

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-857

Anonymous Referee #2

Referee comment on "Global emissions of perfluorocyclobutane (PFC-318, $c\text{-C}_4\text{F}_8$) resulting from the use of hydrochlorofluorocarbon-22 (HCFC-22) feedstock to produce polytetrafluoroethylene (PTFE) and related fluorochemicals" by Jens Mühle et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-857-RC1>, 2021

Rev of ACP-2021-857

Jens Muhle

This manuscript reports a decade of measurements of perfluorocyclobutane ($c\text{-C}_4\text{F}_8$) from the remote AGAGE sites. $c\text{-C}_4\text{F}_8$ is a long-lived potentially important greenhouse gas. The measurements accurately define emissions, indicating they are clearly northern hemisphere and correlated with the production of HCFC-22. The analysis shows that $c\text{-C}_4\text{F}_8$ is a likely by-product and from the observations they calculate an emission factor. The authors argue that better process management could reduce these fugitive emissions, which are much larger than the direct intentional production reported to the UNFCCC. This work is an important extension to the Mühle et al. (2019) work on this gas.

The manuscript is well written (except see below) and provides a valuable contribution to our understanding of the synthetic greenhouse gases and their potential role in climate change. The authors need to focus more on what is new here and not confuse with A5, non-A5, and China (3 different entities?). Further, the data archive must be upgraded before publication.

L30 – Glad to see a clear chemical definition, noting the range of names used to describe $c\text{-C}_4\text{F}_8$.

L84 – Can you comment on whether the pollution events that were removed contained high levels of $c\text{-C}_4\text{F}_8$? Thus indicating nearby production? Which stations? This might be

useful.

L120 – It would be good to include the black diamonds in Fig 2 in the legend, making it clear that they are the global c-C4F8 emissions. BTW, is it clear that China is neither A5 nor non-A5? Is it being double counted here and in the Table? This is confusing.

L135 – I do not understand the effort at linear fitting in Fig. 3. It is confusing. The TOTAL (green) fit makes some sense, presumably implying a source of ~0.14 Gg/y that is from non-HCFC-22 sources, and your yield of 0.31% (kg/kg). The blue fit of global to only A5 emissions does not make sense. The explanation in L126-155 does not help. Why do you come up with an emission factor assuming that only A5 countries have processes that emit c-C4F8. If this is the case, then why fit to global? Please introduce the logic of this approach if you think it relevant.

L174ff – Again, this is confusing with the separation of China and comparing it the A5 and non-A5. Discussing China, and then eastern China is more confusing as to what is measured and what is known.

L181-201 – This conclusion section is again very confusing for this reviewer. It mixes discussion of the processes in great detail with the regions. It brings in A5 and non-A5 and then discussions Eastern China, China, and Russia, without any understanding as to why these are important. I think the authors want to emphasize the Muhle et al (2019) regional attribution with this global one. I would de-emphasize the previously published work and focus on the A5 and non-A5. Then separately discuss China if you want but do not confuse with the A5 and non-A5 modeling here.

L202-206 – This is a clear summary, the above is confusing.

*L210 – I am afraid that the data availability is really inadequate and so 'old'. You must post on a DOI the datasets used here, particularly Table 1 and Figures 2 and 3 so that others can compare readily with this work. While AGAGE seems to live forever, it is not appropriate to list you data from a non-ODI source like your own website. Please use a regular doi, I am that MIT must have one.