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Geoscientific Model Development Discussions

# *Interactive comment on* "Overview of the Coupled Model Intercomparison Project Phase 6 (CMIP6) experimental design and organisation" *by* V. Eyring et al.

**V. Eyring et al.**

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**Reply to Chris Jones**

Thanks Chris for the helpful comments. We have now revised our manuscript in light of these and the other comments we have received. A pointwise reply is given below.

**[note - as a co-chair of C4MIP this has a carbon-cycle centric view of the world, but these are my own comments and not an "official" C4MIP contribution.]**



**Overall a good overview and description of CMIP/CMIP6 and DECK runs. The experiment descriptions and rationale were clear. Just a few minor comments which hopefully will be helpful.**

**My main comment is that I had feared some confusion around the need for emissionsdriven Pictl and historical runs if you are running emissions-driven runs in C4MIP. I think you handle this well, but you could add a couple more specific details, and also site the C4MIP documentation paper (which will be Jones et al 2016 GMD – currently in prep). A couple of things are worth being explicit:**

We have added a few more details, see also below. We are not referring to any specific CMIP6-Endorsed MIP paper since they are currently still in preparation or just submitted. However, we make clear that the MIPs are detailed in these papers and have done so for C4MIP here.

**- for both control and hist, the C-driven and E-driven variants should be identical in all forcings except the treatment of $CO_2$. This sounds obvious but worth saying it clearly.**

This has been added for clarification.

**- The name "emissions driven control run" may be confusing as in fact there are no emissions. I can't think of a better name, so you should explain that what this means is:**
**a) atmospheric $CO_2$ concentration evolves prognostically in response to natural land and ocean carbon fluxes**
**b) external input of $CO_2$ from either fossil fuel or land use is prescribed to be**

**zero**
**c) $CO_2$ is therefore free to evolve and should be stable in the long term but will have some internal variability. In the C4MIP paper we define a desirable level of drift in the control run as within 5 ppm per century in the atmospheric $CO_2$. We recommend for spin-up that the concentration-driven control run is spun-up first and then can be used as a start point for any final spin-up in emissions-driven configuration. It might be useful to include this level of technical detail in the Appendix on the control run.**

We have added this clarification at the end of Section A1.2 and refer to the C4MIP contribution for further details.

**A few minor comments:**

**- p. 10549, line 1. As per Gavin's review, land-use is not excluded from PictI, but it is held fixed at 1850 so there is no land use CHANGE. 1850-level crop, pasture and management activities etc should be held fixed so there is no long term change in any land surface properties**

Sentence deleted and land use further specified in the appendix.

**- p.10549, line 16, and later in the appendix p.10565 line 6. What month is recommended for the quadrupling? January? You mention an ensemble of runs starting at different dates – how much were these looked at last time? I know there is some dependence possibly on the date of quadrupling so presumably all models should choose the same date. If you request an ensemble, can you specify what you want? 12 runs from a different month, 4 runs quarterly?**

Sentence changed to 'In the first, the $CO_2$ concentration is immediately and



abruptly quadrupled from January 1850 values.' to be more precise.

We have added a sentence at the end of section A1.3 recommending that the start-months be spaced evenly throughout the year for ensembles.

**- p. 10556, line 15. Better to say "isolating" than "looking". Land-use was included as a forcing in CMIP5 and there are papers which look at it. Rather, LUMIP is the first time a set of experiments have been designed around this as a focal point.**

Changed as suggested.

**- p. 10559. lines 19-21. A1.1 AMIP. You say that having land carbon diagnostics on for the AMIP run will be valuable for evaluation as the surface climate will be closer to observed. I think we need some caution here as the carbon cycle will be dependent on how it is initialised at 1979. The long memory of land carbon stores mean it is out of equilibrium by then, so can't just be spun up be repeating the 1970s over a few times. You certainly don't want to repeat a single year multiple times as suggest on line 27. May be OK for atmospheric variables but not land carbon. The carbon fluxes will be dependent on the carbon stores and the only robust way to initialise these (obs don't exist at the scale we need) would be to take from a historical run. In general, if we want a more realistic surface climate to drive the land-carbon fluxes a much better option is offline land runs (as per the TRENDY activity, and LS3MIP) – here land models can be run with observed meteorology but run for the full 20th century so don't have the initialisation problem in 1979. So overall I'm not convinced evaluation of land carbon from AMIP will be that useful.**

We have removed the sentence 'This will enable evaluation of the carbon cycle

component of the model when climate conditions are more similar to the observed than in coupled atmosphere-ocean simulations.' in response to this comment.

**- p.10566, line 5. instead of "fluxes" can you say "fluxes and stores". The carbon pools are actually more important (IMHO) than the fluxes, but always get sidelined...**

Changed as suggested.

**- p. 10567, line 20. Can you mention harmonisation of the forcing data between historical and future scenarios? Where will this be fully documented? In the forcings paper? In ScenarioMIP? It's one of those essential cross-cutting things which everyone might leave to someone else...**

The harmonization is considered in the timeline to produce the forcings for CMIP6. The harmonization is now added as suggested on page 10547 where forcings are first mentioned.

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Interactive comment on Geosci. Model Dev. Discuss., 8, 10539, 2015.