

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-243

Anonymous Referee #1

Referee comment on "Aerosol particle characteristics measured in the United Arab Emirates and their response to mixing in the boundary layer" by Jutta Kesti et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-243-RC2>, 2021

Kesti et al. present 1 year of aerosol and boundary layer data collected in the UAE. The manuscript analyzed size distributions, CCN properties and new particle formation events in the context of the evolution of the boundary layer

Overall the manuscript is well written and easy to follow. The dataset represents a valuable contribution toward understanding aerosol properties in an undersampled region of the world. The analysis of the new particle formation events seems to be done somewhat hastily and requires more attention to detail. The conclusion that downward mixing initiates NPF at the site may be correct, but it doesn't seem to be directly shown in this work. This would require a detailed understanding on what caused nucleation in each event, which neither the authors nor anyone else really knows in the field setting. There is also the possibility that it is initiated aloft and newly formed particles are mixed down. These uncertainty should be acknowledged in the text. My main critique of the work is that it is purely observational with few tangible new scientific findings. I recommend that the manuscript is published as a "Measurement Report" instead of a "Research Article" if following comments can be addressed.

Comments

Please state the make, model in the text and briefly discuss the operating principle of the CCN instrument as well as the supersaturation calibration procedure.

Figures 8 and 11 should be presented as a histogram and include a measure of the range. This could be visualized either through vertical errorbars or transparent shading for the three distributions.

There needs to be more detail given for the derivation of growth rates. Please specify the method used and show an example in a supplement.

Please provide statistics for the growth rate.

Applying a single growth rate to determine the start time is questionable. It needs to be derived through extrapolation from each event.

Please justify the use of a single growth rate to extrapolate to the start time. Growth rates often differ in different size ranged. Provide an estimate of the uncertainty in your procedure

Why was 1 nm selected as the starting point? Clusters typically activate at 3 nm or so. Please justify or change definition.

The concept of downward mixing of particles/precursors and it's relationship to NPF needs to be explored in much more detail, both in the context of the literature and the observations that purportedly support the conclusion reached here. There is also a significant body of literate on the subject (See e.g. <https://acp.copernicus.org/articles/18/1835/2018/acp-18-1835-2018.pdf>, <https://acp.copernicus.org/articles/21/7901/2021/acp-21-7901-2021.pdf> and references therein)