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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "MALTE – Model to predict new aerosol formation in the lower troposphere" *by* M. Boy et al.

**Anonymous Referee #1**

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This manuscript presents a novel model system in which a one-dimensional meteorology model has been merged with an aerosol dynamics model in order to investigate atmospheric nucleation events. This kind of approach is a logical extension to previous modelling studies of new particle formation, and as such, very suitable for publication in ACP. I have no criticism concerning the model structure, however, I do have serious concerns about how the model runs were conducted and about the interpretation of the results, and cannot support acceptance of the manuscript to ACP before these concerns have been properly addressed.

Major comments: The major problem here is that the authors use modelled H2SO4 concentrations to calculate particle formation and growth. First they show that the model overpredicts H2SO4 concentrations, then they make conclusions about the nu-

cleation rate dependence on [H2SO4] and about the relative contributions of H2SO4 and organics to particle growth rates based on the incorrect (i.e. modelled) H2SO4 concentrations. This is not logical.

It is ok to show Fig. 2 and to discuss the H2SO4 prediction. However, the model should be rerun for Figs. 3-9 using measured instead of modelled H2SO4 concentrations. Presently, the dependence of the nucleation rate on [H2SO4] is based on too high sulfuric acid concentrations, and it is therefore possible that the value chosen for the kinetic koefficient K (p. 3483) is too low, which would lead to two errors canceling each other.

Fig. 8 indicates that on March 20, the contribution of sulfuric acid to particle growth is up to 5 times the contribution of organics. However, on that day, the modelled sulfuric acid concentration is most of the time 2-4 times higher than the measured value, indicating that the condensation rate of H2SO4 in the model is 2-4 times too high.

Minor comments: P. 3479: actinic flux "values are further validated by short wavelength radiation measurements from Hyytiälä at noon to reflect the real daily irradiance input of the selected day". What does this mean in practice? Is the calculated actinic flux somehow normalized using the measured radiation? If so, why is only noon value used and not all measured values? There is certainly variation in cloudiness throughout the day also on nucleation days.

Bottom of p. 3485: particle distribution will be affected by horizontal advection during the day. This is certainly true. Now, particles larger than 100 nm will probably affect the condensation sink the most, but on the other hand, the new particles do not grow to 100 nm during the day (at least on the days shown in this paper). Wouldn't it be possible to update the size distributions of particles $>$ 100 nm constantly during the model run using measured values?

P. 3486 and Fig.3: Why do (modelled) 3 nm particles appear still at midnight, or is it just that earlier formed 3 nm particles do not grow? If so, isn't the coagulation sink strong



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enough to deplete their concentration? And at what time does the modelled nucleation actually stop?

English: The English should be improved. Here are just some random samples: P. 3468, Blackkader -> Blackadar P. 3468 and also elsewhere, gouverning -> governing P. 3480 and elsewhere, Koehler -> Köhler P. 3484, marginal smaller -> marginally smaller

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 3465, 2006.