, see Fig. 10) and Mahieu et al. (doi:10.1038/nature13857, see Fig. 4). Wouldn’t this be helpful when addressing the “HCFC-22 unexplained relative trend”? A brief discussion putting these findings into perspective is welcome in section 5.5.

Specific comments

Please, also consider the following suggestions and corrections:

Page 14785-L7: the modeled spectrum is fitted to the observation, not the opposite!

ACPD
15, C4828–C4832, 2015

Change to ". . .fitting of the modelled spectra to measured limb spectral radiances".

Page 14786-L7: replace CHF2Cl by CHClF2 to conform to the IUPAC nomenclature of organic chemistry (i.e. here alphabetical ordering of the substituents).

Page 14786-L15: I believe that the IPCC assessment (the so-called "AR-5") should also be cited here.

Page 14786-L18: the correct word for 2007 is "Adjustment", not "Amendment". So update to "The 2007 Adjustment to the Protocol. . ."

Page 14787-L20: ground-based might be misleading here, I suggest "from surface long-term data records"

Sections 3 and 3.1: even if the information is available from the references you are citing, you need to mention here the actual line or cross-section parameters adopted in the MIPAS retrieval scheme for the target and interfering species!

Page 14790-L2: suggest changing to ". . .the sole contribution of HCFC-22 is shown in red."

Page 14790-L21: you are retrieving HCFC-22 from 7 years of observations, and the error budget provided in Table 1 corresponds to a single observation. How could this be? At the very least, we need to know if these numbers/figures are representative/typical, or correspond to a "best-case". E.g., do you see a significant scatter among the individual/per orbit error evaluations? This is also important in view of the comparisons with other instruments presented in section 4.

Section 4.1: here also, you have to mention the origin of the line parameters used for the ACE retrievals. Different line parameters could lead to systematic biases. A proper validation exercise requires this kind of information.

Section 4.3: Same remark as for sections 3.1 and 4.1 (spectroscopy). Also, the MIPAS, ACE and MkIV retrievals use dissimilar windows. What about the possible impact of

ACPD
15, C4828–C4832, 2015

these choices on the (validation) results? This should be quoted.

Page 14796-L25: change to “on a 1 km”.

Page 14796-L27: change to “Fort Sumner, NM”.

Section 4.4: The statistics of the comparisons (probably a word more appropriate than “validation” in the context of this paper) are extremely different. Only a handful MkIV or cryosampler flights are presented (btw involving MIPAS means. . .) when more than 8000 collocated measurements with ACE have been used! It is unclear to me whether this is properly accounted for in the concluding remarks of section 4.4.

Section 5.1: This section starts with a brief description of Figures 10 and 11. Then suddenly, on line 19, you discuss about the results of Fig. 14 (compare Fig. 14, but with what?) and of Figure 15 on next line. These figures have not been described nor introduced in the text and they are mentioned before Fig. 12 and 13. This needs to be seriously revamped, eventually involving a new ordering of the figures and/or sections.

Page 14799-L16: “compare Fig. 15, panel 2”, what do you mean here? Do we need to compare panel 2 with the other ones? With another figure of the present paper, or of another paper? Please specify.

Section 5.4: an alternative title might be “Comparisons between tropospheric and surface growth rates”.

Page 14804-L6: change to “do not reach the ground”.

Page 14816-L11: change CHCLF2 to CHClF2.

Figure 8: the two different green curves are hard to distinguish once printed.

Figure 9: are the thin curves on the lower panel identified in the legend?

Figure 15: the panels are really small, it would probably be preferable to arrange them as in Figure 13.

ACPD
15, C4828–C4832, 2015

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 14783, 2015.

ACPD

15, C4828–C4832, 2015