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Geoscientific
Model Development
Discussions

Interactive comment on "Modelling the mid-Pliocene Warm Period climate with the IPSL coupled model and its atmospheric component LMDZ4" *by* C. Contoux et al.

Anonymous Referee #2

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The manuscript submitted by Contoux et al. entitled "Modelling the mid-Pliocene Warm Period climate with the IPSL coupled model and its atmospheric component LMDZ4" adds to the intercomparison initiative PlioMIP presented in Haywood et al. (2010) and Haywood et al. (2011). The authors aim at modeling the mid-Pliocene Warm Period using the Institut Pierre Simon Laplace model (IPSLCM5A).

The presented manuscript here summarizes the modeling strategy utilizing the atmosphere-only and coupled ocean-atmosphere climate models. The results chapter focuses on the general climatological parameters. Contoux et al. also include a discussion of the results.

The manuscript presented here is a valuable contribution to the overarching project PlioMIP. I would recommend the manuscript for publication in GMD after addressing the following specific comments (minor revisions, clarifications) and minor technical corrections.

COMMENTS/CLARIFICATIONS

Introduction, page 517, lines 10-19

Various proxy data, e.g. delta 18O data from marine cores, do not indicate a record of continuous, sustained warmth for the period suggested, in fact providing us with evidence of high (global) climate variability. How can you justify the modeling for such a (climatologically) long time period, which additionally seems to be quite heterogeneous?

Model description, page 519, lines 5-7

The description of land ice included in ORCHIDEE is not used when coupled to the atmosphere. What are the consequences given the fact that LMDZ accounts for the land ice instead? The mid-Pliocene ice sheets drastically differ to modern configurations (e.g. Hill et al. 2007). How do you treat the two different ice configurations in the Pliocene vs. modern scenarios? How does this impact the results of this study?

Experimental Design, page 520-522

For the AGCM experiment the authors prescribe SSTs. How are SSTs handled by the atmospheric component of the model? Fixed or slab-ocean component? Comment on the consequences of choosing one or another? How does this compare to other models in the PlioMIP framework and comply with the guidelines of PlioMIP? Please clarify.

Experimental Design, page 522, lines 1-3

BIOME4 data set consists of 28 data types, which are converted using 11 plant functional types. Explain potential consequences for the interpretation of simulated temperatures and other variables associated with an information loss of vegetation types?

Experimental Design, page 522, lines 14-15

For the AOGCM experiment, the integration time is set to 50 years. By consulting Figure 5, the last 50 years show high variability. How do the results (e.g. mean annual surface temperatures, precipitation) change when the results are based on a longer (>150 year) time period?

Results, pages 522-526

Some figures do include significance testing (as indicated by dotted areas). Add notion to those performed tests and the consequences for the stated results into the text section.

Results, pages 523-524

The authors are discussing the potential causes and mechanisms behind simulated precipitation results. This discussion could be included in a separate (new) discussion section. While I appreciate the detailed dynamical discussion of simulated precipitation patterns, it should be included in a new section, together with (at this point) missing discussion of temperature mechanisms and causes (section 4.1.).

Results, pages 522-526

The authors had the advantage of running AGCM and coupled AOGCM experiments for the Pliocene and pre-industrial scenarios. The authors should also include and discuss a direct comparison of the atmosphere-only vs. coupled model results. Use the results in Table 2 where significant differences are apparent between AGCM and AOGCM results.

Results, page 525, lines 21- page 526 line 2

Additional sensitivity tests are performed by the authors and are very valuable. In the

abstract the authors highlight those tests. Nevertheless, this section falls short later in the results section.

MINOR CHANGES/ TECHNICAL CORRECTIONS

Abstract, page 516, line 13

The authors are presenting annual temperature anomalies relative to control runs. However, this is not explicitly stated in the “Abstract”. Add for clarification.

Abstract, page 516, line 15

The authors state that “precipitation has a different behavior in the coupled ...”. The wording needs to be more specific here.

Introduction, page 517, line 16

“. . . more and more interested. . .”. Please rephrase (style).

Introduction, page 517, lines 17

Add comma after “. . . Chandler et al. (1994)”

Model description, page 518, line 2

Remove the word “together”

Model description, page 518, line 9

Replace “is” by “are”

Model description and experimental design, page 517-522

Introduce PlioMIP guidelines and definitions of “preferred” and “alternate” files for atmosphere-only and coupled runs right at the beginning of the methods section. This would help the reader to understand the tests performed for this intercomparison and puts the model description into context.

Experimental Design, page 521, line 15

“. . . anomaly method . . .” Detail or at least reference to Haywood et al. 2010, 2011.

Results, page 523, line 3

Change “Himalaya” to “Himalayas”

Results, page 525, line 10

“. . .are a very interesting feature. . .” Rephrase. Be more specific.

Results, page 526, lines 5-6

“. . ., and so does model results.” change to “. . ., and so do model results.”

Table 1

What is the basis for creating the percentiles?

Figure 3

Anomalies are more telling than absolute values. Add spatial differences anomalous to modern.

Figure 5

Label all x- and y- axes appropriately.

Figure 7

The figure depicts regions of significant results (dotted). Please indicate method of calculating the significance in caption. Also add to discussion in text (section results).

Figures 11 and 12

Combine?
