

## ***Interactive comment on “Why formation rate of 3 nm particles depends linearly on sulphuric acid concentration?” by M. Kulmala et al.***

**M. Kulmala et al.**

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First of all, we would like to thank the referee from his/her valuable comments, which will improve our paper. Our answers/comments to specific comments are:

- 1) We will consider the title once again. In addition, the discussion will be written in a way that reveals more clearly that not all days have the mentioned linear relationship, as suggested by the reviewer.
- 2) The reviewers concerns about the  $n_1$  vs  $n_3$  relationship are valid if  $J_1$  and  $J_3$  are compared at the same time. The theory presented in the paper, however, requires including a time lag. This means that  $J_1$  and  $J_3$  should be compared for the 'same' particles. Coagulation will complicate this analysis, as pointed out by the referee. However,

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intermodal coagulation in this range is typically insignificant in the atmosphere. Both these issues will be clarified in the revised manuscript.

3) The missing source term will be explained. Actually we are considering the activated part of cluster population, and clusters themselves are in equilibrium in with their sources and sinks (i.e. coagulation to existing aerosol particles).

4) The referee's point about the time window when the correlation holds is right. We will mention and explain this in the revised manuscript.

5) Actually in this MS we investigate what is the slope predicted by the activation theory and we also show that the predicted slope is unity. We also show that at least in some observed atmospheric conditions the slope is unity. This is the first time, when this kind of result is shown.

6) In our revised MS we will also state more clearly that all analyzed days exhibit power law dependence (with an exponent between one and two). We believe that similar pictures of additional days will not help in explaining our ideas. The more detailed analysis of different days is given in our follow up paper by Sihto, Kulmala et al., which also will give much more evidence to support our hypothesis.

On minor/technical comments: a) comments to numerical values of  $C_i$  will be given. b) Justification to comments of organics needed will be given. c) Figure 1 will be better commented. d) Lines in Figure 2 will be explained. Actually solid line is number concentration and green plusses (+) are sulphuric acid concentrations. Both scaled.

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