Review of manuscript by Sime et al. entitled ‘Summer surfce air temperature proxies point to near sea-ice-free conditions in the Arctic at 127ka’.

The authors present a well though-out and well written study to study LIG sea-ice changes and simulated relationships between changes in temperature and sea ice. I have only a few comments which are listed below.

Main comment:
To make this work more directly relevant to a larger public and to the understanding of ongoing climate change, it would be usefull to compare the presented findings with observational records. In particular, I’m wondering if from observational estimates one can also deduce a relationship between changes in Arctic summer temperatures and sea-ice area, and how such a relationship would compare to the LIG-based estimate. A dSIA of 4.4 mil. km2 for a dSSAT of 3.7, gives dSIA of 1.18 mil. km2 per 1K dSSAT. Potentially, there is a difference because the LIG climate was close to equilibrium while an observational estimate would be based on transient climate change. Another problem could be that the LIG winter forcing was negative, while the present-day GHG-driven winter forcing is positive. Nonetheless, this could be a nice addition to the presented work.

Minor comments:
Line 25: So dSIA corresponds to NH-wide changes in sea ice while dSSAT corresponds to local, proxy location changes in temperature? Reword to make this clear.

Lines 85-88: You make it sound like it is either sea-ice changes or vegetation changes, while in reality they will very likely go hand-in-hand. It is hard to imagine a sea-ice free Arctic that is several degrees warmer in summer, that does not see any changes in vegetation on the surrounding continents. And indeed, these vegetation changes will likely feedback on the temperature and sea-ice changes.

Figure 2: why not show the observational sea-ice concentrations on all the maps, or in a separate plot?

Lines 299-302: by using percentage changes, is EC-Earth no longer an outlier as mentioned above, or is it still an outlier?

Figure A4: using this metric is seems HadGEM3-GC31-ll is now an outlier!

Technical comments:
Line 91: maybe better to use ‘reconstructed’ instead of ‘observed’ throughout the text to avoid confusion with recent and present-day observations? Or alternatively, consequently use ‘proxy observation’ as you do on for instance line 106?

Figure 1: the figure and legend shows empty and filled red circles, but they appear both to be SI, IP25. What is the difference between them? Why are the sea-ice reconstructions shown on this map, are they used in this study?

Line 267: remove ‘for any model’?

Lines 285-287: perhaps reverse the order of 1 and 2 to be coherent with earlier mentioning.

Figure 8: add legend to the figure or mention in the caption that the legend can be found in figure 7.

Figure A5: indidate what is on the x-axis and y-axis.