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Interactive comment on "Landfast sea ice stability – mapping pan-Arctic ice regimes with implications for ice use, subsea permafrost and marine habitats" *by* Dyre O. Dammann et al.

Anonymous Referee #1

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Dammann and others present a nice study demonstrating a novel utility of SAR Interferometry (InSAR) for mapping landfast sea ice. They show it is possible to classify several different types of landfast sea ice as well as demonstrate potential predictability for ice arch collapse using Nares Strait as an example. This paper is well-written and the figures clearly fit the text for which they were created. I do however have a couple suggestions that I think need to be addressed prior to publication.

General Comments

1. It is possible to classify landfast ice directly from calibrated SAR imagery. In this respect, it would be useful to illustrate to the reader how much additional information

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Discussion paper

the interferogram provides. A good way to do this would be show a SAR image in Figure 3 and point out how identifying the individual landfast classes without the use of an interferogram would be difficult.

2. Discussion on ice arch collapse embodies more literature than cited in the manuscript. The Barber et al. (2018) reference is good and very appropriate but investigations into this process have been ongoing for many years prior. Melling (2002) originally suggested it with respect to the Northwest Passage in the Canadian Arctic under a warming climate. This process was then quantified by Kwok (2006) and more recently by Howell et al. (2013) using Radarsat imagery, with the latter study showing evidence for multi-year ice increases in recent years. Haas and Howell (2015) further provided ice thickness measurements for a gradient from the Arctic Ocean to the southward shipping channels of the Northwest Passage. Overall, the relevance of the technique presented in the manuscript for predicting ice arch collapse from InSAR is important but some additional citing literature (as outlined above) providing a more comprehensive discussion is required.

Specific Comments

Page 3, Line 28

Specify the dates and beam mode for the S1 images. Not the entire list of images just more details on the beam modes used on the analysis.

Page 4, Line 35

I would think (and argue) that landfast regions in the Canadian Archipelago are as just as important for shipping. They would also be useful a region to test the ice collapse prediction process similar to Nares Strait. See General Comment 2.

Page 8, Line 12 and Lines 33-34

The process of ice arch breaking and thick multi-year ice from the Arctic Ocean being transported southward and into shipping lanes extends beyond the work cited in the

manuscript. See General Comment 2.

Page 8, Lines 14-28

A recent study by Moore and McNeil (2018, GRL) documents the 2017 ice arch collapse in Nares Strait. It might be worthwhile verifying if the interferograms are in agreement with what is documented by Moore and McNeil.

References

Haas, C., and S. E. L. Howell (2015), Ice thickness in the Northwest Passage, Geophys. Res. Lett., 42, 7673–7680, doi:10.1002/2015GL065704.

Howell, S. E. L., T. Wohlleben, M. Dabboor, C. Derksen, A. Komarov, and L. Pizzolato (2013), Recent changes in the exchange of sea ice between the Arctic Ocean and the Canadian Arctic Archipelago, J. Geophys. Res. Oceans, 118, 3595–3607, doi:10.1002/jgrc.20265.

Kwok, R. (2006), Exchange of sea ice between the Arctic Ocean and the Canadian Arctic Archipelago, Geophys. Res. Lett., 33, L16501, doi:10.1029/2006GL027094.

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