

Review of Estimation of Arctic Land-Fast Ice Cover based on SENTINEL-1 SAR Imagery, Juha Karvonen

by Valeria Selyuzhenok

General comments:

Overall, most of my comments were considered. The manuscript has improved after the revision. The methodology is presented in a more clear way and the new figures allows for easier evaluation of the methods performance. This new information triggered additional questions. Please, consider the following comments:

1. The introduction presents a short overview of landfast ice studies including different methods of fast ice detection. It is not clear why a new method is required and how it would contribute to scientific progress. I suggest to add few sentences clearly describing the objective of this study.

Page 2, lines: 31-33: “The algorithms proposed in this study are used for creating daily time series of the Kara and Barents Sea LFI extent in high-resolution gradually complementing the existing Arctic LFI time series derivable from Arctic operational ice charts.”

It should be clear to the reader why it is important to produce daily (not bi-weekly or weekly) data set and in what sense the new data set would complement operational charts?

Doesn't actually FMI-B produce 2-weeks average fast ice product?

2. The methodological section has improved, but I find it a bit difficult to follow.

I suggest restructuring the section in the way that it consecutively describes each step of the algorithm as they indicated in Figure 3. Please, avoid duplication: the paragraph on page 5 starting from line 10 seems to be an extended version of the text on page 4, lines 17-28.

3. Discussion and conclusions require major modification

- Misleading interpretation of the results

Without knowing the purpose of the study, it is difficult to judge whether the performance of the developed methods is good enough. For some purposes it might be important to know that probability of fast ice presence in the detected area is very high. Than, indeed FMI-B method would be more reliable, compared to FMI-A. However, FMI-B product would be irrelevant to quantify changes in fast ice cover, since it detects only half of fast ice area.

Page 8, line 21: “FMI-B can then be considered as an algorithm locating the LFI areas with a high confidence.”

FMI-B algorithm systematically underestimates the LFI area (Fig. 9, Tab.1). It shows only 50% of fast ice presented on operational charts. The author also mentions that fast ice edge location is not presented correctly compared to AARI charts (page 6, lines 28-30). I assume that at this stage, the algorithms can not be considered as a reliable method to map fast ice operationally. I recommend that further improvements (e.g. suggested by the author on page 10, lines 6-11) are made in order to provide more reliable operational data.

- Missing references

Page 9, lines 12-22:

Comparing the presented method with other studies, the author does not provide any references. Please, refer to literature to support your conclusions.

- Redundant information

Page 7, line 13– page 8, line 2:

The comparison of air temperature measurement from the Longyearbyen weather station with variations in annual fast ice development neither belong to this methodological paper, nor present relevant scientific results.

Linking 2 years of fast ice annual cycle with air temperatures measured 1500 km away from the study area does not make sense to me. First, there are several studies investigating fast ice development in the Kara Sea (Divine et al. 2003, 2004, 2005; Olason 2016) which indicate that air temperature is not the only factor controlling fast ice cover. Second, data from the Longyearbyen weather station are not representative for the study area because it can be affected by different atmospheric circulation regimes. To use such data, the authors should first prove that at least the atmospheric circulation over Svalbard and the Kara Sea were similar during the season. It might be more reliable to use reanalysis data. I recommend removing these paragraphs.

4. In general the text is difficult to read. I feel that the English may need improvements.

Specific comments:

Page 1, lines 23-24 – page 2, lines 1-2 :

The part regarding fast ice modeling was marked for improvement during the interactive discussion. It has become even more confusing. It is not clear why author starts talking about fast ice thermodynamic and dynamic modeling. The paragraph does not seem to bare any relevant information. I suggest clarifying the message and including references to modeling studies or removing the entire paragraph.

Page 6, lines 7-8:

The FMI-B underestimates LFI, compared to AARI charts (Table 1, Figure 9). It does not seem to perform better, than FMI-A. Although FMI-B produces less false positive estimates, the number of true positive is also reduced. Would FMI-A produce similar results applying higher threshold?

Figure 8 : It is not clear to me what is shown in (c).

Figure 10 : What are the borders of the regions (SW, NW, Ob)? Why do these regions come into play? It would be more useful to provide the curve for the entire area to compare it with the AARI data.

Technical comments:

The text requires careful proofreading to exclude typographical errors.