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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.

Anonymous Referee #2

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Dear authors, Your paper is largely well written and provides interesting information on changes in lake ice conditions in the Arctic that should be relevant to the readership of "The Cryosphere". The combination of SAR data and modeling to assess climate impacts is new and distinguishes this paper from other efforts. While the paper is reasonably well written in parts, my main concern are an overlong and rather confusing composition of sections "Discussions" and "Summary and Conclusions". While these sections contain all the required material and findings, a certain lack of structure makes it very difficult to find their story lines. This is especially true for Section 5. I would like

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you to consider (re)structuring these last two chapters of the paper to improve their clarity. The requested modifications are somewhere between a major and a minor revision requirement. More details in the following comments:

General comments: 1. As mentioned above, your two main Sections (Sections 5 and 6) are difficult to read and almost exhausting. First and foremost, I think this is due to the lack of any structuring element especially in section 5. The unstructured running text makes it very hard to recognize a consistent story line in these sections and it makes it difficult to stay focused. Finally, the language in these sections is, in parts, quite imprecise, adding to my confusion and frustration. I would suggest to re-organize these sections into byte-sized pieces that have individual clearly phrased sub-headings and can be digested independent from each other. Also, please try to highlight better what the real difference between Sections 5 and 6 is? To me, at some point, these sections seem to blur together.

2. One last comment about Sections 5 and 6: It seemed to me that some of the conclusions and statements in Sections 5 and 6 aren't based on the SAR or model data and seem additionally rather speculative. I would suggest reducing the amount of speculative statements. I think they distract from the focus of the paper and lower the relevance of the paper rather than increase it.

3. Throughout the paper, you introduce measurements and derived averages without providing any information about their accuracy. For instance, on page 3788 you state "maximum ice thickness . . . is happening earlier by 6 days . . . and is delayed by 7 days . . .". I am guessing these are averages that were derived from field or remote sensing measurements, which, as such, need to be associated with standard deviations. Only with error information attached are these numbers meaningful. Without accuracy information, there is no way for me to judge the significance and relevance of your statements.

4. While you don't really talk about it, I am convinced that the temporal sampling of the

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freeze-thaw process with remote sensing data is very sparse. Please make sure that you add more details on the temporal sampling throughout the observed seasons to the paper, in order to allow for an assessment of the potential and limitations of your study.

5. In Sections 4.1 and 4.2, you mention results of many statistical tests but you never show any data or test variables that would verify your statements. Please provide more information on the test and don't require the reader to simply believe you.

Specific Comments:

1. Page 3785, line3: please add "water composition" and "water dynamics" to the list of parameters that may cause heterogeneous scattering responses

2. Page 3786, line 20: replace "excludes" with "precludes"

3. Page 3787, line 6: add the word "an" before ". . . area that is dominated . . ."

4. Page 3788, line 8: you write "+-1 degree Celsius change in air temperature resulting . . .". What air temperature are you talking about here? Monthly average temperatures? Daytime temperatures? Nighttime air temperatures? Average column temperatures or temperatures in the first 5 meters over ground? Be more specific.

5. I would add a trend line to Figure 2 to better support some of your trend statements that you are making in the text.

6. Page 3789, line 19: You write "Optimum radar images are acquired . . ." — optimum in what sense? Be more specific.

7. Page 3790, line 25: Consider changing ". . . off the ice surface . . ." to ". . . off the ice-water interface . . ."

8. Section 3.1: How do you deal with occasional registration issues and geocoding errors of the ERS imagery? Will such issues lead to the mis-interpretation of the data? Have you analyzed how often geocoding errors occur and how they may affect your

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results?

9. Section 3.1, assessment of area percentages: Your percentage calculations and area percentage assessments are limited by the low resolution of your system. E.g., if a lake is only 1 pixel large, you can only say that this lake is either 100% frozen to the ground or 100% covered by floating ice. Hence, especially if your test site is dominated by very small lakes, your area percentage assessment might become very coarse.

10. Page 3794 and Table 1: Table 1 only shows the April and May data that was used in your study even though from reading first sentence in Section 4.1 I expected the Table to show the full list of used data sets. Seeing the full list of data would be desirable as it would allow the reader to get a sense of the temporal sampling issues that might be inherent to your data. A complete Table 1 would make assessing the potential and limitations of your study easier and more transparent. Adding more measurement information (e.g. backscatter time-series plots) to Section 4.1 would enhance its clarity.

11. Section 4.1: Measured mean fraction of grounded ice: Also here, measurements are presented without standard deviations. Please add some information about the variation of the data.

12. Figure 6: You mention that Figure 6 would show the correlation between the "transition toward lower fraction of grounded ice ..." and "trend toward thinner ice ...". I disagree with this statement in the sense that I don't think the bar plot-type Figure 6 is helpful with identifying such correlations. I would suggest to change this Figure into a scatter plot, as scatter plots make correlation behavior very easy to see. It would enhance the clarity of your discussions.

13. Section 4.1: Trend detection using the Mann-Kendall test: did you include the uncertainty of your observations in this trend analysis?

14. Figure 8: I don't see any indication of a "period of accelerated decline in maximum ice thickness" in the model data plotted here (the lines in Figure 8 don't show a visible

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acceleration).

15 Page 3796, lines 4-8: Please add standard deviations to your estimates of changes in freeze-up dates and break-up dates.

16. Page 3796, first two sentences of Section 5: I would remove these sentences from the document. Your document is addressing longer term trends in lake ice behavior and the reader is going into this Section with this expectation. Starting off with a discussion of short term (seasonal) trends is therefore confusing and I would suggest removing these sentences from Section 5.

17. Page 3796, line 19: You write "A specific temporal pattern in the evolution of the grounded ice fraction . . . was not observed . . ." – what time frame are you talking about here? Seasonal? Long term? Please try to increase the clarity here.

Interactive comment on The Cryosphere Discuss., 7, 3783, 2013.