Review #3

In this opinion piece, Martin et al. summarize the outcome from a questionnaire on Southern Ocean modelling biases and needs that was answered by by of group of about 100 modellers, about half of them identifying as oceanographers, the rest modelling some other sub-field of the Antarctic and Southern Ocean climate system.

Aim of the questionnaire was to get an idea of what are considered the most pressing questions in Southern Ocean research by modellers with the purpose to bring that perspective early on into the upcoming IPY and Antarctica InSync programs, and to better align observational and modelling efforts.

With a fairly high turnout of responses to the questionnaire and a range of specific modelling sub-communities involved, the opinion piece is certainly helpful for that purpose, although the authors do mention that a few modelling communities are under-represented in the answers.

In their analysis of the answers given, the authors discuss that a large fraction of the questionnaires mentions processes occurring on the shelves, such as the representation of shelf-ice cavities, and open ocean convection as two processes requiring more attention in model development and evaluation. Many of these are connected with improving parameterizations of processes in cavities, scale-aware mixing modelling, or of topographic overflows.

Concerning the scientific focus, the authors note that many of the respondents mentioned the role of the Southern Ocean for heat, freshwater, and carbon budgets, i.e. in some way or another the role of the Southern Ocean in the climate system. They mention that processes shaping the oceanic processes themselves, such as an understanding of the circulation are not mentioned as part of the big questions anymore.

Concerning the observational needs by the community, the authors note somewhat of a disconnect between the stated use of mostly gridded data sets like the World Ocean Atlas, and a desire for more direct in-situ observations. The authors interpret this as a need for using in-situ data for better process understanding, while gridded products are preferred for model evaluation, despite their larger distance from 'real' observations. This is an interesting point.

It is important to note that the manuscript not only presents the outcome of the questionnaire but in each of the three main points adds some perspective from the authors of the opinion piece themselves. In the parts on the scientific focus this consists in adding aspects that the authors find important (so do I) but that haven't been mentioned. In other parts (especially on data requirements) it is somewhat unclear what is output from the questionnaire and what is the author’s opinion. So, while overall the analysis done in this opinion piece is quite helpful for the stated aims of aligning modelling and observational efforts, I feel that there should be a somewhat better separation in writing between the presentation of and the comments and opinions of the authors. This should be fairly easy to correct.

Thank you for this generally positive assessment regarding the usefulness of our study. In revising the manuscript we have addressed your remarks and concerns. For instance, we acknowledge now in the abstract already the participation bias towards the physical ice-ocean modelling community. Regarding the “big questions” we have rephrased the respective sentence to clarify that the processes less prominently mentioned still play a role in nowadays grand challenges. We also revised and extended the discussion of in-situ observations and gridded products, noting that the former are a crucial contribution to the gridded products. We also acknowledge now that this is known to the community and that emphasizing the need for more in-situ data could point at a wish for more process understanding but could also be interpreted as an appreciation of in-situ data forming the basis of gridded data products. This alternative interpretation is now included. Overall, we have tried

to include wording (“we think”, “we believe”, “we suggest”, etc.) that helps to separate survey results from author interpretations.