The Cryosphere Discuss.,
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Interactive comment on "Brief communication: A submarine wall protecting the Amundsen Sea intensifies melting of neighboring ice shelves" *by* Özgür Gürses et al.

Anonymous Referee #2

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1 Summary:

This paper is a direct response to one of the geoengineering solutions presented in Moore et al 2018. The authors use a global ocean model to determine how an engineered submarine wall in the Amundsen Sea might affect the integrated basal melt rate of Antarctic ice shelves. They find that, as deep warm water is prevented from entering the ice shelf cavities of the Amundsen Sea, basal melt rates in other locations are increased. The net effect of the submarine wall is an integrated 10% decrease in basal melt from a control case.

2 Recommendation:

This paper is timely and well-written. It provides a concise response to an earlier publication (Moore et al 2018), and illustrates one specific aspect of the complexity of geoengineering problems. Namely, that if heat is blocked from melting certain ice shelves, it may well go elsewhere and cause additional problems. There are many ways this paper could be expanded, however, the authors have done well in isolating and investigating a specific problem and containing it to a brief comment. I recommend publication after a few minor modifications.

3 General comments:

I strongly encourage the authors to make the data used for this paper freely available online. Ideally, this would include model source code, forcing files, and code used for analysis. At the least, the authors should deposit a subset of model output used for the calculations in a repository such as Zenodo.

There are several interesting points of discussion the authors do not address. As this paper is a direct comment on Moore et al 2018, it is up to the authors if they want to include further speculation. Here I list several of these points, for both the authors and the broader community to consider:

- Where does the heat go? If the integrated basal melting loss around Antarctica is 10% lower in the WALL experiment, the heat that would have caused melt must be somewhere else. Is it still in the ocean (and what part), transferred to the atmosphere or to sea ice melt, or somewhere else?
- The model uses forcing for present day conditions. Under future warming scenarios, would the WALL experiment cause more or less integrated basal melt?

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Discussion paper

- Both this paper and Moore et al 2018 focus on sea level rise and investigate geoengineering possibilities that may also affect aspects of the climate outside of sea level. In this case of a wall, oceanic heat is redistributed and water circulation in ice shelf cavities in the Amundsen Sea is reduced. This has implications for the local ecosystem that is controlled by ice shelf cavity circulation (e.g., St. Laurent et al 2017). It would be useful to note that geoengineered 'solutions' to sea level rise affect more than just the target area or problem, as the climate system is not separable into individual pieces.

4 Line comments:

Line 58-60 - It would be useful here to know that the WALL in your simulations does not match the wall in Moore et al 2018. Option to include a brief discussion why, or refer the reader to a later section.

Line 81 - Remove the fraction; use only the 85% value

Line 135+ - A portion of the references are redundant.

5 References:

Moore, J. C., Gladstone, R., Zwinger, T., Wolovick, M. (2018). Geoengineer polar glaciers to slow sea-level rise. Nature, 555(7696), 303-305.

St-Laurent, P., P. L. Yager, R. M. Sherrell, S. E. Stammerjohn, and M. S. Dinniman (2017), Pathways and supply of dissolved iron in the Amundsen Sea (Antarctica), J. Geophys. Res. Oceans, 122, 7135–7162, doi:10.1002/2017JC013162.

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