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Interactive comment on “Iterative land proxy based reconstruction of SST for the simulation of terrestrial Holocene climate” by K. Haberkorn et al.

Anonymous Referee #1

Received and published: 10 April 2012

This manuscript describes a new method to reconstruct changes in SST by selecting the values that give the best agreement between model results and proxy data on land. The principle of the methodology is interesting but the way it is implemented is not adequate at this stage and the results are too preliminary to be convincing. The presentation should also be strongly improved. I could thus not recommend the publication of this manuscript in Earth System Dynamics.

1/ As I understand it, the method reconstructs spatially homogenous changes in the oceanic region of interest shown on Fig. 4. This is not valid for me as different regions, different latitude bands, are expected to respond in a different way during the Holocene. The technique should thus aim at reconstructing the spatial pattern of SST changes. If this is really the goal of the method (page 178 line 17), this is not explained clearly in

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the text. In addition, some elements are really confusing, in particular for a key element in the experimental design: when reading the sentence page 160, line 7 "The reference simulation yields a time series of SST for the Holocene which is characterized by the long-term changes in orbital and GHG forcing" I could not understand its link with page 159, line 27 : "As a reference experiment, we choose a Holocene climate simulation with prescribed SST based on the climatological annual cycle".

2/ There is no validation of the methodology, proving that the reconstruction has some skill. A brief comparison with some additional data is given but the discussion is very superficial. A reconstruction over the past 150 years or tests using some synthetic observations using the results of other models could bring useful elements of validation, but it is done presently.

3/ The method heavily relies on the connections in the model between ocean and land and assumes that any mismatch between model results and land data is due to the SST signal. This means that the SST changes obtained are compensating for all the model errors. There is thus a large chance that the SST changes are overestimated or underestimated because of this assumption but this is not discussed.

4/ The authors only use one time series to reconstruct past SST changes. This is clearly too low as the climate system has many degree of freedom and the temperature changes at one point can have different causes. It is only by ensuring the compatibility with several data that we can reasonably says that the model gives the right signal at the points of interest for the right reason.

5/ The authors claim that SST reconstructions are less reliable than land temperature estimates but I am not convinced by this statement and this is not really justified in the present manuscript.

6/ A more minor point is the fact that in the text, SST is considered as the driver of climate (e.g., line 1, page 150) while to me, the ocean is one element of the coupled climate system, as the atmosphere, land, etc.

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7/ The authors give much information that is not really related to the topic, making the discussion hard to follow. For instance, it is said page 153, line 17 that it is not intended to investigate the real Holocene while the first paragraph of page 154 explains that the final aim is to link Holocene climate to human settlement. The last paragraph of page 155 (following page 156) is also useless to me. Page 156, line 19, it is explained that this study relies on a compilation of 124 proxies to get at the end only one proxy selected (page 157, line 8). The authors present page 177-178 a methodology that is not used in this study, etc.

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