

Interactive comment on “Incorporation of the C-GOLDSTEIN efficient climate model into the GENIE framework: the “genie_eb_go_gs” configuration of GENIE” by R. Marsh et al.

Anonymous Referee #2

Received and published: 5 February 2009

Here is my reviewer's comments to replace the previous one. This time I review this paper as a kind of benchmark work.

[General comments]

The paper as a benchmark presents much important information, but as it sometimes lacks sufficient explanation and discussion, the impression of the manuscript is written for people in a closed community. Thus, for making it published as a paper towards more general readers, the authors need to add more explanation and discussion – particularly, I expect the authors to consider the following points.

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(1) Motivation of the experiment

I felt it is better to state the reason why the model has four defaults (currently written in p11) in Introduction, so that the reader can more easily accept the motivation and purpose of the experiment.

(2) How to deal with "unplanned" changes

In the experiment, some settings should have been changed to ensure numeric stability (page 13). Thus, the authors need to put short discussion on the physical adequacy and the effects of those "unplanned" changes—particularly, to open/close the Greenland-North America pathway may result in significant impacts—isn't it better to arrange the land-sea map keeping the pathway open rather than closing it?

(3) Precipitation problem

Although it is generally difficult for EMBMs to get a good representation in precipitation on land, I think it is inevitable to discuss this problem when an EMBM is incorporated in an ESM—provide quick evaluation in precipitation on land and a short discussion on whether or not we can couple this model with vegetation models.

(4) Summary

Even as a benchmark, I still think that the "summary and discussion" section is too weak. The selected important and/or arguable results are expected to be concisely restated with some discussion— e.g., the 72x72s' impressive behaviors in Figs 40a, b. In addition, it will be helpful for us to discuss on what the choice of the mesh may cause when incorporated in the ESM, on variables particularly sensitive/insensitive to changing the mesh, and on whether we can say one mesh has significantly better performance than others, etc.

[Specific comments]

P3L6 Put quick explanation of "deep time"

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P4L3-4 Not only the wiki pages, provide direct link to the model code so that readers can easily access the files referred to in the paper (e.g., ginie-embm/src/fortran/makefile(p8L14), those in Table1)

P8L19-20 Provide quantitative information on the condition to be precipitated (in specific humidity and/or relative humidity).

P11L4-18 It will be better to move (at least some of) this part to Introduction, as the reason why the model has four defaults is closely related to the motivation and the purpose of the experiment.

P11L20 Explain the purpose (and a conclusion) to use the 36x36s' topography in 72x72s—it may be interesting as an experiment, but questionable as a default. Also, explain how land-sea distribution is determined for other meshes.

P13L13-14 (1) The sentence says Greenland is detached only in 36x60, but in figures (Fig 1,2,etc) GL is attached only in 64x32. (2) Provide detailed explanation on the reason why the authors did not use the same condition (in that GL attaches/detaches to/from North America)?

P13L15-16 Explain physical meaning of isles=1 and =2.

P14L15- Provide quick explanation of the initial conditions.

P15L8-10 The model itself outputs the maps (either in NetCDF or in ASCII), or you used some analysis codes?

P16L14-17 In Fig. 17, it is not easy to compare 72x72s and other meshes. If possible, arrange the figure so that all meshes can be easily compared to each other. Moreover, although the text says >3 levels convected in 36x36s, there seems no such grids in the figure.

P17L5-6 Why can you say so?

P21L2-3 Provide formulation for how both of grid-cell areas and observed variance are

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considered, so that we can see the method works well for the comparison of different meshes.

P22L11-12 Do you have a plan to use different (not determined by sophisticated methods, but "subjectively" selected) parameters for other meshes?

P23L14 556ppmv is not the doubled value of 282.9 (Table 4). Deferent values are used as "pre-industrial" in these two cases?

P23L22 What does "initial" here mean? Did you use different initial conditions for four meshes?

P24L13-14 Explain how you parameterized the radiative forcing sensitivity for changing (increasing) CO₂ concentration.

P25L17-18 Provide some examples of consistency with findings of Lenton et al. (2007)

P26L11 Why do you think 36x36s runs so fast (in comparison to 64x32)?

P27L14 How many model years is "nearly one month" equivalent to?

Table8 (1) Is it difficult to calculate the total cost (considering both of atmosphere and ocean)? (2) Why do you think 36x36s (parameters are tuned for this) atmosphere has the poorest score?

Figure 5 How deep are "upper" and "deep"?

Fig 41 May be better to explain in the caption what the soil/dashed lines indicate.

[Technical corrections]

P7L3 upsteam->upstream

P23L23 Fig 16 -> Fig. 18?

P27 L11 delete one of two "yet".

Table 6 "heat" is omitted in the parameter names of the 6th and 7th items.

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Interactive comment on Geosci. Model Dev. Discuss., 2, 1, 2009.

GMDD

2, S7–S11, 2009

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