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Atmospheric Chemistry and Physics Discussions

Interactive comment on "On the Climate Sensitivity and Historical Warming Evolution in Recent Coupled Model Ensembles" *by* Clare Marie Flynn and Thorsten Mauritsen

Anonymous Referee #3

Received and published: 21 February 2020

This manuscript presents an overview of ECS and and historical warming in a set of CMIP5 and CMIP6 models. The manuscript is well written, clear and concise. It describes some interesting findings. I would recommend publication after minor improvements as suggested below.

* There is significant overlap with the recently published paper Zelinka et al. (2020; doi:10.1029/2019GL085782). Given the close timing, this is not a serious problem. However, this manuscript should compare and contrast their findings to the ones in Zelinka. Ideally, the sets of CMIP5/CMIP6 models in this work should be a superset of the sets in Zelinka. I would also recommend listing models in Tables 1 and 2 with

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Discussion paper

the same alphabetical convention for easier comparison with their Tables S1 and S2. I also noticed that while most ECS values are close, some differ more substantially: EC-Earth3-Veg (4.33 vs 3.93) and SAM0-UNICON (3.72 vs 3.30). Is it perhaps because these models drift more than others, and thus the details of the drift correction matter more?

* Line 72: SW and LW feedback: I assume the procedure applies to both all-sky and clear-sky feedback parameters discussed later? Is the drift correction the same as well?

* Lines 80-81: There are additional significant volcanic eruptions (Santa Maria 1902; El Chichon, 1982) that fall within the period. Are they not excluded because they don't fall during the beginning or end portions of the periods over which averaging is performed? Please clarify.

* Lines 85-86: the logic for the varying averaging length periods is not very clear. Please explain the reasoning behind these particular choices. Also, are the results sensitive to these choices?

* Section 3.2 (lines 116-130). I had to read this section several times to really understand it. It could benefit from being rewritten more clearly. Some specific points:

- Lines 119-120: specify the mean of the Gaussian distribution for the feedback parameter.

- Lines 120-121: why 3.7 W/m2 with 10% standard deviation? The standard deviation for F_2x in Tables 1 and 2 is larger than 10% and the mean lower than 3.7 W/m2.

- Consider possibly swapping x-y axes in top panel of Figure 3 so that the black and red vertical lines align across the two panels.

* Line 222: reference is missing year.

* Figure 4: it's difficult to differentiate between black and dark gray lines. Why not use

the same color convention as in Figures 1 to 3: black for CMIP5 and red for CMIP6?

* Figure 7 caption or corresponding text: please clarify precisely what is being plotted.

* Figure 8 caption or corresponding text: “anomaly” with respect to what period?

* Figures 10 and 11: consider changing the figure aspect ratio to provide more resolution along the horizontal axes.

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