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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Particle formation in the Arctic free troposphere during the ASTAR 2004 campaign: a case study on the influence of vertical motion on the binary homogeneous nucleation of H_2SO_4/H_2O" *by* F. Khosrawi et al.

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This paper describes nucleation modeling simulations on an Arctic free troposphere new particle formation (NPF) event seen on May 24, 2004 from ASTAR campaign, to understand the effects of airmass history on NPF in free troposphere. While NPF studies have been frequently made at the ground level, studies in the free troposphere especially in Arctic are very rare, and so this paper is within the scope of ACP journal. Considering this unique dataset and quantitative approach using a microphysical model combined with backward trajectory calculations, this paper should be published after

the following comments are addressed carefully.

First of all, serious technical editing of the entire manuscript is required, to correct grammatical errors and revise the manuscript in proper English.

Main scientific comments include the range of H2SO4 concentrations used in this simulations (0, 40, 80 pptv) are way too high – I understand that H2SO4 levels in free troposphere are less than e7 cm-3 range (pptv) so this simulation should be made more reasonably at atmospherically relevant conditions; such as e5, e6, e7, and e8 H2SO4 cm-3 range.

While the authors focused on why NPF took place on May 24 and not on other days, it would be more important to also address when NPF does not occur. It is well recognized now that NPF takes place in almost all parts of the world, except some specific regions such as Amazon forest boundary layer; however, what is unclear is when NPF does not occur and why. This is a far more important question. The authors claimed that during the entire ASTAR 2004 campaign, there was only one NPF event. This is a very unique opportunity to address this question – perhaps this would become more important contribution of this paper to the aerosol science community.

It would be useful to mention how binary nucleation schemes Karcher (1998), Jaecker-Voirol et al., 1987) and Laaksonen Kulmala (1991), used in the authors' modeling simulations, stand as opposed to current nucleation parameterizations. Also, it is unclear to me why HNO3 is included in this nucleation simulations, as HNO3 vapor pressures are too high to contribute condensation for nucleation of small particles considered in this work (as opposed to micron size PSCs).

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 21959, 2009.