

Review of: "Revisiting the challenges of ozone depletion from a prospective LCA perspective"

Cameron Rae

Potential competing interests: No potential competing interests to declare.

Overall, it was an interesting read, well-written, easy to follow. A few figures and citations could go a long way!

The introduction & methodology were good, I'd only say that "LCA" & "ODP" are defined multiple times in the introduction, and also echo that UN Environment Programme is usually abbreviated UNEP - though these are merely aesthetic issues in my eyes.

A sufficient number of examples are presented in 3.1 to demonstrate the overestimation of ODP in current databases, though I think if these examples could be compiled into a figure or timeline that shows the example overestimations, it would add considerable value to illustrating the point stated in the abstract that "It was found that the phase-out of ODS due to the Montreal Protocol is currently not well represented in background databases, potentially resulting in large overestimations of the ODP by banned substances."

In section 3.4, the first paragraph states "Since the Kigali amendment of 2016, these HFCs are also being phased out, although with a longer timeline than the CFCs", I think a quick comment on the relative atmospheric lifetimes of the different species (e.g. HFCs, CFCs, N₂O, aerosols) would add context to the situation, given they all have different timelines for emission/ reduction estimates as well as different ODPs.

The second paragraph in 3.4 states "Another link is related to CO₂ and CH₄ emissions, which increase climate change, but decrease ozone depletion due to stratospheric cooling, which alters ozone chemistry kinetics." For a well-mixed gas such as CO₂, the induced stratospheric cooling might have differing regional effects on ozone concentrations- a significant amount of historical ozone depletion in the lower stratosphere at higher latitudes is from surface reactions on polar stratospheric clouds, which may form when stratospheric temperatures drop below the threshold for nitric acid condensation around 195K (e.g. Solomon [1999], particularly section 3 of that article: "Heterogeneous Chemistry Under Cold Conditions: The Antarctic Ozone Hole").

For the rest of 3.4, I think it would add a lot of value to the article to include figures and/or more citations, for example "Climate change also accelerates the Brewer-Dobson circulation and stratosphere-to-troposphere transport of ozone. This is the most likely explanation as to why no significant ozone layer recovery has been observed at mid-latitudes, despite the decrease in ODS emissions." or later on "However, certain HFOs are converted to trifluoroacetic acid (TFA) in the atmosphere, which is a toxic substance." The other subsections in section 3 are littered with citations to follow up with, which is good, and 3.4 should be no different than the rest of this section.

In section 4, if the statement of “Finally, a future development is the inclusion of CFs for stratospheric aerosols in life cycle impact assessment methods.” could be reconciled with the statement from 3.2 “Consequently, deriving CFs for aerosols is likely not yet feasible.” I think a quick comment on how this could be feasible, or about what issues remain as obstacles to achieving this, would add significant value here. The outlook and conclusions look good.

References:

Solomon, S. (1999), Stratospheric ozone depletion: A review of concepts and history, *Rev. Geophys.*, 37(3), 275– 316, doi:[10.1029/1999RG900008](https://doi.org/10.1029/1999RG900008).