

***Interactive comment on* “The relationship between aerosol and cloud drop number concentrations in a global aerosol microphysics model” by K. J. Pringle et al.**

Anonymous Referee #1

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This paper presents regional biases in cloud droplet number when using either empirical schemes or mechanistic treatments. The concepts presented are useful and in general the paper is well written. However, there are a few suggestions that could be considered to strengthen the paper.

1. The lack of other aerosols but seasalt and sulfates leads to a problem when diagnosing reasons as to why biases in cloud droplet number may be great, or not, especially in regions where aerosols may contain more than one species. How do you plan to address this? Maybe only analyze those regions where sulfates or sea-salt are expected to dominate.

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2. The concept presented in Figure 6 is good but could the figure be improved? It looked a bit blurry.
3. When Figure 7 is first described on page 3220, please state why those regions were considered. Intuitively one expects to see results presented, so what would be more useful is to compare to observations if any could be found. Regions considered should have been based on regions where some field campaigns were conducted so you could support evidence of bias of empirical vs. mechanistic treatments more robustly. Also, you could have considered results from Bennartz (2007, JGR) that shows the global distribution of cloud droplet number and there have been several field campaigns which have measured cloud droplets and aerosols. This would greatly strengthen the paper.
4. Point 5 on page 3224 suggests Arctic cloud droplet number is predicted to be low if one uses the correlation relation. This is important. How well can you support that point based on your modeling exercise? Once again, having some observations would have been useful.
5. Table 1 should report cloud droplet number without significant digits as is done in the text on page 3224.
6. Why do all regions have the same cloud droplet number in Table 1 for the mechanistic treatment? Do you not consider variations in aerosol properties at all? I thought that Figure 10 was a good example of showing how the bias may change across regions but it would have been more useful if aerosols changed as well. Does GLOMAP not calculate aerosol properties?, and if it does as shown, I could not quite follow why only updraft velocities change when using the mechanistic treatment. That is a bit limiting.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 3207, 2009.

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