

Review of “Warming effects of reduced sulfur emissions from shipping”
Yoshita et al.

The authors report on the warming observed in a global climate model when regulated reductions in sulfur emissions from shipping are prescribed. These reductions are compared against “business as usual” sulfur emissions, showing a global mean average warming of 0.04 K and interesting regional differences in radiative forcing and temperature responses. Regional differences were partly attributed to dynamic changes to atmospheric circulation and precipitation patterns. Overall, the paper is well-written and provides an interesting investigation into the radiative response of changing global aerosol emissions in a global climate model and its implications for future warming. The paper is well suited for ACP and I have only a few comments to be addressed in a minor revision.

- Introduction, Lines 33-35: I think an appropriate reference to work on “invisible ship tracks” could be included here, see (Manshausen et al., 2022).
- General figure comment: the authors should add letters to plots that have multiple panels so they can be clearly identified and referenced in the main text. There are many such instances where data in a specific panel is referenced, but the reader is required to hunt for that panel because it is not specified (see some specifics in the following comments).
- Line 103: Are you missing the citations Sellar et al. (2019) and Senior et al. (2020)? I don’t see these citations in the reference list.
- Continuing the point in the previous comment, I am particularly interested in how the baseline simulations and PI temperatures were estimated. Can the authors please speak more to these simulations, the uncertainty, and their comparison to other CMIP6 historic simulations (and correct the citations)?
- Line 115: The citation Ghan (2013) is not provided in the reference list. Given that the ERF is a key feature of this paper, I ask that the authors please provide this citation and explain the methodology used.
- Line 120: “The spatial pattern of changes in sulfate burden largely follows the pattern of emissions...” please reference Fig. 1c at the end of this statement.
- Line 134: “...consistent with the reduced sulfur emission in Figure 1...” please reference panel c of Fig. 1.
- Line 151: “...correspond to the regions with relatively strong positive ERFs.” Please reference Fig. 3.
- Line 183: “Seasonally, the warming...” After looking at Figure 6 for several moments, I finally noticed that the left ordinate has different maximum limits for

each panel. Is there a specific reason this was done? Further to that point, the authors argue that the warming is “larger and more significant” in NH summer than winter. For this statement, the seasonal difference in warming should be quantified in magnitude and with statistical significance. Are the authors able to attribute the difference to specific processes? Does the seasonal difference relate at all to the change in circulation/precipitation patterns discussed earlier in this section?

- Line 209-211: This statement about “climate responses to other step changes in forcings” is rather vague. Can the authors please provide clarify with a few examples of such changes/responses with citation?

References

Manshausen, P., Watson-Parris, D., Christensen, M., Jalkanen, J., & Stier, P. (2022). Invisible ship tracks show large cloud sensitivity to aerosol. *Nature*, 610(7930), 101-+. Article.