**Atmospheric
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Discussions

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# *Interactive comment on* "Semi-empirical parameterization of size-dependent atmospheric nanoparticle growth in continental environments" *by* S. A. K. Häkkinen et al.

**Anonymous Referee #1**

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The manuscript presents a semi-empirical parameterization for growth rates of particles smaller than 20 nm. The manuscript is well written and it is within the scope of Atmospheric Chemistry and Physics. However, my main concern about the manuscript is how useful such a parameterization is for global scale models.

On page 8493, it is said that in large-scale models, the SOA is assumed to be either non-volatile and assumed to condense kinetically or have range of volatilities but to be in thermodynamical equilibrium. There is also a possibility to calculate the condensation kinetically assuming SOA to have a range of volatities and still calculate condensation kinetically. This method has been used by e.g. Pierce et al. (2011).

What would be the benefit of the parameterization given in the current manuscript over the method used by Pierce et al. (2011)? The correlation between the observed and parameterized growth rates do not seem overly good.

The $k$ parameter values given on page 8508 differ significantly between those fitted to Hyytiälä and EUCAARI stations. Did you compare how the values differ for individual EUCAARI stations and if so, how did they compare? It would be vital to see how fitted and observed growth rates differ for individual stations in e.g. Fig 7 before the parameterization could be recommended to be used in global models. In addition, the parameterization should be compared against observations in different types of locations.

Minor comments: Although it may obvious for most readers, it would be informative to say that the sizes are in diameter.

Page 8511, lines 8: What do you mean by "the scale at which many global models operate"?

Page 8512, lines 13-15: What do you mean by "This result is reasonable in the light of the thermodynamics of evaporation.."

Pages 8531-8535, Figures 3-7: The 1/1 line would be easier to visualize if x and y axis were the same.

Some global models that include SOA use two-product or volatility basis set approach. Could this parameterization be implemented in such models? How would you take into account the loss of gaseous SOA precursors of different volatilities during growth of sub 20nm particles?

## References

Pierce, J. R., Riipinen, I., Kulmala, M., Ehn, M., Petäjä, T., Junninen, H., Worsnop, D. R., and Donahue, N. M.: Quantification of the volatility of secondary organic compounds in ultrafine particles during nucleation events, Atmospheric Chemistry and Physics, 11, 9019–9036, 10.5194/acp-11-9019-2011, http://www.atmos-chem-phys.net/11/9019/2011/, 2011.
//www.atmos-chem-phys.net/12/3147/2012/, 2012.

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