

The Cryosphere Discuss., author comment AC2
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Reply on RC2

Isolde A. Glissenaar et al.

Author comment on "Impacts of snow data and processing methods on the interpretation of long-term changes in Baffin Bay early spring sea ice thickness" by Isolde A. Glissenaar et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-135-AC2>, 2021

We thank the anonymous referee for their quick and useful comments. We appreciate the time and effort dedicated to providing feedback on our manuscript and are grateful for the comments and believe we have been able to address each of them.

1. The long-term sea ice variation in this study is limited to March (early spring) rather than the freezing season or all year round. So, to avoid misunderstanding, I would suggest the study period, i.e., March (early spring) should be addressed in the title of the study.

As suggested by the reviewer, we have added 'early spring' to the title.

2. I really understand that the field observations in Baffin Bay is rather limited, but some ULS-based SIT observations would be helpful. For example, some information can be obtained from Curry et al. (2014, <https://doi.org/10.1175/JPO-D-13-0177.1>) or Davis Strait Freshwater Flux Array.

Thank your for this suggestion. We have added a comparison of ICESat to ULS draft observations (2006-2008, as available on http://psc.apl.uw.edu/sea_ice_cdr/Sources/Davis_Strait.html) in Davis Strait from Curry et al. (2014). We include a comparison of the mean and distribution of drafts around the buoy locations with the ICESat along-track observations for all processing methods in the Supplementary Materials (S5). We have added the main results of this to the main paper in a new section in the results, which is further discussed in section 4.3.

3. Adding some comparisons (e.g., Figure 5) with the AWI CS2SMOS SIT would be interesting because the present AWI retrieval product (CryoSat-2) used AMSR-2 snow depth climatology in Baffin Bay.

We have added a comparison of the AWI CS2/SMOS SIT product with the CryoSat-2 LARM SIT product in the Supplementary Materials (S5) which is discussed in the main text in section 4.2. We find thicker sea ice thickness in the CryoSat-2 SIT product than the AWI CS2/SMOS SIT product, which is expected because the SMOS sensor can measure thinner sea ice. The spatial pattern of SIT is similar for both products.

4. Another suggestion is to add some comparisons with the numerical model results (e.g., PIOMAS), although the CIS charts has been already used. I would also suggest to show some comparison with an ensemble based estimation of the sea-ice variations in the Baffin Bay (Min et al., 2021, <https://doi.org/10.5194/tc-15-169-2021>).

We have briefly looked into a comparison with PIOMAS. The PIOMAS sea ice thickness

product seems to show very little spatial variability in Baffin Bay. We have not added this to the manuscript as we believe this will raise more questions than it gives answers to the research questions. We have added a comparison with the ensemble-based estimation of SIT from Min et al. (2021) in the Supplementary Materials (S5) which is discussed in the main text in section 4.2. We also find thicker sea ice from the mean of all processing methods with CryoSat-2 than in the Min et al. (2021) ensemble-based estimation in most of Baffin Bay.

5. The main findings in this study are significant, however, some deeper explanations/discussions on how the different snow depths influence the different SIT retrievals is also interesting.

We have added a discussion on how a potential of snow depth affects the SIT retrievals for the different sensors in section 4.2. This discusses how a potential negative bias in a snow depth product leads to an overestimation in SIT from laser altimetry and an underestimation in SIT from radar altimetry, leading to an underestimation (or more negative) trend in sea ice thickness when combining ICESat and CryoSat-2 in estimating a trend.