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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global Warming Potentials for the C_1-C_3 Hydrochlorofluorocarbons (HCFCs) Included in the Kigali Amendment to the Montreal Protocol" *by* Dimitrios K. Papanastasiou et al.

Anonymous Referee #3

Received and published: 2 March 2018

General comments:

The paper by Papanastasiou et al. provides estimates of lifetimes, ODPs, REs, GWPs and GTPs for a large number of HCFCs. The study is comprehensive and provides estimates that are very relevant for the recent Kigali Amendment to the Montreal Protocol. Although I recommend publication of the paper, there are some issues that need to be addressed first. Please see detailed comments below.

Specific comments:

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Discussion paper

Abstract: It would be good to include some of the results in the abstract. E.g., give the range of lifetimes and GWP 100-year values.

Page 1, line 23: "Reliable" is too strong in my opinion, considering that the difference from experimentally-derived values can be quite large for some compounds (as shown in Fig. S3).

Page 2, line 1-2: The sentence looked a bit strange to me. Perhaps better with "an exemption for countries with high ambient temperature"?

Page 2, line 17: Please change "global temperature potentials" to "global temperature change potentials" throughout the manuscript.

Introduction: There are hardly any references to previous work, although I know a lot of work has been done on the topic of calculating absorption spectra and resulting metrics. I do not ask for a review of previous work, but some introduction to the topic on calculated vs. experimental spectra should be included. I also suggest to add references to GWP, ODP and GTP on first use, as all readers may not be familiar with all the terms.

Table 1: Where is the IR absorption spectrum for HCFC-123a from? For many of the compounds, absorption spectra are available from several sources (see Table 4 in Hodnebrog et al., 2013). What is the reason for using absorption spectra from (in most cases) only one of the sources? Would be good to briefly state that. Also, in footnote 2 the terms lifetime-adjustment and stratospheric temperature correction have not been defined and could therefore seem confusing for readers not familiar with these. I suggest referring to the appropriate method section where these terms are explained.

Page 5, line 4: As I understand it, these are comparisons to experimental data. I suggest changing to "... for the training dataset with experimental rate coefficients...", just to make that clear.

Page 7, line 14-16: Is this shown somewhere? If not, adding "(not shown)" to the end of the sentence would be clarifying.

Page 8, line 5-6: Differences look larger than 2% in Fig. 3, especially for the band around 1100-1200 cm-1.

Figure 3: It would be much easier to compare the calculated vs. experimental spectra if they were in the same plot.

Page 10, line 9-11: Perhaps I missed something, but is it shown somewhere that the broadening leads to better agreement with experimental HCFC spectra? As I interpret Fig. 5, it only shows the difference with and without the broadening and not comparison to experimental data.

Page 10, line 23: I cannot see that Figure 5 includes all HCFCs studied, when compared to Table 2.

Figure 5: I think there is something wrong with the labeling above the plots - compounds HCFC-224 to HCFC-233 are listed twice. A minor point is that it would be more natural to switch the order of the plots, since the broadening sensitivity is discussed first.

Page 11, line 15: Could you include "(see Section 5)" at the end of the sentence? I started looking for the datasheets in the supplementary information without finding it, before I realized these were only available on a web site.

Page 11, line 20: Isn't the IntRF_CO2(T) the integrated radiative forcing of CO2? Also, M_HCFC in the formula is not defined, I think.

Page 11, line 24-25: In my opinion, Figure S3 is important enough to be in the main manuscript instead of the supplementary. In addition it would be good with a table or figure comparing the calculated REs with those from the training dataset.

Page 11, line 29-31: The section on GTP is very short. I suggest to merge it with

section 2.5?

Page 14, line 18-19: Where is the comparison of REs between calculated and experimental section shown?

Table 2: I suggest stating that the range in GWP100 values is due to different isomers, so that the range is not misinterpreted as uncertainty due to the method.

Technical corrections:

Page 11, line 21: "as described above" -> "as described in Section 2.1" ?

Page 12, line 2: "stratosphere-adjusted" -> "stratospheric temperature adjusted"

Page 15, line 15: "didn't" -> "did not"

Supplementary Fig. S1: "Burkholder et al." is listed twice in the caption.

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