

# ***Interactive comment on “Using a single column model (SGRIST1.0) for connecting model physics and dynamics in the Global-to-Regional Integrated forecast SysTem (GRIST-A20.8)” by Xiaohan Li et al.***

**Anonymous Referee #2**

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## Summary

This manuscript presents results of the coupling of the CAM5 physics parameterization to a single column and simplified 3D dynamical model (SGRIST and GRIST-CAM5phys, respectively). The main result of the paper is that both SGRIST and GRIST-CAM5phys closely match the output of the CAM5 single column model (SCAM) and CAM5 with finite volume dycore (CAM5-FV). Generally minor differences in simulation outcomes are noted and are attributed to differences in numerics (e.g., time integration method and physics-dynamics coupling) without much in-depth exploration.

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While the paper presents minimal novel scientific results, it does show technical advances in keeping with many of the authors' other recent publications and demonstrates the feasibility of the SGRIST and GRIST-CAM5phys model configurations under idealized conditions. I believe the paper would be easier to digest if some of the previous results simply cited (i.e., details of the ptend coupling strategies) were described here, even if briefly.

Overall, I have a few general comments and numerous minor/typographical comments, thus I recommend the authors attend to these concerns before the paper is accepted. The suggested revisions are uniformly minor in scope.

In the remainder of the review, references to specific passages are accompanied by a line number (e.g., L134 refers to line 134 of the manuscript).

#### General comments

- Why have you chosen CAM5 physics to start with? It has been demonstrated quite clearly over the last 5 years or so that CAM6 physics with a unified turbulence and macrophysics scheme (CLUBB) produces superior results to the disjoint combination of separate moist turbulence, shallow convection and macrophysics schemes. This is not necessarily an indictment of your approach; I simply want to understand the rationale.

- I'm not convinced that you actually explore any of the "additional uncertainties" (L65) introduced by the physics package. You appear to just plug it in and go – there's no discussion of how the physics package was changed for this implementation, or any assessment of parameter uncertainty, etc. In fact, the goal of this paper seems to be to reproduce as closely as possible the CAM5 solutions. So what "uncertainties" are you addressing?

- Results shown in Figures 2b-c, 4 and 5 compare SGRIST and SCAM with no external reference to gauge whether SGRIST represents improvement, degradation or

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persistence compared with SCAM. Reference LES solutions should be available for all the SCM cases, and I recommend the authors include such output so that statements such as that given in L212-214 (“...are in good agreement with the [LES] in Park and Bretherton [2009]”) can be directly evaluated.

- Similarly, a general statement (L241-242) is made that “micro- and macrophysics variables are sensitive to the profile of humidity, which varies with the time integration method in the dynamical component.” It would be helpful to add SCAM results to Figure 3 to evaluate this. Do you mean that the grid-mean humidity profile is different in SGRIST and SCAM output? Or is this an issue that arises “internally” during a timestep? If this is indeed a consequence of intra-timestep evolution, a more in-depth analysis to explain how these differences arise is desirable. As it is currently written, this point regarding differences in time integration reads like an unjustified conjecture.
- Please describe the CAM5-FV configuration (grid spacing, timesteps, etc.) used for APE simulations.

#### Specific comments

L213: Cumulus cloud fraction is too high by at least a factor of 2, which I wouldn’t call “good” agreement. But it’s hard to tell without an LES plotted in the figure (see general comment above)

L221-224: Did you change how MG is substepped?

L230: Did you use RRTMG normally during the 15 h run (i.e., with shortwave radiation on)? Or did you use the simplified longwave parameterization suggested by Ackerman et al. (2009)?

L319: Add units to SST (equation 4). I assume this is in degrees C. Figure 11: Add y axis labels (at least to panels a and d)

#### Typographical comments

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L58: “complexity” instead of “complex”

L60-61: Not sure what is meant by “well-expected” – I suggest removing “well”

L65: “intricate” doesn’t make sense here.

L184: “despite that the dynamical. . .” instead of “despite the dynamical”

L264: weather modeling is not “factual” – it is still a simulation. Perhaps “operational” would better capture your meaning?

L312: “with the CAM5-SE dribbling. . .” instead of “with the CAM5-SE with the dribbling”

L334: “participating” instead of “participated”

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-254>, 2020.

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