Geoscientific
Model Development
Discussions

Interactive comment on "Development of the GEOS-5 atmospheric general circulation model: evolution from MERRA to MERRA2" *by* A. Molod et al.

Anonymous Referee #2

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Review of 'Development of the GEOS-5 atmospheric general circulation model: evolution from MERRA to MERRA2' by A. Molod and co-authors for consideration in Geophysical Model Development.

In this manuscript the authors disentangle the development from one version of an atmospheric model to the next. This is something that is not often done, but the resulting information is useful for both users of the model and derived products, as well as for developers of other models that can find inspiration in their work. To be complete, I would add some tabulated global means of fluxes, precipitation, cloud cover/liquid/ice, etc. for the various runs.

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Interactive Discussion

Discussion Paper

My main problem with reading the manuscript is that the authors take their new model as a starting point, and then back-track towards the old model. This is confusing because as the reader you naturally think forwards and not backwards, i.e. the effect of improving ocean surface roughness is this and that. Another general issue is the figures which need improvement. I provide several suggestions below.

All in all, I can recommend the manuscript for publication only after relatively major revisions.

Comments

Section 3.3 got fairly confusing, partly because of the back-tracking issue, partly because the authors seem to define heat-flux positive upwards (which is fairly uncommon). If anything the Louis-scheme is among the more diffusive, which is also seen by the fact that the model hardly visits the very stable regime. Thereby sentences such as "indicating less sensible heating when using the Louis scheme", if not incorrect, become fairly difficult to comprehend.

Section 3.5 is also difficult to comprehend for the uninitiated. I would suggest to add a better description of the parameterization, and to use a different figure to display the effects. The annual cycle of the zero-wind contour is not something that the most readers will be familiar looking at.

It may be worthwhile to contrast the strategy to limit convection at higher resolutions with alternative strategies to enhance the parameterized convection to avoid explicit convection (e.g. Bechtold et al. 2008, QJRMS, their equation 3).

The figures are all plotted using the rainbow colour scale, which is an unfortunate choice for a number of reasons elaborated here: http://www.climate-lab-book.ac.uk/2014/end-of-the-rainbow/.

Beware that acronyms must be defined.

7576, 11 The term "nature run" is unspecific and not used later.

7577, 27 I would avoid using hyphens, here and in most other places.

7580, 17 'changes at a time'

7584, 20, In my book a higher critical RH should give you less cloud fraction. If the model behaves differently then this is worth an explanation.

7586, 13 What is SD?

7588, 3 It is 'ERA-Interim' here and elsewhere.

7589, 4 'severely'

Table 2, What is Fortuna AGCM?

Figure 1. It is odd that the data shown in panel a (up to 0.001) is not visible in the lower left part of panel b).

Figure 2. Panels b and e show the same thing.

Figure 9, panels a and b are the same.

Figures 11-14 are too small to be readable in print.

Figure 15, caption does not reflect the displayed quantity.

Figures 16-17, panels b, e and h can be deleted.

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Interactive comment on Geosci. Model Dev. Discuss., 7, 7575, 2014.