The Cryosphere Discuss.,
doi:10.5194/tc-2016-125-RC1, 2016

The Cryosphere Discussions

Interactive comment on "Signature of Arctic first-year ice melt pond fraction in X-band SAR imagery" *by* A. S. Fors et al.

Anonymous Referee #1

Received and published: 3 September 2016

The manuscript is dedicated to the melt pond fraction estimation from X band of polarimetric SAR. This sensor is not dependent on cloud cover or presence of daylight, which is an advantage over radiometers like MODIS and MERIS. Currently, melt ponds are poorly represented in the climate models, and the melt pond research is therefore an important topic which fits well into the scope of the journal. The paper is well written and the text extensively referenced. However, the manuscript still has some potential for improvement in the points listed below.

1) The study is limited to the drifting first year ice and to the X band only; in the Introduction, the authors give a very extensive literature review which reveals a massive amount of work already published regarding SAR X and C bands for melt ponds on many ice types for many locations, among which the landfast FYI and MYI. What is the motivation for this additional study for drifting ice and X band? Drifting FYI is a widespread

ice type indeed, but it features a variety of subclasses which calls for a robust method. What is the advantage of X band over other SAR bands for this challenging task?

2) The study is dedicated to the comparison of helicopter-borne imagery to the dual polarisation X band SAR data. Overall, 4 SAR scenes have been taken, to which the helicopter data were possibly accurately collocated. Nevertheless, the comparison data shows considerable scatter, the Spearman correlation was used instead of Pearson (could you please justify this), and the noise equivalent was subtracted. The authors are struggling to collect all the available signal which is over the noise floor and compare it to the airborne data. However, even with this cumbersome approach, the correlation coefficients of the developed empirical relationships are R^2=0.15 and 0.21, which is a very weak to weak correlation for Spearman. The authors state the surface deformation as a reason for the scatter and claim the correlation "significant" and enough to give a starting point to MPF evaluation, but the reviewer fails to see how it could work.

Under these circumstances, the quality of the developed method when applied to a variety of different X-SAR images of drifting ice (even with known wind speed) is very hard to estimate, even when the one smoothes out or grids the retrieved pond fractions to coarser resolutions.

3) The authors compare MPF distributions from airborne and retrieved from SAR data. To evaluate the quality of the results even better, it would be good to show also the spatial situation: the MPF retrieved from SAR plotted on a lat-lon map and the airborne reference data overplotted on the same map using same colorscale. Upon checking spatial features or spatial uniformity, the reader can make sure that the retrieved MPFs are not random numbers, but really correspond to the field situation.

The authors come to the conclusion that the dual polarimetric SAR data in X band can be used for melt pond estimate given the appropriate wind speed, incidence angle, surface deformation ranges and also upon extensive smoothing or even taking the

mean value over the whole scene.

The impact and importance of such a product is not sufficient for advancing our understanding on melt pond processes and can only serve as complementary data for other studies. Currently, the manuscript serves more as a fundamental study on the SAR features in X band and more displays limitations than advantages of the data.

I recommend to support the shown MPF results with possibly more SAR scenes and definitely show the spatial MPF maps to confirm the quality of the pond retrieval, or refocus the manuscript on signatures of various ice/pond types in X band without the actual MPF retrieval.

Technical:

- Please add the error bar of the empirical fit in Eq. (16) and (17) on the corresponding figures, this helps to estimate the quality of the MPF retrieval.

- please add the correlation coefficient values into the abstract and into figure captions where you present the empirical fits.

- I suggest to merge the subsection 4.1 Sea ice conditions into the subsection 3.1 Study region. Current section 4.1 logically fits better to 3.1.

Interactive comment on The Cryosphere Discuss., doi:10.5194/tc-2016-125, 2016.