Interactive comment on "The Scenario Model Intercomparison Project (ScenarioMIP) for CMIP6" *by* Brian C. O'Neill et al.

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The paper clearly describes the experiment design and its rationale of a model intercomparison 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 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.

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.

Minor comments:

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

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

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 cases.

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

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

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")?

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.

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

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

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.

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.

12. (P. 16, L. 2) "a long term equilibration temperature of 1.5 degrees C": It needs some assumption about climate sensitivity, a specification like "central estimate" or anything to that effect.

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

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