

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 #2

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Jones et al. describes a new, fast-track experiment, ZECMIP, under joint sponsorship of C4MIP and CDRMIP within CMIP6. The experiment is timely and of high relevance to on-going scientific discussions regarding methodological approaches for refining the definition of carbon budgets to meet certain policy-relevant global mean temperature goals. The authors propose a simplistic, but methodologically sound, approach to provide a scientific basis for understanding the effect of future warming or cooling after complete cessation of CO₂ emissions: the so-called "Zero Emissions Commitment" (ZEC).

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This paper is novel, timely, and of high relevance to the audience of GMD. A multi-model comparison is of high importance due to the current lack of scientific consensus (order of magnitude, but also sign of effect).

Relevant comments are provided below, which mostly consist of clarification of expected results and possible pitfalls that could be observed during the experimental exercise.

1. P5L16-17. The authors note that "branching off" either from concentration-driven runs (experiment 1pctCO₂) or emissions-driven runs (experiment A0) presents modelers with a decision or choice. What is the effect of choosing one option or the other? Do models that choose 1pctCO₂ over A0 introduce additional uncertainty in the resulting estimation of ZEC?
2. P6L8-9. Another model decision described is the use of spatial patterns of emissions, where the authors suggest using a globally uniform pattern at the Earth's surface. What other options are available to the modelers? What effect on experimental results are expected from each choice? Is there a rational for choosing an option *other* than uniform-at-surface? These questions may be less relevant for experienced ESM developers, but would be enlightening for readers from other disciplines.
- 2a. Could a standard spatial pattern be derived from other CMIP6 MIPs (e.g., ScenarioMIP)? Would this provide any better consistency in ensemble comparison?
3. P8L1-2. Is it possible to be more precise as to the proposed distribution (Normal, Cauchy, Logistic, etc.) and associated parameters defining them?
- 3a. Similar to reviewer 1, please provide the rationale for choosing such a distribution. For example, why would a truncated log-normal distribution not be more appropriate (more emissions early with a decreasing tail profile)?
4. While the A-set of experiments seeks to provide a scientific basis for initial estimations of ZEC, the B-set of experiments also provides very important information and

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context (i.e., do emissions rates significantly affect the estimation of ZEC). I would thus argue that it is also of high priority. While indeed there are resource and time limitations, it would be useful to the reader to understand what implications the lack of this information has on the estimation of ZEC. Is it possible to show results for the B1 experiment similarly to Figure 1? This would at least provide such context.

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