

## ***Interactive comment on “Scenario and modelling uncertainty in global mean temperature change derived from emission driven Global Climate Models” by B. B. Booth et al.***

**Anonymous Referee #2**

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In this study, the authors examined scenario and modeling uncertainty on global mean temperature change derived from emission driven perturbed parameter ensemble of a global climate model, and compare the results with those from the CMIP5 models. This is a timing subject, and model results are carefully examined and useful insights have also been gained through this analysis. I would recommend its publication after my following comments are addressed:

Section 2.1.1: I totally agreed with Reiviewer #1 that this part needs more clarification. For example, it is not clear to me how you come to a 68 member ensemble. The authors need to list how parameters are perturbed for each constituent ensemble. Also, what

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is the exact criteria for rejecting those 11 members? Even if the authors refer Lambert et al. (2012) for details, the basic details needed to be provided here for readers to understand this manuscript without having to reading Lambert et al. (2012). What is more, Lambert et al. (2012) is a submitted manuscript.

Section 2.1.2, the first paragraph: This paragraph needs more clarification too. It is not clear to me why the comparison with C4MIP is not straightforward to do (so you mean that C4MIP use CO<sub>2</sub> concentrations while this paper uses CO<sub>2</sub> emission). Also, it is not clear to me how Booth et al. (2012a) addressed this issue using a simple model.

Section 2.2: In terms of RCP8.5 and 2.6, so you mean that only CMIP5 RCP8.5 experiments are emission-driven, while CMIP5 RCP2.6 is concentration-driven?

Page 1063, lines 14-21, RCP2.6: Since there is no official equivalent emission pathway for RCP2.6, how did you derive CO<sub>2</sub> emission for RCP2.6 in the ESE?

Section 2.2, last paragraph: This paragraph is not clear to me. First, I do not understand why the historical boundary conditions are different between RCP and SRES. I would think the model starts to diverge when you apply different future pathways, but how these affect the historical boundary conditions. Second, you mentioned this is due to current uncertainties in the nature of historical change. I am not sure why this is related to your configurations. I am also not sure why 1945 is chosen, but not a more recent time, such as 2000.

Page 1065, lines 2-13: Although the authors pointed out that the approach for examining the role different sources of climate projection uncertainty play is from Hawkins and Sutton (2009) in the caption of Figure 1, it is better to briefly describe how this is performed (also, it is better to mention this in the main text, but not in the caption of Figure 1). Also, the last part of the caption for the second panel in Figure 2 is repetitive.

Page 1065, lines 15-16: I am not sure why this “, as might be inferred at first glance, imply that the emission scenario uncertainty is playing a LARGER role on the timescale”,

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since Figure 1b shows a SMALL scenario component of the total variance in the next 30 years.

Section 3.1, last paragraph: I also agreed with Reviewer#1 that this discussion of the increasing spread in temperature with increasing RCP is of any real value. For a given spread in climate sensitivity, the temperature spread will surely increase with increasing RCP.

Page 1067, Lowe et al. (2009), lines 10-14: So what is the physical explanation behind Lowe et al. (2009) finding, and is the physical mechanism identified in Lowe et al. (2009) included in the ESE used here?

Page 1067, lines 22-25: "a small number of models" any references on this?

Page 1067, line 9: a brief description of SRES A2?

Page 1067, lines 14-15: not sure why you need to include the information of A2 to inform the A1B range.

Page 1056, line 19: legecy -> legacy

Page 1056, lines 19-21: "concentration driven" appeared twice in that one sentence

Page 1056, lines 21-24: The sentence of "Our ensemble ..." is not clear, and needs clarification

Page 1058, lines 3-5: this sentence is not clear to me

Page 1062, line 20: "the the" → "the"

Page 1063, line 20: "timeseries" → "time series"

Page 1068, line 27: "Section Sections" → "Sections"

Page 1069, line 25: "6.13 relative to #"?

Page 1070, line 11: "use" → "us"

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Page 1071, line 19: "that that" → "that"

Page 1071, line 3: though → through

Page 1068, line 2: "sumulated" → "simulated"

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