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Atmospheric
Chemistry
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Discussions

# *Interactive comment on* "Atmospheric sulphuric acid and aerosol formation: implications from atmospheric measurements for nucleation and early growth mechanisms" *by* S.-L. Sihto et al.

**Anonymous Referee #2**

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In this manuscript, the authors present the analysis of the relationship between the aerosol number concentration and sulfuric acid concentration observed on 15 days during QUEST 2 campaign. Specifically, the authors use this relationship to determine whether the particle formation occurs according to the activation or kinetic mechanism, as well as to calculate the growth rate of particles from 1 nm to 3nm. The manuscript is well written and touches a very relevant subject for ACP. I recommend the manuscript to be published after meeting the following comments.

My main concern is about the ability of the time shift analysis (by observing the graphs of concentrations) to distinguish between the activation and kinetic nucleation mecha-

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nisms. With regard to this several points in the paper need to be discussed / explained in more detail.

1. P.3853, line 23: "the time delay was determined both by looking (at) the first rise of the N_3_6 and [H2SO4] or [H2SO4]ˆ2 curves and the form of the curves during the whole event". a) It is not clear how the beginning of the event and its duration were determined. I understand that because of the experimental noise it may be difficult to provide exact criteria, but at least some qualitative guidelines, which the authors used, need to be given here. b) Does not the form of the curve include its rising part? Or were the two used with different weights in finding the time delay?

2. P.3856, line 15: were the number concentration in size range 3-6nm and sulphuric acid concentration clearly correlated after the time delay correction or without it?

3. Figures 1 and 2 and discussion thereof: The graphs show the concentrations on the log scale. The problem with this is that power functions could look very similar to each other on the log scale. For example, if you plot y = x with the y-scale scale set 0.7 to 33 and y = xˆ2 with the scale set 1 to 1000, both for x = 1 to 30, they will look very close to each other. Thus, both functions can be fitted to observations by changing the scale of the y-axes. Further, Fig. 2 shows that it may be difficult to fit the complete curve with any of the two functions. In Fig 2b it is clear, that the [H2SO4]ˆ2 curve only fits well its top part to the data, while the periods prior to and after the event are 1 - 2 orders of magnitude below the observations. At the same time, on Fig.2a it looks like a shift of [H2SO4] curve to the right may provide a "good" agreement with the part preceding the event, the rising part and the top of the number concentration curve, but fail at the end of the event. Why was then the [H2SO4]ˆ2 curve chosen? How different would be the delay time, if the activation mechanism were assumed instead?

4. Table 1: similarly to the above discussion it is not clear why some events were attributed to one class or the other. For example, on days 80, 82, 85, etc., the difference in R is so small that I do not believe it is significant. Also, it appears that the R was

calculated using the same time delay for both mechanisms. If different delays were used for different mechanisms, would the correlation be affected?

5. Page 3862, line 21: Were [OH]*[terp]/CS and [O3]*[terp]/CS correlations done with a time delay, or the data were used as is?

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Interactive comment on Atmos. Chem. Phys. Discuss., 6, 3845, 2006.