"Investigating future changes in the volume budget of the Arctic sea ice in a coupled climate model" by Ann Keen and Ed Blockley

Response to Editor (in blue)

Comments to the Author:
Dear Ann, dear Ed,

thanks again for submitting this work to The Cryosphere. I am happy to now accept it for publication.

In reading the final version, I noted however to instances where an additional clarification would be helpful. Please consider including one or two sentences for the following to items:

1. Given that most climate models output the "equivalent ice thickness" (Hibler, 1979), which is the grid-cell average thickness of the ice including the zero-ice thickness of any open water in that cell, I would find it helpful to clarify that your "effective ice thickness" is the real ice thickness not including any contribution from open water.

2. Frazil ice:It might be helpful to clarify how the frazil ice contributes to the thickness of the existing ice. This is because one would usually expect a higher ice growth per unit area of open water than per unit area of existing ice, so one would expect a higher ice growth of frazil than of basal ice. I assume that the total growth of frazil ice is indeed higher in the model, but is than converted into ice-thickness change by averaging the frazil-ice growth over the area of the ice-covered part of the grid cell. This should be explained.

Thanks again for submitting this work, which will nicely inform upcoming papers based on hopefully widespread CMIP6 SIMIP output!

All the best, and have a good summer,

Dirk

Response from Authors:

Dear Dirk,

Thank you for your suggestions, which we have addressed as follows:

1) We have altered the text to clarify that our effective ice thickness is the total volume of ice within the domain of interest, divided by the area of the domain (also including the impact of any overlying snow).

2) We have added some text to clarify how our model deals with the frazil ice formation.

We hope these changes do make things clearer.

Thank you for your work as Editor of our manuscript, and we look forward to the new opportunities offered by the CMIP6 SIMIP data.

Wishing you also a good summer,

Ann and Ed.