

Interactive comment on “ESD Ideas: Global climate response scenarios for IPCC AR6” by Rowan T. Sutton and Ed Hawkins

Anonymous Referee #3

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The authors present a useful approach to explore how climate impacts jointly depend on forcing scenario (as encapsulated in SSP socio-economic pathways) and on climate response scenario (as encapsulated in equilibrium climate sensitivity as determined using abrupt 4xCO₂ experiments). This could be published as-is, but I offer the following minor comments for the authors to consider.

The authors might comment on the non-monotonic behavior exhibited in Figure 1d. Why is there a local maximum in crossing time for ECS=2K models (i.e., crossing the 2°C threshold sooner if ECS is lower or higher than 2K)? Is this just due to the limited sample size of models that performed all of the experiments necessary to make the figure (multiple SSPs and abrupt-4xCO₂). Do the results change materially if the analysis is restricted to only the 9 models that are present in all experiments (it appears

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that the limiting experiment is SSP1-1.9). Perhaps as more models get published, this noise will beat down? I suppose that the smaller the warming threshold, the greater the possibility that internal variability or inter-model variability could give rise to such non-monotonic behavior when there is such a limited model sample size.

Suggest labeling the ECS bin edges instead of the midpoints, as they are not evenly spaced and it is unclear what marks the transitions, especially from 5K to “warmest” and from “coolest” to 2K.

Would there be any value in making a version of panels (d) and (e), but showing the GSAT change relative to the baseline at 2050 and at 2100, as a joint function of ECS and SSP? This is basically what is shown in panels (a) and (b), but might be clearer if presented like (d) and (e).

While I understand the motivation and appeal of exploring the joint dependence of a climate impact on two “scenarios” – socio-economic and climate response (or forcing and response), I’m not really a fan of the phrase “climate response scenario” and would prefer that “scenario” be reserved for SSPs. Scenarios in the climate context have historically referred to plausible future social-economic futures (SRES, RCP, SSP) for which humans have some role in determining. ECS is a different beast. Could it just be referred to as “climate response”?

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