

Interactive comment on “The Scenario Model Intercomparison Project (ScenarioMIP) for CMIP6” by Brian C. O’Neill et al.

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We thank the reviewer for thoughtful comments which we believe have led to an improved manuscript.

Comment:

The paper clearly describes the experiment design and its rationale of a model inter-comparison project for future climate projections based on different socio-economic scenarios as a part of CMIP6. I appreciate the effort of the author group to put together this design for the benefit of multiple research communities and end users of its outcomes. The choice of SSP for each scenario is based on highly complex consideration and how reasonable it sounds to research communities and users would be the key to the success of this paper. And my general impression is that it has been fairly

C1

successful.

I have two relatively substantial comments and some minor comments (mostly editorial).

1. As mentioned in page 7 (and almost repeated below and in page 11), “An enabling hypothesis of the parallel process is that differences in climate change projections would be small enough...” At the same time, it is also recognized that this hypothesis will be tested in answering to one of the major research questions of this project together with other MIPs, i.e., “Are differences in regional forcing : : : a source of significant differences in climate outcomes across a matrix row?” (page 7). Logically, we should be prepared for the possibility that the difference in climate outcomes due to different regional forcing is substantial and “the enabling hypothesis” fails to some extent (If we ignore this possibility, the research question cited above would be pointless). I hope to see some discussion as to how could the parallel process framework be reshaped or complemented depending on the extent to which its enabling hypothesis possibly fails.

Response:

If climate turns out to be much more sensitive to regional differences in land use change than currently expected, the use of ScenarioMIP simulations in impact studies that assume the same global mean forcing pathway but different land use outcomes (driven e.g. by a different SSP) would not be possible. It would mean that every scenario (ie, SSP-forcing combination) is unique, and every scenario therefore requires its own dedicated ESM simulation. The parallel process and matrix approach to combining SSPs and RCPs would not be invalidated, but the practical implication would be that many more ESM simulations would be required to provide the necessary climate information for integrated analysis. We have added some text to p. 8 to describe this situation.

Comment:

C2

2. The rationale of choosing SSP3 for SSP-7.0, preferring particularly high aerosol emissions and land use change (page 12 and 13), seems contradictory to what is implied by the second goal of choosing SSP-based scenarios, that is, “avoiding SSPs with trends for land use or aerosols that are outliers relative to other SSPs” (page 11). It needs more explanation to make them compatible. Or, personally, I don’t think the second goal is really necessary.

Response:

As indicated on p. 11, “one or more” of the three goals were used in choosing a particular SSP. In the case of SSP3-7.0, the first goal (a pathway that facilitated climate research) was dominant, and took precedence over the second goal. The second goal comes into play in other choices, e.g. for SSP2-4.5. We have modified the text slightly to clarify this aspect of the SSP choice.

Minor comments:

Comment:

1. (P. 1, L. 23) “that that”: You should delete one?

Response:

Fixed.

Comment:

2. (P. 2, L. 11) “IPCC AR5 : : (IPCC 2007a)”: It should be “AR4”.

Response:

Fixed.

Comment:

3. (P. 6, L. 27) “as long as it is feasible that within that SSP emissions could be made consistent with that forcing pathway.”: It would be helpful to give examples of infeasible

C3

cases.

Response:

We have added text to refer the reader to section 3.1.1 where feasibility is discussed.

Comment:

4. (P. 7, L. 16) “(AerChemMIP)” The opening parenthesis is mistakenly in Italic.

Response:

Fixed.

Comment:

5. (P. 8, L. 4) “biophysical effects”.: It needs some explanation.

Response:

We have added an explanation.

Comment:

6. (P. 8, L. 5) “global average forcing”: Would it be better to say “global average radiative forcing” (in contrast to “forcing due to the biophysical effects”)?

Response:

We have made the recommended change.

Comment:

7. (P. 10, L. 27) “2.0 W/m² pathways”: It seems that it has not yet been decided whether it is exactly 2.0 or not according to page 14.

Response:

We have corrected the text to refer to “<2.6 W/m² pathways”.

C4

Comment:

8. (P. 11, L. 6) "IA models": Perhaps it should be "IAMs" or "IAM models" to be consistent with other parts of the text.

Response:

Fixed.

Comment:

9. (P. 12, L. 23) "Table 1": It should be "Table 2".

Response:

Fixed.

Comment:

10. (P. 13, L. 11-12) "a forcing level common to several (unmitigated) SSP baseline scenarios": It would be helpful to give which SSPs they are.

Response:

We have edited the text to indicate that the scenario has a similar forcing level to the SSP2 baseline scenario as well.

Comment:

11. (P. 14, L. 21) "SSPx-y": The same notation was used before in a totally different context (Page 6). To avoid confusion, a different notation would be better.

Response:

Good point, we have changed the notation to SSPa-b, here and in Table 2.

Comment:

12. (P. 16, L. 2) "a long term equilibration temperature of 1.5 degrees C": It needs some

C5

assumption about climate sensitivity, a specification like "central estimate" or anything to that effect.

Response:

We have clarified that this refers to the expected outcome for the median of CMIP5 models.

Comment:

13. (P. 16, L. 5) "SSP1-26": It should be "SSP1-2.6".

Response:

Fixed.

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