Review on "Aerosol specification in single-column CAM5" by B. Lebassi-Habtezion and P. Caldwell

Major comments:

Single-column model (SCM) is an important tool for the climate model developments. This study implements different approaches of aerosol specification for the SCM of the NCAR/DOE CAM5, and examines effects on SCM simulations under several cloud scenarios.

This study is a useful contribution to the global climate model (GCM) community regarding the importance of aerosols for simulation of clouds when GCMs have been implementing the aerosol effects on clouds.

I feel this manuscript in current version was prepared rash and there are many places through the text needing to improve the accuracy of wording. Some important references relevant to this study are missing.

I recommend the publication of this manuscript after my comments are sufficiently addressed.

Other comments:

1. P7694. Line 25-28. The current statement is a bit confusing and please change the wording here "This finding suggests…". Since ARM95 is a convective case, and CAM5 does not treat the aerosol activation and droplet nucleation for this type of clouds, the underestimation of predicted droplet concentrations suggests that CAM5 needs to include the sophisticated cloud microphysics and aerosol effects for this type of clouds.

2. P7696. Line 19. Citation of Abdul-Razzak and Ghan, 2000 is not correct one. Cite Ghan et al. (2012) and put behind Liu et al. (2012).

3. P7697. Line 17. Remove "simplified". "Easter et al. 2014" is not a correct one, replaced by "Liu et al., 2012)".

4. P7702. Line 26. Please give a reference for the "State University of New York (SUNY) objective analysis method".

5. P7703. Line 9. At which vertical level is Nd/Ni in Table 1?

6. P7704. Line 9. "4.45 kgkg-1 s-1" is 8 orders of magnitude higher than other numbers here. Is this a correct value?

7. P7706. Line 10. Change "not" to "no".

8. P7706. Lines 22-24. This issue is not new and has been identified by earlier studies, e.g., Liu et al. 2011. Please cite this study.

9. P7707. Line 5 and other places. The CAM5 model time step is 30 min not 20 min.

10. P7707. Lines 22-28. Earlier studies have found the overestimation of ice number from Meyers et al. parameterization and also tested several new parameterizations. These studies (e.g., Liu et al. 2011, Xie et al. 2013; English et al. 2014) should be mentioned and discussed.

11. P7708. Line 17. "The Default, PrescAero, and ObsAero cases showed an average Nd value of 51 cm-3". However, it is not 51 cm-3 in Table 3. Please clarify.

12. P7708. Line 24. Is there a reason why "All the models simulated CLC (0.18), and LWP (19.4 gm-2) very well as compared to LES, (0.19) and (19 gm-2), respectively".

13. P7709. Line 13. Why does the ObsAero give the lowest aerosol burdens compared to Default case?

14. P7709. Lines 23-25. Mass flux figure is shown in Fig.8b not 8a. How do you know "condensate is overpredicted"? Condensate is shown in Fig.8a not in Fig.8b.

15. P7710. Line 27-28. Why the Nd from prescAero is so different from that from the 10-years prescribed climatology (Figure 11)?

References

English, J. M., J. E. Kay, A. Gettelman, X. Liu, Y. Wang, Y. Zhang, and H. Chepfer (2014), Contributions of clouds, surface albedos, and mixed-phase ice nucleation schemes to Arctic radiation biases in CAM5, *Journal of Climate*, *27*, 5174–5197. doi: http://dx.doi.org/10.1175/JCLI-D-13-00608.1.

Ghan, S. J., X. Liu, R. C. Easter, P. Rasch, and J.-H. Yoon (2012), Toward a minimal representation of aerosols in climate models: Comparative decomposition of aerosol direct, semidirect, and indirect radiative forcing, *Journal of Climate*, *25*, 6461-6476.

Liu, X., S. Xie, J. Boyle, S. A. Klein, X. Shi, Z. Wang, W. Lin, S. J. Ghan, M. Earle, P. S. K. Liu, Z. Wang and A. Zelenyuk (2011), Testing cloud microphysics parameterizations in NCAR CAM5 with ISDAC and M-PACE observations, *Journal of Geophysical Research*, *116*, D00T11, doi:10.1029/2011JD015889.

Xie, S., X. Liu, C. Zhao, and Y. Zhang (2013), Sensitivity of CAM5 simulated Arctic clouds and radiation to ice nucleation parameterization, *Journal of Climate*, *26*, 5981–5999, doi: http://dx.doi.org/10.1175/JCLI-D-12-00517.1.