

## **Second Review of Qiao et al. (2025)**

I thank the authors for their thorough responses to my and the other two reviewers' comments and the major revisions made to the text. I believe the paper has been much improved based on these suggestions and the incorporated changes. However, I still have a number of largely editorial and some technical comments and suggestions that I feel will strengthen the paper and overall improve its clarity before it is suitable for publication.

### **General Comments**

- There are several places where the authors use the word “discrepancy” when they mean “differences.” “Discrepancy” suggests compatibility while “difference” is a distinction between things. Please make sure that the right word is being used. I believe most times “discrepancy” is used in this paper it should be replaced with “difference”, but please verify.
- The authors generally took my previous suggestion to remove the article “the” when it was superfluous, but in some places it was incorreced deleted, e.g. Section 3.3, Line 496: “Among them, [the] degree of impact...” The article is necessary here. Please verify that these are revised properly.
- I, again, encourage the authors to make a concerted effort to carefully re-read the paper in its entirety with revisions to ensure its clarity. There are several passages with missing words and punctuation errors that make the text a bit difficult to follow in some place.

### **Response to Author Responses**

- RC3.38: I thank the authors for clarifying in their response why two different reanalysis datasets were used, however I believe this should also be briefly detailed in the main text; ERA5 for dynamical properties (because of better in situ agreement), MERRA2 for thermodynamics and composition.
- RC3.45: Please specify the range of summed NC in the Flores 2020 study for inclusion in the main text.
- RC3.56: these are not discrepancies they are differences

### **Editorial Suggests and Technical Comments on the Revised Manuscript**

- Introduction, Line 58: “...between different areas.” Replace “areas” with “regions.” The same should be done for line 74.

- Introduction, Line 62: "...observed that the average micrometer aerosols..." I believe the phrasing here should not be "micrometer aerosols." Do the authors mean, "accumulation- to coarse-mode aerosols"? <1µm aerosol are not "micrometer aerosols" nor is this standard terminology.
- Introduction, Line 75: "...most available marine aerosol data..." Replace "data" with "measurements."
- Section 2.2.1, Line 162: "the" (and "diameter") should be included in the sentence, "...which has 52 size channels in [the] 0.5 to 20 µm [diameter] range."
- Section 2.2.1, Line 170: Replace "Thereby" with "Therefore"
- Section 2.3.1, Line 220: "For atmospheric aerosol [component data]..." The phrase "component data" is vague. This should be replaced with "composition."
- Section 2.3.1, Line 226: Here, and wherever appropriate, "discrepancy" should be replaced with "differences".
- Section 2.4, Line 264: Can the authors be a bit more specific when they say, "sharp decrease and increase in NCs"? Is this a visual inspection of NC changes or was a statistical method applied to identify these rapid changes in NC?
- Section 3.1, Lines 291-306: It is important for the authors to acknowledge that a potential leading cause of the differences in aerosol NC reported in this study as opposed to those compared to in literature (Table 2) are the differences in size range measured. This is not mentioned anywhere in these passages.
- Section 3.1, Line 343: Please revise, "The previous study proposed ..." to "Previous work has proposed..."
- Table 3: I still don't believe it is appropriate to use the word "total" when discussing accumulation + coarse-mode aerosol. I recommend that the authors use "sum" here and elsewhere when the two modes are summed.

- Section 3.2, Lines 384-385: “These aerosols underwent atmospheric ...” The authors should state that the aerosol “likely underwent dry deposition, wet deposition, and aging processes” associated with the “long-range transport.” No evidence has been shown that each of these processes definitively happened. This is the same for the subsequent two sentences as well, which are worded a bit definitively without evidence.
- Section 3.2, Lines 400-403: The authors need to specify what statistical test was performed to determine statistical significance for the differences compared in these lines (and elsewhere mentioned).
- Section 3.3, Line 495: Here and elsewhere, please use “composition” instead of “components.”
- Section 3.3, Line 510 (and elsewhere in this section): The authors have not revised the word “total” to “sum” as discussed in their response. Please make this revision. Figures 7-11 should also not say “total.”
- Section 3.3.1, Line 570: How do the authors know that the “marine aerosols had a relatively short lifetime”? Where was this discussed or shown?
- Section 3.3.1, Lines 570-577: The language in these passages are still more declarative than what can be supported by the measurements. An example of where this can be improved is: “Under the influence of sea surface wind, ocean wave fluctuations and sea surface friction [MAY] increase with intensified wind stress.” Word like “can”, “may”, “might suggest” would improve these passages. Things like “bubble rupture” and “wave fluctuations” were not reported in this study and are speculative based on the assumed relationship to the correlations, therefore should not be discussed definitively.
- Section 3.3.2, Line 594: The “accumulation mode was likely more sensitive to SST”. Is this sensitivity implied because of the larger slope? Please clarify and state in the main text what is meant.
- Section 3.3.2, Line 594-597: “This observed trend was inconsistent...” The authors state that their trend is inconsistent with prior laboratory studies but “consistent

with the previous studies.” Were these “previous studies” ambient measurements or also laboratory studies but using a different experimental set up? Please clarify and state the difference/similarity in the main text. The same is necessary for the following sentence which states, “a recent study.” This description is vague and should state whether laboratory or ambient measurements.

- Section 3.3.2, Lines 604-613: This passage is still written confusingly and too conclusively. First, I don’t understand why “meanwhile” is used at the beginning of the passage. If in relation to the previous sentence/discussion, do the authors mean to use a phrase like “accordingly”? I interpret the structure of this passage as: Near-surface air entrainment volumes and plunging jets were changed (prior sentence). [Accordingly], the bubble rupture changed (following sentence). This should be followed (as a new sentence) with “smaller daughter bubbles” were LIKELY produced BECAUSE larger drops ruptured; then, these smaller drops CAN produce submicron aerosol.
- Section 3.3.2, Line 608-610: Please revise (in brackets): “The [generation] of daughter bubbles [decreases] with an increasing ratio of seawater density to viscosity and a decreasing ratio of seawater viscosity to surface tension. [Therefore], under increasing SST, the ratio...”
- Section 3.3.2, Line 614: Delete “meanwhile.”
- Section 3.3.2, Line 635: replace “meanwhile, they might” with “they might also”
- Section 3.3.2, Line 636-638: The sentences in these lines can be combined for clarity, “The difference in the SST-T2m might ... during the experiment and should be considered further in subsequent targeted research.”
- Conclusions, Lines 660-661: The authors should include the size ranges for their defined accumulation and coarse modes here.
- Conclusions, Lines 670,672 (elsewhere in this section): Please use “aerosol composition” instead of “aerosol components.”
- Conclusions, Line 674: “...diminishing continental aerosol [contributions].” Do the authors mean concentrations? Please clarify and revise.