

Interactive comment on “A model for particle formation and growth in the atmosphere with molecular resolution in size” by K. E. J. Lehtinen and M. Kulmala

Anonymous Referee #2

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General Comments:

The manuscript represents a substantial contribution to the area of atmospheric chemistry and physics as it introduces a new discrete model for new particle formation and growth in the atmosphere and its application to analyse particle formation and growth events as observed in a Finnish Boreal forest.

The scientific approach and the applied methods are valid and results are discussed in an appropriate and balanced way.

The results and conclusions are presented in a well structure way. The theory section of the paper is clearly and concisely written. However, the results section needs major

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improvement as it somewhat incomplete and lacks clearness. The conclusion section needs minor modifications as it is somewhat incomplete. The length of the manuscript as well as the number and quality of the figures are appropriate.

Specific Comments:

In the results section, results from the new discrete model are compared to those of an older sectional model (Kulmala et al., 2000). Differences between the two models are discussed in the text but no figure is given in which the differences and the achieved improvements are quantified. I therefore strongly recommend to include such a figure into the result section. Therefore only a few model runs should be needed. Model differences could be quantified in terms of standard deviations of the obtained particle size distributions and, if meaningful, total particle number concentration. Another possibility would be to include a contour plot similar to those presented in figure 2, generated using data from the old sectional model, to at least get a visual impression.

Regarding figures 3, 4 and 5 the explanation how peak locations and heights are determined from the experimental time series is written in an unclear way. I strongly recommend, to explain this procedure in more detail. Furthermore it remains more or less unclear how the solid lines in figures 4 and 5 are determined. Are they the result of a simple curve fitting procedure or are they determined via model calculations as suggested by the last sentence on page 1799, lines 11 - 13 ? In addition it should be noted, why no fitting / model results are plotted in figure 4 b) for the peak height. I recommend to add these results even though the experimental relationship is not linear.

The conclusion section mainly focuses on the newly developed discrete model. Its application to the experimental results is more or less neglected. Therefore, I strongly recommend to include a few more sentences regarding this topic, e.g. explain the ``key qualitative behaviour of such systems``.

Technical Corrections:

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Page 1796, line 13: change ``condensation is treated as collisions with class 1`` to ``condensation is treated as collisions of classes i with class 1``

Page 1797, line 24: period is missing

Page 1806, Figure 4 b): ``dN/(dlog dp)max`` should be changed to ``peak height`` to be consistent with the other figures.

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 1791, 2002.

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