Geosci. Model Dev. Discuss., 3, C709–C713, 2011
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Geoscientific
Model Development
Discussions

Interactive comment on "Evaluation of a present-day climate simulation with a new coupled atmosphere-ocean model GENMOM" *by* J. R. Alder et al.

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Received and published: 20 January 2011

General Revisions:

We have used both the spirit of the reviewer's comments and our own critical review to revise the manuscript as a whole so that it flows better and reads a bit more logically. The overarching recommendations from both reviewers are to reduce the number of figures and to focus more on evaluation of GENMOM and less on comparison with other AOGCMs. We agree with these recommendations and we have accommodated them by: 1) including only one figure in which we compare GENMOM surface temperature and precipitation with NCEP and three other AOGCMs (as opposed to eight).

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Interactive Discussion

Discussion Paper

Based on the recommendation of Reviewer 1, we now plot only the anomalies for each model. This has eliminated three figures without diminishing the information we feel is needed. 2) We have added to the discussion of GENMOM and minimized the comparison of GENMOM with the other AOGCMs to a sentence in the discussion of surface temperature (p. 8, line 13) and precipitation (p. 9, line 6), ocean temperature (p.9, line 19) , salinity (p., 10, line 12) and parenthetically in the overturning (p. 11, line 1). We feel it is essential to keep some comparison in the paper because it is valuable and necessary to benchmark our model against other models.

Reviewer #2 Overall comment This paper presents basic climatological features of a new coupled (non-flux corrected) climate model, GENMOM, based on GENESIS v3 and MOM2. It is not a revolutionary, but a necessary paper: new climate models, and versions thereof, have to be conveniently documented by citable references. Although the paper does not present any substantial new concepts, ideas, or methods, it should therefore be published in GMD which appears to be the right journal for such a paper. The quality of the presentation is generally good. Concerning the scientific requirement of reproducibility of the results, it is regrettable that there is no information about the conditions of the distribution of the model code, and that apparently there is not a more detailed technical report available.

Reviewer #2 Specific comments T31 is a rather low model resolution nowadays. Are higher-resolution version available (and if yes, how do they perform) or planned?

Response: A 2x2 degree version was developed, but it has not been formally evaluated. The following text was added to the introduction:

“A higher resolution 2o x 2o is under development.”

In the Genesis 3 description, it is not very clear what is new compared to previous model versions. In general, an evaluation of the model with respect to previous versions (possibly in uncoupled or flux-corrected mode) might have been useful.

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Response: The following text is in the introduction: “GENESIS version 3 expands on version 2 by including the NCAR CCM3 radiation code. The ocean can optionally be represented by fixed sea surface temperatures, a slab or mixed layer or by the MOM2 ocean general circulation model.”

Additionally, the flowing text is in the conclusion: “Version 3 of GENESIS (Zhou et al., 2008; Kump and Pollard, 2008) incorporates the NCAR CCM3 radiation code (Kiehl et al., 1998) and the ocean is represented by the MOM2 ocean general circulation model (Pacanowski, 1996).”

These two sentences should now clarify what is new in the current version of the model. The manuscript primarily focuses on GENMOM vs observations and and secondarily on IPCC class models. To compare GENMOM to previous versions of GENESIS 1 & 2, the reader would need to follow the references and review the GENESIS 1 & 2 evaluation papers. A comparison of GENMOM vs GENESIS might be informative, but is outside the scope of this paper.

"The bottommost level is 660 m thick": This thickness should depend on bathymetry... otherwise, what happens e.g. on the continental shelf?

Response: GENMOM using the MOM2 ocean model uses a fixed depth z-coordinate system. Continental shelves in GENMOM are usually 2 – 3 layers thick, though these layers are thinner than deep ocean layers. [No change to text]

"Continental freshwater runoff is ... spread over the ocean": Is this still state-of-the art?

Response: A river routing scheme is available in GENMOM. As we discussed in the reply to Reviewer 1, we are working on improving the routing, particularly with respect to overturning. [No text change]

Eight selected IPCC AR4 models: How were these selected?

Response: See General Revisions. The three models were somewhat arbitrarily chosen but we included GFDL CM 2 and MPI ECHAM5 because we also use those models

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(along with GENMOM) in our parallel regional model efforts.

Use of NCEP for all validation fields to ensure consistency: Is that true? In the re-analysis, some fields are analyzed, others not. Therefore these fields different are not necessarily physically entirely consistent.

Response: NCEP was used for simplicity and to keep the observations as consistent as possible (with known issues with NCEP notwithstanding).

Bering strait closed: A word about the consequences?

Response: Earlier work with GENMOM with an open Bering Strait at T31 resolution produced an even weaker AMOC (<9 Sv). [No text change]

Atmospheric fields: It would have been nice to present systematically the differences between the model and NCEP fields. Otherwise it is hard to see the biases in model fields that exhibit strong gradients.

Response: The already has a fairly large number of figures. We believe that the analysis of the selected atmospheric fields adequately evaluates the model for the purposes of this paper. [No text change]

weak Southern Ocean pressure gradient: Might be a resolution issue linked not only to the topographical forcing, but also the atmospheric dynamics itself

Response: See comments to Reviewer #1 on weak wind stress in the SH. Low resolution leads to weak wind stress that affects ocean surface processes and circulation. This, of course, involves both atmospheric and oceanic dynamics.

Ocean currents: It would have been nice to have a more quantitative assessment of the model quality, for example by indicating the strength of the Antarctic Circumpolar Current etc.

Response: The strength of the ACC is noted in the text (Pg 14 line 11-12) and is found to be 35% weaker than the observed 119 Sv. [No change to text]

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Interactive Comment

Almost nothing is said about the simulated interannual and interdecadal variability. This is clearly something that must be addressed in a revised version. ENSO, NAO, SAM, etc.: Are these realistic in the model? (Amplitudes and spatial patterns)

Response: A separate evaluation for the GENMOM simulation of ENSO is in preparation and nearly completed. Preliminary finding shows that ENSO in GENMOM has good amplitude, period, spatial pattern but is lacking somewhat with regard to the seasonal timing of ENSO. NOA, PDO, SAM have not been evaluated. [No change to text]

Interactive comment on Geosci. Model Dev. Discuss., 3, 1697, 2010.