**Climate
of the Past
Discussions**

Interactive comment on "Mid-Holocene ocean and vegetation feedbacks over East Asia" *by* Z. Tian and D. Jiang

Anonymous Referee #3

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The authors Z. Tian and D. Jiang investigate, using the model CCSM4. how the ocean and vegetation contributed to the mid-Holocene climate in East Asia. The ocean contributes strongly to the temperature change, whereas the vegetation feedback is small. Novel here is the simulation set-up, which allows them to study in-depth the East Asian region with CCSM4. This study should fit well in 'Climate of the Past', however I recommend some considerable changes prior to publication.

General comments: The motivation of this study is not clear. Previous studies have investigated this region before with a similar comprehensive simulation set-up and the PMIP project provides many mid-Holocene simulations. The authors mention the use of CSSM4, which hasn't contributed to PMIP before, and that the chosen model set up allows, in part, the disentanglement of contributions from the oceans and from vegeta-

tion. The authors should state this clearly in the introduction. Along the same lines, the authors should define precisely the region they want to investigate. In the manuscript different terms are used (e.g. East Asia, China, national scale).

The paper is not well structured. Often the reader does not know if the analysis refers to PMIP simulations or to CSSM4 simulations. In addition, parts of the introduction are repeated in the results section (e.g. page 87, 18 is clearly part of the motivation which should be mentioned only in the introduction). The last section: 'Discussion and Conclusions' does not include a discussion. The manuscript needs a clear introduction, a section with CSSM4 results, followed by a section on a comparison with proxies and a discussion of your results with previous modelling studies including a comparison to PIMP-simulations. If you want to discuss the results whilst reporting these same results, you need to highlight more clearly to the reader what the actual results are (e.g use present tense for your analysis, past tense for previous studies).

To perform a clean factor separation, it is recommended to add two new simulations with prescribed ocean but dynamic vegetation (AV6k and AV0k) in order to calculate the vegetation feedback. Your definition of the vegetation feedback includes as well the synergy effect between ocean and vegetation (see Berger 2011, Berger, A., Claussen, M., and Yin, Q.: Factor separation method and palaeoclimates, in: Factor Separation in the Atmosphere-Applications and Future Prospects, edited by: Alpert, P. and Sholokhman, T., Cambridge Univ. Press, 2011.).

The orbital changes affect the length of the seasons. How did you treat this effect when you calculated the seasonal changes? (e.g. Joussaume, S. and Braconnot, P.: Sensitivity of paleoclimate simulation results to season definitions, J. Geophys. Res., 102, 1943–1956, 1997., Timm, O., Timmermann, A., Abe-Ouchi, A., Saito, F., and Segawa, T.: On the definition of seasons in paleoclimate simulations with orbital forcing, Paleoceanography, 23, PA2221, doi:10.1029/2007PA001461, 2008.).

It is astonishing that the models and proxies do not agree. The study would gain con-

siderably from an extra paragraph examining the possible reasons for this temperature mismatch.

Specific comments

Page 76: mention in the abstract the comparison with proxies

Page 79, 11: mention in the introduction how the orbital changes affected the seasonal radiation

Page 78, 10: add Dallmeyer et al. (2010)

Page 79/80: describe the land component of the model and its performance

Page 80, 25: this sentence is not clear, did you also prescribe the changes in greenhouse gases or did only the PMIP simulations do this?

Page 82, 7: the vegetation feedback cannot be directly estimated from (AOV6k-AOV0k)-(AO6k-AO0k). I suggest you add another set of two simulations AV6k and AV0k to extract the vegetation feedback by (AV6k-AV0k)-(A6k-A0k).

Page 82, 25: the definition of 'effective precipitations' should be provided here

Page 83, 1 -27: it is not clear if you analyse your data set or the PMIP simulations

Page 84, 1-11: it would be nice to describe the results of the figures instead of just mentioning them

Page 85, 11-21: this section is a discussion -start with your results

Page 86, 11 – 26: this belongs in the method part

Page 87, 1: as mentioned above with this set-up you are not able to precisely extract the vegetation feedback. Your definition of the vegetation feedback includes the synergy between the ocean and vegetation

Page 87, 18-29: this was already mentioned in the introduction (see78, 20-25)

Page 88, 5: you mention Fig. 6 but start describing it only in line 19. Again first mention your results and deal with the PMIP comparison separately.

Page 89, 3: which Fig. are you referring to? Fig. 7?

Page 89, 11: the Fig. shows a strong cooling, a warming of 0.0003K seems to be insignificant

Page 91, 11-19: should go into the introduction

Page 92, 1-4: this also belongs in the introduction. There is a contradiction here: you say you use a higher resolution of the model than in PMIP3 but this is in contrast to page 82, line 16.

Page 92, 6: the vegetation feedback is something novel in this study, therefore you should include a figure with the vegetation distribution, later you mention a 'forest increase' (e.g. line 24) and it would support this statement

Page 93, 10: what do you mean by 'forest spring'?

Page 95, 5-15: it is not possible to compare the AOV and AO simulations from PMIP in order to interpret the vegetation feedback, as they use different set-ups.

Page 95, 18: delete "reliable"

Page 96, 5 -: elaborate on this fact

Page 97, 10: this is summary and it would gain from some clear conclusions

Figures: use either 90 or 95 % confidence interval for all figures, add significance test to Fig. 6