

## ***Interactive comment on “IcePAC – a Probabilistic Tool to Study Sea Ice Spatiotemporal Dynamic: Application to the Hudson Bay area, Northeastern Canada” by Charles Gignac et al.***

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ICEPAC – A PROBABILISTIC TOOL TO STUDY SEA ICE SPATIOTEMPORAL DYNAMIC: APPLICATION TO THE HUDSON BAY

Reviewer #2, We thank you very much for your valuable and helpful comments on our work. We made all suggested modifications to our manuscript. CG

R = Reviewer comments A = Author response and B = Manuscript modifications

A modified version of the manuscript is found as supplementary file.

GENERAL COMMENTS

C1

R: I agree with the comments from Referee #1 that the use of “meltdown” throughout the text and figures should be changed to “melt”.

A: The terminology was modified throughout the manuscript.

R: This sentence should be revised. “raise” should be “increase” or similar. Clarify if the Arctic has warmed or will warm by 2 deg. C. Apprehend is not the best word choice in this sentence. “. . .will tend to amplify” Are you suggesting the process of Arctic Amplification here? More background detail on the physical processes is needed to make this connection.

A: The sentence was modified to put emphasis on the fact that effect of climate change is “stronger” in the Arctic and that this phenomenon, the “Arctic Amplification”, is expected to strengthen in the decades to come.

B: Modifications were made from line 30 to 32.

R: The phrase “permit to analyze” implies that there are restrictions on how the data may be used. Probability analyses may not be readily available to users, but this does not mean that they could not be produced. I suggest revising this sentence.

A: Other reviewers suggested this modification too. Therefore we have changed the sentence formulation as suggested.

B: Modifications were made on line 61 to 63.

R: Cryogenic cycle isn’t the right phrasing here. I suggest changing to seasonal sea ice cycle or similar.

A: The terminology was modified throughout the manuscript.

R: These are competing ideas. If complete freeze-up occurs in late December, why is the annual maximum extent in April? This needs to be clarified.

A: We agree with your comment.

C2

B: This sentence was reformulated to make things clearer (line 89 to 93).

R: Markus et al. (2009) is not a study of sea ice extent. It should not be cited here. Also, Cavalieri and Parkinson (2012) is an update of the data examined in Parkinson and Cavalieri (2002, 2008) and Parkinson et al. (1999). Citing just the 2012 paper is sufficient.

A: As suggested, only the (Cavalieri and Parkinson 2012) paper was kept as a reference.

R: Figure 2: Adding some more description of the different panels in the figure caption would be helpful since the later steps of the process have not yet been described in text.

A: Description of the steps was added to the Figure 2 caption.

R: Figure 5: "C%det" is not explicitly defined in text or the figure. Is this the same as SICdet? Define the notation in the figure caption or text.

A: Figure 5 was modified to make sure every parameter presented in the flowchart was correctly identified.

R: Expand the acronym for NSIDC the first time it is used. Also, the content of the webpage listed changes frequently. A specific link to the anomaly maps that were compared with the author's data needs to be provided.

A: The NSIDC acronym is now defined the first time it is used in the text.

B: The definition is given on line 166.

R: Figure 6: I agree with Referee #1, I think a regular scatter plot would better show the spread in the probability curves for each site and take less time for readers to interpret

A: Figure 6 was modified to make sure its interpretation was easier for the readers.

B: Interpretation was provided in the text between lines 323 and 351.

C3

R: After what inquiry? Is this personal communication? With whom? (About the OFB site showing incoherent sea ice concentration behavior)

A: Using the term "inquiry" was maybe not appropriate here. The term was literally translated from French and was not necessary in the context. Therefore, it was removed.

R: Figure 7: The MODIS data need to be properly cited.

A: Done.

R: It is important to note that SIC thresholds to define sea ice retreat (advance) should be used only after the annual SIE maximum (minimum). For example, the first week that SIC is above 15% at a given pixel during a calendar year would likely be in week 1, not during autumn freeze-up. What time constraints were applied to the data to define the likely freeze-up or melting periods?

A: Queries for the freeze-up events were from week 44 (September 1st) and up and those for melt events were made from week 14 (April 1st) and up. Both events were to be sustained for at least 3 consecutive weeks to be considered valid. These details were added to the manuscript in section "4.1 Analysis with the IcePAC tool".

B: The modifications were made from line 367 to 373.

#### TECHNICAL CORRECTIONS

All technical corrections were done to the manuscript.

Please also note the supplement to this comment:

<https://www.the-cryosphere-discuss.net/tc-2018-178/tc-2018-178-AC2-supplement.pdf>

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Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-178>, 2018.

C4