

Response to RC2

We authors thank you for your time and constructive comments on the manuscript “Changes in the annual sea ice freeze-thaw cycle in the Arctic Ocean from 2001 to 2018”. We would consider each comment carefully and incorporate practically all of them.

Specific comments:

L156-157: I would rephrase the definition of the continuous melt/freeze onset to the “the day after which ice surface melting/freezing conditions persist”.

Reply: We will modify the definition of continuous melt/freeze onset as the suggestion.

L224: There is no Table S1.

Reply: Table S1 is in the supplement, which refer to the summary of surface and basal melt/freeze onsets from different methods.

L241: Paragraph 3.1 (Comparison of ice surface melt and freeze onsets from different methods): The period of time covered by this analysis is unclear. You mention that you use 55 IMB trajectories but not the time period.

Reply: Thanks for your comment. We check the time period of 55 IMB trajectories analyzed here, and the time period will be specified to “2002 to 2018” in the manuscript.

L265: I would replace Figure 3 by a table since half of the entries are empty.

Reply: We consider to retain the figure, since the colormap also shows the level of difference between 4 pairs of surface melt and freeze onsets.

L291: I would suggest using days instead of “d” here and throughout the manuscript

Reply: We will unify the units of “days” and “d” as “days” throughout the manuscript as your suggestion.

L308-309: Please rephrase “FO is primarily controlled by the decline of net shortwave radiation as the approaching of polar night”. The sentence is confusing, not clear.

Reply: The point we want to express is that when the polar night approaching, the both the net shortwave radiation and net longwave radiation decreases. And the heat balance during before and after FO shows that the decline net shortwave radiation is the primarily controlling factor of FO. We will rewrite the sentence to make the expression clear.

L 310: Table 2 is not referenced in the text.

L381: Table 4 is not referenced in the text.

L334: you mention Figure 5b but there is no previous mention of Figure 5a.

Reply: we will add the reference of the Table 2 Table 4 and figure 5a in the text.

L314: Can you be a little more specific than “~several mK”?

Reply: we will modify the sentence refer to the original of Shaw et al. (2009), and specify “~several mK” to “within a few mK of the freezing point”.

L331-332: I would rephrase “Here we further investigate the mechanism relevant to the BFO from the perspectives of both sea ice itself and underlying Ocean”. It is unclear.

Reply: To make the expression more clearer, the sentence will be rewritten as “We further investigate the mechanism relevant to the time lag between BFO and SFO from the perspectives of both sea ice itself and underlying Ocean.”.

L435: I believe you are referring to Figure 4 instead of Figure 3?

Reply: Thank you for your information. It is a mistake and. It should be “Figure 4c and 4d” instead of “Figure 3c and 3d”.

L12: Replace “from surface” by “of the surface”.

L94: Replace “show” by “showed”.

L327: “absorbs” instead of “absorb”.

L356: Delete “here”.

L501: Replace “ascribe” by “attributed”.

L502: replace "Lagrangion" by "Lagrangian".

L507-507: I would rephrase” Second, the presences of ice interior melt” to “Second, interior ice melt”.

L516: Replace “varieties” by “diverse”.

Reply: All the grammatical mistakes and inappropriate expressions will be revised as your suggestion.