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Geoscientific Model Development Discussions

Interactive comment on "Overview of experiment design and comparison of models participating in phase 1 of the SPARC Quasi-Biennial Oscillation initiative (QBOi)" *by* Neal Butchart et al.

Anonymous Referee #3

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Review of "Overview of experiment design and comparison of models participating in phase 1 of the SPARC Quasi-Biennial Oscillation initiative (QBOi)" by Neil Butchart and many others

Recommendation: Minor revisions

This study introduces the model integrations performed as part of the first phase of the QBOi, a model intercomparison project that hopes to shed light on the processes that lead to a spontaneous QBO and how they will change in the future. Such a project is sorely needed in our field, and I look forward to reading future papers that utilize this model output. I have only a few minor comments, and after the authors address them

the paper will be ready for publication.

1. Figure 2: The use of filled black patches for the "mean annual cycle" forcing is visually confusing. I suggest a thick line.

2. It is too late to correct this, but in retrospect there probably should have been guidance for the ozone profile to be used for models without interactive chemistry. There are ozone-temperature feedbacks in this region that will differ among models, and unraveling the causes of these feedbacks will likely be hard. Again, I don't think it is worth rerunning experiments, and hopefully the archived ozone will suffice.

3. The numerical, thermal, and mechanical dissipation used by each model likely differs, and these three sources of dissipation might be important for the QBO momentum budget in some models (e.g. Yao and Jablonowski,2015, already cited). I have two suggestions: first, please ask the models to submit their wind and temperature tendencies due to these three sources of dissipation (or at least the total tendency due to dissipation)! Zonal and monthly mean is probably good enough. Second, please add a column to table 6 or 7 (or a new table) where each model reports on how it implements numerical, thermal, and mechanical dissipation. It might also be helpful for each model to state which advection scheme/dynamical core it uses.

4. Figure 7, top left panel: I suggest writing the model names in color. Also, two colors appear to be used for more than one model (at least to this reviewer's mildly color-blind eye). Specifically, the shade of red used for MIROC-ESM (F-H) and HadGEM2-AC (P-WM) is very similar. Similarly, the shade of green used for LMDz6 (P-L) and EMAC (F-H) is very similar. Please adjust the colors to add more contrast.

5. Page 23, line 4 "between" is misspelled

6. Table 4: it would be helpful if one level near 200hPa was also included, as one might want to compare the upper tropospheric resolved wave spectrum (i.e. Wheeler and Kiladis 1999 diagrams) among models. That is, the resolved wave spectrum near

the top of convection will differ among the models (possibly due to different convection schemes used by each model), and it might be interesting to relate any differences in QBO morphology to differences in tropospheric wave generation that are in turn related to convection schemes. This additional level will also allow one to study the affect of vertical resolution in the TTL on resolved wave vertical propagation – it is conceivable that models with coarser vertical resolution will have stronger degradation in their resolved wave fluxes between $\sim$200hPa and $\sim$100hPa.

7. The native vertical levels of each model (i.e. the data underlying figure 4) should be made accessible, perhaps as a data supplement or hosted on the QBOi website.

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