Author response to: Interactive comment on “The C4MIP experimental protocol for CMIP6” by C. D. Jones et al., R. J. Stouffer

Review comments in BLACK

Author responses in Blue/Italics

General Comments

I found the paper well written and clear. I recommend it be accepted with minor revisions.

Thank you

Specific Comments

1. Lines 1-5 Introduction – What are error bars on these carbon estimates? The values given have the units (i.e 1 PgC) appearing significant.

These are reported to the nearest 5 PgC as per IPCC AR5, WG1 Ch.6 and Le Quere et al. we have now added in the uncertainty estimates also:

“Over the industrial era since about 1750, it is estimated that cumulative anthropogenic carbon emissions from fossil fuels and cement (405±20 PgC) and land use change (190±65 PgC) have been partitioned between the atmosphere (255±5 PgC), the ocean (170±20 PgC), and the terrestrial biosphere (165±70 PgC) (values to the nearest 5 PgC, from Le Quéré et al., 2015).”

2. Page 6 and top of 7 – It is good to have a list of “coming attractions” for CMIP6. It would also be good to mention important things likely to be still missing – Very high ocean resolutions (10 km are finer), improvement in the way Land Use changes are being implemented in models, going away from the so-called big leaf vegetation models toward having multiple vegetation types in a grid cell, etc. Will the new features narrow or increase the uncertainty of past and/or future estimate of carbon changes? What is the impact on missing processing on the uncertainty estimates for the future? I would like to read the authors’ opinions on these questions.

All these ideas would be nice to pursue. We mention some of the key areas we think might change but feel it is premature to try to predict in more detail how some of the expected model changes will feed through to changes in results. For nitrogen there is evidence (from modelling and theory) of how this may affect outputs and so we feel that speculating on the sign (but not magnitude) of this response is appropriate. We have added that we would expect inclusion of permafrost carbon to also increase the carbon release due to climate warming – this is well founded and based on IPCC AR5 assessment:

Added to p.7: "AR5 assessed that permafrost carbon release was likely, and therefore would increase the climate-carbon cycle feedback, but with low confidence in the magnitude (Ciais et al., 2013)"

For other processes – such as enhanced ocean resolution we do not know how this may affect either baseline simulations nor the models' sensitivities to changes.

Improved treatment of land-use is also expected for CMIP6 but we leave discussion of this to LUMIP.

We also felt that the paper is already long and have tried not to increase the length through discussion – that may be more appropriate in another forum than the GMD documentation paper. We note that an increase in model SPREAD is not the same as increasing the uncertainty – it may simply be that models were artificially close to start with due to a common missing process. By representing this process, the spread of results may increase to better characterise the true and existing uncertainty.

3. Page 18, line 7 – "present" – Do you mean present or a given date (December 31, 2014 as an example). If the later, state the date and not use "present".

Thank you. This was sloppy and we meant the end of the CMIP6 historical period, defined as end of 2014. We have corrected this. Ditto in section 3.3.1.