

We appreciate the additional feedback from Alexander Archibald. Below we provide point-by-point responses (in red) to the reviewer's comments (reproduced in black italics), with manuscript modifications in **bold**.

Further points to make clearer/elaborate on in the conclusions:

1) Figure 1. I am still puzzled as to how there are such large and significant tas changes in small regions over land. I mean here the changes over South America, Africa, North America and China. The authors have stated "the localized mechanisms behind these changes are not clear and will be investigated in future studies" and I would really urge that. I just don't get how such a significant response can be generated from VOC chemistry and I think it would be useful if the authors expand in the conclusions in how they could determine the localized mechanisms and or how important the results of Figure 1 are to the topic under study?

Thank you, we agree that this topic is deserving of further study, and we have added the following text to the Conclusions to emphasize this (lines 659-664):

“While we explored the mechanisms of the large-scale temperature changes, our simulations also show significant localized temperature changes over land. The reasons for these localized changes are unclear, and this is an important topic for follow-up study. Such investigation would require analysis of regional changes in shortwave, longwave and dynamical heating, going beyond our zonally averaged analysis of these quantities.”

2) Experiment design. The authors have tried to focus on VOC effects on climate and I really do love this. But this is a can of worms in my mind. Figure A2 underscores that there are significant ozone differences that are present in the models. If we want to attribute the role of VOCs would we not be better if we could do that by fixing the ozone too? Otherwise are we not looking at the climate response to different ozone fields? How much of the spread in ozone is due to the VOC chemistry and how much is due to other differences in the model set up? Again, I think a further comment on how experiments could be designed to better investigate these issues in the future would be very valuable.

Thank you for this feedback. Our analysis showed evidence that ozone changes likely do not drive the climate response, as the strong warming in the Southern Polar Stratosphere (SPS) is mostly driven by dynamical heating. Nonetheless, in future studies, it is worth doing controlled experiments with prescribed ozone to confirm that the ozone changes do not have a strong climate effect. Furthermore, the ozone changes are interesting in their own right and deserving of further study. We have added text to this effect in the Conclusions (lines 681-685).