Understanding Changes in Cloud Simulations from E3SM Version 1 to Version 2
Yuying Zhang et al.

Response to reviewer 1

We thank the reviewer for his/her constructive comments, which have helped further improve the clarity and quality of the manuscript. We have made changes to the original manuscript based upon the suggestions and comments from the reviewer. Our detailed responses (blue) to the reviewer's questions and comments (Italic) are listed below.

Reviewer 1's comments

This study attempts to understand cloud changes induced by the E3SM version change from version 1 (E3SMv1) to version 2 (E3SMv2) with comparisons between E3SM COSP simulator results and corresponding satellite data. Also, the authors try to decompose the cause of cloud change from changes in each physics scheme (MG2, CLUBB, and ZM). This paper seems to achieve the authors' goal of showing the cloud changes of the newly released version of the model and which process influences those changes. I think this paper is valuable to be published after some revisions.

Main Comment

1. *For the sensitivity tests, it will be more helpful for the reader's understanding if the authors can explain more about the parameter tuning and dCAPE_ULL trigger (object and results, briefly) even though the authors already refer to Ma et al. (2022), Golaz et al. (2022), and Qin et al. (2023).*

Response: Follow the suggestion, we have provided more information about what are changed in the four sensitivity tests. See the revised Section 2.3.

2. *I think some modifications can improve Section 4. Section 4 comprises many figures and explanations for the figures, but the objective for Section 4 does not seem clear to me. I think there might be two different ways:*
    - *Simplify Section 4 and concentrate more on the connection between Figures 7~11 and 12~17.*
    - *Describe details about how the newly adapted processes in E3SMv2 derive the differences in figures 12~17.*

Response: We thank the reviewer for the constructive suggestion. Following the suggestion, we largely simplified Section 4 by moving Figures 12~17 to Appendix and making a closer connection between Figures 7-11 and 12-17 in the discussion. See Section 4.1 and 4.2 in the revised manuscript.

3. *Some comments for specific sentences*
    - *Line 146~148: If a reference can be added, it will be helpful.*

    Response: Klein et al. (2013) and Zhang et al. (2019) are added.

    - *Line 196~197: If authors explain more about the "additional information", it will be helpful.*

    Response: More information has been added (lines 220 to 223 in the revised manuscript):
    "For instance, the degradation of total cloud fraction simulation in E3SMv2 over the tropical and subtropical regions as shown in Figure 1 is primarily due to errors in low clouds since middle and high clouds are generally improved over these regions (Figures 3c, 3f, and 3i)."

    - *Table 1: How about adding some information about temporal and spatial resolution, which might be different from each other?*

    Response: The information about temporal and spatial resolution is added in Table 1.

Technical Comment

1. *Both τ and Tau are used in the manuscript. It seems better to select one of them to avoid confusion.*

    Tau is used in the entire manuscript.

2. *Both N.H. and N. Hemisphere are used. It seems better to select one of them to avoid confusion.*

    N. Hemisphere is used in the entire manuscript.

3. *Line 200: reginal->regional* (Changed)
4. *Line 540: cloud fraction->CRE* (Changed)