

Response to Reviewer #2:

We sincerely thank the reviewer for taking time to review our manuscript and offering constructive comments and suggestions. The modifications and answers that have been made to address the reviewer's concerns are listed below.

Review of “Description of historical and future projection simulations by the global coupled E3SMv1.0 model as used in CMIP6” by Zheng et al., submitted to GMD

Major comments:

The authors documented some future climate characteristics of E3SMv1.0 at the highest emission scenario, with a focus on regional responses. Moreover, the impact of anthropogenic aerosols on the warming was emphasized by comparing the SSP5-8.5 and SSP5-8.5-GHG simulations. This manuscript aims to describe the experiments and present the most notable features revealed in these experiments. It is found that the results are generally well presented. However, there is a lack of statistical significance when presenting the changes in future projections and the comparisons between SSP5-8.5 and SSP5-8.5-GHG. Therefore, I request minor revisions of the manuscript.

To address the reviewer's comment about the statistical significance of the comparisons, a two-sided t-test with the null hypothesis that the GHG-only experiment and all-forcing experiment give identical ensemble mean was conducted for the mean SST, SSS and MLD. Regions of significant changes are highlighted using stippling dots in the maps. We also revised the corresponding discussions of these figures in the text (Lines 344-353). In addition, the same t-test has been conducted for the simulated difference in Tair trend, net cloud radiative forcing, and aerosol optical depths between E3SMv1.0 all-forcing simulations and GHG-only simulations (Fig. 15). We also revised the relevant content (Lines 315-317).

Minor comments:

Line 118–120: “CMIP6 models project an overall higher warming with a larger intermodal spread ... compared to the corresponded CMIP5 future climate projects.”

Please cite related works.

We cited three previous works as references “(e.g., Meehl et al., 2020; Brunner et al., 2020; Tebaldi et al., 2021)” (Lines 124-125).

Line 127: “E3SMv1.0 simulated global mean Tair anomalies” → “The simulated global mean Tair anomalies in E3SMv1.0”; “demonstrates” → “demonstrate”

Corrected. Thank you.

Fig 3: It seems that there is an evident double-ITCZ problem in E3SMv1.0. Can you discuss a little about the impact of such bias on the projection?

We added a brief discussion about the double-ITCZ bias and its potential impact with a couple of references: “As shown in Fig. 3, E3SMv1.0 has the double-ITCZ bias that is persistent in generations of CMIP models (Tian and Dong, 2020). The double-ITCZ bias is found to have a large impact on the projection of precipitation and tropical climate change. Specifically, the projected precipitation change tends to be proportional to the precipitation bias in the double-ITCZ regions (Brown et al., 2015; Zhou and Xie, 2015; Samanta et al., 2019).” (Lines 164-167)

Line 204: Please explain why January-February-March are used for boreal winter and July-August-September are used for boreal summer?

The ocean has a larger thermal inertia than the atmosphere so there is a delay in the seasons in the ocean as compared to the atmosphere. It is conventional to use January-February-March for boreal winter and July-August-September for boreal summer to describe the seasonal variation of ocean variables. This explanation has been added in the manuscript (Lines 246-248).