

## ***Interactive comment on “Faster decline and higher variability in the sea ice thickness of the marginal Arctic seas” by Robbie D. C. Mallett et al.***

### **Anonymous Referee #2**

Received and published: 13 December 2020

The manuscript argues that the snow climatology normally used when retrieving sea ice thickness from altimeter is missing trends and interannual variability. This results in a statistically significant faster decline of Arctic sea ice in the Arctic marginal seas.

The link between the snow cover and the retrieved ice thickness is not new but the quantification is interesting and any progress towards understanding the snow cover is of importance. The use of Warren and modified Warren climatologies has been an issue for a while but there has not been any obvious alternative. I find this paper of interest to the community.

General notes Please be consistent and call sea ice the same. First example is on line 19 where it is mentioned as both sea ice and ice. I would prefer the first.

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I would reconsider whether it is necessary to plot all panels for all areas and month in different figures. These become very small. Maybe it is better to show a few representative panels and put the rest in the supplementary material.

#### Minor comments

Line 10 and 11. It is true that knowledge about the polar climate is important for the polar climate, but I think that for this abstract it is a bit out of context to include stakeholders from Arctic shipping in the description. I would stop the sentence with mentioning the polar climate system (line 10).

Line 23 Agreed that thick ice has some of the properties mentioned, however thick ice do not make it easier to predict the ice cover. Assimilation of a correct ice thickness as oppose to a correct ice concentration has more memory and therefore the predictions are improved. Please rephrase

Line 34 ERS is mentioned here but its full name is mentioned on line 118. Please state full name here including the abbreviation and use the abbreviation in the rest of the text

Line 107 There is an issue with the reference. Henceforth W99?

Line 136: More a comment. It would be surprising if the variability of snow only depended on where the first year ice and the multi year ice was located.

Line 154 I would not start by describing why W99 is not mentioned.

Line 155: We instead compare. . . should include a reference to figure 3.

Line 168 remove one of “of”. Typo.

Line 184: I would replace shaded with color coded.

Line 249 – 254 I think that the readability of this section can be improved if the flow of this section is improved.

Line 272. Is the Central Arctic for all ice types already mentioned in line 263. If this is

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not the same point then please clarify.

Line 278 “in for each region in for each month.” Should it be “one for each region and for each month. Please modify

Line 497. The las sentence should be reformulated. I think that a word is missing after positive in line 499.

Figure 1 W99 IAV values should be mentioned in figure text. If they are not used then remove the green bars

Figure 2 “Variability is displayed in a band where ice types typically fluctuates”. Should this be High variability . . . .

Figure 5: I would reduce the number of panels and only show the ones that are commented on. The rest can go to the supplementary material. Details are very hard to see in these small panels.

Figure 6: The axis labels says meters but there are no ticks on the axis. I think that it should be added

Figure 7 a and b labels should be added. I can guess which are a and b but it should not be left to the reader to guess. In addition I would like to move the colorbar outside of the figures and enlarge it a bit, It should be commented why the fraction of total variance can extend beyond 0 and 100. For instance November central Arctic figure b (I suppose) extend from -18 to 118 (or something like that.

Figure 8 Should It be modified Warren? Labels say w99

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-282>, 2020.

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