Atmos. Chem. Phys. Discuss., 2, S28–S29, 2002
www.atmos-chem-phys.org/acpd/2/S28/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Application of the variability-size relationship to atmospheric aerosol studies: estimating aerosol lifetimes and ages" *by* J. Williams et al.

Anonymous Referee #1

Received and published: 6 March 2002

The paper contains several interesting points on variation of aerosol concentrations as a function of aerosol of aerosol size. Also the obtained residence times are very interesting ones.

However, I do not agree with the conclusion that the variability in Aitken mode is mainly due to coagulation. Also, authors mentioned that condensation will mainly affect on variations in the accumulation mode, which is not scientifically sound. Condensation has strongest effect on particle growth in nucleation mode, following Aitken mode. The importance of accumulation mode in condensation point of view is that accumulation mode is big sink for condensable molecules and therefore makes condensational growth of nucleation and Aitken modes slower.

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It is unclear for me how the authors have obtained their conclusions from Figure 3. In my point of view coagulation and condensation would together expalin the observed values better than coagulation alone.

I think that the most part of this missinterpretation is due to their model simulations, where condensation has not simulated in proper way. i) in condensational growth the condensation of some other molecules than sulphuric acid should be condsidered, since the growth due to sulphuric acid condensation is too slow ii) the numerical diffusion due to used sectional model is important in condensation point of view and causes possible errors in interpretation. iii) the nucleation model is not adequate. This will cause several problems including the errors of mutual importance of condensation and coagulation. It is very difficult to use any nucleation model to predict concentrations of 20 nm particles if condensation growth is not correctly simulated.

The other issue is the effect of mixing, turbulence etc. on observed variation. I would like authors to consider this also.

Technical errors: there are some missprints page 47 line 21 should be Mäkelä page 57 line 13 what is 10-3 and 103 ?? Figure 3 is unclear.

Interactive comment on Atmos. Chem. Phys. Discuss., 2, 43, 2002.