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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impact of nucleation on global CCN" *by* J. Merikanto et al.

Anonymous Referee #1

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The manuscript by Merikanto et al. presents the relative contribution of three sources of CN and CCN: primary emission, upper tropospheric nucleation and boundary layer nucleation. The paper gives new information on the importance of secondary aerosols on climate, and provides insight on what will happen when e.g. anthropogenic primary emissions are changed. Although the uncertainties in predicting CN with a global model are significant with current knowledge, the paper addresses different error sources with a sensitivity analysis.

The paper is well written, and data in figures and tables is clearly presented. Below are three major comments that should be accessed before publication.

The experiment 8 (UTN+BLN) requires some additional description. Is the experiment conducted with only gaseous sulfur and organic emissions? What happens with the 2.5% fraction of SO2-emission which is normally emitted as primary particles? Is this

2.5% not emitted at all, or emitted as gaseous compound?

Figs. 1A and 1B show that (PR+UTN+BLN) generally produces less CN and CCN (0.2%) than (PR+UTN) above 4 km. If you have defined (BLN) = (PR+UTN+BLN) - (PR+UTN), it would mean that (BLN) is negative above a certain height. In other words, BLN reduces particle concentrations in the upper troposphere, when added on top of primary emissions and upper tropospheric nucleation. It is not clear from the text what causes this.

What is the reason for choosing Kulmala et al. (1998) parameterization as the standard scheme for binary homogeneous nucleation instead of newer Vehkamäki et al. (2002)?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 12999, 2009.