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Geoscientific Model Development Discussions

Interactive comment on "The Met Office Global Coupled model 2.0 (GC2) configuration" *by* K. D. Williams et al.

Anonymous Referee #2

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In this paper the coupled configuration of the Met Office Unified Model GC2 is presented. GC2 represents the next step along the path to unified or seamless modelling across space and time scales that range from numerical weather prediction to seasonal forecasting to climate prediction. GC2 represents an advance for both seasonal prediction (GloSea5-GC2) and climate prediction (HadGEM3-GC2) as a single model will now underlie these efforts respectively replacing GloSea5-GA3 and HadGEM2-AO. The paper is clearly written and well organised. I have only minor revisions to suggest and so, subject to their consideration, I recommend publication of this study in Geoscientific Model Development.

Minor Comments:

1) This study presents an overview of the coupled configuration of GC2 and references

several studies that provide further detail of each component (eg atmosphere, ocean, sea ice etc.). I was able to find all of these more detailed studies except for that related to sea ice, GSI6.0, (ie Rae et al. 2014, which should be 2015 now). It would seem that a summary paper such as this should come out after, rather than before, all of these more detailed studies are available for review. I would not hold up the publication of this work for the absence of this one study but it makes evaluation more difficult.

2) pg 523-524. It is suggested that, while the plan is for earth system components to be built on finalised versions of the new physical coupled model configurations, the next ESM will be built on GC3 rather than GC2. Why? Is there a technical reason? I would have thought that far more insight into the earth system components would be possible if the same version of these components were put into GC2 AND GC3. Following the authors approach, the only comparison available will be a much older ESM built on a different underlying physical coupled model with the new ESM built on GC3. Any such comparison would include climatic differences as well as earth system component differences between these models.

If, however, the same new earth system components were put into GC2 and GC3, much more insight would be available. That is, one would have information about the climatic differences between GC2 and GC3 as well as their differences with the new earth system components ESM1_GC2 and ESM1_GC3 (sorry I don't know what your naming convention will be for this). This would allow an analysis of the the impact of the earth system components on the climate to be distinguished from differences in the physical climate. For example, the impact of including the new version of earth system (ES1) components is provided by either of the two responses:

(a) ESM1_GC2 - GC2 or ESM1_GC3 - GC3.

Systematic patterns in these two responses provide a more robust indication of changes due solely to the new version of the ES1 components. The "nonlinear" or higher-order impact of including the ES1 components on the different model climates

could also be determined by looking at the response difference:

(b) (ESM1_GC3 - ESM1_GC2) - (GC3 - GC2)

and this response difference should account for differences in the two responses in (a)

One could then envision similar analyses in the future where the next version of earth system components, ES2, were added to both GC3 and GC4.

3) top of pg 528. It would be helpful if you could also provide the number of simulated years per day you expect to get with the final load balanced version of GC2 in each of its configurations (ie resolutions etc.) used for seasonal prediction and climate prediction.

4) For difference plots such as panels b - d of Figs. 6 and 8, it would be helpful to also provide a global RMS value for the differences displayed. Perhaps this could be included in the title of the figure and referred to in the text. This would provide a bulk measure for the differences displayed.

Interactive comment on Geosci. Model Dev. Discuss., 8, 521, 2015.