

This is a well-written, well-organized and well-illustrated paper. It presents the results of original research and makes a valuable contribution to knowledge and understanding of passive microwave remote sensing as a tool for deriving ice phenology, in this case on two very large northern Canadian lakes – Great Bear and Great Slave. Lake ice phenology is an important indicator of climate variation and change and, at a time when observation networks on the ground have been greatly diminished by short-sighted governments, the results of this paper are particularly important as they show that accurate large lake ice phenology records are possible using passive microwave remote sensing. In this regard I think that the authors are being a little too modest about the new algorithm and how their results compare with lake ice phenology records derived by other means. I would say that their work is a significant advance and that the results are the better than those derived by other means. It is to be hoped that the new algorithm will be adopted to document lake ice phenology at a larger number of lakes in the future (and that a quantification of uncertainty/biases will be attempted – see p. 17, lines 2-3), and applied retrospectively to older passive microwave data to extend the phenology record back in time.

Specific Comments

1. I recommend avoiding the use of ‘phonological’ and instead use ‘phenology’ exclusively.
2. The ‘cross-’ in ‘cross-compare’ and ‘cross-comparison’ is redundant. One need only use ‘compare’ and ‘comparison’.
3. This paper describes phenology ‘variables’ not phenology ‘parameters’. Parameters are invariant. Freeze onset, ice-on etc are very definitely variable, as demonstrated in this paper. Thus they are variables.
4. Melt onset (MO) must be defined early in the paper rather than waiting until p. 14, line 25.
5. Sections 5.1.1 and 5.1.2, but particularly 5.1.2, contain much extraneous information as the authors apparently attempt to explain the T_b variability. I don’t think this is necessary, particularly as the explanations derive from observations often made elsewhere in studies not concerned with T_b . Thus I see no need for the material on, e.g., fluxes and heat exchange, snow ice and clear/black ice, etc....
6. Regarding Section 5.3, did the authors experiment with different thresholds and those presented in this section are the optimum thresholds? If there was experimentation, do we need to see some of those results in the paper?
7. The results presented in Section 6 can be fairly dense and difficult to follow due to the level of detail. I recommend making life a little easier for the reader by referring only to the earliest and latest dates of events. There is no need to describe events that closely follow the extremes.

8. The paper has nine tables. This is rather a lot, but perhaps it doesn't matter so much in an online publication. Nonetheless, it will be a dedicated reader who ploughs through all that detail.

Page-by-page comments

1. Page 2/Line 30 (2/30): I suggest '*in situ* observations of lake and river ice'.
2. 3/13: I suggest using 'shrinkage' instead of 'diminishing trend'.
3. 3/19: 'Obscurity' is incorrect. The correct word is 'obscuration'. What is obscuring the lakes besides cloud cover? Darkness? Perhaps you want to say 'obscuration by darkness and extensive cloud cover'.
4. 3/22: GSL needs to be spelled out in full as GSL has not been used so far in the main body of the text.
5. 3/24: I don't think it is necessary to explain why the QuikSAT mission ended. Thus, delete 'due to antenna spin rate degradation'.
6. 3/29: I recommend deleting 'one of the two lakes in this study'. This will reduce the length of an already very long sentence without any loss of value.
7. 4/1. I recommend 'Measurements by' rather than 'Measurements from'.
8. 4/4: I recommend 'measurements for estimating' rather than 'measurements of estimating'.
9. 4/25: I recommend 'ice cover' rather than 'ice surface'.
10. 5/30: I recommend not placing the lake average depths in parentheses, and instead write 'and, respectively, have surface areas of $31.3 \times 10^3 \text{ km}^2$ and $28.6 \times 10^3 \text{ km}^2$, and average depths of 76 m and 88 m (references)'.
11. 6/1: The Arctic Circle does not influence weather and climate. It is not a boundary between climate zones.
12. 6/5: The seasons need to be defined in the text. They are defined in Table 2, but it would be useful to do it in the text too.
13. 6/10-11: I recommend 'and therefore the GSL open-water period is about four to six weeks longer than it is at GBL'.
14. 6/21: Ascribing temperature differences between GBL and GSL to the latitude difference is as erroneous as invoking the Arctic Circle to explain temperature differences.
15. 7/7: I suggest writing 'and the along-track and cross-track sampling interval of each channel'.
16. 7/18-20: The sentence beginning 'The sampling intervals ...' is repetitive (see line 7) and can be deleted.
17. 7/2021: I suggest 'except for 89 GHz, for which we chose a 5 km grid spacing.'
18. 8/6: Is it necessary to refer to 'polar darkness'? It is simply darkness. See also 8/29.
19. 8/7: Has 'SIR' been defined in full earlier in the paper?

20. 8/10: I would prefer to see '24 km and 4 km' rather than omitting the unit after 24.
21. 8/14-15. The 4 km IMS product was used for comparison with what? With your products? I think it should be made clear.
22. 8/23: Are the lake ice fraction values 1 and 0 actually tenths, i.e., 1/10 and zero tenths?
23. 9/4-5. I suggest 'through ice seasons required the seasonal evolution of horizontally and vertically polarized T_b at different frequencies be examined first.'
24. 9/8: It's not necessary to refer to 'from nearby meteorological stations' as those stations are described in Section 4.1.2. Instead, say 'from the meteorological stations'.
25. 9/14-17: The sentence beginning 'The bottom panel of ...' basically repeats the figure caption and can thus be deleted.
26. 9/25: I recommend 'increase' instead of 'augment'. Likewise, 'increase' instead of 'augmentation' in 9/27.
27. 10/3-5: The sentence beginning 'An augmentation in T_b ...' is repetition – see 4/23-26.
28. 10/7-8: The three references are inappropriate, as those studies were not concerned with T_b .
29. 10/14: I recommend 'exceed' instead of 'surpass'.
30. 10/17: Isn't there a primary reference that can be used instead of Jeffries et al.? The latter is a review paper and thus a secondary reference.
31. 10/18: Besides not seeing the relevance of uniform internal structure and surface roughness, I don't think I can agree that the internal structure becomes uniform during melting. For example, candling due to absorption of solar radiation along congelation ice crystal boundaries creates a very non-uniform internal structure.
32. 10/21-22: Do you mean to indicate that wind-roughened melt ponds are removed or do you mean to indicate that wind-roughened melt ponds are present?
33. 12/19: I recommend 'ice-free season from those of later days'.
34. 14/9: I recommend 'due to the fact that water depths in the confidence region'.
35. 14/10-11: I recommend 'between 20 m and 80 m in GSL; GBL therefore takes longer to lose its heat.'
36. 14/19: Instead of 'It must be bear in mind' I suggest 'One should bear in mind'.
37. 14/21: Delete 'therefore'.
38. 14/28: Another reference to latitude as the explanation for temperature difference. Why not omit latitude and simply note that the MO differences between the two lakes are due to spring air temperature differences?
39. 15/21: Delete 'spatially'.

40. 16/10-11. It is probably not necessary to refer to river water melting both the bottom and sides of the ice. It is probably sufficient to refer only to the influence of the inflowing Slave River.
41. 16/31: I don't understand 'methods' in 'methods and satellite sensors'. Method and approach are practically synonymous. Do you mean field/in situ methods or field/in situ observations?
42. 17/1: I suggest 'level of agreement with existing products'.
43. 17/3: I suggest 'This is a topic that merits investigation in a follow-up study'.
44. 17/16: By 'wind-roughened cracks' do you mean 'wind-roughened water in cracks'?
45. 17/20: I suggest 'ice-covered lake surface, and not as much by'.
46. 17/31: I suggest 'extensive cloud cover during this period'.
47. 18/8: I suggest 'are also quite similar between'.
48. 18/12: I suggest 'phenology parameter among products examined.' Delete 'herein' too.
49. 18/15: I suggest 'on average from IMS'.
50. 18/18: I suggest 'AMSR-E suffers from land contamination'.
51. 18/20: AMSR-E IDCp estimates are slightly shorter than what? Those available in IMS?
52. 18/21-22: I don't understand the meaning of the sentence 'Since ICDp is calculated from ice-on to ice-off dates such differences are possible.'
53. 18/26: I suggest that the comparison is less useful or less meaningful.
54. 18/28: I suggest 'with AMSR-E compared to those determined'.
55. 19/5: I suggest 'that CIS is a weekly product'.
56. 19/6: Rather than use 'may' can't you be more definite and say that the differences are attributed to the temporal resolution?
57. 19/25: As noted earlier, I don't think latitude is a major factor.
58. 29, Figure 1. What do the arrows indicate? River flow direction? Need to add a note to the figure caption. Also, I would like to see the sampling site dimensions given in kilometers as well as seconds.