The Cryosphere Discuss.,
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The Cryosphere Discussions

Interactive comment on "Seasonal timeline for snow-covered sea ice processes in Nunavik's Deception Bay from TerraSAR-X and time-lapse photography" *by* Sophie Dufour-Beauséjour et al.

Anonymous Referee #2

Received and published: 6 November 2019

The manuscript presents monitoring of the seasonal evolution of sea ice cover in a Canadian fjord, using satellite images and photographs. They use TerraSAR-X images and co-located photographs to monitor the fjord to identify different development stages of the sea ice. The manuscript is within the scope of the journal and though the manuscript contains some interesting results it needs to be considerably rewritten before it can be accepted.

Specific comments The abstract is rather imprecise, e.g. it is claimed that Inuit's have reported greater inter-annual variability in the seasonal ice conditions. In which way were there changes? Since when have they reported this? This information is very

useful and it would have been very nice if these observations were further reported and explored within the manuscript. Why can we expect increase in solid precipitation? Over which time period? Please rewrite the abstract to focus on the main findings and points addressed within the manuscript.

The manuscript is very long and contain information that is well covered in other works, e.g. the sea ice evolution during the year. Please reference these works instead, and only highlight things of specific importance and relevant to the scientific work carried out within this manuscript. This would significantly shorten the manuscript, e.g. can section 2 be significantly shortened to possibly cover $\frac{1}{2}$ page instead of the near 3 pages. The study area section can also be shortened, e.g. is the tidal range not important for the rest of the study. Similarly, is the last paragraph in section 3 not relevant for the presented work. Please revise the work bearing in mind what you are trying to convey and new scientific findings.

Please expand the methods section to explain to the reader what is done in the study and how the results are achieved. E.g. define and explain why the following is calculated; first freezing degree-day, freeze-up, frost flower maximum and winter onset?

According to the manuscript frost flowers could not be observed in the photographs, and as far as the reader can work out a peak in SAR backscatter values is therefore inferred to correspond to frost flowers. Though this is not again specifically stated in the methods section. Moreover, how do you know that frost flowers were present? Could the post-freeze-up peak be related to increased sea ice thickness?

Why are not snow thickness information reported for any other time period than April 2017? In order to fully address the scientific topic indicated in the title of the paper information about the snow thickness is essential for the sea ice monitoring. It is unclear to the reader how are the estimates about the snow cover carried out? Photographs? Is there information about snow cover thickness and distribution? Judging by the title the manuscript should only contain information about snow-covered sea ice. Yet figures

showing e.g., grease ice and pancake ice has no snow cover. Consider updating the title to reflect the sea ice included within the study. Please discus how do you expect the snow-cover to affect the results?

Why is beta nought used instead of the more commonly used sigma nought? Since beta nought is used please use the symbol beta in all the figures 6, 10, 11, 12 and 16 instead of the symbol sigma.

The incidence angle difference within the dataset is significant (8o), how does this affect the presented results? The fjord is given as 20 km wide (a scale bar would be nice to see in Figure 2), how much of the overall area is covered by the 15km wide TerraSAR-X images?

It is in the discussion stated that the sea ice observed in the ship wake was broken. How is this verified? How are wind effects accounted for in these observations? Would it be possible to include observations from these ships?

It is in the manuscript stated that the X-band backscatter change is expected to be similar to one in C-band. A suggested to corroborate this is to include Sentinel-1 images overlapping the fjord to investigate if these C-band images show the same evolution as the TerraSAR-X images. The use of Sentinel-1 may also reduce the revisit time.

Rather than stating that the standard meteorological station at the airport is not used, a correlation measure between the used temperature and the airport temperature would have been beneficial. Such a comparison would also have verified the supposedly heated camera case claim, rather than a statement that the authors think that it is so. At what altitude is the temperature sensor located?

As stated in the manuscript is FDD used, yet the unit used was oC, please explain? Also freezing at +3.5 oC to +4oC seems a bit high. Why is 0oC used when sea ice is investigated as it will likely freeze at -1.8oC. Are there any sea water temperature measurements? It is mentioned in the discussion that the Deception river has warm

water, please provide a temperature time series for this river or at least give some specific temperatures.

How do the values in e.g. Fig. 10 relate to e.g. work by Onstott 1992?

Additional comments According to the temperature records, as presented on row 254, temperatures are recorded between 11 September 2015 – 16 September 2016 and then from 18 September 2018 (?) to 31 August 2018. Please clarify.

Ibid. is not a way to reference that I've seen in this journal before. Whilst this might still be ok, many of the references where ibid. has been used are not correct and the statements that are supposed to be covered in those references are not included here. E.g. on row 129 the "white ice" term is attributed to Johansson et. al., 2017 and on row 400 correctly to WMO. Moreover, when referring to the WMO terminology please include the full reference, (WMO, 2014).

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