

Interactive comment on “Modelling the contribution of biogenic VOCs to new particle formation in the Jülich plant atmosphere chamber” by L. Liao et al.

Anonymous Referee #3

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1 General comments

The manuscript presents a study where a box model has been used to investigate secondary organic aerosol formation from volatile organic gases emitted by three different trees. In the study, a box model was used to simulate experiments from a measurement campaign which has been described in a previous publication by Dal Maso et al., 2014. The manuscript is within the scope of Atmospheric Chemistry of Physics, the modelling framework is valid for this study. However, the main results of this study need to be better justified in order to publish this paper. Experiments have been modeled,

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but it is unclear what extra knowledge does the model bring to these measurements.

2 Specific comments

One of the main results of this study is that sulfuric acid is one of the critical compounds in the nucleation process. This is probably true, but it can not be verified using simulations made in this study. Both nucleation mechanisms used in the model require that there is sulphuric acid, otherwise there will be no nucleation making it a critical compound. It would be useful to test if organic nucleation mechanisms that do not require sulphuric acid (see e.g. Paasonen et al., 2010) would succeed or fail simulating particle formation in these conditions.

Another main result presented in the abstract is that reversible gas-wall partitioning must be considered in the model. This has already been established by Matsunaga and Ziemann (2010) and confirmed by more recent studies.

Page 27980: It is said that OH oxidation product ELVOC_{OH} was used in Equation (2). This choice has not really been justified in the text. Ehn et al. (2012) have suggested that also ozone oxidation of biogenic volatile compounds produces extremely oxidized compounds that can play a role in new particle formation. Why was $\text{ELVOC}_{\text{O}_3}$ omitted in the nucleation calculation?

Page 27981: ELVOC and SVOC yields have to be given for Equation (3) (see comments by Referee 1)

Page 27982: It is unclear how the parameter values in Equation (4) were determined and how it was verified that with these values the observed reversible wall losses were captured.

Page 27983: Why were “only 4 lamps used on the remaining days”?

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Page 27983: How were the concentration values for inorganic compounds determined?
How sensitive are model results to these choices.

Page 27985: I don't understand the explanation for using 80 % increase in the UV-light. What was this extra sink for O₃? Why was it necessary to model O₃ concentrations if the main purpose of this study was to investigate new particle formation? Measured O₃ concentrations could have been given as an input for the model as it was done for H₂SO₄. This way, there would have been fewer sources for uncertainty in the simulations and the analysis of factors affecting new particle formation and growth would have been more straight forward.

Figure 14: What does the term "total volume fraction" mean?

3 Technical comments

Figure 1 is not required to explain the model structure.

Figure 3: Most compounds included in the figure do not show in the graph. Those compounds should be removed to allow for choosing colors that can be distinguished. Now, for example, different shades of blue are difficult to distinguish.

4 References

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