Atmos. Chem. Phys. Discuss., 8, S8972–S8974, 2008
www.atmos-chem-phys-discuss.net/8/S8972/2008/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Aerosol indirect forcing in a global model with particle nucleation" *by* M. Wang and J. E. Penner

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Received and published: 11 November 2008

We are grateful for the evaluations of the reviewer, which have allowed us to improve and clarify the manuscript. Below we address the reviewer comments. The reviewer comments are in italics and our response is in bold.

Anonymous Referee #2

This outstanding paper clarifies many aspects of the dependence of CCN concentration and aerosol indirect forcing on new particle formation. By running a variety of simulations using different combinations of treatments of primary sulfate emissions and of particle nucleation in the boundary layer and free troposphere, the authors are able to isolate the dependencies on each combination of processes. The emerging picture of competition for sulfuric acid vapor provides much needed understanding of the com-

plexities of the dependencies. Although the study is limited in that it considers only the first aerosol indirect effect, the authors have turned this limitation into a strength by using it to permit a wide range of sensitivity experiments that might not have been feasible had the second aerosol indirect effect been treated.

My only significant comment is that the nomenclature for the experiment names could be better. The term 1st is not readily identified with the empirical nucleation treatment,and the term PAR is not readily identified with primary sulfate emissions. I would suggest the terms EMP and PRM, respectively.

We changed BL1st to EMP. For primary sulfate emissions, we think "PRIM" is better. So PAR is changed to PRIM.

Minor comments.

1. page 13950, line 17. Change "capable" to "able".

Done.

2. page 13952, line 22. Should be Easter et al. (2004).

Done.

3. Page 13955, line 6. Eqn (1) should be Eqn (3)?

Yes, it is changed.

Using this method to determine c,shouldn8217;t the value of c depend on the amount of accumulation mode aerosol?

We did more tests, and the following is now added to the text: "The coefficient c should also depend on the mean velocity and the number concentration of accumulation mode aerosol (radius > 50 nm). But, since the large scale vertical velocity in a grid of the GCM is normally less than 0.05 m/s, we neglect the dependence of c on the mean velocity as an approximation. Moreover, as long as the accumulation mode

ACPD

8, S8972–S8974, 2008

aerosol concentration is less than 1000/cm^3, the cloud droplet number concentration calculated from this approximation is within 10% of that calculated by integrating over the normal vertical velocity distribution."

4. Page 13959, line 24. Remove comma.

Done.

5. Page 13960, line 10. Remove comma.

Done.

6. Page 13965, line 26. Remove comma.

Done.

7. Page 13969, line 24, change STAT to STRAT.

Done.

8. Page 13973, line 4. Remove comma.

Done.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13943, 2008.