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Interactive comment on "The Path to CAM6: Coupled Simulations with CAM5.4 and CAM5.5" *by* Peter A. Bogenschutz et al.

Anonymous Referee #1

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This paper documents coupled simulations of two major developmental versions of Community Atmosphere Model (CAM) towards CAM6. Critical mean climate quantities and variabilities that are commonly used to characterize model performance are presented and discussed in an incremental manner designed to illustrate the impact of two set of major changes expected to be adopted by CAM6. The changes include new microphysics, aerosol, and ice nucleation in CAM5.4 configuration, and additionally an unified parameterization with an assumed-PDF (CLUBB) for turbulence, shallow convection and warm cloud macrophysics in CAM5.5 configuration. Important improvements are identified in each configuration, along with some degradations; and the attributions of them are convincing. Particularly this is for the first time the performance of the emerging assumed-PDF (CLUBB) method is documented in coupled mode, which

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Discussion paper

is expected to be a very useful reference for further development and application in CAM or other climate models. The presentation is succinct, thoughtful and well organized, along with many useful insights on tuning, coupling and perspective of CLUBB. The paper is suitable for GMD and can be published essentially in current form, after addressing the minor specific comments below.

Specific comments:

1. Only the atmosphere model is described in the section 2 for model description. Given that this work is to document the coupled simulations, it is useful to also briefly describe other model components used, assuming the same are used for all the CAM configurations in this work.

2. Figure 1 on the preindustrial runs: CESM-CAM5.3 at year 402 is assumed to have a globally averaged surface temperature near the stable equilibrium of 287.0K. Why CESM-CAM5.4 and CESM-CAM5.5, which were initialized with CESM-CAM5.3 at year 402, have substantially higher initial global mean surface temperature? This appears inconsistent given the description in the text. Is there something missing?

3. Page 8 line 4, it is not an accurate statement suggesting that "improvements stem from reduction in magnitude of the errors", given pattern correlation coefficient remain unchanged. From Figure 3, it can also be seen that both error magnitudes and patterns change; and there exist quite regions with error magnitudes become larger.

4. Figure 10 on relative AMOC strength between CESM-CAM5.3 and CESM-CAM5.5: the authors speculated that the difference in simulated surface wind stress in the north Atlantic could be the likely cause. Large difference in southern mid-latitude surface wind stress between them could be an even larger factor (e.g., Delworth and Zeng 2008, GRL, doi:10.1029/2008GL035166). Suggest to review and revise this speculative attribution.

5. Figure 6 includes the diurnal composite of precipitation for the tropical Africa, but

essential no description in text. Suggest to add some description for it, though the points to make can largely be reflected in the Amazon composites.

6. Page 5 line 21, redundant word “that” is used.

7. Page 11, last line, given the context, “inter-annual seasonal tropical variability” should be “intra-seasonal . . .”.

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