

# ***Interactive comment on “Open Source Algorithm for Detecting Sea Ice Surface Features in High Resolution Optical Imagery” by Nicholas C. Wright and Christopher M. Polashenski***

## **Anonymous Referee #2**

Received and published: 21 October 2017

The manuscript presents an algorithm for segmenting high-resolution hyperspectral, RGB, and panchromatic imagery into three classes: snow and ice, melt ponds and submerged ice, and open water. The algorithm appears to have good performance throughout the seasons, despite the challenging conditions during summer. Unique to this work is that the algorithm and training sets have been designed as an open source tool to invite and facilitate community use. This, together with the thorough error analysis by the authors, sets the stage for a successful, sustained effort from the community to extract much-needed sea ice information from a variety of high-resolution imagery. Overall, I find the manuscript to be well suited for the Cryosphere, and highly recommend publication once the following issues are addressed:

Line 50. I suggest adding Fetterer and Untersteiner (1998) and Arntsen et al. (2015) to the reference list.

Line 66. This isn't quite right. Several previous works have demonstrated surface feature retrievals from high-resolution imagery throughout the seasonal evolution of ice surface conditions.

Lines 136+. How does the algorithm differ from that in Miao et al? Please describe any differences.

Line 236. Does this melt pond definition include or exclude melt ponds that are melted through? Relative to previous works, is it typical to include submerged ice in the melt pond class or is it unique to this approach?

Line 241. Submerged ice isn't a type of melt pond. Please clarify this point. It would be helpful to comment on the effects of submerged ice on melt pond statistics of area and geometry, especially for scenes of advanced melt in the marginal ice zone.

Line 245. Would this criterion also include sea ice darkened by sediment and algae during the melt season?

Lines 252 and 307. Please provide more details on the shadow detection step for panchromatic and multispectral imagery. Does it differ from previous works?

Line 290. Please describe how image dates are used in the classification scheme.

Lines 305/491. How does this step distinguish a neighboring ridge from snow-covered ice? It's not clear, does the algorithm identify ridges as a separate class?

Line 310. Here and elsewhere, trade-offs in computational expenses are mentioned. It would be helpful to give a ballpark estimate of the computational expense if possible, e.g., is it  $O(N)$  or  $O(N^2)$ ?

Line 313. It's surprising that the Literal Image Derived Products from the Global Fiducials Library have been excluded from this analysis, as these publicly available images

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have been the data source for several analyses of high-resolution sea ice imagery (Arntsen, Fetterer, Kwok, Webster). Do the authors anticipate that users will find the algorithm suitable for processing this imagery given its radiometric inconsistencies? Why or why not?

Line 319. Are the different results between experienced and inexperienced users a matter of definition? For example, how do experienced and inexperienced users classify submerged ice near floe edges?

Lines 361+. It would be helpful to explicitly include submerged ice in the melt pond class throughout the text and figures. For example, instead of “Melt pond,” please state “Melt pond and submerged ice” or “Melt pond + submerged ice.”

Lines 406+. Is this an Eulerian or Lagrangian site? How do the authors distinguish changes due to spatial heterogeneity from seasonal melt progression?

Lines 508+. For the aggregate-scale analysis, what type of ice was present in the analyzed scenes? How might the results change based on the presence of different sea ice types?

Lines 760/Figure 4 & 779/Figure 8. I suggest presenting the pixel counts as percentages of the total pixels evaluated and providing the total pixel count in the caption for ease of reading.

Line 782/Figure 9. In the caption or text, please provide the average scene size.

Line 786/Figure 10. Please state whether this site was Eulerian or Lagrangian in the caption.

Line 791/Figure 11. I suggest adding the resolution size as a secondary x-axis on the top of the plots for ease of reading.

Technical comments:

Line 52. Morphology seems like the wrong word here.

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Typos in Lines 170, 293, 324, 396, and 170.

Line 191. Boundary seems like a better word than interface since the ice-ocean interface can be interpreted as the ice floe bottom.

Line 283. Here or earlier, I suggest defining texture since it has multiple meanings.

Lines 798-802. Inconsistent font.

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2017-154>, 2017.

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