

Distribution of landfast, drift and glacier ice in Hornsund, Svalbard – Review

The authors present a study of fjord ice composition in Hornsund, Svalbard. An algorithmic approach to determining different ice classes is detailed and the resulting maps over 11.5 years of observations are investigated for trends and correlations. Remote sensing of fjord ice is rarely investigated and the paper presents novel results in that area of study. The language of the paper is clear and concise and most explanations are easy to follow.

Minor Comments:

Specific:

3.2.1: If I understand the method correctly, I think this paragraph should be slightly reworded so that it is more obvious from the start, that persistence refers to ice or water classes in the preliminary classification, not about the persistence of actual ice. I think it would help if terms such as ‘moving’ and ‘stationary’ pixels are avoided, as pixels do not move but rather the class in that pixel changes (or not).

3.2.3: It looks like the distance is arial not shortest path on water. This should probably be mentioned and potential errors discussed (1/2 sentences).

3.2.4 L. 299: *“Time series of pixel values were used to re-classify drift ice into landfast ice in bays in the periods of high sea ice coverage over the entire fjord (Fig. 8e)”*

I do not understand this sentence. How were the time series used? Is this still automatic or is there manual inspection involved? Why is this necessary/correct?

5 L. 463: I am not sure the usage as an uncertainty ‘envelope’ is reasonable, as an envelope suggests a constraint which is not given here.

5 L. 524 onwards: *“Secondly ...”*. I do not understand this sentence. Stronger correlation between which variables characterise the coverage?

General:

I think it would be good to discuss the potential impact of using drift retrievals to identify landfast ice rather than class persistence. As a reader I find it hard to judge how often the concentration of drift ice might be so high, that it is statistically likely to have a persistent ice pixel over 15 days, even though the ice is drifting (different ice in that pixel in each of the acquisitions).

It might be interesting to discuss if, based on your derived statistics, some reasonable predictions can be made for example in autumn about the length of the next ice seasons. Of course, 11.5 years is not a lot of data for such an endeavor, so one should still be careful with such statements.

As most of sea ice remote sensing relies on rather complex physics motivated or data driven per scene algorithms for delineating classes, I think it would be worth investing a paragraph into the advantages and disadvantages of forgoing this step and working with ice/water masks, thresholds and statistics instead. This will also establish this work more firmly in relation to existing scientific discourse.

Technical/Language:

41. “Lack **of** ...”

208. “same class (**moving or stationary**) were put ...” – just recall what the classes are for clarity.

Table 2. Please explain somewhere what marks the beginning and end of the sea ice/landfast ice season. Thank you.

272. Thresholds were set on which variables/parameters?

327. What are the integers in brackets? Are these numbers ever used again?

442. “...provided sufficient SNR values **and good coherence between the two acquisitions** ...”

442. “ i.e. thickness dependent due to the level ice formation” – I don’t understand what is meant here, please clarify.

474. “...twice as ~~landfast~~ as...”. This entire sentence needs to be restructured to be grammatically correct.

515. “... but it may also **be a second order effect** of local weather conditions...”

521. “... winter **air** temperature ...”

524. I think -1.9 should be unbreakable by linebreaks.

539. “... the 15-day persistence **criterion** ...”

543. “... period with **an** average frequency These were used to characterize **the** spatial and temporal ...”