Geosci. Model Dev. Discuss., 4, C1300–C1303, 2012
www.geosci-model-dev-discuss.net/4/C1300/2012/

Geoscientific
Model Development
Discussions

Interactive comment on "The CSIRO Mk3L climate system model version 1.0 – Part 2: Response to external forcings" *by* S. J. Phipps et al.

Anonymous Referee #3

Received and published: 9 January 2012

The authors describe the behavior of the CSIRO Mk3L climate model introduced in Part 1 under various "standard" forcing scenarios: mid-Holocene, transient Holocene, last millennium, and CO2-scenarios. The authors describe the model's response in terms of surface temperature, precipitation, and ENSO variability to orbital forcing applied in the time-slice mid-Holocene experiments and evaluate the influence of different acceleration factors of the applied orbital forcing in transient simulations of the last 6.000 yr. In the second part the authors investigate the models behavior to additional forcing, such as TSI, volcanic aerosols, and greenhouse gases in the last millennium. In the last past the model's response to different CO2-stabilization scenarios is investigated. The CSIRO Mk3L climate model behaves well within the range of paleo-reconstructions and other comparable climate models under the respective forcing scenarios.

The paper is very well written and structured and describes the different experiments in a concise and straight forward manner. It succeeds in giving an overview of the model's performance under the different forcing scenarios and points out the potential shortcomings. It is, thus, a very suitable extension of the companion paper describing the model itself. From my point of view, there is one major concern the authors should discuss: How does the flux correction applied in the model affect the results obtained for potentially different mean states of the climate system in the mid-Holocene and also in the CO2-scenarios, especially in terms of the response of the ocean circulation discussed in chapter 5. If this point is addressed I would recommend the publication in GMD. Also, the authors might want to consider a few minor comments that I listed below.

Minor comments:

For the mid-Holocene experiment, could you please state, why you chose a relatively short spin-up period of 100 yr? Since the control run itself has a non-negligible drift, how does the drift change, when you apply the forcing? And how large is the drift in the analysis period you consider?

For the different analyses performed, could you please indicate where the changes compared to the control run are significant? Also how dependent are the results to the analysis period you consider?

Why are ocean variables (temperature, sea ice, and deep-water formation) only discussed in the CO2-stabilization scenarios?

In the difference plots, could you introduce a white interval around zero? Otherwise, it is difficult to decide whether a small signal is there, or not.

Specific comments (Page and line numbers refer to the printer-friendly version of the manuscript.):

p.3367/l.5: Please give some representative citations.

GMDD

4, C1300–C1303, 2012

3367/12: I think “Berger 1978” is the more appropriate citation here.

3367/14-17: Is the annual mean insolation dependent on the obliquity? I could imagine it is more the eccentricity of the Earth’s orbit.

3367/22-24: Not necessarily. The PMIP2 study (Braconnot et al. 2007a) suggests substantial changes in the annual mean as well.

3368/19-25: Maybe you can discuss the results obtained in Vamborg et al. (2011).

The effect of a dynamic background albedo scheme on Sahel/Sahara precipitation during the mid-Holocene, F.S.E.Vamborg, V. Brovkin, and M. Claussen Clim. Past, 7, 117-131, 2011

3372/27-3373/5: If there is a westward shift, what happens if you choose Nino 4?

3373/22+23: “boreal” instead of “northern”?

3376/14: How was significance tested here?

3377/22-23 To my knowledge, the “abrupt desertification” of the Sahara in the Holocene is still under discussion (e.g. Kropelin et al. 2008, Brovkin and Claussen 2008)

Climate-Driven Ecosystem Succession in the Sahara: The Past 6000 Years, S. Kröpelin, D. Verschuren, A.-M. Lézine, H. Eggermont, C. Cocquyt, P. Francus, J.-P. Cazet, M. Fagot, B. Rumes, J. M. Russell, F. Darius, D. J. Conley, M. Schuster, H. von Suchodoletz, and D. R. Engstrom Science 9 May 2008: 320 (5877), 765-768. [DOI:10.1126/science.1154913]

Comment on "Climate-Driven Ecosystem Succession in the Sahara: The Past 6000 Years", Victor Brovkin and Martin Claussen Science 28 November 2008: 322 (5906), 1326. [DOI:10.1126/science.1163381]

3378/26-28: I am skeptical that millennial-scale variability can be discussed using ac-

GMDD

4, C1300–C1303, 2012

celerated experiments.

3379/2-4: If this is a robust feature, what could be the physical mechanism behind it?

3383/15: Introduce abbreviation for equivalent CO2

3386/25: write “Earth”

3388/19-21: Can you show the evolution of the AMOC? How large is the heat transport associated with AMOC?

3394/18-20: Please give the percent values as you do below.

Interactive comment on Geosci. Model Dev. Discuss., 4, 3363, 2011.