Review #1

In this opinion paper, Martin and colleagues summarize the outcome of a survey conducted in preparation for a SOOS/OCEAN:ICE Workshop, aiming to highlight research priorities by the modeling community ahead of Antarctica InSync and the IPY.

While the results of the survey are certainly useful and worth publishing, the respondent group is very likely skewed towards physical ocean and ice scientists. The authors acknowledge this, but I think this could be highlighted even more for increased transparency (e.g., in the abstract). The fact that certain marine biogeochemical and atmospheric processes are not ranked high amongst suggested research priorities does probably reflect the group of respondents more than being a true reflection of what the whole polar scientist community thinks. While the ad hoc survey design and advertisement likely affect the robustness of the results, the authors report on the survey outcomes, as much as possible, in a balanced and objective way.

Overall, the paper is well written, and I have only minor comments, see below. As a result, I can recommend publication as an opinion paper once my comments below have been addressed.

Thank you very much for your kind and helpful feedback. In revising our manuscript we will carefully implement the suggested improvements.

Main comments:

My only main suggestion to the authors is to consider adding an appendix to the paper to include the exact questions and answer options given in the survey. I acknowledge that the authors make these available in the cited Zenodo repository, but I think not every reader would go there to check. While reading the paper, I found myself wondering about the exact wording of questions and answers multiple times, and I think making these more readily available would help the reader.

We will add the original questionnaire text either as appendix or supplementary material to make it more accessible.

Specific comments:

L. 21-29: In my opinion, the abstract would benefit from more explicitly mentioning that the survey results are most robust for the physical ocean-ice sciences. While I appreciate the way in which authors acknowledge throughout the text the shortcomings related to survey design and/or expertise of the respondents, I think it would be more honest if the abstract made it clear that biogeochemists, ecologists, and atmospheric scientists were likely underrepresented. In a way, the same applies for the title, which makes the opinion piece sound more comprehensive than it truly can be, given the group of respondents.

This is a valid point. The focus on physical ocean-ice science was unintended and, in hindsight, is simply owed to the biased selection of the questionnaire authors. We acknowledge this in the abstract now: "While this initiative was tailored mostly towards physical ocean and ice modelling, its outcome specifically supports …".

We refrain from changing the study title, however, because we still think the invitation for participation in the survey was shared widely enough for other communities to participate in the survey—the results do reflect such participation though in smaller numbers—and to keep an obvious connection to the survey title.

L. 34: I suggest starting a new sentence: "Ocean heat is a major…"

agreed

L. 56: "[…] the *physical* ocean modeling community" ?

Yes, it is true that physical oceanography was the focus. Good suggestion to state this clearly here.

L. 57ff: I didn't fully understand what to make of this sentence. Why "initially"? Can you elaborate in the text on why and how you changed your approach, e.g., in advertising the survey? Or did you decide to be more inclusive once you started receiving responses to the survey, realizing that modelers using a wider variety of tools answered the questions? Some clarification and/or rephrasing could help here.

Valid remark. We decided to rearrange the entire paragraph to more clearly state the intention and focus of the survey but also its shortcomings.

"The survey was designed with primarily the physical ocean modeling community in mind and thus pre-defined answers often highlight physical oceanographic processes (see Appendix). Although leaning towards such processes, coupled interactions with other components of the climate system, such as sea ice, ice shelves, and the atmosphere were considered as well. Contributions related to biogeochemical processes and ecosystem modeling were also encouraged though not covered comprehensively. It turns out that a more careful selection of the pre-defined answers would have been advantageous and likely beneficial for a broader coverage of these coupled processes. Relatively little use was made of the free text option "Other" by the respondents. Similarly, the survey started out with an emphasis on probing modelling groups using realistic regional Southern Ocean configurations and CMIP-class global climate and Earth system models to study the historical period and maybe 21st century projections. However, it evolved into covering a much broader range of spatial and temporal scales, and model complexities, for which the respondents did make use of the free text comment fields. For pragmatic reasons, we limited the geographical region and defined the Southern Ocean as the area south of approximately 50°S in the survey context."

L. 75: delete "modeling" (or something else is missing)

good catch, thank you

L. 100: This is where I first started to wonder what the responses were offered (see main comment above): only "oceanographer" or was the specification of sub-disciplines possible? Do you have any insights into how many of the respondents do not identify as physical oceanographers but biological or chemical ones?

No, unfortunately we do not have such granular information. Again, a shortcoming of the survey design and certainly part of the experience we take away from this exercise. We have added a few lines on this to the conclusion section hopefully being of guidance to similar future initiatives.

"There are also some experiences to take away from this exercise, in particular how the pool of respondents shapes the usefulness of the survey, how to ask targeted questions without being exclusive, how pre-defined multiple-choice answers simplify the analysis but reduce the variety of responses, and which metainformation really is instrumental for interpreting the responses. All of this is well known and demonstrates the importance to involve experts on questionnaire design rather than constructing an ad-hoc survey. Nevertheless, the feedback by the community to our survey has been very positive indicating that such surveys can be a valuable tool for future international program planning."