The Cryosphere Discuss.,
https://doi.org/10.5194/tc-2020-171-RC3, 2020

The Cryosphere Discussions

Interactive comment on "Spring melt pond fraction in the Canadian Arctic Archipelago predicted from RADARSAT-2" *by* Stephen Edward Lee Howell et al.

Anonymous Referee #3

Received and published: 6 October 2020

This paper derives the melt pond faction in month of April derived from Radarsat-2 imagery to predict the resulting sea ice area over the ensuing summer melt season within the Canadian archipelago, from years 2009-2018. The best results were found to be between stage of development in April and melt pond fraction, following the related paper by Scharien et al., 2017. Other comparisons were more challenging but were well explained.

Due to my tardiness with this review, which I apologize for, I did read the other two reviews and the authors' response to both. I generally agreed with the reviewers comments and the responses were well posed. I will only add a couple of additional com-

ments, that may be a little different.

1. Figure 7. As with the other two reviewers, I had some concerns with this figure, due to the relatively limited area of the lidar observations. The inclusion of the aerial photography and SAR comparisons that were added in Figure 7b are a valuable addition. Going back to Figure 7a, the Radarsat results themselves have no response to the changing melt conditions before, during and after. There is little change between the two years. Before the addition of Fig. 7b, I was thinking of not including it. I now wonder if they included a few more surrounding pixels to examine, like a 3X3 window, some variation might appear. How many R2 frames were examined during the field measurements periods?

2. Section 3.2, first paragraph regarding R2 and Sentinel-1. Please add that S1 data collections for sea ice nominally also use HH polarization, same as R2. I am wondering about differences in the noise floor and SNR between the two systems that may be leading to some of the differences seen in Fig. 6. Were an approximately equivalent number of images used by both sensors about the same or different, thinking about Fig. 2?

3. Modis comparisons with R2, section 3.2 and Fig. 8. Please specify the resolution for the Modis products. What is the sensitivity of Modis to melt pond size? If one makes the assumption that Modis may not detect smaller ponds, that by itself may account for the differences seen in Modis Max pond fraction and R2 results, couldn't it? Also the 8-day composite of Modis may limit small pond fraction. Please clarify the impact of Modis resolution on pond fraction.

4. Regarding Figs. 3 and 4 and Fig. 9 and 10. The relationship between stage of development and pond fraction was quite clear, shown in Fig.3-4. The greatest extent of low fractions were nearly all up in the northern CAA, with more variability, higher fractions in other areas. Then you come to Fig. 9 where any possible trend that one might expect in the MY/low fraction area in the north and in other regions goes away.

The authors explain the variations in A and B, in melt pond fraction/week of strongest correlation, by dynamics, southward transport of lower pond fraction ice. The patterns in Fig3-4 were so clear and then it becomes unclear, although there is some similarity in patterns between Viscount-Melville and McClintock in Fig. 10. It's all pretty interesting and rather surprising. I urge the authors to continue to investigate this topic. Perhaps the addition of ice motion drift can provide more insight.

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