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Geoscientific Model Development Discussions

Interactive comment on "Automatic tuning of the Community Atmospheric Model CAM5.3 by using short-term hindcasts with an improved downhill simplex optimization method" *by* Tao Zhang et al.

Anonymous Referee #1

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Review of: "Automatic tuning of the Community Atmospheric Model CAM5.3 by using short-term hindcasts with an improved downhill simplex optimization method" by Zhang et al

General Comments:

This manuscript is a nice but limited analysis using an automated method for parameter tuning with a global atmospheric model. It is well written and interesting, but limited in scope, and not that well related to previous work. I'm not sure of the statistics, and the dependence of the improvement on (A) the trajectory used and (B) on the specific comparison data sets. I think the paper may be suitable for publication in ACP with

some significant revisions along the lines noted below.

General

1. The paper needs more discussion of previous work. There are several studies cited such as Qian et al 2015 and Zhao et al 2013, Yang et al 2013, that have tried similar approaches with CAM5. Are results consistent, especially with parameters overlapping between many of these studies? This should be mentioned in the discussion

2. I am not sure what the statistics are, but how significant is a 10% improvement?

3. I am curious since you state the method is dependent on the initial choice of parameters whether you get the same results if you start with a different set of parameters. Another way of saying this is: how do you know you have a true minimum and not a local minimum in the difference/error metrics?

4. Most of the improvement is in the LW Cloud Forcing. This is probably not surprising from the choice of parameters, as noted. Please discuss how the choice of parameters might influence the results. Also, I am concerned that the ISCCP data set is a bit old: what happens if you (A) compare the result optimized on ISCCP with CERES-EBAF LWCF (And SWCF), or (B) use CERES-EBAF in the estimation.

I am very curious and this paper would be of more utility if it showed sensitivities to observational data sets used, and whether they are of sufficient quality that training against different data sets yields different answers.

Specific Comments:

Page 2, L28: if you tweak parameters in it you need to mention the stratiform cloud microphysics. You are mentioning the ice sedimentation velocity, so please describe the microphysics.

Page 3, L4: verification of hire tuned model

Page 3, L8: hindcasts of July 2009 are used

Page 3, L9: All of the 3 day simulations

Page 3, L13: hindcasts are typically from a single day.using 3 days errors may be evolving, and that may bias results? It looks like the biases are systematically evolving from figure 1between day 2and 3. How does that affect the results?

Page 3, L18: The NCEP/NCAR analysis is an older product with known biases. Are you sure these do not affect results? Maybe also add a more modern reanalysis?

Page 3, L21: while testing how the model...

Page 4, L14: missing a description of how this relates to previous CAM5 tuning exercises.

Page 5, L12: how sensitive are results to choice of metric, weighting, etc?

Why does a zonal mean reduce biases in short term forecasts? I don't follow the logic. If the biases are not random, they will not average out.

Page 6, L2: how do you know there is not a local minimum using this method? Have you tried approaching fro different initial locations in the parameter space?

Page 6, L24: I think you should speculate here or in the summary about what these parameters do. Using sedimentation velocity increases ice mass which increases the LWCF cloud forcing.

Page 6, L26: define moderate and noteworthy. Do you mean significant in some way? These are vague concepts. If you start from a different place do you get a different answer?

Page 6, L32: what is the observational dataset used to compare the LWCF? Is it isccp? If so, CAM5 was probably tuned on CERES, a different data set. How much would that matter? What if you used a different data set?

Page 8, L25: a warmer atmosphere

Page 9, L9: how much does the choice of variable s matter? If you chose liquid microphysical parameters, would you see more optimization in SWCF?

Page 9, L14: is this improvement significant in any sense?

Page 9, L19: is the improvement in the broader metrics smaller?

Page 19, Figure 4: if this is cloudsat only it is not an appropriate comparison as cloudsat misses high thin cloud the model represents. Please explain the figure In more detail.

Page 20, Figure 5: probably not the right data set. Are results the same with CERES EBAF.

Specifically: if you optimize on one data set, and compare against another, do you still see improvement?

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