Geosci. Model Dev. Discuss.,
https://doi.org/10.5194/gmd-2019-153-RC1, 2019

Geoscientific Model Development Discussions
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Interactive comment on "The Zero Emission Commitment Model Intercomparison Project (ZECMIP) contribution to CMIP6: Quantifying committed climate changes following zero carbon emissions" *by* Chris D. Jones et al.

Anonymous Referee #1

Received and published: 26 July 2019

[General comments] Jones et al. describe in this paper new experimental protocols for multi-model comparison study on Zero-emission commitment (ZEC) – global climate changes after future stoppage of anthropogenic CO2 emission. The authors design the protocols for Earth system models (ESM) and ESM of intermediate complexity (EMICs), to contribute to ongoing project "Coupled model intercomparison project phase 6 (CMIP6)". Because of urgent necessity in this science region and resource limitation of modeling centers, they propose a minimal set of experiments for evaluating ZEC in models.

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As addressed by the authors, ZEC evaluation in models is an important and urgent issue for discussing remaining carbon budget for achieving specific mitigation goals. The scenario design for tier1 experiment is very simple – branching-off from 1%CO2 experiment by giving zero-emission, with free-evolving atmospheric CO2 concentration. This simplicity will be appreciated by many modeling centers, and the idealized scenario simulations are helpful when exploring underlying mechanism of ZEC. In addition, these protocol and simulation results will enable us to interpret ZEC in the context of transient climate response to cumulative emission (TCRE), which has been facilitated to approximate remaining carbon budget.

This paper is clearly written, and authors well summarizes the scientific question, experimental protocols and procedure in ZECMIP. Other comments are listed below, and all of them don't require much effort.

[Other Comments]

-P4, L3: Spell-out "CMIP6"

-P5, L26: about A0 experiment A0 experiment ("esm-1pctCO2") is an optional experiment, depending on the choice of modeling centers. Since A0 experiment seems not to be "tierized", I concern about the fate of the simulation output: do you expect modeling centers to submit A0 output to ESGF? Or do you have other plans for data archiving and sharing?

-P6, L9-12: about diagnosed compatible emission I propose another option to make diagnosed compatible emission without interannual variability – curve fitting to cumulative carbon emission, like,

1. Diagnose cumulative, not annual, carbon emission (CE)
2. Fit a curve to time–CE plots (like CE(t) = a*t + b*t^2 + c*t^3 + d*t^4)
3. Make annual emission from the fit curve

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This method assures cumulative emission (if fitting is successful) and does not require multiple ensemble members.

-P7, Fig. 1 Label (a), (b), and (c) on panels

-P7, L19∼: Why do we need “bell-shaped” emission (smooth transition of emission rate) for discussing ZEC dependency on emission rate? Readers would be happy to see the rationale.

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