

Review of “Improved simulation of clouds over the Southern Ocean in a General Circulation Model” by Vidya Varma et al.
***Atmospheric Chemistry and Physics* Manuscript # acp-2019-884**

General Comments

Varma et al. perform global climate model (GCM) simulations with modified cloud parameterizations to investigate why GCMs underestimate cloud albedo over the Southern Ocean. This is a long-standing bias in GCMs, so it is an important scientific problem. The results are important, clearly presented, and fit within the scope of *Atmospheric Chemistry and Physics*. I have several suggestions for minor technical corrections that are listed below. I recommend that the paper be accepted for publication after these issues are addressed.

Technical Corrections

- Pg. 3 line 24 – Change “changing the detrainment temperatures to be very cold from the default values” to “changing the detrainment temperatures to be colder than the default values.”
- Pg. 4 line 32 – When you say “changes to nucleation temperature shows some sensitivity” it is unclear what you are talking about. Do you mean LWP shows some sensitivity to changes in nucleation temperature? Please be more specific.
- Pg. 5 line 22 & 25 – change “is showing” and “showed” to “show”
- Pg. 5 line 33 – Change “taking the anomaly of TOA SW flux between the cloudy and non-cloudy grid boxes” to “taking the difference between all-sky and clear-sky conditions.”
- Pg. 6 line 11 – Change “don’t” to “do not”
- Pg. 7 line 3 – Do you really need to use the abbreviation “SLC”? You only use this word three times in the paper. The abbreviation SLC is defined in the introduction and then used near the end of the paper, so some readers may forget what it means by the time they see it in the discussion section. I suggest that you spell out the word and drop the abbreviation.
- Pg. 7 line 18 – What is a “frontal steady state”? Can you define this more clearly?
- Conclusion – It would help to state how much of a reduction you see in the Southern Ocean shortwave radiation bias in your simulations, rather than just saying that the bias is reduced.
- Figure 5 – Make the scale of the x-axis the same for 5a and 5b.