Atmos. Chem. Phys. Discuss.,
doi:10.5194/acp-2016-330-RC2, 2016

Atmospheric Chemistry and Physics Discussions

Interactive comment on "New Particle Formation in the South Aegean Sea during the Etesians: importance for CCN production and cloud droplet number" *by* P. Kalkavouras et al.

Anonymous Referee #2

Received and published: 19 August 2016

The manuscript presents measurements of the number size distribution and chemical composition of submicron aerosols at two islands in the Eastern Mediterranean. The analysis is based on a measurement period over two weeks in the summer 2013, during persistent transport of continental airmasses from north to the sites. A chemical transport model and airmass back-trajectories are used to identify the source areas and transport routes of aerosols to the sites. Using case studies of two new particle formation (NPF) events the contribution of NPF to both the cloud condensation nuclei (CCN) and cloud droplet (Nd) concentrations is assessed. The results for CCN and Nd are based on Köhler theory and parameterizations.

I agree with the comments presented by the anonymous referee #1, and would like the

Printer-friendly version

Discussion paper

authors to address my further comments below. After addressing these comments I can recommend the manuscript for publication in Atmospheric Chemistry and Physics.

General comments:

Page 5, lines 6–7: Is it known what are the possible reasons for the underestimation of organic matter concentrations in the model results; could it be due to underestimation of primary emissions or underestimation of SOA formation in the model?

Page 5, lines 8–12: Care should be taken when using the HYSPLIT model with the GDAS 0.5° input data: the back-trajectory results might differ from those obtained with GDAS 1° input data due to the differences in the airmass vertical advection calculation method between these two datasets (see e.g. Su et al., 2015). Perhaps the authors could check that their back-trajectories shown in Figure 2 remain the same if using the GDAS with 1° resolution as input meteorological data.

Page 8, lines 6–7: Why are coagulation losses not included in the calculation of the formation rate of nucleation mode particles? This should be fairly straightforward to calculate based on the measured size distributions, and including the coagulation losses would make the calculated formation rates more readily comparable to literature values (which typically account for coagulation).

Page 10, line 4: Where does the 3 hour difference in the comparison between particle observations at Santorini and Finokalia come from? Based on the particle size distribution data in Fig. 8 the particle formation at both stations seems to start at 9 a.m. on 23 July, and the only appreacable difference in the particle concentrations in Fig. 4 seems to be in the nucleation mode concentration (i.e. intensity of particle formation).

Regarding the discussion on the CCN-sized particles and the calculated hygroscopicity parameters, it would be interesting to see how the results differ on days without new particle formation. This type of comparison between NPF and non-NPF days would put the results presented in the manuscript better into context with regard to the importance

of NPF to CCN and cloud droplet number at the Aegean Sea. Where there during the campaign any such non-NPF days for which the parameters of Table 3 could be calculated and reported for comparison with the two NPF days?

Minor and technical comments:

Page 2, line 30: The sentence starting with “Short-lived events of small number young Aitken particles” is difficult to understand, consider revising it. Does “small number” refer to low concentrations?

Page 3, line 4: should be “prior to reaching . . .”

Page 7, line 2: “non-refractive” should be “non-refractory”

Page 8, line 21: A more recent reference for NPF event classification is Kulmala et al. (2012).

Page 10, line 3: In the sentence “ . . . have trace a lower number of . . .” the word “trace” should be omitted.

Page 10, line 21: As also suggested by the other referee, Section 3.5 could be divided into two parts, one dealing with CCN concentrations and another dealing with cloud droplet concentrations. That would make this section more readable.

Page 13, line 30: “. . . have a similar to ozone behavior . . .” should be “. . . behave similarly to ozone . . .”

References:

Kulmala, M., Petäjä, T., Nieminen, T., Sipilä, M., Manninen, H. E., Lehtipalo, K., Dal Maso, M., Aalto, P. P., Junninen, H., Paasonen, P., Riipinen, I., Lehtinen, K. E. J., Laaksonen, A., and Kerminen, V.-M.: Measurement of the nucleation of atmospheric aerosol particles. Nature Protocols 7, 1651–1667, 2012.

Su, L., Yuan, Z., Fung, J. C. H., Lau, A. K. H.: A comparison of HYSPLIT backward

trajectories generated from two GDAS datasets. Science of The Total Environment 506–507, 527–537, 2015. doi:10.1016/j.scitotenv.2014.11.072

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2016-330, 2016.

Printer-friendly version

Discussion paper