

***Interactive comment on* “Evolution of the seasonal temperature cycle in a transient Holocene simulation: orbital forcing and sea-ice” by N. Fischer and J. H. Jungclaus**

Anonymous Referee #2

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This study presents a straightforward and clear experiment examining how variations in seasonal insolation propagate through to surface temperatures. In particular, the effect of sea ice on the seasonal cycle is clearly demonstrated. The paper is a little brief in parts, but is in general well-written and the introduction and discussion are clear, and I would recommend this paper for publication, if the following points are addressed:

- 1) The introduction is a little short, in particular a short review of some of the available data that can address the problem of seasonality change is encouraged.
- 2) I found the results section a little confusing, as it is not clearly stated that the authors use the mid-Holocene as a reference point. In general, paleoclimate anomalies are

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with reference to a modern or control run, and so it is not initially clear what the authors mean when they describe 'a southward shift of the ITCZ', for example.

3) I found the comparison between temperature gradients a little confusing. The authors note that the model does not get the summer cooling observed over the south of Europe, and this results in a different gradient from the pollen-based LTG. When the authors consider a gradient across all continents, they do get a LTG trend similar to that of the European pollen (although at a different magnitude). Why is it that including all continents increases the resemblance to Europe? Is there summer cooling elsewhere in the Northern Hemisphere that can compensate for the lack of cooling in Europe? If so, the authors should consider a wider comparison with paleo-data, at least for the initial mid-Holocene time period (e.g. the cooling at latitudes demonstrated over a much larger region by Davis and Brewer (2009)).

4) The authors say that their temperature changes are related to changes in the NAO. Can they add more detail to this about how such a relationship would work. Further, the authors should cite and compare the results of the simulated NAO with Gladstone et al (2006; GRL), particularly with respect to the three hypotheses of changes in NAO state at the mid-Holocene (greater amplitude of NAO; more time in positive NAO; change in mean state with no change in variability)

5) The citation Davis et al 2011 is not found in the bibliography.

Interactive comment on Clim. Past Discuss., 7, 463, 2011.

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