

***Interactive comment on* “Simulation of particle size distribution with a global aerosol model: contribution of nucleation to aerosol and CCN number concentrations” by F. Yu and G. Luo**

Anonymous Referee #2

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This paper describes a new aerosol microphysics scheme that has been incorporated into a global chemical transport model. The formation rate of secondary particles is calculated using an ion-mediated nucleation mechanism which is shown to well reproduce annual mean particle number concentrations observed at various sites around the world. Secondary particle production is shown to dominate the formation of cloud condensation nuclei (CCN) in large parts of the atmosphere. This is one of the first studies to estimate the fraction of global CCN to come from particle formation.

The paper is well written and further contributes to our understanding of the role of particle formation in controlling global aerosol. It will be of interest to the atmospheric

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science community and I recommend publication after the comments below have been addressed.

Major comment:

One of the significant conclusions of this work is that ion-induced nucleation can explain a large fraction of observed particle number. This conclusion is contrary to a number of existing studies (e.g., Kulmala et al., 2007; Boy et al., 2008) which suggest that ion-induced nucleation is not a dominate particle formation mechanism. However, there is no reference to these previous studies or any explanation for this significant difference in conclusions. At the very least I think a discussion of these previous studies should be included, if it is not possible to account for the difference in conclusions.

Minor comments:

P10600, L20: Change “Pierce and Adam” to “Pierce and Adams”

P10601, L13: Change “w” to “W”

P10601, L16: Spracklen et al., 2006 was the first study to include this empirical mechanism in a global model.

P10601, L20: This implies that Hyytiala is the only location where this parameterization has been shown to match observed nucleation events. However, this parameterization has now been shown to work at a number of locations (e.g., Riipinen et al., 2007; Kuang et al., 2008).

P10604, L27 and L28: Should this be GEOS?

P10614, L1 Change to “Existing”

Table 1. Are some of these observations not CN3 (> 3 nm dry diameter)?

Additional references:

Kulmala et al., Science, 318, 5847, 89-92, 2007. Boy et al., Atmospheric Research,

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90, 2-4, 151-158, 2008. Spracklen et al., ACP, 6, 5631-5648, 2006.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 10597, 2009.

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