

[Home](#)[Online Library ACP](#)[Recent Final Revised Papers](#)[Volumes and Issues](#)[Special Issues](#)[Library Search](#)[Title and Author Search](#)[Online Library ACPD](#)[Alerts & RSS Feeds](#)[General Information](#)[Submission](#)[Review](#)[Production](#)[Subscription](#)[Comment on a Paper](#)[Volumes and Issues](#) [Contents of Issue 20](#)

Atmos. Chem. Phys., 8, 6085-6102, 2008

[www.atmos-chem-phys.net/8/6085/2008/](http://www.atmos-chem-phys.net/8/6085/2008/)

© Author(s) 2008. This work is distributed

under the Creative Commons Attribution 3.0 License.

## Case studies of particle formation events observed in boreal forests: implications for nucleation mechanisms

F. Yu<sup>1</sup> and R. Turco<sup>2</sup><sup>1</sup>Atmospheric Sciences Research Center, State University of New York at Albany, 251 Fuller Road, Albany, New York 12203, USA<sup>2</sup>Department of Atmospheric and Oceanic Sciences, University of California at Los Angeles, 405 Hilgard Ave, Los Angeles, California 90095, USA

**Abstract.** Aerosol nucleation events observed worldwide may have significant climatic and health implications. However, the specific nucleation mechanisms remain ambiguous. Here, we report case studies of eight nucleation events observed during an intensive field campaign at a boreal forest site (Hyytiälä, Finland) in spring 2005. The present analysis is based on comprehensive kinetic simulations using an ion-mediated nucleation (IMN) model in which the key physical and chemical parameters are constrained by a variety of recent measurements. Out of the 22 days of the campaign on which nucleation events were observed, eight major events were selected for detailed analysis on the basis of indications that the observed air masses were relatively homogeneous. In most of these cases, reasonable agreement is found between IMN predictions and field data for a range of variables, including critical nucleation sizes, size-dependent overcharging ratios, and the concentrations of 1.8–3 nm stable clusters and 3–6 nm particles, and their diurnal variations. The possible reasons leading to substantial differences between observation and theory in some cases are also explored. Statistically, roughly 80% of the nucleation events recorded during the Hyytiälä campaign exhibited mean size-dependent particle overcharging ratios within the range of, or exceeding, those predicted by the IMN model, suggesting that ion nucleation processes were significant during these events. The nucleation rates calculated using the IMN modeling approach are contrasted with those predicted by other theories/models, and key differences between the results are discussed. In particular, it is concluded that the ion nucleation model originally developed by Lovejoy et al. (2004) significantly under-predicts ion nucleation rates, and cannot explain the new