

Interactive comment on “PLASIM-GENIE: a new intermediate complexity AOGCM” by P. B. Holden et al.

Anonymous Referee #1

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The paper describes PLASIM-GENIE a new intermediate-complexity Atmosphere-Ocean Earth System Model, designed for simulations of millenium+ length. The new model is well suited for studies of long-term climate change, its simulation of present-day climate is acceptable, its formulation is mostly described well, and I recommend publication subject to the following changes being made.

1. It's not 100% clear whether or not this model has a carbon cycle, and what aspects of this are turned on or off. The model is described as an AOGCM (suggesting no C-cycle), but section 2.1 and others do allude to the simulation of different carbon pools on land, which is slightly confusing. I presume there is some sort of diagnostic C-cycle which does not affect atmospheric CO₂, but does affect vegetation. However GENIE-1 does contain a fully interactive C-cycle. The abstract, introduction, section 2.1 and

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other sections have to be clearer about which parts of the C-cycle are on or off. Any flexibility in the C-cycle (ie: being run in a diagnostic mode to simulation terrestrial pools but without affecting the ocean and atmosphere) should be noted, as potential users of this AOGCM would be interested in this.

2. What is the difference between PLASIM-GENIE and OSU-Vic? Is the UVic ocean component a frictional geostrophic model like GENIE? OSU-UVic is also downloadable, so potential users of PLASIM-GENIE should know the differences between the two.

3. The following parameterisations in section 2.1 need to be clarified/described in more detail (a sentence or two on each will do): -"shortwave and longwave radiative transport"; this is a very confusing term and in particular needs clarifying -"interactive clouds"; are these based on relative humidity? -"diffusive transport"; I guess this is some sort of hyperdiffusion? -how many visible and IR bands are there in PLASIM's radiation scheme?

4. Section 3.2: Radiation and convection seem to account for a very large percentage of the CPU load: potential users might want to replace the radiative scheme with something that is quicker- but also more general and flexible, e.g. a simpler semi-grey scheme (e.g. one LW band emits from the surface, one from the atmosphere depending on some simplified optical depth). Could the authors add a sentence on how easy this might be to do (from the point of view increasing this model's potential user base)

5. Section 3.3: Why does conversion from PE to KE necessarily cause an energy imbalance? This should be explained in detail- or at the very least a citation to other work that clearly explains why the imbalance happens should be included.

6. Figures 2,3,4: it is very hard to see what the differences between model and reanalysis are without difference plots. Contours plots of differences between PLASIM-GENIE and reanalysis need to be made for these three figures so readers can see what and where they are for themselves.

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7. Suggestion: the simulation of aridity seems pretty good- the authors might want to state the simulation of aridity in the abstract so potential users who are interested in model/observations comparisons are more likely to investigate the rest of the paper.

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