The Cryosphere
Discussions

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**Interactive
Comment**

Interactive comment on "Response of ice cover on shallow lakes of the North Slope of Alaska to contemporary climate conditions (1950–2011): radar remote sensing and numerical modeling data analysis" *by* C. M. Surdu et al.

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We thank Reviewer 3 for taking time to read and provide valuable comments on our paper. Considering that Reviewer 3's comments were received five weeks late (after the closing date for comments of October 14), when all revisions had already been made to the current manuscript (based on comments from two reviewers), we were only able to address a few of them. Answers to these have been copied below.

1. Reviewer 3 comment: P3788 L19-24: This is a good hypothesis, however it seems

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out of place in the "Study Site" section. Suggest moving to a more appropriate section.

Response to Reviewer 3's comment: We agree with Reviewer 3 and we moved this paragraph in Section 1 - Introduction.

2. Reviewer 3 comment: P3789 L9-11: Please clarify – would you expect these to be the same? If so, is this an indication/effect of measurement uncertainty?

Response to Reviewer 3's comment: This concern was addressed in the responses to Reviewer 1 and 2. Response is copied below. The differences in both overlapping and non-overlapping areas are in order of 1-2%. The differences in the grounded ice fraction observed in the overlapping ascending and descending images are attributed to the right-looking ERS geometry. The SAR looking geometry of ERS – from the east in ascending mode and from the west in descending mode – limits the identification of the exact same ground features in overlapping images due to the angle of illumination. Issues such as foreshortening and layover are known to result in possible deformations in areas where the topographic slope is greater than $10°$. However, considering that the study area is a coastal plain, such deformations are unlikely and the difference in the grounded ice fraction is associated with the illumination differences. We felt that it was important to report this difference (1-2%) between ascending and ascending as previous studies have generally been silent regarding the geometry of overpasses (i.e. dates are usually provided in papers but not overpass mode). The text was also updated to show this additional comment (Section 3.1).

3. Reviewer 3 comment: P3790 L1 – P3791 L7: These paragraphs appear to contain information that is not suited for the methods section. Suggest moving to a more appropriate location such as the Introduction, or creating a "Background" section.

Response to Reviewer 3's comment: We considered Reviewer 3's suggestion and thus have added Section 2 – Background that now includes these paragraphs.

4. Reviewer 3 comment: P3729 L2-3: Visually assessed against the original SAR

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image for what?

Response to Reviewer 3's comment: The segmentation results showing the distribution of grounded and floating ice were visually assessed against the original SAR image in order to determine the overall accuracy of the segmentation. However, we were asked to remove material related to the accuracy assessment by Reviewer #1, which we did in our revised version of the manuscript. We do, however, make reference to recent studies that have reported the suitability (high accuracy) of the image segmentation algorithm used in this study to other investigations on sea ice and lake ice.

5. Reviewer 3 comment: P3791 L18: It's not clear why the user would select 3-5 classes at first. Please clarify.

Response to Reviewer 3's comment: Given that different ice types present on lakes, we used a 3-cluster segmentation (two floating ice classes and one grounded ice class) and in order to further verify the performance of the 3-cluster segmentation, a 5-cluster segmentation was at times performed. This clarification was also added in the manuscript.

6. Reviewer 3 comment: P3793 L21: Why chose a mean depth of 3m? On P3787 L15-19 the authors indicate a range of lake depths with most being 1.4-1.5 m deep and only 23% possibly being over 2.2 m. How much of an effect on the simulations does the lake depth have?

Response to Reviewer 3's comment: Considering that the study area likely includes several lakes that are deeper than 2.2 m, we chose to use a 3m depth to run the model. However, we compared the ice thickness, freeze-up and break-up dates from simulations at 1.5 m and at 3-m depth and outputs indicate that the differences are extremely small between the two (0.01 mm or less for ice thickness and 0.02 days or less for freeze-up and break-up days).

7. Reviewer 3 comment: P3797 L10: Suggest starting a new paragraph at "Ice regimes

of shallow. . ."

Response to Reviewer 3's comment: This suggestion was considered and text was updated to reflect this change.

8. Reviewer 3 comment: P3798 L3: Suggest indicating which figure in this manuscript after ". . . SAR data."

Response to Reviewer 3's comment: This suggestion was considered and text was updated to reflect this change.

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