

Interactive comment on “Characterization of aerosol particles at Cape Verde close to sea and cloud level heights – Part 1: particle number size distribution, cloud condensation nuclei and their origins” by Xianda Gong et al.

Anonymous Referee #2

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The manuscript discusses aerosol size distributions and CCN measurements made at multiple supersaturations observed at Cape Verde as part of the MarParCloud project. Measurements were conducted at two stations – a low-altitude, coastal station (CVAO) and a higher-altitude, mountainous station (MV), with the latter station being located close to cloud level. The size distributions are fit to 2-3 lognormal modes (Aitken, accumulation, coarse), and very rough inferences of aerosol type are drawn from relative fractional contributions of these modes as well as HYSPLIT air mass backtrajectories. CCN measurements show size-dependent hygroscopicity with lower kappas observed

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at higher supersaturations (with the implication that these measurements are representative of smaller aerosol sizes). This leads to the interesting conclusion that cloud processing both transitions aerosol from the Aitken to accumulation mode, but also slightly increases the kappa. Overall, the paper is well written and relevant to ACP. I recommend publication after the following comments are satisfactorily addressed:

1) The paper as it is currently written stands on its own, and from the brief description given of the second paper, it also sounds like it too will adequately stand on its own. Consequently, I recommend that the title be revised so that this is not be a two-part paper. Alternatively, the authors should provide a copy of the companion manuscript and explain why the two are inextricably linked.

2) The language and concept of deploying a "trimodal parameterization method" as described in the abstract and elsewhere (e.g., Pg. 9, Lines 2-3; Pg. 24, Lines 7-8) implies that something novel has been developed, which is not the case. The size distribution measurements are fit to multiple lognormal functions to derive summary statistical parameters, using fit functions that are textbook and commonplace. Please revise this language to indicate that the "parameterization method" is actually "fitting the data to multiple lognormal functions".

3) How were the size modes and backtrajectory information synthesized to arrive at the four aerosol type classifications in the present paper? Would it make more sense to conform to the 5-type classification scheme of Fomba et al. (2014)?

4) The sentence on Pg. 2, Line 14 is awkward and unnecessary. I suggest it be removed.

5) Pg. 2, Ln. 22-23: Karydis et al. (2011) did not find that dust contributes up to 40% to CCN on a global basis. This was found for the N. African and Asian desert regions.

6) Pg. 3, Ln. 9: remove "besides"

7) Pg. 3, Ln. 12: Quinn et al. (2017) did not find that "marine aerosol" contributes

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less than 30% to CCN. They use the term "sea spray aerosol", and suggest that SSA contributed less than 30% to CCN. Organics and secondary sulfate of marine origin can dominate CCN in remote regions.

8) Pg. 3, Ln. 16: Something is amiss with the total mass reported of 47.2 ± 55.5 , as it implies substantial negative mass ($\sim -8.3 \text{ ug/m}^3$). I suspect that the observations here lack normality and the use of an arithmetic mean and standard deviation is inappropriate.

9) Pg. 3, Ln. 31 (and multiple instances elsewhere): The use of the phrase "to the best of our knowledge,..." is sloppy writing and gives the reader the impressions that the authors have not done their due diligence in conducting a literature survey. If the statement is true (which I think it is), then it should stand on its own without the need for such a caveat.

10) Pg. 3, Ln. 31: "filed" = "field"

11) Pg. 4, Ln. 18: "see" = "sea"

12) Pg. 4, Ln. 20-21: Is it really the first time these measurements have been conducted in Cape Verde? Why is the "to the best of our knowledge" caveat here?

13) Pg. 4, Ln. 25: Please update reference or remove it if the paper is still in preparation.

14) Pg. 4, Ln. 30-31: Are the winds always from the northeast?

15) Pg. 4, Ln. 31-33: Please add citations to support these sentences related to annual rainfall and precipitation even frequency.

16) Pg. 7, Ln. 3-4: How was the APS data used to correct the MPSS data for multiple charges as the APS is measurement aerodynamic diameter? What assumptions were invoked?

17) Pg. 7, Ln. 5: "base" = "basis"

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18) Pg. 7, Ln 11: Please add a sentence to the end of this paragraph summarizing how approximately how large the particle loss corrections ended up being (e.g., on the order of 10%, something smaller, or something larger?).

19) Pg. 10, Ln. 2: What is meant by "behavior of aerosols" here? Is this discussed in this manuscript?

Table 1: Please reformat the table so the Measurement Site and Location fields are on the same line as the other information.

Table 3: I don't understand what is being presented in the kappa column. Is one of the numbers the + and the other the -? If so, which is which. Would it be better to report the geomean */ geostd?

Figure 12: It would be really interesting to use the median size distributions from Fig. 5 to compute and overlay lines of constant kappa for each case to evaluate how the box-whiskers fall across the range of hygroscopicities.

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