

The Cryosphere Discuss., referee comment RC1
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Comment on tc-2021-353

Anonymous Referee #1

Referee comment on "Seasonal Sea Ice Prediction with the CICE Model and Positive Impact of CryoSat-2 Ice Thickness Initialization" by Shan Sun and Amy Solomon, The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-353-RC1>, 2022

This manuscript analyzes impacts on sea ice thickness initialization on the simulation of sea ice extent and sea ice volume with the Los Alamos sea ice model (CICE) by comparing two sets of experiments initialized from the Climate Forecast System Reanalysis (CFSR) and CryoSat-2 satellite observations. The analysis of the experiments confirms results from earlier studies on initial sea ice thickness impacts on seasonal sea ice predictions. The manuscript is well structured and presentation of the results is reasonably clear. I would recommend acceptance of this manuscript for publication with a few minor revisions as listed below.

- Lines 30-32: Suggest adding Collow's study to the citation. The work by Collow et al. (2015) is one of the earliest studies specifically on the need for improved sea ice thickness initial conditions. (Collow, T. W., W. Wang, A. Kumar, and J. Zhang, 2015: Improving Arctic sea ice prediction using PIOMAS initial sea ice thickness in a coupled ocean-atmosphere model. *Mon. Wea. Rev.*, 143, 4618-4630. DOI: 10.1175/MWR-D-15-0097.1).
- Line 41: Suggest indicating that the UFS is to be the next NOAA's operational coupled atmosphere-ocean-sea ice-land system for S2S predictions.
- Fig. 1: Reduce thickness of the curves so the differences can be seen more clearly.
- Lines 84-84; "The 12 once-per-month runs in 2014 are shown here as an example, as year to year variations are relatively small". Does this mean the amplitude of interannual variations is smaller than that of model errors?
- Lines 87-89: "The Arctic SIE forecast matches observations better in the warm season than in the cold season at all lead times, and a positive SIE bias is seen in the cold season. When the SIV in the Arctic is higher than observations or reanalysis to begin with, this positive SIV bias often remains in the model throughout the forecast.". Although initial sea ice thickness may have some impacts in the cold season, its impact is more significant during the melt season because it directly affects the melt rate. The larger SIE error in the cold season could be related to other factors such as model physics, atmospheric forcing, initial ocean state, and ocean dynamical processes.
- Lines 94-97 and Fig 2: To see the comparison between CTRL and Alt-Init more clearly, I suggest adding two panels to show the differences between CTRL and Alt-Init, one for SIE and the other for SIV. For SIE, it looks like the improvement in the summer melt

season (Jun-Sep) is larger due to the use of better initial sea ice thickness.

- Fig. 7: I suggest making the curves 7c and 7d thinner.
- Lines 140-141: "Apparently, there are more bottom and top melt in the Beaufort, Chukchi and East Siberian Seas in the alt-init run than in the control run, ...". It looks to me the Alt-Init produces less top melt (blue colors) in Chukchi Sea and East Siberian Sea, and a large part of Beaufort Sea in the lower-left panel of Fig. 8.