Review

Sea ice melt pond fraction estimation from dual-polarisation C-band SAR – Part 1: In situ observations

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General Comments:
The authors present a study of in situ measurements of a first year sea ice surface in the Canadian Archipelago during summer melt. These measurements contain dual-polarisation radar scatterometer data, physical measurements of the surface, LiDAR measurements, and wind speed measurements.
The authors can explain the dielectric contrast between free surface water of ponded areas and ice surface by using the VV/HH polarisation ratio (PR) and Bragg scattering theory.
This study shows that melt pond fraction can be retrieved with the PR approach and could therefore be applied to analyze corresponding satellite scenes.

The knowledge about melt ponds on Arctic sea ice is needed for several climate science disciplines, like model parameterization, sea ice process studies, sea ice and weather forecasting...the effort to map the melt pond fraction of the entire Arctic is a challenge and can only be done with remote sensing techniques. Due to cloud cover, SAR or Microwave systems have an advantage compared to optical retrieved data. And as we all know, in situ measurements are a rare but urgently needed instrument to validate satellite retrieved data.

In general, the paper is well written and structured and it is logically linked to a Part II – paper (application of the method using RADARSAT-2 SAR data). The methods for data acquisition and data analysis are scientifically sound and well described. Especially Chapter 3 is written very comprehensible.

One week point in this paper is the missing discussion of the application of the method on MYI.
My suggestion is to publish this paper after minor revisions.

Specific Comments:
Abstract:
p. 806 , l. 12: ovoid abbreviations in the abstract or specify rms-height

1. Introduction
p. 808, l. 28: specify rms-height once
p. 808 bottom: give examples where volume scattering occurs

2. Physical model
1 Paragraph: Avoid parenthesis where possible
p. 811, l. 14-16: In my opinion this “problem” is exactly one task to figure out with this study. - the same with the azimuth (l. 17 ff.)
p. 812: l. 27/28: Isn't it that we expect more the behavior of a bare ice surface from the ice covered ponds? If not, please explain.

3. Methods
p. 815, l. 21 Please write once yearday (YD)

p. 815, bottom: why is it necessary to generate these small scale elevation maps? What is the expectation out of it?
p. 217, l.17: define i

4. Results
p. 819, l.4.: In my opinion there is no difference observable.
p. 821, l. 15: You write two ocean models. - you mentioned them already in the method section. Please specify them.
p. 821, l. 16: I cannot find the modeled ocean PR in Fig. 5

5. Discussion
p. 825, l. 15-20: Further discussion of the effects of MYI would be appreciated. What results could we expect from higher surface roughness? Is the application of SAR data on MYI theoretically possible?
p. 826, l. 6f. Deeper ponds would be expected on MYI – see comment above.

6. Conclusions
P. 827, l. 21 ff: as far as I understood, the Bragg limit is defined as “ks < 0.3, where k is the radar wavenumber and s the surface rms-height.”
Therefore I need ancillary information – at least the rms height - to define the Bragg limit.

Technical Comments:

Fig 2, right bottom: please insert units next to the color bar