Review of revised version of “Modeling the effect of Ross Ice Shelf melting on the Southern Ocean in quasi-equilibrium” by Xiying Liu.

Ryan Walker
8 August 2018

The revised version has been greatly improved from the original, and is now very clear and much more interesting. I thus have only a few suggestions to offer.

I originally commented about the (at least to me) unusual choice to compare model experiments with full sub-ice shelf thermodynamics and bathymetry to a scenario with bathymetry but no sub-ice shelf melting instead of to a scenario where ice shelves are entirely excluded.

Your response is very interesting, as I generally work on understanding the interplay between ocean thermodynamics and ice shelf/stream dynamics, but haven’t thought too much about the cavities influencing large-scale ocean dynamics solely through their geometry/bathymetry. I haven’t seen any other modeling that attempts to separate thermodynamic effects from purely bathymetric effects, and I think this idea is a good contribution, especially given what you’ve said about the bathymetry as a larger influence on the circulation. Comparison between two effects that are real can be more interesting than comparison with a scenario (no ice shelves) that is a model deficiency rather than a physical process.

However, I don’t see this explanation written in the revised manuscript. I think a paragraph (probably in section 2) outlining the reasons for your choice of experiments to present would be useful to many or most readers. It would be beyond the scope of this short, well-focused paper to also present your experiments with ice shelves excluded. But a few comments (and maybe a supplemental figure if you want) regarding your preliminary work should help to clarify things.

Other comments:

Section 1, Line 14) Cut “The” at start of sentence.
Section 1, Line 17) Better to write the melt rate in meters per year for consistency with the rest of the manuscript.
Section 3.1/Figure 2) Could you comment on the spatial distribution of the seasonal cycle in your experiments, and what the likely causes are? From earlier work that I’m familiar with, I’d expect that it would be changes in warm currents near the ice front, but I’m curious what you got.
Figure 5) This color scale is much easier to read than the original, but maybe point out in the caption that the intervals are uneven.
Section 3.2, Line 5) Be clear that you’re linearizing the equation of state here.
Figure 7) I think subplot (a) needs its own color bar.