

The Cryosphere Discuss., referee comment RC2
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Comment on tc-2021-6

Anonymous Referee #2

Referee comment on "The contribution of melt ponds to enhanced Arctic sea-ice melt during the Last Interglacial" by Rachel Diamond et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2021-6-RC2>, 2021

Review of Diamond et al.,

Diamond et al. analyse the processes leading to Arctic sea-ice loss during the Last Interglacial period (LIG) in the HadGEM3 model. The HadGEM3 is the only model simulating an ice-free Arctic in summer at the LIG. The authors analysis suggests that the sea-ice loss is due to thermodynamic processes, and particularly the creation of melt ponds in late spring/early summer. While the HadGEM3 Arctic sea ice LIG results were presented in Guarino et al., 2020, this study looks in more details at the processes at play. As such, this is an interesting study, well suited for TC, however, I find it a bit hard to follow, with many missing links between sentences/paragraphs/sections. I detail a few comments below but encourage the authors to read their manuscripts and improve the flow and links, particularly in the Introduction and the first part of the results.

Section 3.1 (before 3.1.1, as a side note, maybe the structure of the results need to be amended):

- A first short paragraph and figure showing a comparison between observed and simulated monthly Arctic sea-ice area would be useful.
- Since the anomalous Arctic sea-ice loss is due to the higher seasonal insolation at the LIG compared to PI, it would be useful to show in figure 1 high northern latitude insolation in PI and LIG. The addition of the insolation curve could also lead to a much earlier discussion of the conundrum: i.e. the maximum insolation anomalies are in June while the maximum sea-ice anomalies are reached in August. An earlier statement on that issue could make the flow of the paper easier to understand.

Figure 6 clearly shows the maximum short-wave anomalies in June, yet I find it surprising that during the early years of the spin up (Fig. 5), Aug. and Sept are the ones decreasing sharply and quickly while July (and June) sea-ice decreases less and more slowly.

As such, I am not so convinced of the usefulness of Fig. 5 (which could be moved to SI?), but wonder if it would make sense to instead show the timeseries of meltpond area in May and June in the spin up (i.e. similar to Fig. 5 but for meltpond area).

Another option would be to show sea-ice volume instead of area. Indeed, the July sea-ice area is 50% smaller in LIG than PI, but it is also much thinner, and sparse.

- It is quite interesting to show the SST and SSS changes in the Arctic, however this is very briefly mentioned and I don't find the flow of the beginning of section 3.1. logical.

Section 3.1.1: How were the ice volume tendency due to thermodynamics and dynamics calculated (Figs. 7 and 8)?

Section 3.1.2:

There are a lot of figures (and sub-panel) in the manuscript, and I wonder if all are necessary.

For example, are figures 10a,b necessary? Similarly, wouldn't only fig.12a be sufficient? Maybe only Fig. 13b is necessary.

P16, L. 240-255: PI SW as well as albedo differences between LIG and PI are discussed while not shown. Maybe at least the albedo could be shown in figure 13 instead.

Minor points:

P1, L. 20: "affect"

P1, L. 24: what are you referring to here?

P3, L. 68: Please add a transition sentence before that section

P4, L. 120 and 122: I doubt the model is "in equilibrium" after 350 years of spin-up. Please modify to "quasi-equilibrium" or "the surface variables have reached a steady state".

P6, L. 151: remove "is"

P6, L. 153: "year" or "years"?

P6, L. 154: "Figure 5 shows that..."

P16: Many full stops are missing.

P18: Section 3.1. discusses "sea-ice area" whereas section 3.3. discusses "sea-ice extent". It would be good to only discuss one or the other.

