

## ***Interactive comment on* “Nucleation and growth of sulfate aerosol in coal-fired power plant plumes: sensitivity to background aerosol and meteorology” by R. G. Stevens et al.**

### **Anonymous Referee #2**

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This study explores the role of new-particle formation in coal-fired power plant plumes. New particle formation in power plant plume is poorly treated in large scale aerosol models and previous work has demonstrated a large sensitivity of such models to this process. In this work an aerosol microphysics scheme is coupled to a large eddy model and used to simulate new particle formation in two different power plant plumes. Aircraft observations of gas-phase and particulate species are used to evaluate the model.

The study makes substantial progress towards understanding the key processes that control new particle formation in power plant plumes. The paper is very clearly written

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and well within scope of ACP. It will be of considerable interest to the community. I recommend publication after a few very minor comments have been addressed.

#### Minor comments

In a number of cases throughout the text it would improve the paper to add a quantitative comparison to support qualitative statements: e.g., P24780, L8: “agree quite well”; P24780, L18: “agree better...slight low bias”.

P24787, L13. I don't understand why this is the case: “pre-existing particles smaller than 30 nm that were mixed into the plume; however, these are an artifact of our calculation and should not truly be considered new particles. “ Please explain and if possible clarify in the manuscript.

P24787, L21. Change “Spracklen, 2008” to “Spracklen et al., 2008” and “Sihto, 2006” to “Sihto et al., 2006”. There may be others I did not spot, please carefully check throughout.

P24787, L18. Add “(equation 1)” after “fitting parameter A”.

Figs 3b, 4, 6b etc. I found these plots hard to read and this may be worse when they appear smaller in the ACP version. Restricting the y-axis to a narrower range in plots 3b and 6b, making lines thicker etc might make the plots more readable.

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 24765, 2011.

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