Geoscientific Model Development Discussions

Interactive
Comment

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.

R. Marsh et al.

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We thank both referees for their thorough reviews.

We appreciate both referees' set of comments, and we succinctly respond below to each comment in turn.

Referee #1

We will fundamentally re-work the manuscript, as encouraged.

General Comments

1. We will revert to a more orthodox scientific journal style.

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2. We will clarify the model version naming convention.

3. We are presenting four versions of the model as a unique selling point of GENIE (rather than four recommended, tuned and tested versions), although we appreciate the referee's concern. To address this concern, we will advise caution in the use of un-tuned configurations, and we will recommend that some tuning (of un-tuned versions) is undertaken by new users.

4. We will consider whether to either include the full set of model equations (along with parameter tabulation), or to remove details that demand further such extensive description. The point of noting "trivial" constants (although possibly dispensible) is to stress that these are indeed universal throughout the model components. This is surprisingly non-trivial (in earlier versions of GENIE, and - we suspect - other modelling frameworks!). Ocean temperature and salinity will be re-defined as prognostic variables, along with velocity. We will clarify the distinction between prescribed "output" and prognostic output. The "net freshwater flux from Atlantic to Pacific" is indeed akin to flux correction, and this will be more explicitly stated. The preferred value (0.32 Sv) is as inferred from atmospheric observations by Oort (1983), and seems appropriate as we diagnose approximately 0 Sv net flux in GENIE (without this prescribed flux). Without this additional term in the freshwater budget, the Atlantic overturning is incorrectly reversed. We will explain how shortwave radiation is computed and further stress that the surface albedo only varies with variations in sea ice, for which the albedo is a linear function of sea ice temperature (in a limited range). The issue of a land scheme can be more clearly explained: in the genie_eb_go_gs experiments presented here, we effectively use a default zero-order land scheme; the option to use genie_eb_go_gs_el, including the "simple" land scheme of Williamson et al. (2006), will be briefly outlined.

5. The meshes are generated with an objective procedure, although some manual steps are inevitably involved. This will be briefly outlined in the revised text. It is not yet our intention to add this option (mesh generation) to the GENIE framework. We will detach Greenland from North America on the 64x32 mesh and repeat the experi-

ments. The Indonesian Throughflow (ITF) is closed in the experiments presented here, although experiments with ITF open have been carried out with the 36x36s mesh. We will comment further on this option, with reference to that work.

6. We accept that there are too many figures, and we will reduce the total number considerably. However, we disagree that the sensible flux is "meaningless" due to differences in the treatment of land and the ocean - it is an integral component of the vertical heat balance in the model. If we retain convection depth, we will change this variable as plotted, in line with the suggestions. We will in general seek to show a range of model-observations differences, as suggested. We feel that deeper analysis of the net freshwater flux into the Atlantic for each model version would be beyond the scope of a GMD paper, and this was largely addressed in Lenton et al. (2007), to which we may further refer.

References:

Oort, A. H. (1983). Global atmospheric circulation statistics, 1958-1973. NOAA Prof. Pap. 14

Williamson, M.S. Lenton, T.M. Shepherd, J.G. and Edwards, N.R. (2006). An Efficient Numerical Terrestrial Scheme (ENTS) for Earth System Modelling, Ecological Modelling, 198, 362-374.

Referee #2

We will add more explanation and discussion, as encouraged.

General Comments

1. We will bring forward to the Introduction an outline of the four default versions (meshes).

2. We will open the Greenland-North America pathway in the 64x32 mesh and repeat the experiments with this version of GENIE (see response to referee 1).

3. We will compare simulated precipitation with observations (see response to referee 1) - this will highlight an inadequacy of the EMBM in this respect, and we will further discuss the necessary improvement to precipitation that is provided on coupling with the simple land scheme (for satisfactory vegetation and terrestrial carbon cycle).

4. We presume that the "impressive behaviour" of the 72x72s version is the weak "oscillations" seen in Fig. 40b. We will anyhow extend the "Summary & Discussion" to cover the wide range of results.

Specific Comments / Technical Corrections

We will address all the points raised.

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

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