

Review on “Effectiveness and limitations of parameter tuning in reducing biases of top-of-atmosphere radiation and clouds in MIROC version 5”

Tomoo Ogura et al.

Overview

The study discussed how much model biases could be removed through parameter tuning using output from MIROC5 AOGCM PPE simulations. The paper is well written and organized. The results should provide valuable guidance to future MIROC developments. To make the results more useful to other models, however, I feel more discussion on what model deficiencies in representing the physics that caused the model biases would be necessary for this study to have broader impact to the field. I recommend a minor/moderate revision before this paper can be accepted for publication. My comments are listed below.

Major comments

1. The major conclusion from this study is that many model biases (specifically SCRE) cannot be removed through parameter tuning. To me, this is not something new or is hard to understand. It has been recognized in the field for a long time. To make the study more valuable, it would be nice if the authors add more discussion on what potential model deficiencies cause these model errors, particularly for those biases that are common in current climate models. The authors have touched the point a bit, but more discussions are needed.
2. As the authors also admitted, the conclusion is largely constrained by the way how the PPE members and PPE design are selected. Although the authors feel that “Whether the main conclusions in the present study are affected by the uncertainty in the PPE design is a subject of future studies” (P14, L29-30), some additional analyses of the PPE simulations should help better understand the model behavior and make their conclusion robust.

Minor comments

1. P1, L19-23, starting with “We used a low-resolution ...”. This sentence is confusing.
2. The last paragraph on P2. It’s hard to believe that all model biases can be explained by factor (b) – parameter settings.
3. P4, L9: remove the sentence after “if”.
4. P5, L19; Impact of using the Suppressed Imbalance Sampling (SIS) method on the study needs to be carefully discussed. To me, the use of SIS has largely limited model responses to the perturbed parameters.
5. P6, L2-12. The description of the PPE simulations is confusing. Please clarify. What do you mean “The TOA radiative imbalance of the 5000 samples is

- estimated using the output of a PPE separately conducted using the atmospheric component of MIROC5”?
6. How many year’s run was made in the 5000 samples?
 7. P6, L13-15. Were the 56 members run for present day conditions with the atmospheric component of MIROC5?
 8. P7, L27-29: the reduction of the SCEF bias may increase biases in other fields.
 9. P13 L22: “The spread is larger than that in MIROC5-PPE”. This is primarily due to how the PPE results are sampled. Using the SIS method significantly narrow-down the spread.
 10. P14, L19-20: “We did not ...”. This is not a good argument.
 11. P14. The first sentence of the last paragraph. As I mentioned earlier, I believe that understanding the impact of the uncertainty in the PPE design is quite critical for this paper.