

Interactive comment on “Evidence of recent changes in the ice regime of lakes in the Canadian High Arctic from spaceborne satellite observations” by C. M. Surdu et al.

Anonymous Referee #2

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Review of paper "Evidence of recent changes in the ice regime of lakes in the Canadian High Arctic from spaceborne satellite observations" by C. M. Surdu, C. R. Duguay, and D. Fernández-Pietro

In the context of research on climate-related changes of the cryosphere, this paper is a useful study that deals with temporal trends of melt onset and freeze-up of Arctic lakes in northern Canada, observed over a period of 15 years. Since radar and optical satellite images were used, a wide spatial coverage of the Canadian Arctic Archipelago could be achieved, with detailed analyses of melt-freeze cycles of 11 selected lakes. Surface temperature data are taken from local weather stations, ERA-Interim reanaly-

C3005

sis data, and MODIS data products. The conclusions are carefully drawn: although the general warming trend in the Arctic is regarded the main reason for earlier melt and longer ice-free time intervals, the influence of shorter temperature variability cannot be excluded. The paper is well structured and written. I recommend publication of the manuscript after moderate changes as suggested below.

Page 6225, lines 16-21: (a) it would be interesting to know how the ice on the lake looks like in the field when it can be detected in an image pixel the first time? (b) The terms “summer ice minimum”, “WCI”, “ice break-up season” should be listed here and explained in more detail: My understanding of “summer ice minimum”, e. g., is that ice is present over the entire year and reaches a minimum extent during summer. The analysis presented in section 4.2, however, seems to use this term also for cases in which the ice vanishes during summer. What is the difference between “ice-free” and “WCL”? The “break-up” season covers a time interval from MO to first day of WCL or, in case of perennial ice cover, from MO to first day freeze-up? “Ice-out” (used e.g. on page 6241, line 8) is “ice-free”?

Page 6229, lines 10 and 14: what is meant by “beginning of winter” and “end-of-winter”: the corresponding meteorological dates? Or the freezing period?

Page 6231, lines 4-8: It should be mentioned that the backscattered intensity depends also on the local radar incidence angle.

Page 6233, line 10: The criteria that were used to merge the five classes determined in the first step into ice and water need to be explained. Figure 2 indicates that in the specific case shown three segments (blue, light blue, yellow) were merged to class “ice”, and two segments (green and red) to class “water”. Same page: Since the temporal gaps between successive satellite images can be as large as 13 days, it needs to be explained how the date for an event (e. g. MO) was determined for time gaps > 1day? This is mentioned for WCL on page 6242, lines 13-16 but is important also for MO, considering the images shown in Fig. 9. It should be indicated that the

C3006

Mann-Kendall test is regarded significant only for values of $\alpha \leq 0.1$ (as the summary indicates. However: on page 6239, lines 13-14 a level > 0.1 is regarded as significant, too. What is the limit?).

Page 6235, line 9: I do not understand the sentence “For the monthly. . .” Seems that a word is missing.

Page 6236: Do MO dates shown in table 3 represent ice break-up in all cases, or is it possible that some dates are biased because of water on ice? (It should be made clear in the introduction that MO means that an ice-free patch appears on the otherwise ice-covered lake surface.)

Section 4.2, Tables 4 and 5: the use of terms “summer ice minimum” is irritating. If the ice cover vanishes completely it makes no sense to talk about “summer ice minimum”. In Table 4, the last day with ice cover is shown (or in case of perennial ice cover, the day of a “real” summer ice minimum?), and in Table 5, the first day with no ice? But differences between corresponding numbers are > 1 in many cases. This should be clarified.

Page 6241 last paragraph and page 6242, first paragraph: Here it is argued that the lower correlation between the date of 0° spring isotherm and WCL timing of those lakes occasionally covered by ice during summer is due to the fact that those lakes are more distant from weather stations, and gridded ERA-Interim climate data cannot represent local conditions adequately. However, for example L4 Devon seems to be rather close to a weather station? The problem of not adequately represented microclimate can be valid for all types of lakes, not only for the occasionally ice-covered ones. And can all of the latter ones be regarded as embedded in a localized microclimate environment?

Page 6243, lines 23-28: the two sentences are partly redundant and can be shortened.

Section 5.2: From the headline (Lake ice in a changing cryosphere) I expected a discussion of different parameters and environmental conditions influencing the seasonal

C3007

lake ice evolution. Instead, only the influence of temperature is discussed in great detail. What is the main message to keep in mind?

Page 6247, line 14: what is meant by “extreme ice event”? Intuitively I would guess much ice on the lake. . .

Interactive comment on The Cryosphere Discuss., 9, 6223, 2015.

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