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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Wintertime New Particle Formation and Its Contribution to Cloud Condensation Nuclei in the Northeastern United States" *by* Fangqun Yu et al.

Anonymous Referee #1

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This paper describes winter time NPF in the northeastern United states using the modeling predictions combined with ambient measurements of aerosol size distributions made at two sites and their contribution to CCN production. NPF is usually considered as a main source of CCN. And observations have shown that NPF usually takes place less frequently during the winter, in many locations over the world. So the results presented in this paper are interesting considering these factors. This is a well-written paper, easy to read.

Perhaps, the model used too high sulfuric acid concentrations to predict NPF winter? We made long-term measurements of NPF and sulfuric acid in Ohio and our measure-

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Discussion paper

ments show that winter time sulfuric acid does not exceed 3e6 per cubic centimeter (Erupe et al., 2010; Yu et al., 2014). And this paper claims that in order to have NPF, sulfuric acid higher than 3e6 per cubic centimeter is needed.

Related to this, at the same site in Ohio, we also found lower frequency of NPF during the winter than other seasons, very likely due to low sulfuric acid concentrations (Erupe et al., 2010; Kanawade et al., 2012).

Does the model consider temperature effects on nucleation and growth? NPF becomes more favorable at lower temperatures, as shown from laboratory studies (Duplissy et al., ; Yu et al., 2017; Tiszenkel et al., 2019). If the model includes this feature, then maybe this is due to lower temperatures?

It would be nice to give some explanation why ternary ion nucleation (as opposed to neutral ternary nucleation) is important? What are the potential sources of ions in winter in the boundary layer?

And is it possible to explain the growth rate from 3 nm to the CCN size with the sulfuric acid and ammonia? If not, what makes new particles grow so fast to become CCN?

References:

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