Atmos. Chem. Phys. Discuss., 9, C9609–C9611, 2010
www.atmos-chem-phys-discuss.net/9/C9609/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Explaining global surface aerosol number concentrations in terms of primary emissions and particle formation" *by* D. V. Spracklen et al.

Anonymous Referee #1

Received and published: 12 January 2010

This is an interesting and thorough paper that should be accepted to ACP.

I have the following relatively minor comments:

1) Abstract, last sentence: I found the phrase "we derive optimum rate coefficients" slightly misleading. Rather than derive, the authors simply choose the coefficients (from a rather limited set of values simulated) that give the best match globally. The truly optimum coefficients are very likely to vary from site to site, and even from day to day.

2) Mineral dust emissions are not simulated; however, they can affect the CN concentrations at least at the Southern European and possibly some of the Asian sites. This

should be discussed.

3) Are particles in the hydrophobic distribution that become hydrophilic moved the second distribution? What is the criterion for this and how sensitive are the results to the assumption used? Is SOA assumed soluble?

4) Although commonly used, the assumption of 2.5% of SO2 emitted as primary sulphate is quite uncertain. Thus one other sensitivity experiment that I would have liked to have seen is a smaller fraction (even 0%) emitted as primary matter. Has such option been run with the model (maybe for some other study)? How would one expect a smaller value to change the results?

5) How representative of their surroundings are the surface sites? The model grid is quite coarse and thus a comparison to observations may not be as straightforward as assumed here.

6) Concerning calculation of NMB, I assume that O_i is the multiyear annual mean from the observations? How sensitive is the simulation result to the year simulated and consequently then, is NMB as defined here a good measure of the model bias?(I do understand that it is not possible to run a computationally intensive global model for the whole measurement period.)

7) Figure 3: Either add the regression lines to the plot or give the regression equations somewhere else. The reader automatically tries to fit by eye the equation to the given data points, which is less than straightforward when the axes are logarithmic. If possible, remove the unnecessary plus signs from the equations in plots a, c and d.

8) I appreciate the idea to use an additional data set to validate the model over the remote oceans. However, I would question the representativeness of the Heintzenberg data set on most latitude bands since it is based on few campaign measurements at only few locations of the latitude bands. Thus, if the model doesn't agree with this data, it doesn't necessarily mean that the fault lies in the model (whereas I think it would be

safer to say so in the case of the 36 long term sites).

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 26377, 2009.