

Interactive comment on “Large-scale features of Last Interglacial climate: Results from evaluating the *lig127k* simulations for CMIP6-PMIP4” by Bette Otto-Bliesner et al.

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Responses to Reviewer #2 cp-2019-174

We would like to thank you for your comments about our manuscript. We believe that the revisions we plan to implement should satisfactorily address your comments.

The first set of similar comments in this review is related to the set of simulations presented in the figures and analysis and included in several queries.

1. Why is HadGEM3 omitted from the sea ice comparison? HadGEM3 was omitted in Figure 8 at the request of the HadGEM3 co-authors. They felt having their results

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published online could lead to a paper that they had submitted on the HadGEM3 Arctic sea ice sensitivity not being sent out for review. We will include the HadGEM3 results in the *lig127k* revised paper.

2. The ACCESS-ESM results in Fig. 16. Indeed, a mistake was found in the dataset provided for the paper. At the time of the submission, as dictated by the IPCC AR6 deadline, many modeling groups were in the process of publishing their data to the ESGF, but since only a few had completed that task, we relied primarily on data sent directly to us. The set of simulations that will be included in the revised paper will be the *lig127k* and corresponding piControl and midHolocene on the CMIP6 ESGF. A table with the DOIs and analysis years for each model will be included in the Supp Info.

3. The completeness of Table 2. The details will be complete in the revised manuscript. At the time of submission of the *lig127k* paper, not all groups had provided this information.

The second main comment concerns the representation of model spread and proxy reconstruction uncertainty in Figures 11-13. We agree that these figures do not show the model spread. Indeed, some of the models compare better to the data than others. Nor do these figures show the proxy reconstruction uncertainties, which can be large, as discernable in the Supp Info. The revised paper will address the reviewer's concerns. First, we will include a table in the Supp Info that shows for every core site, the temperature anomaly and its uncertainty from the proxy reconstructions and the temperature anomaly for each model interpolated to the core location. Both annual and seasonal comparisons will be done. Second, a new Figure will be added showing reconstructed temperature anomalies with uncertainty as a function of latitude for each proxy core, and individual model anomalies at each site to show the spread of model estimates. To make readable, separate panels will be drafted regionally and seasonally.

Several more general comments concern the underlying mechanisms. The reviewer raises lots of great questions, in the main and other comments, that would be interest-

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ing to address using the lig127k simulations as well as across many of the other PMIP4 and CMIP6 simulations.

- Why might models be getting the incorrect pattern of change in some regions (e.g. is it really all down to missing freshwater or dynamic vegetation)? - What factors might contribute to the relatively large spread in simulated responses? - How robust are the seasonal versus annual reconstructions and which one of these tells us most about the model deficiencies? - Why does the sea-ice loss scale with ECS? - How do models with interactive vegetation or LAI differ from the fixed vegetation models?

This paper is meant to be a more descriptive, similar to the companion CMIP6-PMIP4 papers being published in the PMIP4 Climate of the Past Special Issue. The paper already includes 17 figures. More analyses to answer these questions would greatly expand the scope of this paper and best left to current (e.g., Kageyama et al., lig127k Arctic sea ice paper) and subsequent (as happened in previous PMIPs) more-detailed, multi-model topical papers and single model papers (e.g. Williams et al., CPD, 2020; O'ishi et al. CPD, 2020). Discussion and references to previously published results will be added to relevant sections.

In reply to more specific comments:

Lines 595-604: We agree. The text will be revised.

Lines 550, 552, 555, 562, 585: The text will be revised.

Line 583: The text will be clarified.

Line: 627 and Fig. 8: Now including all lig127k simulations, the correlation between the ECS and simulation of Aug-September lig127k minimum Arctic sea ice extent is -0.6, and is significant at the 95% level. Note that the y-axis in all but the first panel are sea ice area 'anomaly' and are labeled correctly.

Fig. 3, a) We are replacing the upper panel of Figure 3 with the MAT differences: PI minus observed to more clearly show the PI biases in surface air temperature. We will

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add the observational uncertainties. b) We prefer to keep the bottom panel as is, i.e. not join the circles. With 17 models now included in this figure, joining the lines would make it less easy to identify individual models (see figure in this reply, note currently for 16 of the models, AWI-ESM-2-1-LR to be added). The models show little spread at low latitudes, a large spread at NH high latitudes.

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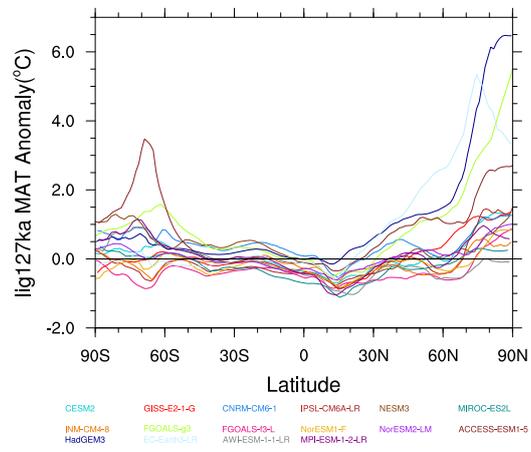


Fig. 1. Alternate bottom panel for Figure 3