

Interactive comment on “Satellite Passive Microwave Sea-Ice Concentration Data Set Intercomparison for Arctic Summer Conditions” by Stefan Kern et al.

Anonymous Referee #2

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Summary

This paper compares ten passive microwave (PM) sea ice concentration algorithms during summer melt conditions in the Arctic. The comparisons are done relative to a MODIS-derived surface classification product that distinguishes open water, melt ponds, and unponded sea ice. Ship observations are also used in the comparison. The ten algorithms are split into four characteristic groups based on the formulation of the algorithms. Comparisons are made for sea ice concentration (SIC) and net ice-surface fraction (ISF = SIC minus melt pond fraction). The results show varied performance of the algorithms during different stages of the melt period. Summer SIC is overestimated

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by some algorithms, but underestimated by others. However, ISF is systematically overestimated by all algorithms. This suggests that algorithm coefficients (tie points) are not representative of pond-covered ice.

General Comment

This is a long-overdue study. SIC during summer has long been issue with PM products. While there have been some comparisons in the past, none as comprehensive as this. The analysis well done and very thorough. This will definitely make an important contribution to understanding of sea ice concentration products. My main comment is that it so comprehensive that it is rather difficult to wade through. Though well-written, there is just many of details and it's difficult to not get lost in the details while trying to read through.

A couple potential things to consider that may make the paper more digestable:

1. In Section 4.1, there is a lot of dense information here and the discussion of the different groups, back-and-forth, in each subsection for each melt regime, is hard to follow. There is a summary section, but that is nearly as long as all of the individual subsections and seems to mostly restate what was said before. One thought is that instead breaking up the subsections by melt regime (pre-melt, melt advance, etc.), break up the section by algorithm groups. Then for each group go through the melt regimes.

Then in the Summary section (4.1.5), bring the different groups together to intercompare. This shows the results in two different ways rather than simply restating the results in the same way.

2. Another thing that is that ASI is part of group III. I understand the reason why in terms of the algorithm formulation. However, repeatedly in the text it is noted that ASI results are more similar to groups I and II. So, while going through all the groups, I was repeatedly having to refer/think back to groups I and II. And it made for added com-

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plexity. Perhaps it would be better to group by their characteristics in the comparison with MODIS.

3. While I commend the thoroughness of the analysis using 10 different algorithms, there are a lot of commonalities between algorithms and I wonder if maybe focusing on some of the algorithms might be more beneficial. This is in practice done to some degree by splitting them into groups and in some places showing group averages (e.g., Figures 4 and 5). But then the analysis still delves into individual algorithm products, which can be confusing. For example, Figure 6 shows only one product from each group, which are meant to be representative, yes? But then why not just use those 4 algorithms instead of 10? The SICCI algorithm for Group I is basically the same – it's just the input TB source and the spatial resolution, right? Similarly, for Group II, they are all largely some implementation of the CBT (the NOAA CDR includes NT1, but its contribution is small), so maybe just use one. For Group III, as noted above ASI doesn't really fit with NT1 and seems to mostly need to be separated out in the discussion.

I can see the value of having all algorithms, but it gets confusing keeping track of which algorithm or which group is specifically being discussed. Perhaps focus on say the four (or five with ASI) representative algorithms in the main manuscript and then compare the other algorithms within each group in the Supplement.

4. The Supplement right now consists of just extra figures. That's okay – it certainly saves some space in the paper. But I think the Supplement could serve as a useful “further discussion/analysis” document, with discussion, where some things could be further discussed, such as in #3 above, and below.

5. While I like the ship-based observation comparison (4.3) – it's a good alternative validation approach. But to me it seems like a diversion from the main thrust of the paper. So this could be something to consider moving to the Supplement. The main rationale in my mind for the section is to address the question of “but how accurate are the MODIS SIC and ISF fields?” That's an important question, but again one that might

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be better treated in a supplement.

I can see where moving material to the Supplement and doing some re-structuring is not trivial, but I think it could be done without too much effort. And while I would suggest doing this for better readability and understanding, the current format is correct scientifically and the analysis is thorough. So, I would consider these minor revisions.

Specific Comments (by line number):

88: What is the “1)? I don’t see a “2)” or beyond – was something left out or is the “1)” extraneous?

139: “these values are not accessible to the user” is a repeat of what is stated in Line 136.

187-188: Why is the ratio of 1 used as a criteria for exclusion? Why does the high SD in the 500 m values indicate MPF that shouldn’t be used?

198: What does “converted into Cartesian coordinates” mean? I think this effectively a drop-in-the bucket re-gridding – is that correct?

202-205: I wonder how the 8-day average affects the analysis? Melt onset can occur quite rapidly – within a day. So, what happens when the melt onset (or transition to other melt regimes) happens within the middle of an 8-day period? I understand the rationale – the MODIS product is an 8-day average – so it makes sense to do it this way. But some discussion of the ramifications (or lack thereof) may be warranted.

599: “surprising”

635-637: the sentence is a little confusing as written, instead of “the number 12 results from” maybe “the 12 fixed TB values are based on”

739: “that” instead of “which”

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2020-35>, 2020.