Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-300

Anonymous Referee #2

Referee comment on "Vertical profiles of trace gas and aerosol properties over the eastern North Atlantic: variations with season and synoptic condition" by Yang Wang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-300-RC2, 2021

The manuscript presents a nice summary of vertical profiles of size-resolved aerosol concentrations and trace gas mixing ratios observed during the two seasons of the recent DOE ACE-ENA campaign. Clear differences in both aerosol and gas concentrations are observed between the winter and the summer with higher concentrations generally observed in the summer. The only exceptions are carbon monoxide and boundary layer ozone concentrations, which were elevated in the winter relative to the summer. Typical bimodal marine aerosol size distributions are presented for the boundary layer, which the authors use to infer CCN-activated vs. -unactivated (i.e., "pre-CCN") fractions. Elevated pre-CCN concentrations in the free-troposphere support the well-established idea that new particle formation does not tend to occur in the marine boundary layer due to the existing aerosol condensational sink. Back of the envelope calculations of the entrainment rate support the idea that these pre-CCN are entrained into the boundary layer, where they grow to CCN-relevant sizes. Overall, the manuscript is well written and the data are well analyzed and presented. Nice job! The paper is relevant for Atmospheric Chemistry and Physics, and I recommend that it be accepted for publication. While I have no major comments or corrections, I did note the following minor issues while reading the manuscript:

Line 475: Change "~350 nm" to "~35 nm".

Please provide a link (preferably https://doi.org/...) directly to the the ENA dataset under the Data Availability section.

Figure 2a: Is the map of the Azores from geographicguide.net subject to copyright and reproduced here with permission?

Figures 6-10: Please note in **both** the captions and in the axis labels if the concentration units are standard (scm^{-3} or cm^{-3} STP) or volumetric.

Tables 2-3: Same comment as above regarding standard or volumetric units and consistency between the captions and the table headings.