

Reply to the reviewer 1's comment

We thank the reviewer for their suggestions and comments, which has improved the quality of our manuscript. The manuscript has been rechecked and the necessary changes have been made in accordance with the reviewer's suggestions. The responses to all comments are given below. Our replies are indicated in red font.

Reviewer #1: This paper reports the results of what appears to have been a careful study of the IR absorption spectra and radiative efficiencies of (CF₃)₂CFCN, CF₃OCFCF₂, and CF₃OCF₂CF₃. As a control experiment the radiative efficiencies of CF₄, SF₆, and NF₃ were measured and shown to be consistent with the accepted literature values. The results reported in the paper are novel and interesting and merit publication, however, the paper is difficult to read in many places and major changes are needed to improve its legibility. Proof reading by a native English speaker would be helpful. I recommend publication after the authors have addressed the comments below.

- Thank you for your comments. Regarding the English writing, we had our manuscript proofread by a native speaker.

(1) The title needs more thought. Is "Measurement Report" needed? Also, given that the absorption spectrum measurements on which the radiative efficiencies are calculated were made at 2 cm⁻¹ resolution, the claim that radiative efficiency estimates are provided using "high-resolution" FTIR spectroscopy is not entirely accurate. I suggest a simpler and more direct title such as "Radiative efficiencies of (CF₃)₂CFCN, CF₃OCFCF₂, and CF₃OCF₂CF₃".

- We agree with the reviewer about using a simpler title. However, this manuscript is intended to be published as a measurement report. Thus, the manuscript title must start with "Measurement Report:" as this is a requirement of the ACP journal (https://www.atmospheric-chemistry-and-physics.net/about/manuscript_types.html). However, following the rest of the reviewer's suggestions, we have changed the title to "Measurement Report: Radiative Efficiencies of (CF₃)₂CFCN, CF₃OCFCF₂, and CF₃OCF₂CF₃."

(2) There is an excessive use of acronyms which makes the paper difficult to read. Some acronyms are obviously needed, but the authors use so many that it is distracting and confusing. I suggest that about half of the acronyms should be removed. As an example, in the abstract and throughout we don't need ACS, HR-FTIR, RC, and CC.

- Thank you for your comment. We have removed the acronyms as suggested.

Specific comments:

(3) Line 24 and throughout, replace "classic GHGs" with "well-studied GHGs".

- We have replaced the term as suggested.

(4) Line 31, "Radiative efficiency (RE) enables the quantification of variations in radiative forcing (RF) ..." doesn't make sense and needs rephrasing.

- Thank you for your comment. We have rephrased the sentence from "Radiative efficiency (RE) enables the quantification of variations in radiative forcing (RF), which is the change in thermal energy flux in the atmosphere caused by a change in the unit concentration of a single greenhouse gas (GHG)" to: "Radiative efficiency (RE) is a measure of the radiative forcing for a unit change in the atmospheric concentration of a single greenhouse gas (GHG)."

(5) Line 33-34, "The pulsed 'unit emission' of a GHG exhibits a timely reduction in the incoming thermal energy flux based on the AL" doesn't make sense and needs rephrasing.

- Thank you for your comment. We have rephrased the corresponding sentence to: "The concentration of a GHG shows a timely reduction according to its atmospheric lifetime, which also reduces the thermal energy flux"

(6) Line 35, "Integrating the RE-adjusted time-varying RF in a designated time horizon yields the global warming

potential (GWP)” is incorrect. The authors should stick with accepted definitions. For example, based on section 5.2.1 of the 2010 WMO Ozone Assessment report (<https://csl.noaa.gov/assessments/ozone/2010/>) the text could read “Integrating the radiative forcing over a designated time horizon yields the absolute global warming potential which has units of $W\ m^{-2}\ kg^{-1}\ yr$. To compare the relative integrated effect of various compounds on climate, the global warming (GWP) metric was developed. The GWP is the ratio of the absolute global warming potential of a gas to the absolute global warming potential of CO_2 , over the same time horizon, and is unitless.”

- We agree with your comment. The sentence was corrected according to the reviewer’s suggestions.

(7) Lines 40-50, the discussion of “errors” associated with the GWP metric is misleading and exaggerated. While it is certainly true that there are limitations in the GWP metric, and there are discussions on how and where it is most appropriate to use GWP values, there are no intrinsic errors in the GWP metric. There are uncertainties in GWP values which reflect uncertainties in the inputs in the calculations. The authors do make a valid point that it’s important to have accurate measurements of absorption spectra and this is the focus of their paper.

- Thank you for your comment. We agree that there is no "intrinsic" error in the GWP metric. In this sentence, we intended to convey that the inaccurate determination or measurement of input parameters for the GWP, such as atmospheric lifetime and radiative efficiency (starting from absorption spectra measurement in the lab), lead to the "arising" error in the GWP metric. Therefore, we have revised our sentence from “as a means of eliminating the intrinsic error in the GWP assessment, the uncertainty in the GWP measurement has gained increasing attention” to: “Therefore, the uncertainty in the measurement of GWP has gained attention as a focus area for improving the accuracy of the GWP.”

(8) Line 47, the “Andersen et al.” reference cited in the text is not in the list of references. I think this should be “Sulbaek Andersen et al.”.

- We have corrected the sentence as suggested.

(9) Line 66, the sentence “High-resolution Fourier transform infrared spectrometer (HR-FTIR, Bruker IFS 125HR) dedicated entire measurement procedure” needs to be rewritten.

- We have revised the sentence to: “High-resolution Fourier transform infrared spectrometer (Bruker IFS 125HR) was used throughout the measurement procedure.”

(10) Line 281, the text “The RE values of SF_6 , CF_4 , and NF_3 were revised using the proposed method, ...” is confusing and should be changed to “To check the methods used in the present work the radiative efficiencies of SF_6 , CF_4 , and NF_3 were calculated and compared to literature values.”

- We agree with your comment. The sentence was corrected according to the reviewer’s suggestion.

(11) Line 308, replace “deviate” with “differ”.

- The word was replaced as suggested.

(12) Lines 355-262, the discussion of “second consideration” and “third contributing uncertainty” are confusing when there’s no first consideration or first or second uncertainty that are mentioned. Please harmonize the text.

- Thank you for your comment. We have changed “second consideration” to “another consideration.” We have also changed “third contributing uncertainty” to “One of the uncertainty sources that we are able to control is the responsivity drift of the FTIR spectrometer.”