

Interactive comment on “Observations of Sea Ice Melt from Operation IceBridge Imagery” by Nicholas C. Wright et al.

Ellen Buckley

buckley@umd.edu

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Major comments:

(1) A number of questions remain about the algorithm performance and the error analysis could be strengthened:

L156. Other than haze, what are the main sources of object misclassifications? L156. How do object misclassifications impact the derived melt pond fraction? On Line 137, you state the shadow detection method is not applied because “typical summer solar zenith angle yields fewer shadows.” The sun angle is still low in the Arctic and ridge shadows do exist in the summer. How are shadows that do exist in the imagery classified if they do not have their own category? Are they classified as melt pond? How

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does excluding this step impact results? How does aircraft attitude and altitude impact the impact pixels and hence, the classification algorithm and derived melt pond fraction? Have the authors re-quantified the algorithm error, given the modifications to the algorithm (Section starting at Line 107), since Wright and Polashenski, 2018?

(2) Designation of ice type

The authors state on L203 that the flight on July 25th 2017 covers first year sea ice. This does not seem justifiable for two reasons. a) the authors provide their own definition of a FYI flight (Line 197, that 90 % of the images in the flight are FYI). Given this definition, and visual inspection of the DMS imagery from the flight, it is not obvious that the flight is over predominantly FYI. A larger percentage of images with pressure ridges and rubbled ice, indicating a long deformation history, and thus, MYI. Many images resemble the MYI depicted in Figure 11a-c and described as “common examples of ponded multiyear ice floes with characteristically blue ponds that are well consolidated by surface topography” (Line 258). b) the location of the flight line north of Ellesmere Island in the Central Arctic is over sea ice known to be the oldest and thickest ice in the Arctic, and highly unlikely to be predominantly FYI in origin. The 2017 Arctic Report Card found that the ice in this region in March is predominantly MYI (Figure 3c, Perovich et al., 2017). Given that it is well known that the ice in this region is some of the thickest ice in the Arctic (e.g. Figure 2b, Sallila et al. 2019), this area is highly unlikely to be predominantly FYI.

For reference: Perovich, D., Meier, W., Tschudi, M., Farrell, S., Hendricks, S., Gerland, S., Haas, C., Krumpen, T., Polashenski, C., Ricker, R., & Webster, M. (2017). Sea Ice [in Arctic Report Card 2017], <http://arctic.noaa.gov/Report-Card> Sallila, H., Farrell, S. L., McCurry, J., & Rinne, E. (2019). Assessment of contemporary satellite sea ice thickness products for Arctic sea ice. *Cryosphere*, 13(4).

(3) Forcing conditions affecting sea ice floes in survey area

L212. “To investigate melt pond statistics across ice that experienced similar forcing

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conditions, two flights that contained both FY and MY ice were selected for further analysis” How do the authors know this ice has experienced similar forcing conditions throughout its lifetime? Considering the Beaufort Gyre is known to be an especially dynamic area, the ice observed during the flight surveys may have come from different regions. The ice in this region may, at the time of the survey, be experiencing uniform forcing conditions, but the assumption that all ice covered in a survey has experienced similar forcing conditions throughout its lifetime is invalid.

(4) Melt pond fraction calculation clarification:

L175. How is melt pond fraction calculated? If the OSSP algorithm classifies melt ponds and submerged ice in the same category, is submerged ice included in the melt pond fraction calculation? How does the inclusion of submerged ice impact the melt pond fraction parameter?

L177. Why do the authors choose images with open water area < 70% as a threshold for displaying melt pond fraction results? Do you include images with open water area > 70% in melt pond fraction results (Section 3.2 and 3.3).

Minor questions needing clarification in the text:

L80 Are data collected on 15 July 2016 analyzed? This flight survey is plotted in Figure 1, but no results are shown (Figure 4).

L180. The authors state that data from the 20 July 2016 flight were not processed because “not enough usable images” How do the authors determine what was enough?

L184. Does Figure 5 follow Figure 4, and only show melt pond fraction for images with open water area < 70%?

L203: Can you distinguish between the 25July2017 flight A and flight B within the text and/or in Figure 4 (where they are currently shown in the same color)?

L323. How is a melt pond defined in this study? Is a melt pond still a melt pond when it

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has melted through the sea ice? What about other features: melting snow, thaw holes, algae on ice?

Figure 4. Bottom figure. For the 17 July 2017 and 18 July 2017 flights, it looks like there are no images remaining for analysis. Is that correct? Can you provide the total number of images analyzed for each flight, and total discarded? Perhaps this information could be included in a table or added to the figure.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2019-288>, 2019.

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