

Interactive comment on “Modelling the formation of organic particles in the atmosphere” by T. Anttila et al.

Anonymous Referee #1

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General Comments

Overall, this work aptly investigates many intricacies of secondary aerosol particle formation, focusing primarily on how this process is regulated by ambient SO₂ concentrations and pre-existing aerosols. However, the novelty of the equations employed is perhaps exaggerated, or is at least not made explicit. Without access to the referenced paper on nano-Köhler theory [Kulmala et al, accepted 2003], it is hard to say what, if any, physical phenomenon captured by this theory (as presented here) extends beyond the well-known Kelvin and solute/solvent effects. The functional equations (1-4) do not appear to merit a new theoretical nomenclature; perhaps there is something “nano” about the way they are implemented in the model that is just not made clear in this manuscript. All this being said, the paper definitely deserves publication after a revision that addresses this issue and some of the more specific comments below.

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- C_0 is the pure component saturation vapor **concentration**, though is it called a **pressure** directly after equation (3).
- The definition of S_{OS} is not consistent. Equation (1) defines S_{OS} as the ratio of the equilibrium surface vapor concentration ($C_{i,eq}$) to the pure component vapor concentration. However, it is later redefined [just prior to eq (3)] as the ratio of the ambient concentration C_{OS} to the pure component vapor concentration.
- It would be most informative to include a governing equation that describes how condensation, coagulation and nucleation are treated in the model.
- It is mentioned that a three-fold increase in SO_2 concentrations, in tandem with a four-fold decrease in the pure organic vapor concentration, would lead to a similar order enhancement of the new particle growth rate. As calculations using 50 and 150 ppt SO_2 are already included in the manuscript, it seems like it would not be too much to ask that these calculations to be re-done using a reduced value of C_0 in order to quantify the above statement.

Technical Corrections

- There are numerous grammatical errors (~ 1 per page). See, for example, the second sentence of section 2.1.
- Use periods instead of commas for the x-axis labels of Fig 1.
- Use $()^\circ$ instead of $()_0$ to imply pure component property. Reserve the subscript for species designations.
- Please define all symbols ($\nu_i = ?$).

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