



EGUsphere, referee comment RC2  
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## **Comment on egusphere-2022-594**

Anonymous Referee #2

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Referee comment on "Summer surface air temperature proxies point to near-sea-ice-free conditions in the Arctic at 127 ka" by Louise C. Sime et al., EGU sphere,  
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This manuscript discusses the Arctic sea ice conditions at 127 ka based on the relationship between sea ice and temperature, it is an interesting topic and well written. However, there are still some questions need to be further discussed.

1. Due to the sea surface temperature (SST) is more related to sea ice than the surface air temperature (SAT), why the SAT is chosen instead of SST?

2. A short summary about why these proxy records are considered to represent the summer surface air temperature should be given in order to better understand the model-data comparison.

3. In lines 210-217, if the simulations show a realistic representation of the geographical extent for the summer minimum, the CO<sub>2</sub> increases 100 (280 to 380) ppmv, the summer minimum SIA decreases 0.7 (6.4 to 5.7) mill. km<sup>2</sup>. How do you think about the sensitivity of Arctic sea ice in response to CO<sub>2</sub>?

4. In part 3.1, different models show significant difference in the simulated Arctic sea ice for both the PI and LIG simulations. What do you think leads these difference between different models? How about the sensitivity of Arctic sea ice in response to astronomical forcing and how about the polar amplification in different models due to both of them have a great effect on the Arctic sea ice?

5. Although your results show that near sea-ice-free conditions in the Arctic at 127 ka, some records indicate that there still exists substantial sea ice (for example, in lines 233-234 and in Stein et al. (2017) <https://doi.org/10.1038/s41467-017-00552-1>). More discussion about these records should be given.

6. In lines 389-391, you state that "the 8 models with largest SIA reduction are all able to match, within uncertainty, the mean PI to LIG summertime Arctic warming of  $4.5 \pm 1.7$  K at the 21 proxy locations". But in lines 397-399, "The two most skilful models simulate an average LIG sea ice area of 1.3 mill. km<sup>2</sup> which is a 4.5 mill. km<sup>2</sup> or 79% reduction from their PI values", only the average result of the two models is given, why not the average result of these eight models?

7. It is not clear that how many model results are used to establish the relationship between  $\Delta$ SSAT and  $\Delta$ SIA, 2 or 8 or 11? If it is 2 or 11, why not 8?

8. The forcing mechanism for the near sea-ice-free conditions in the Arctic at 127 ka should be discussed.