

Interactive comment on “Particle size distributions in the Eastern Mediterranean troposphere” by N. Kalivitis et al.

Anonymous Referee #1

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Statement:

The authors present results from a field measurement campaign conducted in the Eastern Mediterranean. The effects of air mass origins on aerosol total number concentration and number size distribution are explored. The authors also examine sudden disappearance of Aitken mode particles and attribute this phenomenon to coagulation losses and growth by condensation. This manuscript is well written and scientifically important. It should be considered for publication in ACP after considering the following comments.

General comments:

In my opinion the systematic disappearance of the Aitken particles is the single most

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interesting part of this paper and should be explored in more detail, whether here or in a follow-up paper. The dataset definitely seems promising.

Since the disappearance occurred every other day, similarities and differences between the days should be discussed more thoroughly. This could be explored with the aid of coagulation sink and condensation sinks (Kulmala et al. 2001). These parameters could help to pinpoint the processes relevant in the disappearance of the Aitken mode particles and whether they differ between a gradual disappearance and a sudden decrease in Aitken mode particles. If the coagulation sink was large, this could also explain the fact that new particle formation was not observed on a regular basis during this field study as pointed out by the authors. Is there a threshold value of coagulation sink after which Aitken mode particles are lost? Changes from summer to fall in the disappearance is only mentioned but not discussed the article.

Specific comments:

Details on how the formation rates were calculated need to be explained as the results depend on assumed growth rates and assumed initial below the detection limit of the instrument as well as various loss rates.

The data is divided into four time periods A to D. I would like to see characteristic trajectories for periods C and D (Figure 2) and typical size distribution for the period D (Figure 5) or the authors should give reason for omitting these in the Figures and in the discussion. According to Figure 3 the period D seems to contain a large contribution from Aitken mode sized particles. The differences in periods B and D could shed some additional light into the disappearance of Aitken mode particles during period B.

I recommend showing modeled and measured total number concentrations in Figures 9 and 10 in separate panels. The two days seem to differ in terms of total number concentrations and also in terms ratios of Aitken to accumulation mode particles. Currently the comparison between modeled and measured size distributions is quite qualitative.

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The authors should clarify the processes included in their analysis. In the conclusions the authors state that only coagulation into larger particles and condensation of sulfuric acid are included. How about self coagulation? Section 4.1 mentions self coagulation, but erroneously in a context of coagulation with larger particle sizes. This should be clarified.

pp. 6583, line 23. Is the temperature difference of the reaction rate taken into account?
pp. 6584, line 27. Growth factor of 1.15 is assumed. Reference and/or justification should be given.

References:

Kulmala, M. et al. (2001). On the formation, growth and composition of nucleation mode particles. *Tellus B*, 53:479-490.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 8, 6571, 2008.

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